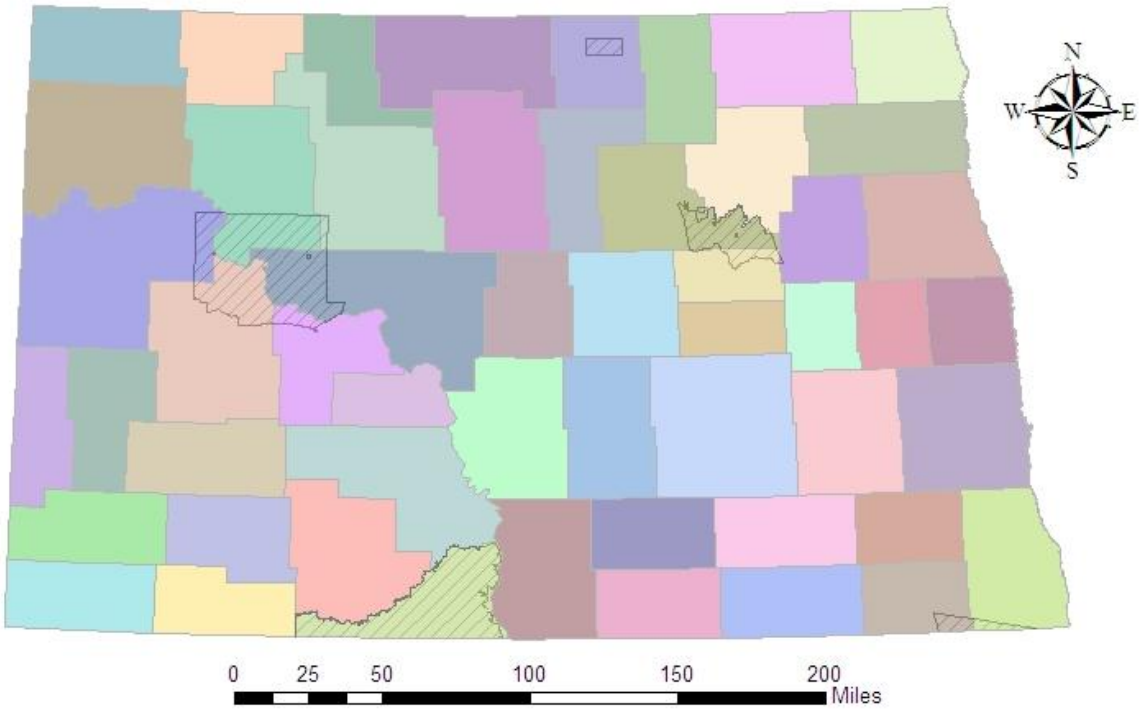
State of North Dakota
Multi-Hazard Mitigation Plan

January 2011



Plan Development Managed by:

NDDES
Homeland Security
State Radio

Plan Prepared by:

BIG SKY
HAZARD MANAGEMENT
LLC

406-581-4512 ▪ www.bigskyhazards.com

EXECUTIVE SUMMARY

Disasters can strike at any time in any place. In many cases, actions can be taken before disasters strike to reduce or eliminate the negative impacts. These actions, termed mitigation, often protect life, property, the economy, and other values. The State of North Dakota Multi-Hazard Mitigation Plan addresses thirteen major hazards with respect to risks and vulnerabilities statewide. Through a collaborative and ongoing planning process, including review of local mitigation plans, the North Dakota hazards were identified, researched, profiled, and prioritized.

The major hazards – communicable disease; dam failure; drought; flood; geologic hazards; hazardous material release; homeland security incident; shortage or outage of critical materials or infrastructure; summer storm; transportation accident; urban fire or structure collapse; wildland fire; and winter storm – are each profiled in terms of their characteristics, history, probability, magnitude, mapping, vulnerabilities, data limitations, and other key documents. The vulnerabilities to jurisdictions, state-owned buildings and property, critical facilities and infrastructure, and new and future development are evaluated for each hazard.

Based on the probability and extent of potential impacts, the hazards are prioritized as follows for the State of North Dakota:

- High Hazards: Winter Storm; Summer Storm; Drought; Flood
- Moderate Hazards: Communicable Disease; Hazardous Material Release; Wildland Fire; Shortage or Outage of Critical Materials or Infrastructure
- Low Hazards: Homeland Security Incident; Geologic Hazards; Urban Fire or Structure Collapse; Dam Failure; Transportation Accident

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

- *Goal 1: Encourage sound state and local planning related to hazard understanding and mitigation.*
- *Goal 2: Enhance the public's awareness of hazards.*
- *Goal 3: Reduce the impact future development has on potential losses and vulnerabilities.*
- *Goal 4: Reduce impacts of flooding to people and property in North Dakota.*
- *Goal 5: Mitigate the effects severe summer and winter weather have on people and property.*
- *Goal 6: Reduce impacts of drought and wildland fires on North Dakota communities.*
- *Goal 7: Reduce population and property losses from human-caused hazards.*

Associated with each of the goals are objectives and mitigation initiatives ranging from snow fences to improved data collection to stormwater management projects. The mitigation initiatives that can be done at the state government level are prioritized based on cost, project management, feasibility, population benefit, property benefit, effectiveness, and the hazards being mitigated. An implementation plan outlines the suggested course of action, given the limited resources available in the state. The state's overall mitigation strategy includes a process for approving, funding, and implementing local projects. The State Hazard Mitigation Team, through the Department of Emergency

Services, is responsible for the maintenance of the plan. Other recommended activities, such integrating this plan into a variety of other federal, state, tribal, and local plans and documents, will further the goals of hazard mitigation in North Dakota.

The State of North Dakota Multi-Hazard Mitigation Plan exceeds the requirements of a state hazard mitigation plan as outlined in the Interim Final Rule published in the Federal Register on February 26, 2002 at Title 44 of the Code of Federal Regulations, Part 201 as part of the Disaster Mitigation Act of 2000. This plan has been approved by the Federal Emergency Management Agency, and therefore, the state continues to be eligible for federal mitigation funds. This plan serves as a guide for understanding the major hazards facing North Dakota and provides a comprehensive, statewide strategy for mitigating some of the impacts.

TABLE OF CONTENTS

1. Adoption Documentation 1-1

2. Introduction 2-1
   2.1 Purpose 2-1
   2.2 Scope 2-3
   2.3 Authority 2-3
   2.4 North Dakota Overview 2-4

3. Planning Process 3-1
   3.1 Background 3-1
   3.2 Roles and Responsibilities 3-2
      3.2.1 North Dakota Department of Emergency Services 3-2
      3.2.2 Federal Emergency Management Agency 3-2
      3.2.3 State Hazard Mitigation Team 3-3
      3.2.4 Interagency Hazard Mitigation Team 3-4
      3.2.5 Local and Tribal Emergency Management Organizations 3-4
      3.2.6 Other Mitigation Stakeholders 3-4
      3.2.7 Mitigation Planning Committees 3-5
      3.2.8 Contractor Services 3-5
   3.3 Workshops 3-5
   3.4 Public Participation and Comment Integration 3-6
   3.5 Integration of Other Plans and Programs 3-7
   3.6 Risk Assessment Methodologies 3-10
   3.7 Hazard Identification 3-14

4. Statewide Inventory 4.1-1
   4.1 State-Owned Buildings and Property 4.1-1
   4.2 Critical Facilities and Infrastructure 4.2-1
   4.3 Population 4.3-1
   4.4 Buildings 4.4-1
   4.5 Economic, Ecologic, Historic, and Social Values 4.5-1
   4.6 Land Use 4.6-1
   4.7 New Development 4.7-1
   4.8 Future Development 4.8-1

5. Risk Assessment / Hazard Profiles 5.1-1
   5.1 Communicable Disease 5.1-1
   5.2 Dam Failure 5.2-1
   5.3 Drought 5.3-1
   5.4 Flood 5.4-1
   5.5 Geologic Hazards 5.5-1

5.6 Hazardous Material Release 5.6-1
5.7 Homeland Security Incident 5.7-1
5.8 Shortage or Outage of Critical Materials or Infrastructure 5.8-1
5.9 Summer Storm 5.9-1
5.10 Transportation Accident 5.10-1
5.11 Urban Fire or Structure Collapse 5.11-1
5.12 Wildland Fire 5.12-1
5.13 Winter Storm 5.13-1

Each Hazard Profile contains the following sections:
5.X.1 Characteristics
5.X.2 History
5.X.3 Probability and Magnitude
5.X.4 Mapping
5.X.5 Vulnerabilities to Jurisdictions
5.X.6 Vulnerabilities of State-Owned Buildings and Property
5.X.7 Vulnerabilities of Critical Facilities and Infrastructure
5.X.8 Vulnerabilities to New and Future Development
5.X.9 Data Limitations and Other Key Documents

5.14 Risk Assessment Summary. 5.14-1
5.14.1 Presidentially Declared Disaster and Emergency Summary 5.14-1
5.14.2 Historical and Potential Loss Summary 5.14-6
5.14.3 Hazard Rankings by County/Reservation 5.14-10
5.14.4 Statewide Hazard Rankings 5.14-16

6. Mitigation Strategy 6-1
6.1 Mitigation Goals, Objectives, and Initiatives 6-1
6.2 Statewide Mitigation Initiatives 6-17
6.3 Local Mitigation Initiatives 6-24

7. Mitigation Implementation System 7-1
7.1 State Capability Assessment 7-1
7.1.1 Mitigation Programs 7-3
7.1.2 Mitigation Legislation, Regulations, and Policies 7-23
7.1.3 Integration into Other State Plans and Programs 7-36
7.1.4 Current and Emerging State Capabilities 7-37
7.2 Mitigation Funding Sources 7-39
7.3 Local and Tribal Capability Assessment 7-44
7.3.1 Current and Emerging Local and Tribal Capabilities 7-44
7.4 Local and Tribal Mitigation Planning 7-47
7.5 Project Management 7-50
7.5.1 Technical Assistance 7-50
7.5.2 Eligibility Criteria 7-51

7.5.3 Project Review 7-55
7.5.4 Benefit-Cost Analysis 7-56
7.5.5 Prioritization 7-56
7.5.6 Environmental Review 7-59
7.5.7 Grant Management 7-59
7.5.8 Project Monitoring and Evaluation 7-60
7.6 Mitigation Implementation System Summary 7-62

8. Plan Maintenance 8-1
8.1 Plan Monitoring 8-1
8.2 Plan Evaluation 8-1
8.3 Plan Updates 8-2
8.4 Plan Update Process 8-2

Appendices
A. Mitigation Planning Committees A-1
B. Invited Stakeholders, Participation, and Public Information B-1
C. Meeting Attendance Records C-1
D. Meeting Summaries D-1
E. Communications E-1
F. Plan Changes F-1
G. References G-1
H. Acronyms H-1
J. Annual Reports J-1
a. 2005 Mitigation Year in Review J-1
b. 2006 Mitigation Year in Review J-3
c. 2007 Mitigation Year in Review J-5
d. 2008 Mitigation Year in Review J-7
e. 2009 Mitigation Year in Review J-9
f. 2010 Mitigation Year in Review J-11
K. Interagency Reports K-1
L. Local and Tribal Mitigation Plans L-1
M. Federal Emergency Management Agency Crosswalks M-1

1. ADOPTION DOCUMENTATION

The State of North Dakota Multi-Hazard Mitigation Plan has been adopted by the State of North Dakota through a letter signed by the Governor on <enter date>. A copy of the letter follows. Through this adoption, state government, across all agencies, is continuing its commitment to hazard mitigation.

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

TITLE 44--EMERGENCY MANAGEMENT AND ASSISTANCE

CHAPTER I--FEDERAL EMERGENCY MANAGEMENT AGENCY, DEPARTMENT OF HOMELAND SECURITY

PART 13_UNIFORM ADMINISTRATIVE REQUIREMENTS FOR GRANTS AND COOPERATIVE AGREEMENTS TO STATE AND LOCAL GOVERNMENTS--Table of Contents

Subpart B_Pre-Award Requirements

Section 13.11 State plans.

(a) Scope. The statutes for some programs require States to submit plans before receiving grants. Under regulations implementing Executive Order 12372, ``Intergovernmental Review of Federal Programs,'' States are allowed to simplify, consolidate and substitute plans. This section contains additional provisions for plans that are subject to regulations implementing the Executive Order.

(b) Requirements. A State need meet only Federal administrative or programmatic requirements for a plan that are in statutes or codified regulations.

(c) Assurances. In each plan the State will include an assurance that the State shall comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding. For this assurance and other assurances required in the plan, the State may:

(1) Cite by number the statutory or regulatory provisions requiring the assurances and affirm that it gives the assurances required by those provisions,

(2) Repeat the assurance language in the statutes or regulations, or

(3) Develop its own language to the extent permitted by law.

(d) Amendments. A State will amend a plan whenever necessary to reflect: (1) New or revised Federal statutes or regulations or (2) a material change in any State law, organization, policy, or State agency operation. The State will obtain approval for the amendment and its effective date but need submit for approval only the amended portions of the plan.

State of
North Dakota
Office of the Governor
John Hoeven
Governor

March 9, 2005

Mr. David I. Maurstad, Regional Director
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, Colorado 80225-0267

Dear Mr. Maurstad:

The State of North Dakota's Multi Hazard Mitigation Plan meets the requirements of the Disaster Mitigation Act of 2000 (DMA2K), Section 322. Section 322 of the Act requires States, as a condition of receiving federal disaster mitigation funds, have a mitigation plan in place which describes the planning process for identifying hazards, risk and vulnerabilities, identifies and prioritizes mitigation actions, encourages the development of local mitigation and provides technical support for these efforts.

The State of North Dakota assures it will comply with all applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR part 13.11 (c). The State will amend the plan whenever necessary to reflect changes in state or federal laws and statutes as required in 44 CFR 13.11 (d). The adoption of this plan demonstrates the State of North Dakota's commitment to fulfilling the mitigation objectives outlines in the Plan and authorized the responsible agencies identified in the Plan to execute their responsibilities.

With the submission of the 2004 North Dakota Multi Hazard Mitigation Plan, the Plan is hereby adopted by the State of North Dakota under the executive powers of the Governor.

Regards!

Sincerely,

John Hoeven

John Hoeven
Governor

38:28:35

600 E Boulevard Ave
Bismarck, ND 58505-0001
Phone: 701.328.2200
Fax: 701.328.2205
www.discovernd.com

State of
North Dakota
Office of the Governor

John Hoeven
Governor

March 3, 2008

Douglas A. Gore, Acting Regional Administrator
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, Colorado 80225-0267

Dear Mr. Gore:

The State of North Dakota's Multi Hazard Plan meets the requirements of the Disaster Mitigation Act of 2000 (DMA2K), Section 322. Section 322 of the Act requires States, as a condition of receiving federal disaster mitigation funds, have a mitigation plan in place which describes the planning process for identifying hazards, risk and vulnerabilities, identifies and prioritizes mitigation actions, encourages the development of local mitigation and provides technical support for these efforts.

The State of North Dakota assures it will continue to comply with all applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR parts 13.11 (c). The State will amend the plan whenever necessary to reflect changes in state or federal laws and statutes as required in 44 CFR 13.11 (d). The adoption of this plan demonstrates the State of North Dakota's commitment to fulfilling the mitigation objectives outlines in the Plan and authorized the responsible agencies identified in the Plan to execute their responsibilities.

With the submission of the 2008 North Dakota Multi Hazard Mitigation Plan, the Plan is hereby adopted by the State of North Dakota under the executive powers of the Governor.

Sincerely,

John Hoeven
Governor

38:47:59

600 E Boulevard Ave.
Bismarck, ND 58505-0001
Phone: 701.328.2200
Fax: 701.328.2205
www.nd.gov

<insert 2011 letter here>

2. INTRODUCTION

2.1 Purpose

The State of North Dakota Multi-Hazard Mitigation Plan has been developed to serve the people of North Dakota by providing the impetus for making our homes, businesses, and communities as safe as possible against the impacts of natural and human-caused hazards. This plan contains a wealth of geographic and demographic information, along with a thorough assessment of the hazards faced throughout the state. This plan addresses the overall capability of state and local governments to reduce or eliminate the vulnerability of our communities to these hazards. Most importantly, the plan outlines a coordinated mitigation strategy, adopted by the State of North Dakota, which includes long-term goals, objectives, and a wide variety of mitigation options.

This plan was developed through partnerships and participation across all levels of government and the private sector to represent the perspectives of North Dakota as a whole, rather than that of one state agency. The lead agency in the development of this plan was the North Dakota Department of Emergency Services (DES), Division of Homeland Security. North Dakota DES coordinates mitigation planning through its multi-agency State Hazard Mitigation Team (SHMT).

The mission of the North Dakota State Hazard Mitigation Team is to assist North Dakota citizens, communities, state agencies, local and tribal governments, and businesses in becoming less vulnerable to the impacts of natural hazards through the effective administration of grant programs, hazard risk assessments, wise floodplain management, and a coordinated approach to mitigation policy through state, regional, and local planning activities.

The North Dakota State Hazard Mitigation Team envisions instituting a statewide hazard mitigation ethic through leadership, professionalism, and excellence, leading the way to a safe, sustainable North Dakota. The team continues to aggressively implement a widely recognized, comprehensive program of mitigation that goes beyond that of solely reducing hazard vulnerability, but also incorporates complementary goals that can address multiple community needs and lead to safer, more sustainable communities. In so doing, the team is helping the Division of Homeland Security in carrying forward a revitalized approach to traditional emergency management. Rather than focusing on short-term solutions to inevitably long-term problems, the team's work emphasizes the need to ensure communities become better able to withstand the forces of nature while at the same time improving their residents' overall quality of life. By avoiding unnecessary exposure to known hazards, communities will save lives and property and minimize the social, economic, and environmental disruptions that commonly follow hazard events. The team has been addressing the needs of current residents and also the needs of future generations. It is hoped that this focus on an integrated, future-oriented approach will result in communities that are less vulnerable and more sustainable. The North Dakota State Hazard Mitigation Team therefore carefully and deliberately embodied the principles and spirit of community sustainability into many sections of this plan.

Shortsighted development patterns have contributed to making some North Dakota communities extremely vulnerable to flooding, winter and summer storms, wildland fire, and other hazards. The State Hazard Mitigation Team can work with communities to reduce their vulnerability by educating about inappropriate land uses and by encouraging the acquisition, relocation, or retrofitting of existing vulnerable structures, along with the protection of valuable natural resources. If a disaster should strike any one of these communities, the State Hazard Mitigation Team can assist the community in building back better and stronger than before.

Through experience, the team has learned that communities will face significant challenges during post-disaster redevelopment on balancing the driving need for rapid recovery with implementing long-term hazard mitigation. The necessity of meeting basic needs and resettling displaced populations immediately following a disaster often overshadows the more abstract, longer-term sustainability considerations. Once full-scale reconstruction is initiated, it is difficult to modify projects in progress to meet sustainability objectives. This phenomenon highlights the need for pre-disaster mitigation planning that incorporates principles of sustainable development within the context of reconstruction so that communities can more easily rebuild in a manner that will make them less vulnerable to future hazard events and improve their residents' quality of life.

The State Hazard Mitigation Team strongly believes that 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 natural hazards are most direct. The team has always supported local self-sufficiency and reliance, providing assistance to communities where it is needed, but allowing local initiatives to take the lead. As noted within this plan, a major goal of the team is to build and support such local capacity and commitment.

The State Hazard Mitigation Team realizes that establishing a true statewide mitigation ethic will take hard work, and quite possibly will require major paradigm shifts among many different entities. State agencies, units of local and tribal government, non-profit organizations, businesses and industries, and private citizens will have to become more involved. This plan is meant to be the first step in that direction.

The purpose of this Multi-Hazard Mitigation Plan is to:

- Serve as a consolidated, comprehensive source of statewide hazard information
- Educate government leaders and the public on their vulnerabilities
- Prioritize and promote cost-effective mitigation solutions
- Provide guidance to organizations and agencies statewide regarding hazard mitigation
- Support requests for grant funding
- Encourage long-term community sustainability
- Improve coordination of mitigation efforts across the state

Through routine monitoring and updating, this plan will remain the guide for the North Dakota State Hazard Mitigation Team to follow in accomplishing its vision of a safe and sustainable North Dakota.

2.2 Scope

The State of North Dakota Multi-Hazard Mitigation Plan was prepared to address all hazards that pose significant risk to North Dakota. Each hazard has been assessed using consistent methodology, while also providing historical background and assessing vulnerability and potential loss. In addressing North Dakota's capability to mitigate the effects of these hazards, this plan analyzes each of the relevant federal, state, local, and tribal government agencies and their applicable programs and/or policies. The mitigation strategy adopted within this plan establishes the long-term goals and objectives for the State of North Dakota and lists possible initiatives to achieve them. The strategy was developed through a tremendous amount of input from statewide mitigation stakeholders and will continue to be monitored and updated on a regular basis.

The mitigation priorities adopted within this plan address long-term permanent solutions to problems caused by hazards throughout the State of North Dakota. While these priorities may shift following a particular disaster event, they are designed to provide the mitigation team with long-term mitigation objectives and solutions. The implementation of this plan is intended to help break the continuing cycle of disaster, damage, and reconstruction, from which our citizens have been suffering, by focusing sharply on the mitigation element of the comprehensive emergency management system. This mitigation element includes policy, planning, and initiatives that will reduce the vulnerability of North Dakota communities to all identified hazards. The mitigation element also includes a strong outreach strategy that will be implemented throughout all phases of emergency management. Disaster preparedness, response, and recovery operations are not focused on within this plan but are instead covered in state and county emergency operations plans (EOPs).

2.3 Authority

The State of North Dakota Multi-Hazard Mitigation Plan has been prepared by the North Dakota Department of Emergency Services, pursuant to Section 322 of the Disaster Mitigation Act of 2000 (P.L. 106-390), which requires the state to develop mitigation plans that:

- Identify the hazards, risks, and vulnerabilities of areas in the state
- Support development of local mitigation plans
- Provide for technical assistance to local and tribal governments for mitigation planning
- Identify and prioritize mitigation actions that the state will support, as resources become available

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.

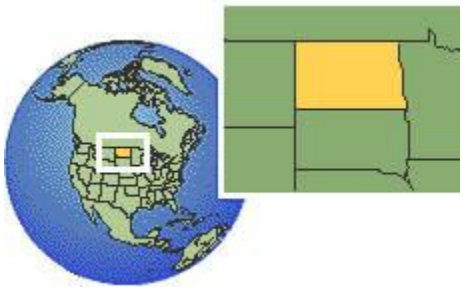
The North Dakota Century Code 37-17.1, as amended, requires the Department of Emergency Services (DES) to coordinate the development of a hazard mitigation plan. The Governor has the leadership role in the issuance of guidance to all state agencies to minimize the effects of hazards on the citizens of North Dakota. In state and federal recovery agreements following a Presidentially Declared Disaster, the

Governor, through the Department of Emergency Services, administers mitigation guidance and funding to state and local applicants.

The Disaster Mitigation Act of 2000 also 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. These plans are an integral part of this state plan and are considered appendices.

2.4 North Dakota Overview

North Dakota is located at the center of the North American continent, bounded on the north by the Canadian provinces of Manitoba and Saskatchewan, on the east by Minnesota, on the south by South Dakota, and on the west by Montana. The state is a land of prairies and cropland. Its area is 70,665 square miles, approximately 210 miles from north to south and 370 miles from east to west. North Dakota is made up of glacial deposits (drift) and former lake (lacustrine) plains formed by continental ice sheets. The state is drained through the Missouri River and the Hudson Bay drainage areas. The divide separating these two major drainage systems runs from the northwest through the central and southeastern portions of the state.



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 15 inches in the west to more than 21 inches in the southeast. 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.

Warm summers and cold winters typify the state's continental climate. July temperatures are the warmest with average temperatures ranging from 65°F in the north to 73°F in the south. January is the coldest month with average temperatures ranging from 2°F in the northeast to 17°F in the southwest. Record temperature extremes exist from –60°F at Parshall on February 15, 1936 to 121°F at Steele on July 6, 1936.

Average monthly snowfall amounts for any location in the state during the winter period of December through March are five to eight inches. Annual average snowfall in North Dakota ranges from fewer than 26 inches in the west central part of the state to about 38 inches in a belt extending diagonally across the state from the northeast corner to the southwest corner.

Weather records and tree ring studies indicate the state experiences cyclical periods of below and above average precipitation. Climatic, geomorphic, and pedologic factors may combine to reinforce periods of drought or flooding, either of which creates a potential economic catastrophe.

North Dakota has a 2009 estimated population of 646,844. The largest cities in the state include Fargo (90,056 people, 2006 estimate), Bismarck (58,333 people, 2006 estimate), Grand Forks (50,372 people, 2006 estimate), and Minot (34,745 people, 2006 estimate). The state's population ratio is about 9.3 people per square mile. (US Census Bureau, 2010a) North Dakota has three Native American reservations within its borders and shares two with South Dakota. The state is comprised of 53 counties and many incorporated cities and townships.

Agriculture is the primary land use and industry in North Dakota. Agricultural production comprises about 90 percent of the 70,655 square miles of land area. Other sectors of the economy include mining, construction, manufacturing, transportation, communications, utilities, wholesale, retail, services, finance, insurance, and real estate.

All of the factors above are important when examining the state's vulnerability to hazards. Thirteen hazards are identified in this plan as having a significant potential threat to the people, environment, and economy of North Dakota. These hazards are:

- Communicable Disease
- Dam Failure
- Drought
- Flood
- Geologic Hazards
- Hazardous Material Release
- Homeland Security Incident
- Shortage or Outage of Critical Materials or Infrastructure
- Summer Storm
- Transportation Accident
- Urban Fire or Structure Collapse
- Wildland Fire
- Winter Storm

This plan, particularly the Risk Assessment (Section 5), outlines each hazard in detail and how it may affect the State of North Dakota. A Statewide Inventory (Section 4) identifies assets and exposures throughout the state that are at risk from the hazards. The Mitigation Strategy (Section 6) outlines solutions to possibly prevent or minimize future damages. The Mitigation Implementation System (Section 7) describes the capabilities and methods used to implement mitigation projects. Each section was developed through a Planning Process (Section 3) designed to involve as many mitigation stakeholders as possible and to incorporate information from a wide variety of other plans and programs related to hazard mitigation. This plan will be monitored, evaluated, and updated as outlined in Plan Maintenance (Section 8).

Additional hazards may exist that were not apparent to the mitigation team or stakeholders through the development of this plan, and certainly, disasters can occur in unexpected ways. Although any and all hazards cannot be fully mitigated, hopefully, this plan will help North Dakotans understand the hazards better and become more disaster resistant.

3. PLANNING PROCESS

3.1 Background

The State of North Dakota Multi-Hazard Mitigation Plan represents a coordinated effort and ongoing commitment to mitigate potential losses and damages caused by the various hazards that occur in North Dakota. The plan was originally implemented in 1989 and updated in 2000, 2002, 2004, 2007, and 2010. The State of North Dakota and its political subdivisions are confronted with the possibility of natural, technological, and human caused hazards that pose a threat to the health, welfare, and security of its citizens. State, local, and tribal governments are responsible for developing and maintaining a high level of preparedness for all hazards, including response and recovery plans, training, development and management of resources; mitigation is the focus of this particular plan. This Multi-Hazard Mitigation Plan was formally adopted in March 2005 as a Standard State Plan, was revised significantly and adopted in March 2008, and updated and improved in March 2011. State adoption was through a letter signed by the Governor, as shown in Section 1, Adoption Documentation. This plan incorporates all changes associated with the implementation of the federal/state hazard mitigation programs, including the applicable sections of the Disaster Mitigation Act of 2000. The State of North Dakota Multi-Hazard Mitigation Plan is updated at least every three years, or after each disaster declaration if needed, by members of the State Hazard Mitigation Team.

The North Dakota Department of Emergency Services (DES) has actively promoted hazard mitigation since 1989. Because of the state's proactive stance on mitigation, in August 1999, North Dakota was designated the first managing state in the western United States.

The key to the development of a sound mitigation plan is the establishment of essential elements of the planning process. The following are some of the elements used to develop this plan:

- Identify the types of natural and human-caused hazards that affect the state and develop a brief history for each.
- Determine the present and future risk and vulnerability of North Dakota citizens to these hazards.
- Determine our present capability to perform hazard mitigation at the local, tribal, state, and federal levels.
- Establish and prioritize the major hazard mitigation issues that should be addressed.
- Determine mitigation measures and strategies for addressing and reducing the state's vulnerability to present and future hazards.
- Outline a system for managing and improving mitigation programs at the state level.

As mitigation planning evolves, improvements and revisions are continuously being made. Beginning in May 2007 and completing in December 2007, a major overhaul of the Multi-Hazard Mitigation Plan resulted in revisions and updates to all sections of the plan to improve readability and usefulness of the plan. Relevant information from the March 2005 edition, with changes, was used where appropriate in the new sections. New information was added to improve the sections, and dated or extraneous information was removed. These changes were made to improve the format of the plan and ensure that

federal regulations continued to be met. An additional focus was to improve the usability and credibility of the plan. Data was used that can be easily updated in the future, and whenever possible, statewide data was used to provide a consistent statewide assessment and to minimize assumptions at the state level regarding hazards and activities at the local level.

During 2010, a new hazard capturing the threat from geologic hazards was added and all sections were reviewed, evaluated, and updated, but the basic methodologies and plan layout remained the same. Further focus was added for vulnerabilities to new development. The mitigation capabilities of state, tribal, and local governments were analyzed in more detail.

Highlights of the major changes made to the plan since 2005 can be found in Appendix F.

3.2 Roles and Responsibilities

3.2.1 North Dakota Department of Emergency Services

The Department of Emergency Services (DES) is the lead agency for emergency management in the State of North Dakota. Hazard mitigation is a key component of emergency management, and therefore, the department assumes an all-hazard mitigation leadership role. The State Hazard Mitigation Officer (SHMO) is housed within the Department of Emergency Services and programs such as the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Flood Mitigation Assistance Program, and Repetitive Flood Loss Programs are managed by the SHMO and staff. Other hazard-specific programs, such as the National Flood Insurance Program and National Fire Plan, are managed by other agencies, but the responsibility of building a state mitigation plan and coordinating overall statewide hazard mitigation lies with DES.

Mitigation planning responsibilities of the North Dakota Department of Emergency Services include:

- Developing and maintaining a statewide multi-hazard mitigation plan based on significant recurring hazards affecting the state.
- Updating mitigation planning documents based on accomplishments, federal and state declared disasters or emergencies, and new information.
- Administering local and state mitigation planning grants and programs, both pre- and post-disaster.
- Coordinating activities of the State Hazard Mitigation Team and Interagency Hazard Mitigation Team.

3.2.2 Federal Emergency Management Agency

The key federal agency in hazard mitigation planning is the Federal Emergency Management Agency (FEMA). FEMA provides financial and technical assistance to states in developing mitigation plans. The agency also reviews and approves state, tribal, and local hazard mitigation plans. Following a disaster, FEMA assists the state in setting up a Disaster Field Office, conducting applicant briefings, and managing post-disaster mitigation programs. FEMA regularly provides technical assistance to the state regarding

mitigation programs and projects. During periods with high levels of disaster activity, FEMA has assisted the state with the review of local mitigation plans.

3.2.3 State Hazard Mitigation Team

North Dakota Department of Emergency Services mitigation staff reviewed state laws, executive orders, and regulations and identified state agencies that have a role or stake in natural and human caused hazard mitigation. Experience through past disasters has also demonstrated which key agencies need to be involved in mitigation. Roles of state agencies vary from regulatory enforcement to construction activities. Sixteen state agencies were identified to have a primary role in hazard mitigation planning. These agencies, designated as the State Hazard Mitigation Team members, include:

- Department of Emergency Services
- Bureau of Criminal Investigation
- Department of Agriculture
- Department of Health
- Department of Transportation
- Division of Community Services
- Forest Service
- Game and Fish Department
- Governor's Office
- Indian Affairs Commission
- National Guard
- Parks and Recreation Department
- Risk Management Division
- State Fire Marshal
- State Historical Society
- State Water Commission

Agencies are added or removed from time-to-time depending on the type of disaster or project reviews.

Responsibilities of the State Hazard Mitigation Team include:

- Coordinating pre- and post-disaster state and local hazard mitigation efforts across individual agencies.
- Working with DES and providing input in the development and maintenance of a statewide multi-hazard mitigation plan based on significant recurring hazards affecting the state.
- Recommending priorities for mitigation in the state.
- Working with the appropriate local agencies in the implementation of mitigation projects and planning initiatives.
- Ensuring that activities, programs, and policies related to hazard vulnerability and management are coordinated by state agencies and contribute to the avoidance and reduction of natural hazards.

3.2.4 Interagency Hazard Mitigation Team

The Interagency Hazard Mitigation Team (IHMT) has both federal and state agencies that convene following a Presidentially declared disaster. Representatives from the following agencies are often on the IHMT:

- SHMT Members (listed in the previous section)
- Federal Emergency Management Agency
- Congressional Offices
- Environmental Protection Agency
- Federal Highway Administration
- Housing and Urban Development
- National Weather Service
- Natural Resources Conservation Service
- Small Business Administration
- US Army Corps of Engineers
- US Department of Agriculture, Rural Development
- US Economic Development Administration
- US Fish and Wildlife Service
- US Geological Survey

Agencies may be added or removed from time-to-time depending on the type of disaster. In past disasters, other states also affected by the same disaster have participated.

Responsibilities of the Interagency Hazard Mitigation Team include:

- Reviewing conditions that led to the disaster.
- Recommending mitigation strategies specific to the disaster.
- Conducting applicant briefings.
- Leveraging project funding.

3.2.5 Local and Tribal Emergency Management Organizations

Local and tribal emergency managers typically have the responsibility for all phases of emergency management, including mitigation. Through their offices or a local planning committee, mitigation plans are written on a county, tribal, or regional scale. These organizations are responsible for writing or coordinating the development of a mitigation plan for their jurisdictions. They also manage related grants and facilitate the implementation of many mitigation activities in their area. The local and tribal emergency management organizations are encouraged to participate in and provide input on the State of North Dakota Multi-Hazard Mitigation Plan. The local and tribal mitigation plans are a critical element of the statewide plan and many of the priorities established in the state plan may have an impact on local mitigation funding.

3.2.6 Other Mitigation Stakeholders

Other organizations and agencies, such as non-profit organizations, businesses, educational institutions, citizen groups, and other federal, state, tribal, and local government agencies, also have roles and

responsibilities in mitigation planning, although their involvement may be secondary to other primary missions within their own organization. These stakeholders have a responsibility to participate in mitigation planning where most relevant, to have an awareness of mitigation planning and activities in the state and their area, and to encourage mitigation where possible within their own organizations.

3.2.7 Mitigation Planning Committees

Mitigation Planning Committees were formed, one for each identified hazard and for other key planning areas, to provide a more in-depth evaluation and analysis of the hazard information in the risk assessment and the associated mitigation initiatives. These committees allow for broader participation by agencies and organizations that have a focus or an interest in a particular hazard. Appendix A lists the individuals and agencies represented on the committees. Membership in a committee is open to all interested persons or organizations. If a logical agency was noticeably missing from the committee, an invitation to participate was extended to that organization. These committees discussed and reviewed information and initiatives specific to their hazard throughout the planning process.

3.2.8 Contractor Services

Mitigation planning is a time consuming process that involves coordination with many organizations, written documentation of a comprehensive plan, and an in-depth knowledge of regulations and best practices related to mitigation plans. To facilitate the development and updates of the 2008 and 2011 versions of the State of North Dakota Multi-Hazard Mitigation Plan, a contractor was hired. Big Sky Hazard Management LLC of Bozeman, Montana, an experienced firm in emergency management, mitigation planning, and meteorology, provided services to the State of North Dakota. Responsibilities included facilitating stakeholder meetings, writing the plan document using new data and information from the previous plan, local and tribal mitigation plans, and input from stakeholders, and ensuring the regulations related to the Disaster Mitigation Act of 2000 were met.

3.3 Workshops

On April 21, 2003, the North Dakota Division of Emergency Management (since renamed the Department of Emergency Services) convened the Interagency Hazard Mitigation Team. The purpose of this team meeting was to assign team members to review and update the eleven hazards addressed in the state's multi-hazard mitigation plan and discuss the enhanced and standard mitigation plan crosswalks prior to submission to FEMA Region VIII.

On February 8, 2004, members of the Interagency Hazard Mitigation Team convened to review the state's revised Multi-Hazard Mitigation Plan. Team members assisted DES staff with the crosswalk and provided comments to various sections of the plan. The plan was submitted and approved by FEMA as a standard plan in March 2005.

During the 2007 update of the Multi-Hazard Mitigation Plan, two stakeholder workshops were held. These workshops featured an extensive broad invitation to many new stakeholders. This broader

invitation through individual phone calls and e-mails to an expanded stakeholder list allowed for more participation in the plan's update than its original development and resulted in additional local, private, and non-profit involvement. Topics of discussion at the first workshop, held on June 19, 2007, included a history of mitigation planning in North Dakota, an overview of the updated enhancement of the plan, re-identification and categorization of the hazards, identification of new information sources, a discussion of existing mitigation programs, and a review of mitigation strategies. Hazard planning committees were established.

During the November 6, 2007 workshop, participants considered the draft sections of the plan, reviewed statewide mapping, prioritized hazards, reviewed mitigation initiatives, identified local mitigation capabilities and limitations, and discussed the integration of the final plan into other plans and documents. Notes from the 2007 workshops can be found in Appendix D. Attendance rosters are in Appendix C. A list of all invited stakeholders is in Appendix B.

Similar to the 2007 update, during the 2010 update of the plan, two stakeholder meetings were held but additional stakeholders were identified and invited to participate to encourage further local, private, and non-profit involvement and new technologies were used to allow others to participate. A list of all invited stakeholders can be found in Appendix B. The meetings were designed to provide broad overviews of the planning process and plan topics. Those interested in details of the specific elements of the plan were invited to participate in the various mitigation planning committees or through plan review.

The first meeting, held on March 3, 2010, provided a brief orientation of the definition and purpose of mitigation, outlined the plan update process, and highlighted elements of the existing plan and the methodologies used. A summary of disasters and mitigation activities during the 2008-2010 period was provided. Participants then provided input and ideas on updates to the plan and signed up for the various mitigation planning committees as a mechanism to provide more detailed feedback.

During the November 17, 2010 workshop, participants, both in attendance and via the internet, were provided with an overview of the updated plan and given the opportunity to provide comments. Notes from the 2010 workshops can be found in Appendix D. Attendance rosters are in Appendix C. A list of all invited stakeholders and their level of involvement can be found in Appendix B.

3.4 Public Participation and Comment Integration

Besides the workshops, stakeholders were given other ways to participate in the mitigation planning process. Mitigation planning committees, as outlined in Section 3.2.7, were open to any person or agency that wished to participate. The plan itself was broken into sections and individual sections were directed at specific organizations for review and comment to encourage focused participation from key stakeholders.

Public involvement to the level that is required for the local multi-hazard mitigation plans was not feasible at the state level. North Dakota's planning process utilized plans and agencies that represented the interest of the general public, and the local mitigation plans were incorporated into the state plan. A

news release was distributed to many of the newspapers, television stations, radio stations, and electronic media outlets in the state informing the public that a draft plan was available for comment. Paid public notices were run in each of the daily newspapers in the state on October 31, 2010. This public information can be found in Appendix B.

The comment period was open from October 15, 2010 to January 2, 2011. All departments in the state were sent a mailing informing them of the draft and asking for comments. Draft sections of the plan were posted on the North Dakota Department of Emergency Services website and the contractor's website. All comments received were thoroughly considered and incorporated into the plan where appropriate. If needed, the validity and relevancy of the comment was checked with subject matter experts or discussed with members of the State Hazard Mitigation Team. Comments related to response needs were not integrated into this mitigation plan, but most comments received were directly related to the plan contents or mitigation in general. A summary of all communications during the 2010 plan update, including which individuals provided comments, is located in Appendix E.

3.5 Integration of Other Plans and Programs

The State of North Dakota Multi-Hazard Mitigation Plan was developed in conjunction with other local, tribal, state, and federal agencies, non-profit organizations, businesses, and educational institutions. Those plans and programs within the state that have possible integration opportunities are listed by organization in Table 3.5A. The specific plans reviewed and incorporated into the State of North Dakota Multi-Hazard Mitigation Plan are shown in Table 3.5B.

Table 3.5A Integration of Other Plans and Programs

Organization	Existing Plans and Programs
North Dakota Aeronautics Commission	▪ Aviation Safety
North Dakota Continuum of Government Team	▪ Continuity of Operations Plan
North Dakota Department of Agriculture	▪ Animal Health
North Dakota Department of Commerce	▪ Community Services Block Grant ▪ Economic Development ▪ State Building Code
North Dakota Department of Emergency Services	▪ Multi-Hazard Mitigation Plan ▪ Disaster Recovery and Mitigation ▪ Emergency Operations Plan ▪ Homeland Security
North Dakota Department of Health	▪ Disease Prevention ▪ Public Health and Medical All Hazards Plan ▪ Pandemic Influenza Response Plan ▪ Environmental Health
North Dakota Department of Human Services	▪ Vulnerable Population Services
North Dakota Department of Mineral Resources	▪ Geologic Research ▪ Oil and Gas Drilling and Production
North Dakota Department of Public Instruction	▪ North Dakota Curriculum Standards

Table 3.5A Integration of Other Plans and Programs (continued)

Organization	Existing Plans and Programs
North Dakota Department of Transportation	▪ State Transportation Infrastructure ▪ TransAction II: North Dakota's Statewide Strategic Transportation Plan ▪ Statewide Transportation Improvement Program
North Dakota Forest Service	▪ Forestry and Fire Management
North Dakota Geographic Information Systems	▪ Geospatial Information and Data
North Dakota Highway Patrol	▪ Traffic Safety
North Dakota Indian Affairs Commission	▪ Tribal-State Relations
North Dakota Legislative Branch	▪ North Dakota Laws and Constitution
North Dakota Office of Attorney General	▪ Crime Prevention ▪ Fire Prevention ▪ Legal Review
North Dakota Office of Independent Review	▪ Workforce Safety
North Dakota Office of Management and Budget	▪ State Facility Safety ▪ Capital Complex Master Plan ▪ Fiscal Management
North Dakota Office of the Governor	▪ Executive Orders
North Dakota Parks and Recreation Department	▪ State Park Management
North Dakota Public Service Commission	▪ Utility and Mining Oversight
North Dakota State Electrical Board	▪ Electric Standards ▪ Electric Inspections
North Dakota State Historical Society	▪ Historic Preservation
North Dakota State Water Commission	▪ Atmospheric Resources ▪ State Water Management Plan ▪ Drought Disaster Livestock Water Supply ▪ National Flood Insurance Program ▪ Flood Control ▪ Dam Safety ▪ Water Supply Programs
North Dakota University System	▪ Oversight of 11 Public Colleges and Universities

Table 3.5B Integrated North Dakota Plans

Plan	Details
Capitol Complex Master Plan	The master plan for the state capitol complex in Bismarck considers all aspects of future improvements and developments to the complex. Specific to hazard mitigation, the plan considers the mitigation of hazards such as terrorism, winter storms, flood, and transportation accidents. The hazard-related recommendations are in line with the mitigation strategies listed in this plan.
Continuum of Government (COG) and Continuity of Operations Plan (COOP)	The COG/COOP development process is conducted by each agency within the state using tools developed by the state COG team. These plans discuss the people and resources needed to continue government services during times of disaster. Through the development of these response and recovery plans, mitigation activities may be identified and are encouraged to be further explored.
Emergency Operations Plan (EOP)	The state EOP addresses how the state will response when a disaster occurs. The plan does not address mitigation, but through the exercise of the plan, mitigation activities may be identified and could be implemented.
Five-Year Floodplain Management Work Plan	Elements of the state's floodplain management work plan were integrated into the state capabilities section and mitigation strategy. This work plan specifically addresses flood hazards only and the management of the Community Assistance Program (CAP) through the National Flood Insurance Program (NFIP).
Multi-Hazard Mitigation Plans	The 2007 and previous versions of the state's mitigation plan were integrated into the 2010 update where applicable and relevant. The 2010 version of the statewide mitigation plan replaces all previous versions. All local mitigation plans were reviewed; information with respect to hazard classifications, potential losses, new development, and mitigation strategies were integrated into this updated state plan.
Public Health and Medical All Hazards Plan Pandemic Influenza Response Plan	The Department of Health's plans address how public health and medical issues are coordinated through the state EOP. Similar to the state EOP, the plans address preparedness and response issues. Mitigation activities identified through the development and exercise of the plans are encouraged. The addition of a communicable disease hazard to the 2007 mitigation plan is one example of how health hazards are becoming better integrated into the state's hazard mitigation plan.

Table 3.5B Integrated North Dakota Plans (continued)

Plan	Details
TransAction II: North Dakota's Statewide Strategic Transportation Plan	The transportation plan provides a strategy for transportation improvements across the state. "Safe and secure transportation" is a primarily goal of the plan. A key strategy is the improvement of "communication, cooperation, and collaboration" processes; integration with DES initiatives is specifically listed.
State Water Commission Strategic Plan	This plan lists objectives and action plans for programs managed by the State Water Commission. Many of the objectives and actions listed in the strategic plan are reinforced in this mitigation plan.
State Water Management Plan / Water Development Reports	The water management plan and related reports give priority to flood control projects and are closely related to the flood and drought mitigation strategies listed in this all-hazard mitigation plan. Most of the state's large flood control and water supply projects are listed in these documents, as is the weather modification program. Water supply projects are the highest priority; health and safety is an alternative prioritization scheme. Many of the goals and objectives listed in the plan are compatible with those listed in this mitigation plan.

3.6 Risk Assessment Methodologies

A key step in preventing and reducing disaster losses is the development of a comprehensive understanding of the hazards that pose risks throughout North Dakota. A realistic all-hazard risk assessment based on historical data that looks at probable losses allows for cross comparisons of hazards and geographic areas and the prioritization of mitigation activities. The following terms can be found throughout this section.

Hazard:	a source of danger
Risk:	possibility of loss or injury
Vulnerability:	open to attack or damage

Source: Federal Emergency Management Agency, 2001.

This all-hazard risk assessment serves as a statewide source of hazard information for North Dakota. Local and tribal mitigation plans are more specific documents regarding hazards in a particular part of the state. Other plans and studies may be referenced and remain vital hazard documents, but each hazard has its own profile in this plan. As more data becomes available and disasters occur, the individual hazard profiles can be expanded or new hazards added. This summary of hazards identifies and describes the major hazards that threaten North Dakota. This statewide risk assessment and the

local and tribal plans are the cornerstones of the mitigation strategy and provide the basis for many of the mitigation goals, objectives, and initiatives.

The North Dakota risk assessment consists of hazard profiles that evaluate the risks from each hazard to the state. A statewide inventory describing the values at risk, such as state-owned buildings and property, critical facilities and infrastructure, population, buildings, economic values, ecologic values, historic values, social values, land uses, new development, and future development, provides background and exposure data for the risk assessment. This inventory was collected from a variety of sources across the state.

Each hazard or group of related hazards has its own *hazard profile*. A stand-alone hazard profile allows for the comprehensive analysis of each hazard from many different aspects. Each hazard profile contains the *characteristics* of the hazard containing information from specific hazard experts and a record of the hazard *history* compiled from a wide variety of databases and sources. Note that the data used was more specific and accurate than the data provided by the SHELDUS database recommended by FEMA.

Using the historical occurrence, or more specific documentation if available, a *probability and magnitude* was determined for a specific type of event. In most cases, the number of years recorded was divided by the number of occurrences, resulting in a simple past-determined recurrence interval. If the hazard lacked a definitive historical record, the probability was assessed qualitatively based on regional history or other contributing factors. If the past occurrence was not an accurate representation, general knowledge of the hazard was used to approximate the types of impacts that could be expected. The hazard frequency and impact ranges show the differentiation between high frequency, low impact events and low frequency, high impact events.

Mapping of the hazards, where spatial differences exist, allows for hazard analyses by geographic location. Some hazards, such as riverine flooding, can have varying levels of risk based on location (i.e. near the river versus far away from a river). Other hazards, such as winter storms or drought, cover larger geographic areas and the delineation of hazard areas is not typically available or useful. In many cases, values at risk are also mapped by county.

Vulnerabilities to jurisdictions were qualitatively described based on the impacts to property, population, and economic, ecologic, historic, and social values that are typically seen in a given disaster. Property impacts were primarily based on historical occurrence and probable losses. Factors used in evaluating the population impacts include the ability of people to escape from the incident without casualty and the degree of warning that could be expected for the event. In general, the loss of life and possible injuries are difficult to determine and depend on the time of day, day of the week, extent of the damage, and other hazard specific conditions. Qualitative methodologies such as comparison to previous disasters and plausible scenarios helped determine the potential losses to economic, ecologic, historic, and social values. In many cases, a dollar figure cannot be placed on values, particularly those that cannot be replaced. Therefore, these types of losses were estimated through narrative descriptions and provide some background on what may occur during a disaster.

A combination of historical data, risk data, and exposure data, if available at the county level, was used to rate each county and reservation. A rating of high, moderate-high, moderate, low-moderate, or low was assigned to each geographic area. The ratings are comparative within the hazard, and are not necessarily an indication of the hazard level when compared to other hazards. For example, a county may receive a "low" flood hazard rating when compared to other counties in the state and a "high" transportation accident hazard rating, but flood is still a greater hazard for that county than a transportation accident. These ratings are generally only useful when comparing geographic areas of the state. Inter-hazard differences are noted in the statewide hazard rankings and the individual local mitigation plans.

In addition to the statewide assessment of the counties and reservations using statewide data for each hazard, each of the counties that completed local mitigation plans conducted their own assessments. A similar approach was used for most areas; each hazard was assigned a "risk class." In many cases, the classes were based on the following criteria shown in Tables 3.6A and 3.6B. Note that some jurisdictions may have used slightly different methodologies.

Table 3.6A Local Risk Analysis Criteria

FREQUENCY	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year, or at least 1 chance in the next 10 years
Possible	1-10% probability next year, or at least 1 chance in the next 100 years
Unlikely	Less than 1% probability in the next 100 years
SEVERITY	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Table 3.6B Local Risk Analysis Classifications

		SEVERITY			
		Negligible	*Limited*	*Critical*	*Catastrophic*
FREQUENCY	*Highly Likely*	**C**	**B**	**A**	**A**
	Likely	**C**	**C**	**B**	**A**
	Possible	**D**	**C**	**B**	**B**
	Unlikely	**D**	**D**	**C**	**C**

The primary limitation with this methodology is that each county, each with their own perspectives and individuals conducting the assessments, determines its risk class for each hazard. In addition, this assessment demonstrates the variation of hazards within the county, showing which hazards have the higher disaster potential, rather than as a comparison to other counties. This information is very important for the integration of local perspectives and hazard assessments, but it does not allow for a very consistent statewide picture.

Potential losses listed in the local plans were also incorporated into the vulnerabilities to jurisdictions section. Many counties, where potential losses were listed, used an assessment conducted by North Dakota State University in 2003 and adjusted the estimates for inflation. Other counties may have used their own methodologies for estimating potential losses. Local plan updates should include updated potential losses that reflect the changes in development for their county.

Vulnerabilities of state-owned buildings and property were assessed using insurance data for "state agencies" from the North Dakota State Tornado and Fire Fund. In some cases, past claims were analyzed to show the historic losses from a particular hazard. In cases where such data was not available or useful, a descriptive analysis of the exposure of state-owned buildings and property was conducted. North Dakota does not have a comprehensive GIS database of state-owned facilities.

Vulnerabilities of critical facilities and infrastructure were similarly assessed using insurance data from the North Dakota State Fire and Tornado Fund. The entity types provided by the fund used in the critical facilities and infrastructure analyses included local government (county, city, township, airport authorities, fair associations, fire districts, park, water districts and others such as ambulance service categories), school districts (limitation: not all districts in the state are insured through the fund), universities (limitation: only includes North Dakota University System schools), and adjutant general. In cases where claims data was available, that data was included. In some cases, past claims were analyzed to show the historic losses from a particular hazard as a basis to approximate potential future losses. Given the nature of critical facilities and infrastructure, the functional losses and alternate arrangements needed typically extend beyond the structure and contents losses. These types of losses can be inferred based on the use and function of the facility. Qualitative methods were used to describe the potential losses to facilities and infrastructure not covered by the State Fire and Tornado Fund.

The assessment on the *vulnerabilities to new and future development* is based on the mechanisms currently in place to limit or regulate development in hazardous areas. Some hazards can be mitigated during development, others cannot. The impacts were assessed through a narrative on how new and future development could be impacted by the hazard given current regulations. Potential loss estimates have not changed significantly due to new development. In some cases, however, the potential losses have changed due to improvements to data used in the evaluation, improved and longer historical data, or inflation.

Many unknown variables limit the ability to quantitatively assess all aspects of a hazard with high accuracy. Therefore, *data limitations* provide a framework for identifying the missing or variable information. These limitations were determined by hazard through the risk assessment process. In some cases, the limitations may be resolved through research or data collection. If a limitation can be reasonably resolved through a mitigation project, the resolution is included in the mitigation strategy initiatives. *Other key documents* are listed since many other plans and studies exist that are important pieces of information regarding a particular hazard and often contain more data than is needed or useful in a multi-hazard plan.

At the end of the risk assessment, the *summary* brings together data from each of the hazards to show comparisons and ultimately rank the hazards statewide. The county ratings were brought together to

show the areas of the state that are most vulnerable to all hazards. The prioritization of hazards into high, moderate, and low categories is based on the classification of hazards by the individual jurisdictions in their local plans.

Due to the inherent errors possible in any disaster risk assessment, the results of the risk assessment should only be used for planning purposes and in developing projects to mitigate potential losses.

3.7 Hazard Identification

Many hazards have the potential to affect the State of North Dakota from global events to isolated, localized incidents. The only limit to the number of hazards that can be identified is one's imagination. To provide a framework for the risk assessment, hazards were identified for inclusion in this plan based on their history of resulting in disaster declarations, their inclusion in previous versions of mitigation and response plans, their inclusion in local mitigation plans, and through input and discussion by stakeholders. Closely related-hazards were grouped together for simplicity.

The 2007 plan featured updates of the hazards identified in the 2005 plan. New hazards identified in 2007 included Communicable Disease and Transportation Accident. The Terrorism/National Security Incident hazard was renamed to Homeland Security Incident. The Shortage of Critical Materials hazard was renamed to Shortage or Outage of Critical Materials or Infrastructure to broaden the scope of the profile. Structure Collapse was added to the Urban Fire hazard. Rural Fire was renamed to Wildland Fire for clarification purposes. The Mass Casualty/Fatality hazard was eliminated and integrated into the hazard profiles of the hazards that could cause mass casualties or fatalities. In 2010, a Geologic Hazards profile was added to capture the landslide, earthquake, and other geologic/mining hazards. This addition was made based on recommendations by the North Dakota Geological Survey and other stakeholders.

The 2010 hazard identification process produced a list of thirteen probable hazard groups to be profiled. Table 3.7A shows the hazards and how and why they were identified. The level of detail for each hazard correlates to the relative risk of each hazard and is limited by the amount of data available. As new hazards are identified, they can be added to the hazard list, profiled, and mitigated. Table 3.7B lists the hazards that were excluded from this plan and the reasons why. The process to identify new hazards in future plan updates should include:

- Evaluation of the identified hazards by stakeholders
- Review of other state plans and programs for other hazards identified and/or managed
- Review of local and tribal mitigation plans for other hazards identified
- Review of recent disaster history for new hazards

Table 3.7A North Dakota Major Hazards

Hazard Profile	How Identified	Why Identified
Communicable Disease (including human, animal, and plant diseases)	▪ Centers for Disease Control and Prevention ▪ ND Department of Health ▪ ND State Board of Animal Health ▪ Pandemic studies ▪ Risk Management Agency ▪ US Department of Agriculture ▪ US Census Bureau ▪ World Health Organization	▪ Global disease threat ▪ History of pandemics ▪ Dependence on agricultural economy
Dam Failure	▪ ND State Water Commission ▪ US Army Corps of Engineers	▪ Numerous dams throughout the state, including 29 high hazard dams ▪ Dam maintenance problems and extreme weather events could cause failures
Drought	▪ Drought studies ▪ Farm Service Agency ▪ High Plains Regional Climate Center ▪ National Drought Mitigation Center ▪ ND State Climate Office ▪ ND State Water Commission ▪ Risk Management Agency ▪ US Department of Agriculture	▪ History of droughts ▪ Importance of large water users and agriculture to the state's economy ▪ Numerous USDA disaster declarations and state declared disasters and emergencies
Flood (including riverine, closed basin, ice jam, and flash floods)	▪ Federal Emergency Management Agency ▪ National Climatic Data Center ▪ ND Department of Emergency Services ▪ ND State Fire and Tornado Fund ▪ ND State Water Commission ▪ US Army Corps of Engineers ▪ US Geological Survey	▪ Extensive history of severe riverine floods and high losses ▪ History of damaging ice jam and flash floods ▪ Ongoing, persistent closed basin flooding ▪ Numerous Presidential disaster declarations for flooding
Geologic Hazards (including landslide, earthquake, and other geologic/mining hazards)	▪ National Earthquake Hazards Reduction Program ▪ ND Geological Survey ▪ US Geological Survey	▪ History of landslide losses ▪ Increase in mining activity and related geologic hazards ▪ Potential for minor earthquake losses
Hazardous Material Release	▪ Environmental Protection Agency ▪ National Transportation Safety Board ▪ ND Department of Emergency Services ▪ ND State Fire and Tornado Fund ▪ US Department of Transportation	▪ History of major hazardous material releases ▪ Highways, railroads, airports, pipelines, and fixed facilities exist throughout the state ▪ Regular truck and rail traffic transport hazardous materials through the state ▪ Numerous fixed facilities house chemicals, gases, and explosives

Table 3.7A North Dakota Major Hazards (continued)

Hazard Profile	How Identified	Why Identified
Homeland Security Incident	▪ Anti-Defamation League ▪ Federal Bureau of Investigations ▪ National Memorial for the Prevention of Terrorism ▪ ND Department of Emergency Services ▪ ND State Fire and Tornado Fund ▪ Southern Poverty Law Center	▪ National indications and foreign threats of future terrorist attacks ▪ Critical national infrastructure, including intercontinental ballistic missiles, exists within the state ▪ Potential for school violence and other domestic attacks
Shortage or Outage of Critical Materials or Infrastructure	▪ ND Department of Emergency Services ▪ ND Public Service Commission ▪ Stakeholder input	▪ Daily and operational dependence on utilities, fuel, and communications ▪ History of power, communication, and water outages ▪ History of critical material shortages
Summer Storm (including tornadoes, hail, downbursts, strong winds, and lightning)	▪ National Climatic Data Center ▪ National Severe Storms Laboratory ▪ National Weather Service ▪ ND Atmospheric Resources Board ▪ ND Department of Emergency Services ▪ ND State Fire and Tornado Fund ▪ Storm Prediction Center	▪ Extensive history of damaging tornadoes, hail, downbursts, lightning, and strong winds throughout the state ▪ Numerous Presidential disaster declarations for severe storms
Transportation Accident (including vehicular, railway, and aircraft accidents)	▪ Federal Railroad Administration ▪ National Transportation Safety Board ▪ ND Department of Transportation	▪ Potential for a serious accident involving multiple patients ▪ History of highway closures ▪ History of railroad accidents ▪ History of small plane crashes
Urban Fire or Structure Collapse	▪ National Fire Protection Association ▪ ND Fire Marshal ▪ ND State Fire and Tornado Fund ▪ US Fire Administration	▪ History of major downtown urban fires ▪ History of structure collapses under heavy snow loads ▪ Potential for structure collapses for a variety of reasons
Wildland Fire	▪ ND Department of Emergency Services ▪ ND Fire Marshal ▪ ND Forest Service	▪ History of large and damaging wildland fires ▪ Scattered government lands and natural fuels throughout the state
Winter Weather (including blizzards, heavy snow, ice storms, and extreme cold)	▪ National Climatic Data Center ▪ National Weather Service ▪ ND Department of Emergency Services ▪ ND State Fire and Tornado Fund	▪ History of blizzards, severe winter storms, heavy snow, ice storms, and extreme wind chills ▪ High probability of blizzards and other potentially damaging storms ▪ Numerous Presidential disaster declarations for severe winter storms

Table 3.7B Hazards Excluded from or Minimally Addressed in this 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.
Extreme Heat	▪ North Dakota does experience high summertime temperatures, but the impacts generally do not exceed local capabilities. ▪ North Dakota does not have a history of any declared state or federal extreme heat disasters. ▪ Some elements of the extreme heat hazard are included in the drought hazard profile and mitigation strategy.
Hurricane	▪ North Dakota does not have an ocean coastline, nor is it located in a potential hurricane impact area.
Levee Failure	▪ North Dakota does have a levee failure hazard, but the hazard areas, history, impacts, and mitigation strategies are addressed through the flood and dam failure hazards.
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.

4. STATEWIDE INVENTORY

In addition to identifying and understanding the hazards that could impact North Dakota, an important aspect of mitigation planning is contemplating the effects such hazards may have on critical facilities, state-owned buildings, and the communities. To thoroughly consider the effects, the assets and values at risk must be first identified. Examples of these assets include the population, state-owned structures, critical facilities and infrastructure, businesses, residences, natural resources, historic places, and the economy. The following sections inventory these assets and values.

4.1 State-Owned Buildings and Property

The State of North Dakota has a specific interest in protecting facilities and property owned by the state. Disasters can damage not only private property, but government property as well, placing a financial and operational burden on the state. Losses can extend from structures and contents to the interruption of services and the general economy.

The North Dakota Insurance Department, State Fire and Tornado Fund provides affordable building and business personal property insurance coverage to state entities and political subdivisions of the state. Through this coverage, the department maintains a list of state-owned buildings that is updated annually, including building property (structure) value (BP), personal property (contents) value (PP), outdoor property value (OP), and trailer property value (TP). These values are either replacement values (RV) or actual cash values (ACV). In some cases, the state may lease a property, and therefore, personal property (contents) values may be listed but the building property (structure) value may not, since the structure is not owned by the state. The State Fire and Tornado Fund does not provide flood insurance, and therefore, does not have flood certificates available for state-owned buildings.

Whenever practicable, buildings and contents are insured for their replacement cost. Because some buildings in North Dakota are old structures, they can no longer be insured for their replacement cost, so they are insured for the actual cash value of the building. This can also apply to some contents as well. Whenever a building or contents are listed as being insured for the actual cash value only, it is understood that the repairs or replacement cost caused by damage from a hazard event could far exceed the insured value of the structure. This is a recognized limitation, but the State Fire and Tornado Fund offers the most complete and accurate account of the value of state-owned structures and their contents.

The database does not contain the latitudes and longitudes of the properties, but does provide an address and county. Geographic Information System (GIS) data for state-owned facilities has not been developed. The value of the state-owned buildings and property were assessed at the county geographic level. Table 4.1A and Map 4.1C show the values of state-owned buildings and property, not including National Guard property (see Section 4.2) or University/College property (see Section 4.2).

Table 4.1A North Dakota State-Owned Building and Property Values by County

County	Building Property (Structure) Value	Personal Property (Contents) Value	Outdoor Property Value	Trailer Property Value
North Dakota	*$852,259,861*	*$197,256,881*	*$33,063,108*	*$143,782*
Adams	$182,318	$72,022	$1,036,513	$0
Barnes	$12,044,156	$2,441,189	$207,967	$0
Benson	$1,936,864	$68,530	$77,175	$0
Billings	$2,596,022	$196,374	$1,438,375	$6,757
Bottineau	$2,573,227	$580,485	$193,447	$0
Bowman	$356,289	$545,640	$1,096,969	$0
Burke	$132,753	$196,804	$210,284	$5,121
Burleigh	$371,471,697	$125,197,471	$6,644,637	$51,900
Cass	$18,977,335	$8,964,210	$325,832	$6,331
Cavalier	$523,183	$259,167	$209,717	$0
Dickey	$397,945	$257,348	$285,142	$0
Divide	$432,120	$192,689	$116,272	$0
Dunn	$4,659,688	$424,695	$763,419	$7,436
Eddy	$0	$55,955	$0	$0
Emmons	$310,327	$214,557	$188,441	$0
Foster	$485,812	$192,900	$193,447	$0
Golden Valley	$1,994,141	$266,512	$991,742	$0
Grand Forks	$21,203,189	$7,907,121	$366,493	$0
Grant	$79,070	$181,944	$363,554	$0
Griggs	$791,263	$123,275	$186,061	$0
Hettinger	$2,229,582	$226,455	$3,910,511	$0
Kidder	$298,022	$45,871	$77,175	$0
LaMoure	$482,314	$46,353	$0	$0
Logan	$538,280	$62,211	$154,350	$0
McHenry	$1,652,669	$384,046	$162,821	$0
McIntosh	$738,518	$259,336	$193,447	$0
McKenzie	$182,747	$208,588	$193,447	$0
McLean	$9,681,927	$1,959,047	$270,622	$0
Mercer	$6,078,970	$200,170	$1,228,077	$5,833
Morton	$29,942,093	$7,299,876	$971,652	$0
Mountrail	$1,384,654	$751,258	$342,480	$8,038
Nelson	$604,274	$242,705	$270,622	$0
Oliver	$1,079,943	$321,236	$209,352	$5,121
Pembina	$6,496,815	$506,448	$154,350	$26,132
Pierce	$123,298	$122,971	$77,175	$0
Ramsey	$23,711,323	$4,594,649	$349,136	$0
Ransom	$17,580,691	$1,744,320	$34,452	$0
Renville	$62,548	$41,159	$77,175	$0

Table 4.1A North Dakota State-Owned Building and Property Values by County (continued)

County	Building Property (Structure) Value	Personal Property (Contents) Value	Outdoor Property Value	Trailer Property Value
Richland	$2,455,867	$521,892	$129,433	$0
Rolette	$10,772,150	$1,491,907	$207,967	$0
Sargent	$134,290	$176,845	$130,792	$0
Sheridan	$382,294	$184,908	$193,447	$0
Sioux	$154,184	$62,223	$77,175	$21,113
Slope	$0	$12,301	$0	$0
Stark	$12,877,749	$4,204,016	$3,155,117	$0
Steele	$174,630	$192,128	$193,447	$0
Stutsman	$144,399,505	$8,439,677	$1,900,254	$0
Towner	$128,822	$57,792	$77,175	$0
Traill	$328,861	$140,467	$111,281	$0
Walsh	$66,324,219	$5,302,704	$157,350	$0
Ward	$58,623,827	$5,681,180	$2,639,963	$0
Wells	$2,796,978	$379,405	$154,350	$0
Williams	$8,690,418	$3,053,849	$363,026	$0

Source: North Dakota State Fire and Tornado Fund, 2010.

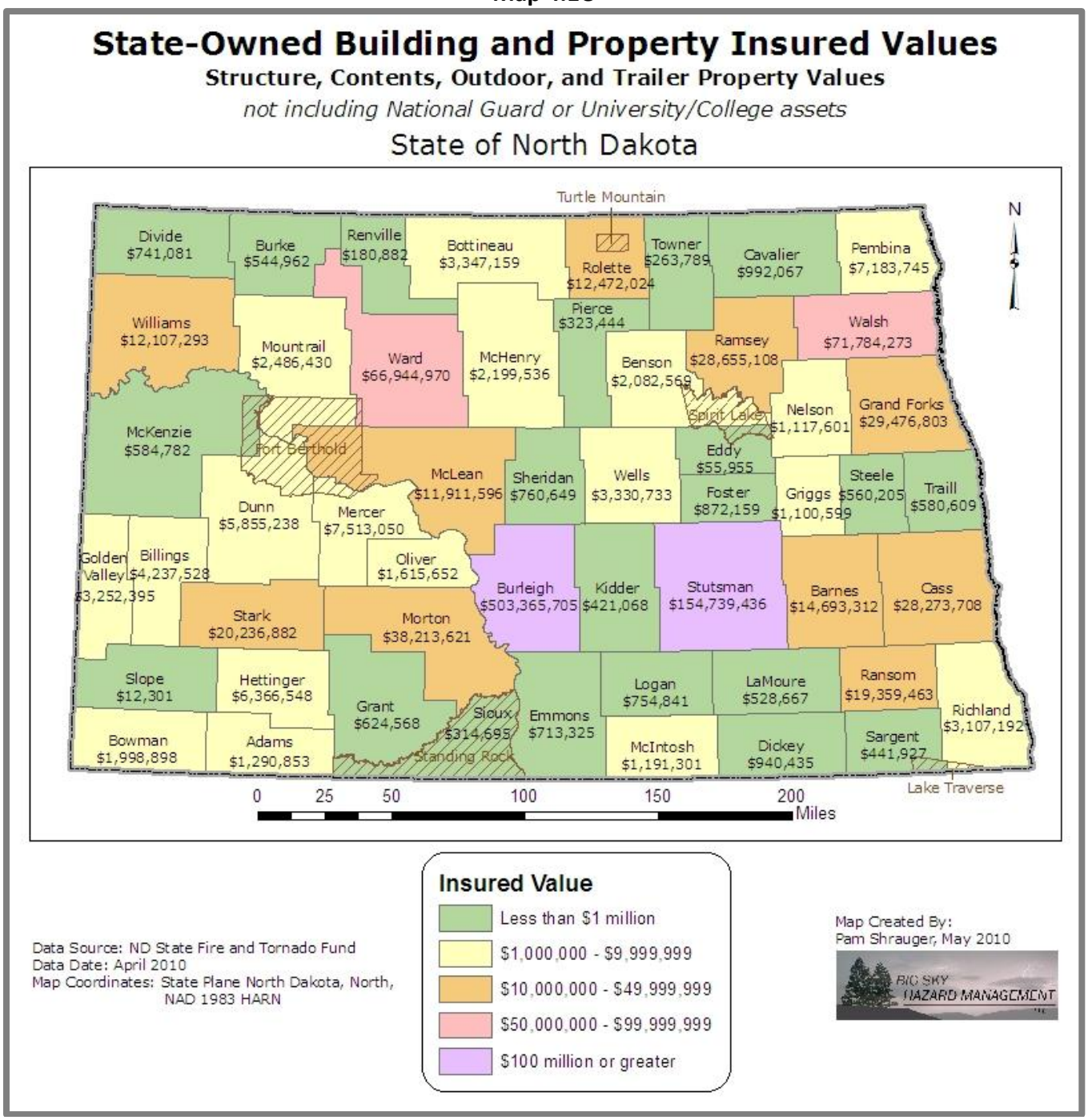
The counties with the highest total values of structure, contents, outdoor property, and trailer property are shown in Table 4.1B along with a summary of the major state-owned complexes.

Table 4.1B North Dakota Counties with the Highest Insured Values of State-Owned Buildings and Property

County	Primary City	Major State Facilities/Complexes
Burleigh County	Bismarck	North Dakota State Capitol Complex Main Offices for Most State Agencies North Dakota State Penitentiary Missouri River Correctional Center
Stutsman County	Jamestown	North Dakota State Hospital James River Correctional Center
Walsh County	Grafton	North Dakota State Developmental Center
Ward County	Minot	North Dakota State Fair Center
Morton County	Mandan	North Dakota Youth Correctional Center Fort Abraham Lincoln State Park

Source: North Dakota State Fire and Tornado Fund, 2010.

Map 4.1C


State-Owned Building and Property Insured Values
Structure, Contents, Outdoor, and Trailer Property Values
not including National Guard or University/College assets
State of North Dakota
Turtle Mountain
N
Divide $741,081
Burke $544,962
Renville $180,882
Bottineau $3,347,159
Rolette $12,472,024
Towner $263,789
Cavalier $992,067
Pembina $7,183,745
Williams $12,107,293
Mountrail $2,486,430
Ward $66,944,970
McHenry $2,199,536
Pierce $323,444
Benson $2,082,569
Ramsey $28,655,108
Walsh $71,784,273
Spirit Lake
Nelson $1,117,601
Grand Forks $29,476,803
McKenzie $584,782
Fort Berthold
Eddy $55,955
McLean $11,911,596
Sheridan $760,649
Wells $3,330,733
Foster $872,159
Griggs $1,100,599
Steele $560,205
Traill $580,609
Dunn $5,855,238
Mercer $7,513,050
Golden Valley $3,252,395
Billings $4,237,528
Oliver $1,615,652
Burleigh $503,365,705
Kidder $421,068
Stutsman $154,739,436
Barnes $14,693,312
Cass $28,273,708
Stark $20,236,882
Morton $38,213,621
Slope $12,301
Hettinger $6,366,548
Grant $624,568
Sioux $314,695
Standing Rock
Emmons $713,325
Logan $754,841
LaMoure $528,667
Ransom $19,359,463
Richland $3,107,192
Bowman $1,998,898
Adams $1,290,853
McIntosh $1,191,301
Dickey $940,435
Sargent $441,927
Lake Traverse
0 25 50 100 150 200 Miles
Insured Value
Less than $1 million
$1,000,000 - $9,999,999
$10,000,000 - $49,999,999
$50,000,000 - $99,999,999
$100 million or greater
Data Source: ND State Fire and Tornado Fund
Data Date: April 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, May 2010
BIG SKY HAZARD MANAGEMENT

4.2 Critical Facilities and Infrastructure

During or following a disaster, some facilities become exceedingly important in protecting the safety of the population, the continuity of government, or the continued delivery of essential community services; these facilities can be termed "critical facilities." Utilities such as electricity, heating fuel, telephone, water, sewer, communications, and transportation rely on established infrastructure to provide services. The providers of these services use a variety of systems to ensure consistent service throughout the state. Each of these services is important to daily life in North Dakota, and in some cases, is critical to the protection of life and property; therefore, this infrastructure can be termed "critical infrastructure."

The "critical facilities and infrastructure" interpretation used in this plan is somewhat different than other definitions used because of security, proprietary, and practical reasons. For example, the US Department of Homeland Security definition of "critical infrastructure" is "systems and assets, whether physical or virtual, so vital that the incapacity or destruction of such may have a debilitating impact on the security, economy, public health or safety, environment, or any combination of these matters, across any Federal, State, regional, territorial, or local jurisdiction." (US Department of Homeland Security, 2009) Based on this definition, the federal government has a set of criteria it uses to collect critical infrastructure data. Similarly, the state has its own set of criteria that is more specific to the state's resources.

As a public document, this plan is somewhat limited in the amount of detail it provides related to critical facilities and infrastructure. For the most part, publicly available data sources have been used to describe and quantify the critical facilities and infrastructure in the state. Since much of the nation's critical infrastructure is owned and managed by private entities, this infrastructure is not well represented in this plan because of the proprietary nature of the infrastructure. These sectors include energy production, transmission, and distribution, food production and distribution, telecommunications distribution, information technology development and distribution, and large public gathering places. A summation by county was provided for some sectors by the North Dakota Critical Infrastructure Program.

When developing the critical facilities and infrastructure list for this plan, the critical facilities listed in local Multi-Hazard Mitigation Plans were considered and included where and if applicable, but generally, the local plans contain more facilities and more specific data on the facilities. By generalizing the data to the county level using publically available data, this allowed for a more consistent statewide approach and also provided some measure of protection for those with security concerns.

Several data sources were used to analyze the level of critical facilities by county, including previous versions of the North Dakota Multi-Hazard Mitigation Plan, North Dakota Critical Infrastructure Program data, North Dakota Fire and Tornado Fund data, and internet research. Using these sources, the critical facilities and infrastructure can be assessed by county in a very general sense with several limitations. As one would expect, the level of critical facilities and infrastructure in an area generally trends with the population of that area.

The data collected by the state and federal government through the North Dakota Critical Infrastructure Program, including the criteria used, are protected for security reasons and cannot be directly published in a public plan such as this. However, a summary has been provided and is shown in Table 4.2A and Map 4.2B. The sectors are generally defined as follows:

- Food / Agriculture: major food distribution centers
- Energy: power generation and chemical facilities
- Public Health: hospitals and public health offices
- Transportation: bridges and major highways
- Emergency Services: police, fire and dispatch centers
- Communications: major communications towers
- Water: treatment facilities

Source: North Dakota Department of Emergency Services, 2010a.

Table 4.2A Summation of Selected North Dakota Critical Infrastructure Program Data

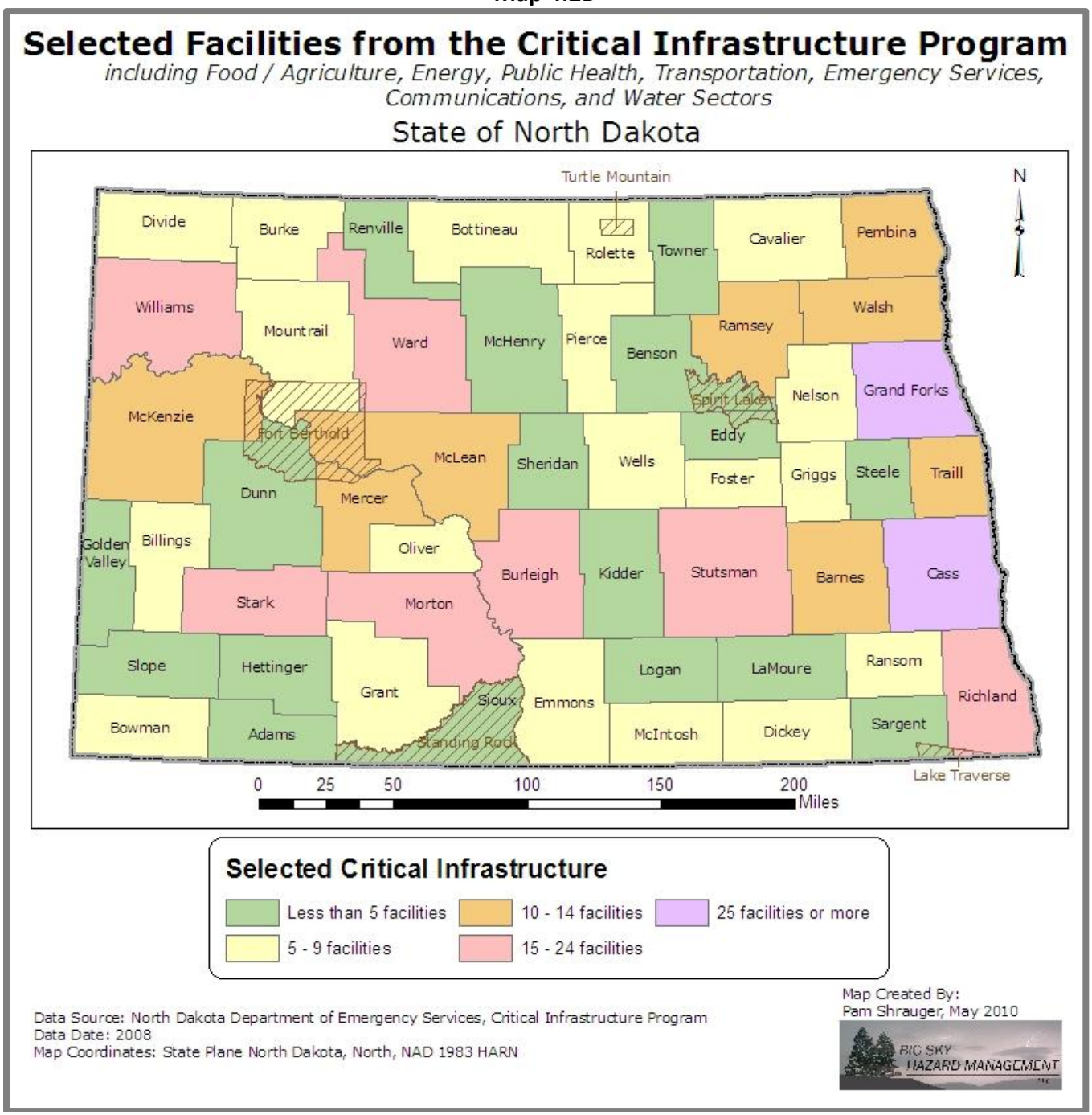
County	Number of Facilities by Sector							TOTAL
	Food / Agriculture	Energy	Public Health	Transportation	Emergency Services	Communications	Water	
North Dakota	*13*	*27*	*95*	*136*	*121*	*44*	*35*	*471*
Adams	0	0	2	1	1	0	0	4
Barnes	0	1	2	2	3	1	2	11
Benson	0	0	1	2	1	0	0	4
Billings	0	0	1	7	1	0	0	9
Bottineau	0	1	1	1	2	1	0	6
Bowman	0	0	2	2	2	1	0	7
Burke	0	1	1	1	1	1	0	5
Burleigh	1	2	3	8	4	3	2	23
Cass	3	0	3	21	5	3	4	39
Cavalier	0	0	2	0	2	1	1	6
Dickey	0	0	2	1	2	1	0	6
Divide	0	0	2	1	2	1	0	6
Dunn	0	0	1	1	1	1	0	4
Eddy	0	0	1	1	1	0	0	3
Emmons	0	0	2	1	2	1	0	6
Foster	0	0	2	0	2	1	0	5
Golden Valley	0	0	1	1	1	1	0	4
Grand Forks	2	2	3	9	6	2	3	27
Grant	0	0	2	0	2	1	0	5
Griggs	0	0	2	0	2	1	0	5

Table 4.2A Summation of selected North Dakota Critical Infrastructure Program Data (continued)

County	Number of Facilities by Sector							TOTAL
	Food / Agriculture	Energy	Public Health	Transportation	Emergency Services	Communications	Water	
Hettinger	0	0	1	1	1	1	0	4
Kidder	0	0	1	1	1	1	0	4
LaMoure	0	0	1	1	2	0	0	4
Logan	1	0	1	0	2	0	0	4
McHenry	0	0	1	1	1	0	0	3
McIntosh	0	0	3	0	2	1	0	6
McKenzie	0	1	2	7	2	1	0	13
McLean	0	2	3	2	2	2	1	12
Mercer	0	4	2	0	4	0	1	11
Morton	2	4	2	7	3	1	2	21
Mountrail	0	0	3	1	5	0	0	9
Nelson	0	0	2	1	1	1	0	5
Oliver	0	2	1	2	1	1	0	7
Pembina	0	0	2	5	3	0	1	11
Pierce	0	0	2	1	3	0	1	7
Ramsey	0	0	2	4	3	1	1	11
Ransom	0	0	2	0	2	0	1	5
Renville	0	0	2	1	1	0	0	4
Richland	0	0	1	8	3	1	3	16
Rolette	0	0	3	1	3	1	0	8
Sargent	0	0	1	0	2	1	0	4
Sheridan	0	0	1	0	1	1	0	3
Sioux	0	0	1	0	1	0	0	2
Slope	0	1	0	1	1	0	0	3
Stark	1	1	3	6	4	1	2	18
Steele	0	0	1	0	1	1	0	3
Stutsman	1	2	2	7	3	1	3	19
Towner	0	0	1	1	2	0	0	4
Traill	1	0	3	2	4	1	0	11
Walsh	0	0	3	2	3	0	2	10
Ward	1	0	3	8	5	3	2	22
Wells	0	0	2	1	2	0	1	6
Williams	0	3	1	4	4	2	2	16

Source: North Dakota Department of Emergency Services, 2010a.

Map 4.2B


Selected Facilities from the Critical Infrastructure Program
including Food / Agriculture, Energy, Public Health, Transportation, Emergency Services, Communications, and Water Sectors
State of North Dakota
Turtle Mountain
N
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
0 25 50 100 150 200
Miles
Selected Critical Infrastructure
Less than 5 facilities
10 - 14 facilities
25 facilities or more
5 - 9 facilities
15 - 24 facilities
Map Created By:
Pam Shrauger, May 2010
Data Source: North Dakota Department of Emergency Services, Critical Infrastructure Program
Data Date: 2008
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
BIG SKY
HAZARD MANAGEMENT

The North Dakota Fire and Tornado Fund provides insurance not only to state government (as was described in Section 4.1), but to local government and districts as well. In fact, most facilities and infrastructure owned by county government are insured through the North Dakota Fire and Tornado Fund. Many cities and townships are as well. Therefore, this data source provides a nearly complete assessment of the replacement values of local government facilities. Certainly all facilities owned by local governments may not be considered critical, but many are. Therefore, the insurance data for counties, cities, townships, airport authorities, fair associations, fire districts, water districts and others such as ambulance services are summarized in Table 4.2C and Map 4.2D. The types of facilities and infrastructure covered by this list includes county courthouses, city halls, community centers, well and pump houses, communications buildings, towers, and equipment, police stations, emergency operations centers, ambulance buildings, road shops, lift stations, fairgrounds, jails, park facilities, water and wastewater treatment plants, fire stations, museums, warning sirens, municipal airport facilities, and storage buildings. Not all facilities or jurisdictions may use the State Fire and Tornado Fund for insurance but most do.

Table 4.2C Critical Facilities and Infrastructure at the Local Government Level

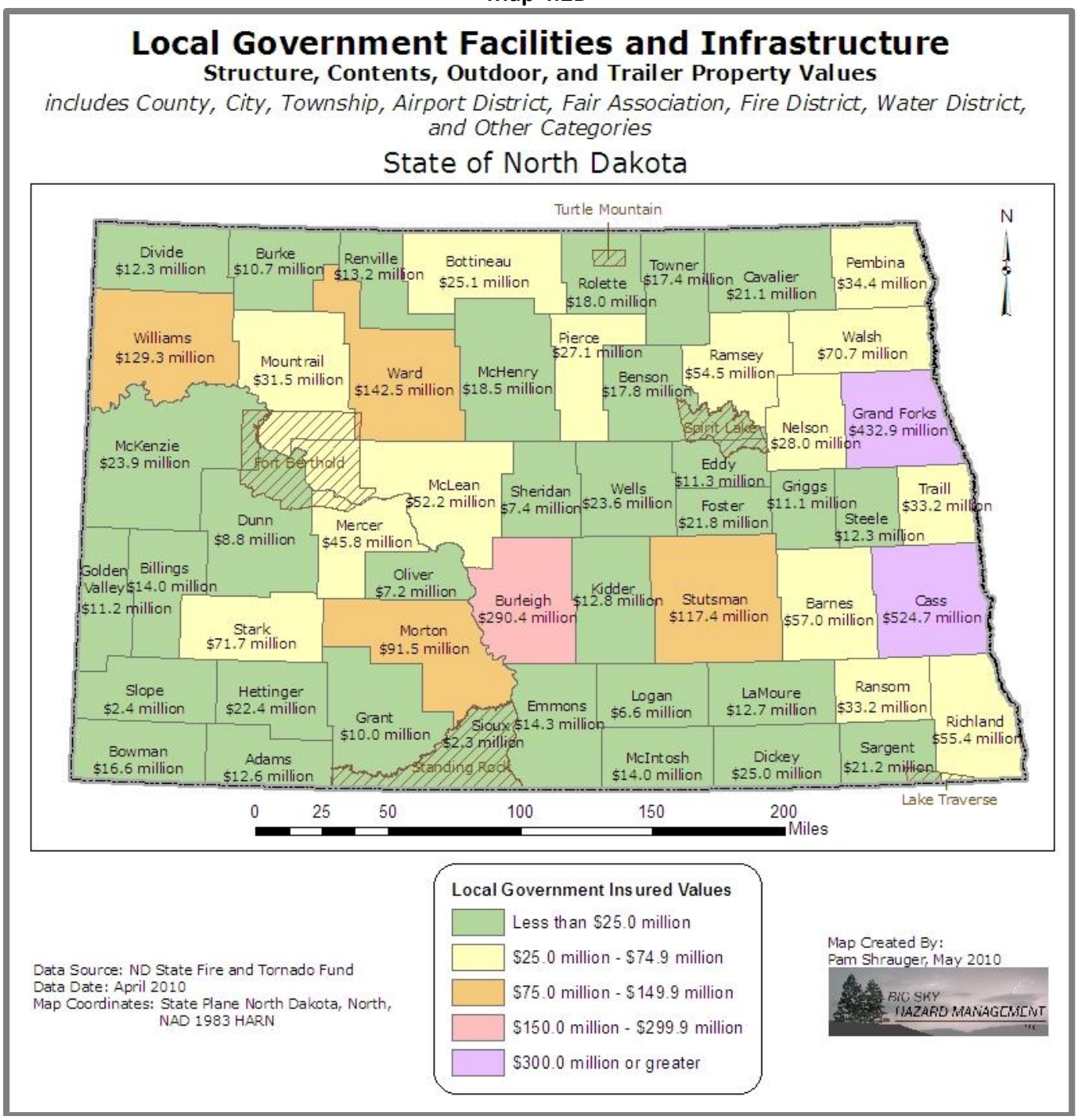
County	Building Property (Structure) Value	Personal Property (Contents) Value	Outdoor Property Value	Trailer Property Value
North Dakota	*$2,240,083,284*	*$262,621,806*	*$300,059,245*	*$117,270*
Adams	$10,250,648	$1,468,688	$864,846	$0
Barnes	$45,675,213	$6,232,633	$5,074,259	$0
Benson	$13,285,879	$1,556,158	$2,945,927	$0
Billings	$11,200,207	$2,358,651	$397,745	$0
Bottineau	$20,297,351	$1,905,121	$2,928,710	$0
Bowman	$12,948,068	$2,668,835	$1,002,727	$0
Burke	$7,030,223	$1,373,309	$2,256,179	$0
Burleigh	$255,576,589	$26,150,828	$8,605,163	$54,985
Cass	$408,921,685	$43,370,889	$72,418,127	$0
Cavalier	$16,503,856	$2,404,118	$2,177,068	$0
Dickey	$20,612,631	$1,763,323	$2,578,612	$0
Divide	$10,488,244	$970,358	$829,930	$0
Dunn	$6,229,604	$1,793,105	$771,295	$0
Eddy	$8,687,380	$1,110,933	$1,492,163	$0
Emmons	$10,903,353	$1,779,157	$1,663,637	$0
Foster	$18,500,676	$1,928,401	$1,367,728	$0
Golden Valley	$8,257,734	$1,411,632	$1,570,545	$0
Grand Forks	$366,950,470	$15,888,169	$50,001,519	$16,940
Grant	$7,867,111	$723,845	$1,445,111	$0
Griggs	$8,104,898	$1,854,974	$1,113,708	$0
Hettinger	$18,485,909	$2,807,132	$1,094,942	$0
Kidder	$10,192,597	$1,930,276	$637,578	$0
LaMoure	$10,722,767	$598,821	$1,390,002	$0
Logan	$4,843,217	$503,055	$1,264,617	$0

Table 4.2C Critical Facilities and Infrastructure at the Local Government Level (continued)

County	Building Property (Structure) Value	Personal Property (Contents) Value	Outdoor Property Value	Trailer Property Value
McHenry	$14,086,871	$1,979,218	$2,430,866	$0
McIntosh	$10,810,251	$1,176,836	$1,980,645	$0
McKenzie	$18,998,333	$3,487,036	$1,379,186	$12,075
McLean	$41,274,926	$5,041,860	$5,881,466	$4,266
Mercer	$34,443,370	$5,506,389	$5,846,449	$1,293
Morton	$75,054,209	$7,820,306	$8,660,378	$0
Mountrail	$26,706,976	$3,280,718	$1,510,145	$5,406
Nelson	$21,359,048	$3,855,283	$2,762,307	$7,496
Oliver	$5,286,712	$759,700	$1,132,046	$0
Pembina	$26,912,717	$4,428,458	$3,080,476	$3,097
Pierce	$23,651,479	$1,880,144	$1,607,182	$0
Ramsey	$44,727,817	$5,250,205	$4,527,132	$6,538
Ransom	$24,413,651	$1,908,135	$6,868,975	$0
Renville	$9,290,346	$2,517,112	$1,343,323	$0
Richland	$40,565,856	$6,591,786	$8,215,708	$0
Rolette	$14,281,170	$1,868,965	$1,891,768	$0
Sargent	$16,762,828	$1,595,926	$2,877,740	$0
Sheridan	$5,962,678	$596,449	$836,345	$0
Sioux	$1,603,447	$228,911	$509,472	$5,174
Slope	$1,708,929	$540,910	$140,747	$0
Stark	$53,611,655	$8,207,393	$9,879,507	$0
Steele	$9,822,437	$1,051,582	$1,378,162	$0
Stutsman	$88,879,957	$6,152,838	$22,394,648	$0
Towner	$14,283,603	$872,216	$2,212,450	$0
Traill	$27,289,565	$2,741,934	$3,196,347	$0
Walsh	$57,597,220	$9,239,449	$3,837,219	$0
Ward	$91,921,687	$33,063,954	$17,537,835	$0
Wells	$15,934,320	$4,378,642	$3,323,886	$0
Williams	$110,304,916	$12,047,040	$6,924,697	$0

Source: North Dakota State Fire and Tornado Fund, 2010.

Map 4.2D


Local Government Facilities and Infrastructure
Structure, Contents, Outdoor, and Trailer Property Values
includes County, City, Township, Airport District, Fair Association, Fire District, Water District, and Other Categories
State of North Dakota
Turtle Mountain
N
Divide $12.3 million
Burke $10.7 million
Renville $13.2 million
Bottineau $25.1 million
Rolette $18.0 million
Towner $17.4 million
Cavalier $21.1 million
Pembina $34.4 million
Williams $129.3 million
Mountrail $31.5 million
Ward $142.5 million
McHenry $18.5 million
Pierce $27.1 million
Benson $17.8 million
Ramsey $54.5 million
Walsh $70.7 million
Spirit Lake
Nelson $28.0 million
Grand Forks $432.9 million
McKenzie $23.9 million
Fort Berthold
McLean $52.2 million
Sheridan $7.4 million
Wells $23.6 million
Eddy $11.3 million
Foster $21.8 million
Griggs $11.1 million
Steele $12.3 million
Traill $33.2 million
Dunn $8.8 million
Mercer $45.8 million
Golden Valley $11.2 million
Billings $14.0 million
Oliver $7.2 million
Burleigh $290.4 million
Kidder $12.8 million
Stutsman $117.4 million
Barnes $57.0 million
Cass $524.7 million
Stark $71.7 million
Morton $91.5 million
Slope $2.4 million
Hettinger $22.4 million
Grant $10.0 million
Sioux $2.3 million
Emmons $14.3 million
Logan $6.6 million
LaMoure $12.7 million
Ransom $33.2 million
Richland $55.4 million
Bowman $16.6 million
Adams $12.6 million
Standing Rock
McIntosh $14.0 million
Dickey $25.0 million
Sargent $21.2 million
Lake Traverse
0 25 50 100 150 200 Miles
Local Government Insured Values
Less than $25.0 million
$25.0 million - $74.9 million
$75.0 million - $149.9 million
$150.0 million - $299.9 million
$300.0 million or greater
Data Source: ND State Fire and Tornado Fund
Data Date: April 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, May 2010
BIG SKY HAZARD MANAGEMENT

Other important critical facilities include specific state-owned facilities and hospitals/trauma centers. Section 4.1 provides an overview of all state-owned facilities but those deemed particularly critical are listed in Table 4.2E. The hospitals were selected based on their trauma designation (Level II) by the American College of Surgeons.

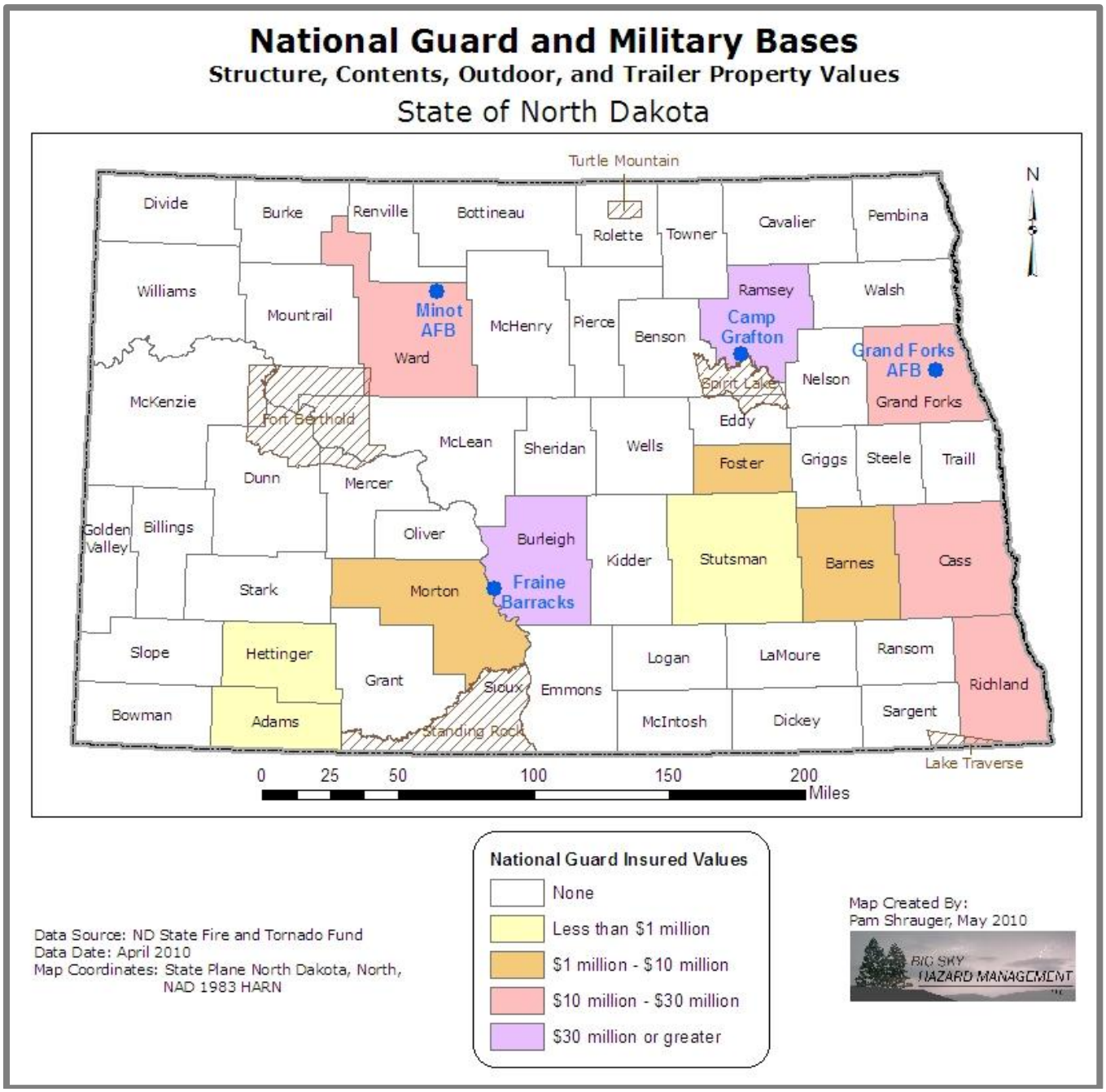
Table 4.2E Critical Facilities – State-Owned Facilities and Hospitals

Facility	County
State-Owned Facilities	
State Capitol Complex and State Offices	Burleigh
State Emergency Operations Center/Fusion Center	Burleigh
State Bureau of Criminal Investigation Lab	Burleigh
Bank of North Dakota	Burleigh
State Department of Health Lab and Morgue	Burleigh
Hospitals	
Medcenter One, Inc.	Burleigh
St. Alexius Medical Center	Burleigh
Innovis Health	Cass
MeritCare Hospital	Cass
Altru Health System	Grand Forks
Trinity Hospital	Ward

Sources: North Dakota State Fire and Tornado Fund, 2010; American College of Surgeons, 2010.

The North Dakota Fire and Tornado Fund also maintains records for the Adjutant General, or the National Guard. Map 4.2F shows the counties in which these assets are located and also shows the two US Air Force bases in the state.

Map 4.2F



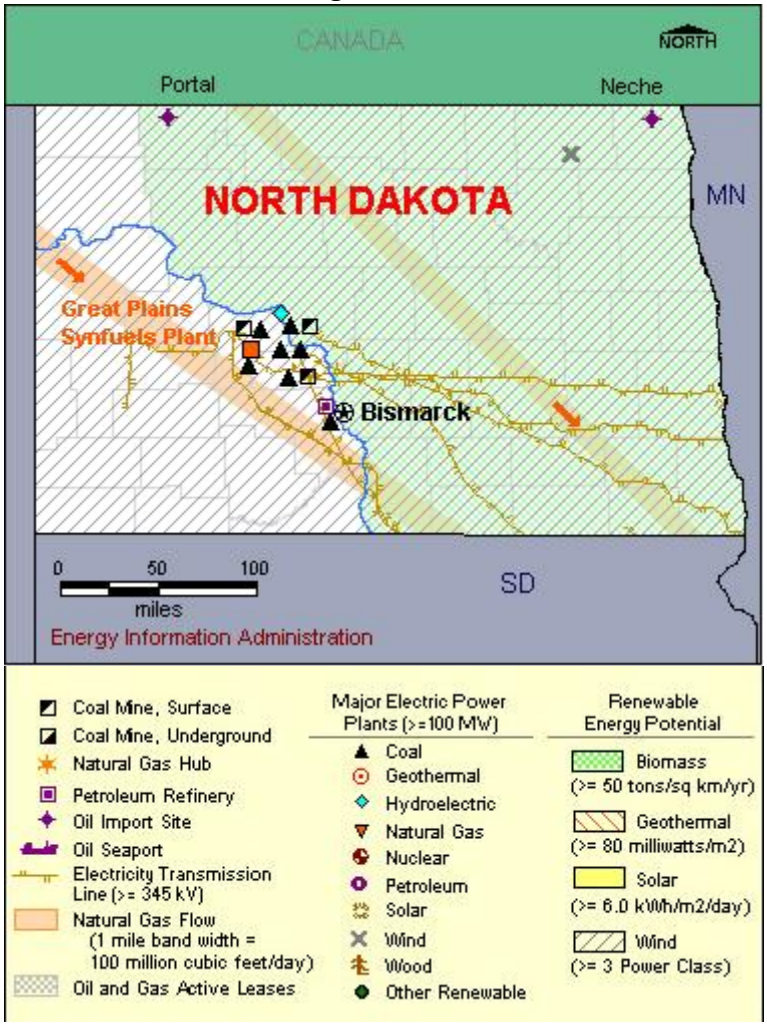
North Dakota has and uses a considerable amount of energy-related commodities. According to the US Energy Information Administration, North Dakota is among the highest in the nation for per capita energy consumption, partly because of the high heating demand in the winter and an energy-intensive economy. Industry accounts for nearly one-half of the state's total energy consumption. Nearly all of the electricity generated in North Dakota is produced by coal-fired power plants. Much of this coal is extracted from large surface mines in central North Dakota. The state is also a substantial producer of wind energy and leads the US in potential wind power capacity. (US Energy Information Administration, 2010) Electricity has become very important, and in fact critical, to daily life in North Dakota and across the nation. Electricity runs lights, computers, medical equipment, water pumps, heating system fans, refrigerators, freezers, televisions, and many other types of important equipment.

North Dakota oil output accounts for about 2 percent of the total United States crude oil production. The Williston Basin in the western part of the state has most of North Dakota's oil reserves. North Dakota has one small refinery that produces transportation fuels for the northern Great Plains and Twin Cities area. Canadian crude oil pipelines also pass through the state en-route to the Midwest refining markets. Oil production has become a leading industry in the current North Dakota economy with growth and expansion expected. North Dakota also has considerable ethanol production capacity but is one of only a few states that allows statewide use of conventional motor gasoline rather than specific gasoline blends. (US Energy Information Administration, 2010)

The Williston Basin in western North Dakota also has substantial natural gas reserves. North Dakota has the distinction of being one of only three states to produce synthetic natural gas and is home to the largest synthetic gas plant in the nation. (US Energy Information Administration, 2010) Two major natural gas pipelines pass through North Dakota from Montana and Canada to the Midwest with several smaller regional pipelines. North Dakota has approximately 1,873 miles of natural gas transmission pipelines. (US Energy Information Administration, 2005)

Figure 4.2G shows the major energy features in the state. Table 4.2A lists the number of "energy" facilities in each county as identified through the North Dakota Critical Infrastructure Program.

Figure 4.2G



Source: US Energy Information Administration, 2010.

During the cold winter months, the heating of homes and businesses is a necessity in the climate of North Dakota. Overall, a variety of fuels are used throughout the state as shown in Table 4.2H and Map 4.2J. Most systems, however, ultimately require electricity to run their thermostats and blowers.

Table 4.2H North Dakota Number of Housing Units by Home Heating Fuel by County in 2000

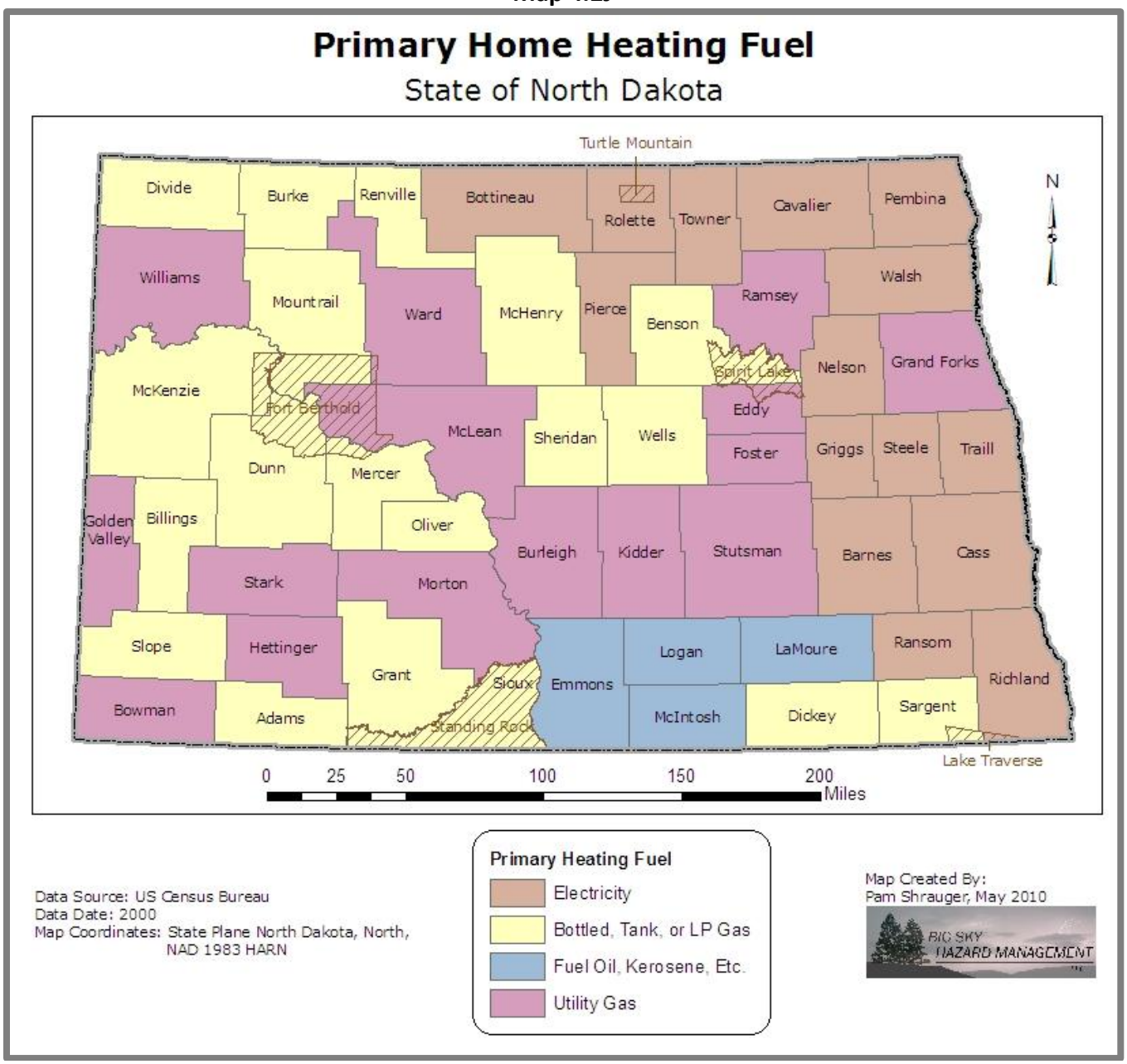
County	Utility Gas	Bottled, Tank, or LP Gas	Electricity	Fuel Oil, Kerosene, Etc.	Coal or Coke	Wood	Solar Energy	Other Fuel	No Fuel
North Dakota	*110,762*	*40,393*	*74,087*	*23,601*	*1,871*	*1,354*	*39*	*3,317*	*1,728*
Adams	176	498	225	149	46	11	0	12	4
Barnes	1,756	540	1,935	577	2	34	0	27	13
Benson	161	867	658	514	8	21	0	89	10
Billings	12	178	129	9	22	13	0	3	0
Bottineau	9	1,000	1,236	571	20	86	0	40	0
Bowman	712	404	178	12	14	2	2	28	6
Burke	128	555	161	93	59	6	0	11	0
Burleigh	20,409	2,542	3,791	164	69	47	3	389	256
Cass	20,739	1,272	24,865	3,085	38	113	2	604	597
Cavalier	629	326	686	339	4	9	0	12	12
Dickey	11	939	620	660	0	9	0	36	8
Divide	9	422	277	199	43	2	0	51	2
Dunn	228	640	342	97	28	19	0	21	3
Eddy	658	175	199	114	5	6	0	3	4
Emmons	280	510	288	679	8	11	0	6	4
Foster	728	246	374	137	2	12	0	41	0
Golden Valley	494	146	68	24	15	7	0	7	0
Grand Forks	12,065	1,639	9,280	1,233	278	91	0	658	191
Grant	11	668	177	285	45	6	0	3	0
Griggs	7	186	491	471	2	10	0	6	5
Hettinger	686	223	171	40	16	2	0	14	0
Kidder	409	345	179	201	14	6	0	4	0
LaMoure	2	501	595	806	6	12	0	9	11
Logan	5	234	197	500	15	2	0	10	0
McHenry	118	1,063	500	713	42	54	0	30	6
McIntosh	7	304	287	829	3	13	0	22	2
McKenzie	750	940	341	27	17	32	0	24	20
McLean	1,929	953	658	149	80	9	0	24	13
Mercer	25	1,913	1,055	141	202	2	2	4	2
Morton	6,943	1,323	1,027	141	186	47	15	123	84
Mountrail	626	1,077	588	134	45	2	0	76	12
Nelson	2	372	754	477	11	6	0	6	0
Oliver	0	506	152	32	89	0	0	12	0
Pembina	876	813	928	841	2	46	0	21	8
Pierce	25	499	750	634	14	14	0	28	0
Ramsey	2,652	627	1,200	308	0	24	0	87	59
Ransom	11	446	922	902	0	46	0	20	3

Table 4.2H North Dakota Number of Housing Units by Home Heating Fuel by County in 2000 (continued)

County	Utility Gas	Bottled, Tank, or LP Gas	Electricity	Fuel Oil, Kerosene, Etc.	Coal or Coke	Wood	Solar Energy	Other Fuel	No Fuel
Renville	12	674	262	88	17	6	0	23	3
Richland	1,735	1,534	2,125	1,321	0	68	6	69	27
Rolette	106	1,730	1,831	735	13	103	0	38	0
Sargent	9	708	453	590	0	18	0	4	4
Sheridan	3	415	127	164	12	2	0	8	0
Sioux	29	946	35	51	9	14	0	11	0
Slope	91	176	24	10	5	5	0	2	0
Stark	5,611	755	2,240	41	127	34	0	50	74
Steele	5	226	381	307	0	0	0	2	2
Stutsman	5,300	1,073	1,554	731	10	93	0	126	67
Towner	7	318	564	304	12	0	0	10	3
Traill	10	846	1,338	1,099	0	21	0	17	10
Walsh	1,650	645	1,752	848	3	57	0	31	43
Ward	16,471	2,289	3,248	427	131	57	7	268	143
Wells	23	1,061	568	517	21	7	2	16	0
Williams	5,412	1,105	1,301	81	61	37	0	81	17

Source: US Census Bureau, 2010a.

Map 4.2J


Primary Home Heating Fuel
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Primary Heating Fuel
Electricity
Bottled, Tank, or LP Gas
Fuel Oil, Kerosene, Etc.
Utility Gas
Data Source: US Census Bureau
Data Date: 2000
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, May 2010
BIG SKY HAZARD MANAGEMENT

Transportation is essential for international, interstate, and intrastate commerce, including the transportation of critical materials such as food and other goods. The primary transportation networks in North Dakota consist of road, rail, and air systems. Map 4.2P shows these networks. Two interstates pass through North Dakota, Interstate 94 and Interstate 29. Highway 2 and Highway 83 are also important travel routes. In all, the state has over 105,000 miles of road, including 18 international highway ports of entry along the Canadian border. According to the North Dakota Department of Transportation, North Dakota has more miles of road per capita than any other state. (North Dakota Department of Transportation, 2010a) The North Dakota Department of Transportation maintains about 8,410 miles of highway. (North Dakota Department of Commerce, 2010b)

North Dakota has a total of 4,978 bridges on three highway systems: state, county, and urban. Of those bridges, 1,714 are on the state highway system (I-29, I-94, and other high traffic volume highways), 3,160 are on the county highway system (county and rural roads), and 104 are on the urban highway system (highways located in a city). The following definitions for bridge ratings were provided by the North Dakota Department of Transportation:

- Structurally Deficient – A bridge designated "structurally deficient" does not mean that the bridge is unsafe; it simply means that the deck, the superstructure, or the substructure has a condition that warrants attention. This can be as simple as a concrete bridge deck needing work and requiring a bridge deck overlay.
- Functionally Obsolete – A bridge designated "functionally obsolete" means that some part of the bridge does not meet a design standard such as vertical clearance, deck width, etc. It has nothing to do with the structural integrity of the bridge.

(North Dakota Department of Transportation, 2010b)

Table 4.2K lists the bridge ratings by type, including railroad and federal owned.

Table 4.2K North Dakota Bridge Ratings in 2008

Type	Total Number of Bridges	Structurally Deficient	Functionally Obsolete
State	1,714 bridges	28 bridges	34 bridges
County	3,160 bridges	621 bridges	233 bridges
Urban	104 bridges	3 bridges	9 bridges
Total	4,978 bridges	652 bridges	276 bridges

Source: North Dakota Department of Transportation, 2010b.

The North Dakota Department of Transportation also keeps a listing of scour critical bridges. Scour is erosion within a streambed due to flowing water. A bridge is scour critical if the bridge foundation is determined to be unstable for the calculated scour conditions. These types of bridges can be especially vulnerable during flood events. North Dakota has a total of 82 scour critical bridges as shown in Table 4.2L. Some of the county bridges listed are on very low volume roads and others are on the list due to unknown foundations and may not actually be scour critical.

Table 4.2L North Dakota Scour Critical Bridges

County	State	County	Urban	TOTAL
North Dakota	*11*	*68*	*3*	*82*
Adams	2	2	0	4
Barnes	0	2	0	2
Benson	0	0	0	0
Billings	1	0	0	1
Bottineau	0	1	0	1
Bowman	0	2	0	2
Burke	1	0	0	1
Burleigh	0	2	0	2
Cass	0	3	0	3
Cavalier	0	0	0	0
Dickey	0	2	0	2
Divide	0	1	0	1
Dunn	0	0	0	0
Eddy	0	1	0	1
Emmons	2	3	0	5
Foster	0	0	0	0
Golden Valley	0	2	0	2
Grand Forks	0	0	0	0
Grant	1	5	0	6
Griggs	0	0	0	0
Hettinger	2	8	0	10
Kidder	0	0	0	0
LaMoure	0	2	0	2
Logan	0	2	0	2
McHenry	0	2	0	2
McIntosh	0	0	0	0
McKenzie	0	1	0	1
McLean	0	2	0	2
Mercer	0	3	0	3
Morton	0	7	0	7
Mountrail	0	0	0	0
Nelson	1	0	0	1
Oliver	0	2	0	2
Pembina	0	0	0	0
Pierce	0	0	0	0
Ramsey	0	1	0	1
Ransom	0	0	0	0
Renville	0	0	0	0
Richland	0	0	0	0
Rolette	0	0	0	0
Sargent	0	0	0	0
Sheridan	0	0	0	0
Sioux	0	0	0	0
Slope	0	2	0	2
Stark	1	2	0	3
Steele	0	2	0	2
Stutsman	0	1	0	1
Towner	0	0	0	0
Traill	0	1	0	1
Walsh	0	1	0	1
Ward	0	2	2	4
Wells	0	1	0	1
Williams	0	0	1	1

Source: North Dakota Department of Transportation, 2010c.

Railroads have long been an important way to transport agricultural goods and supplies in North Dakota. The state has 3,478 freight railroad miles. In 2008, 120.6 million tons of freight was carried in the state. The primary products transported by the railroads originating in North Dakota were farm products. Coal was the primary product transported into North Dakota for use in the state. (Association of American Railroads, 2008) Table 4.2M shows the number of miles of freight railroad operated in North Dakota. Amtrak provides passenger rail service to Williston, Stanley, Minot, Rugby, Devils Lake, Grand Forks, and Fargo. (Amtrak, 2010)

Table 4.2M Miles of Freight Railroad Operated in North Dakota in 2008

Railroad	Miles in North Dakota
Class I Railroads	
BNSF Railway Company	1,732 miles
Soo Line Railroad Company (part of Canadian Pacific Railway)	482 miles
Regional Railroads	
Dakota, Missouri Valley, and Western Railroad	402 miles
Northern Plains Railroad, Inc.	435 miles
Red River Valley and Western Railroad Company	543 miles
Local Railroads	
Dakota Northern Railroad	79 miles
Otter Tail Valley Railroad	5 miles

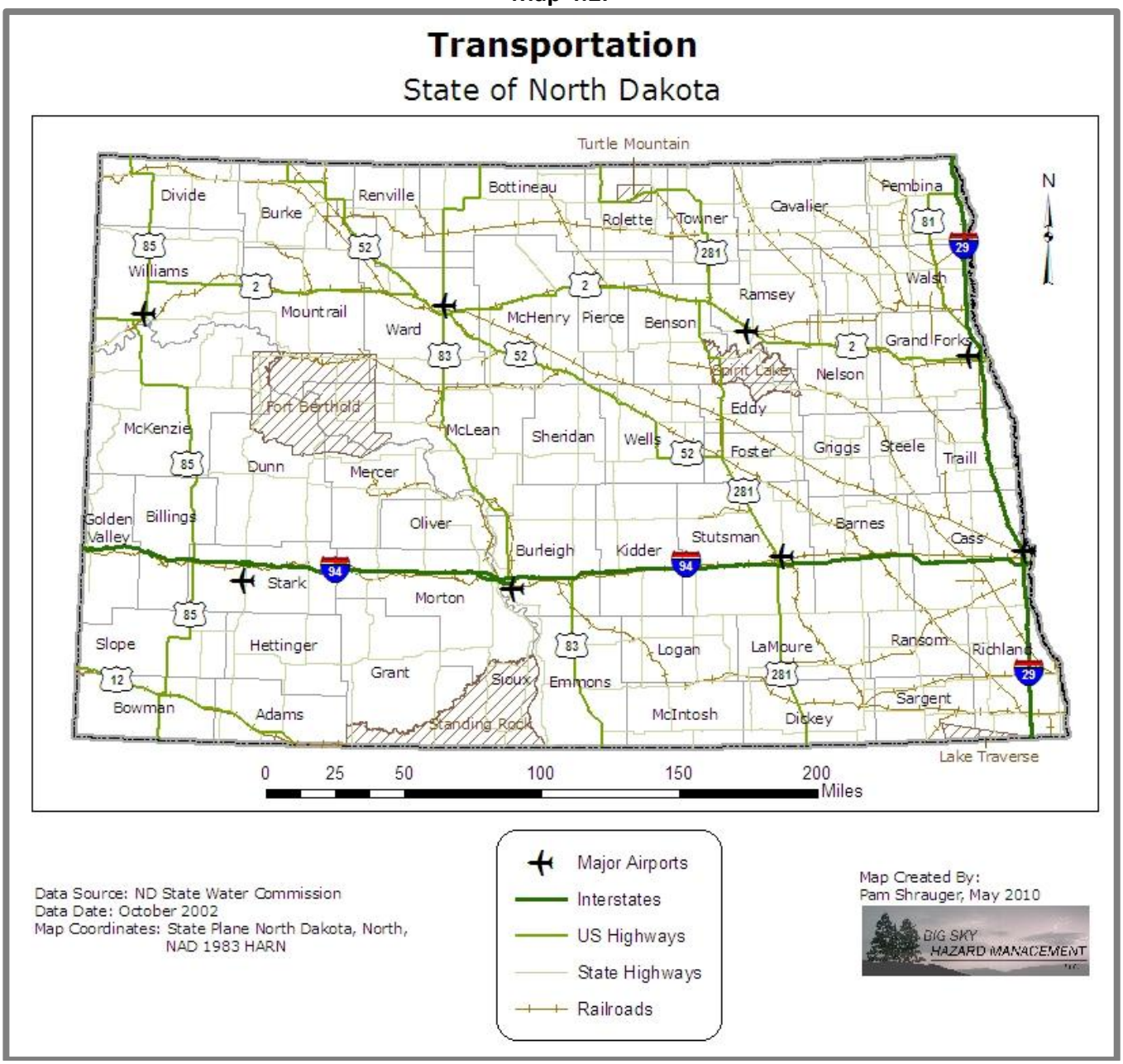
Source: Association of American Railroads, 2008.

Air transportation in North Dakota is provided through a variety of public, private, and government airports. North Dakota has 89 public airports, including eight that provide scheduled commercial passenger service as shown in Table 4.2N. The eight major commercial airports offer 104 daily flights to five domestic hubs and the general aviation airports average 778 flights daily, many in support of seasonal and agricultural activities. (North Dakota Department of Transportation, 2007)

Table 4.2N North Dakota Major Commercial Airports

Airport	County
Bismarck Airport	Burleigh
Devils Lake Airport	Ramsey
Dickinson Airport	Stark
Fargo Airport	Cass
Grand Forks Airport	Grand Forks
Jamestown Airport	Stutsman
Minot Airport	Ward
Williston Airport	Williams

Map 4.2P


Transportation
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Grand Forks
Nelson
Spirit Lake
Fort Berthold
Eddy
McKenzie
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Major Airports
Interstates
US Highways
State Highways
Railroads
Data Source: ND State Water Commission
Data Date: October 2002
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, May 2010
BIG SKY HAZARD MANAGEMENT

Educational facilities can be critical in that they often contain a large concentration of people and important research activities. These institutions can present unique and significant challenges during a disaster. The North Dakota University System (NDUS) has eleven public colleges and universities governed by the State Board of Higher Education. Several private and tribal community colleges governed by other bodies also exist throughout the state and are listed in Table 4.2Q. The NDUS facilities, coupled with their associated insured values, can be found in Table 4.2R. The NDUS insured values can be found by county in Map 4.2S.

Table 4.2Q Private and Tribal Community Colleges and Universities in North Dakota

College/University	Main Campus Location	Typical Enrollment
Cankdeska Cikana Community College	Fort Totten, Benson County	230 students
Fort Berthold Community College	New Town, Mountrail County	200 students
Jamestown College	Jamestown, Stutsman County	1,000 students
Rasmussen College – Bismarck	Bismarck, Burleigh County	400 students
Rasmussen College - Fargo	Fargo, Cass County	750 students
Sitting Bull College*	Fort Yates, Sioux County	300 students
Trinity Bible College	Ellendale, Dickey County	300 students
Turtle Mountain Community College	Belcourt, Rolette County	900 students
United Tribes Technical College	Bismarck, Burleigh County	600 students
University of Mary	Bismarck, Burleigh County	2,700 students

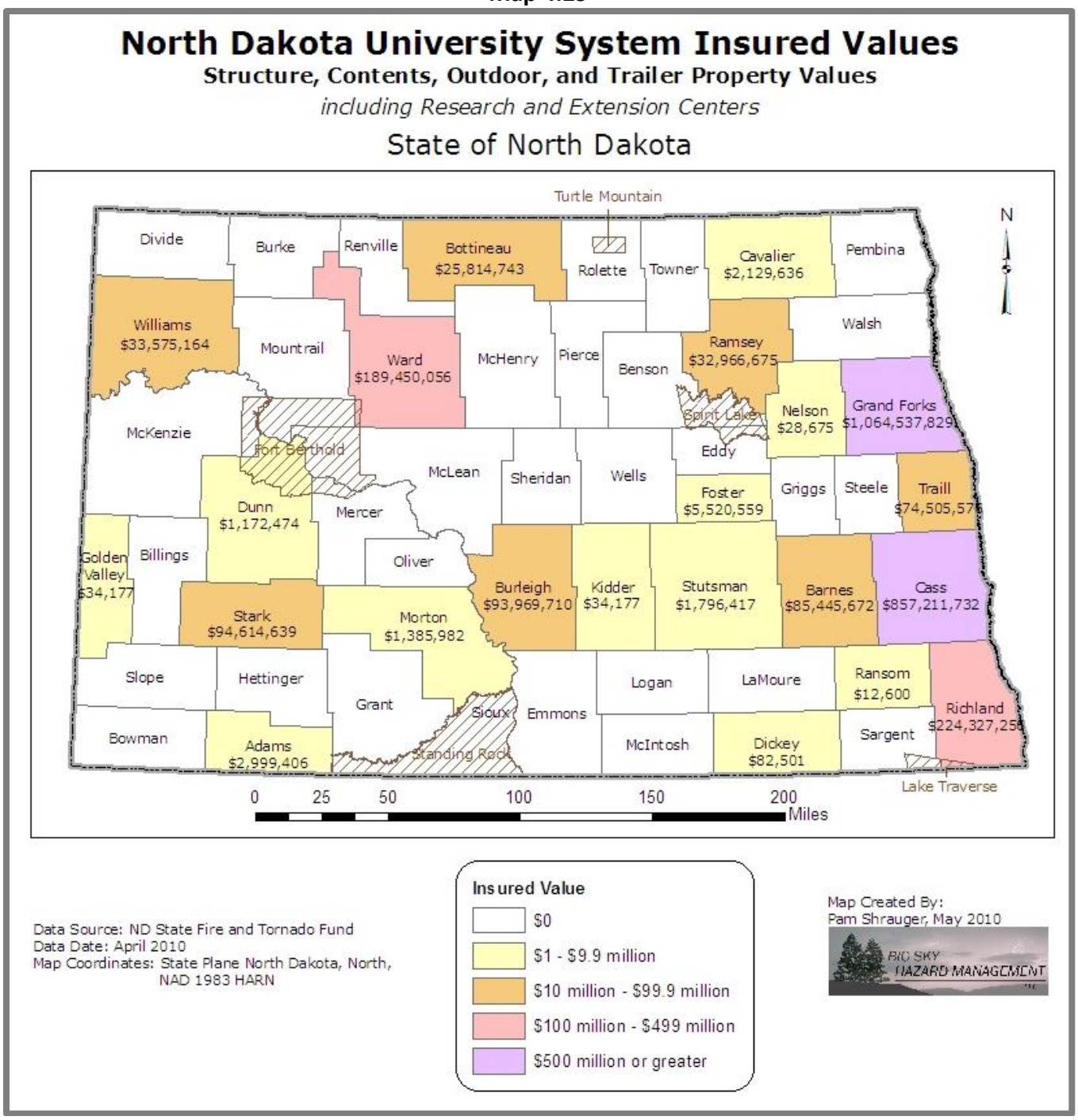
Source: Wikipedia, 2010a.
* has a Disaster-Resistant University Pre-Disaster Mitigation Plan

Table 4.2R North Dakota University System Insured Values

College/University Main Campus Location Typical Enrollment	Building Property (Structure) Value	Personal Property (Contents) Value	Outdoor Property Value	Trailer Property Value
North Dakota University System *Fall 2009 Enrollment: 45,817 students*	*$2,144,043,937*	*$636,773,635*	*$10,779,657*	*$18,427*
Bismarck State College Bismarck, Burleigh County Fall 2009 Enrollment: 4,020 students	$63,726,672	$29,628,309	$895,122	$0
Dakota College at Bottineau Bottineau, Bottineau County Fall 2009 Enrollment: 748 students	$23,255,054	$2,559,689	$0	$0
Dickinson State University Dickinson, Stark County Fall 2009 Enrollment: 2,767 students	$78,955,770	$11,643,935	$24,767	$0
Lake Region State College Devils Lake, Ramsey County Fall 2009 Enrollment: 1,702 students	$27,758,163	$5,238,747	$0	$0
Mayville State University Mayville, Traill County Fall 2009 Enrollment: 887 students	$64,362,274	$9,954,655	$124,622	$0
Minot State University Minot, Ward County Fall 2009 Enrollment: 3,649 students	$156,268,031	$26,276,284	$243,835	$0
North Dakota State College of Science Wahpeton, Richland County Fall 2009 Enrollment: 2,651 students	$199,629,510	$25,199,909	$206,558	$0
North Dakota State University* Fargo, Cass County Fall 2009 Enrollment: 14,189 students	$582,529,524	$293,249,677	$2,737,966	$14,119
University of North Dakota Grand Forks, Grand Forks County Fall 2009 Enrollment: 13,172 students	$849,471,758	$215,092,971	$6,452,860	$4,308
Valley City State University Valley City, Barnes County Fall 2009 Enrollment: 1,083 students	$71,492,650	$13,824,918	$93,927	$0
Williston State College Williston, Williams County Fall 2009 Enrollment: 949 students	$26,594,531	$4,104,541	$0	$0

Source: North Dakota State Fire and Tornado Fund, 2010; Wikipedia, 2010a; North Dakota University System, 2009.
* has a Disaster-Resistant University Pre-Disaster Mitigation Plan

Map 4.2S


North Dakota University System Insured Values
Structure, Contents, Outdoor, and Trailer Property Values
including Research and Extension Centers
State of North Dakota
Turtle Mountain
N
Divide
Burke
Renville
Bottineau
$25,814,743
Rolette
Towner
Cavalier
$2,129,636
Pembina
Williams
$33,575,164
Mountrail
Ward
$189,450,056
McHenry
Pierce
Benson
Ramsey
$32,966,675
Walsh
Spirit Lake
Nelson
$28,675
Grand Forks
$1,064,537,829
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
$5,520,559
Griggs
Steele
Traill
$74,505,57
Dunn
$1,172,474
Mercer
Golden Valley
$34,177
Billings
Oliver
Burleigh
$93,969,710
Kidder
$34,177
Stutsman
$1,796,417
Barnes
$85,445,672
Cass
$857,211,732
Stark
$94,614,639
Morton
$1,385,982
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
$12,600
Richland
$224,327,25
Bowman
Adams
$2,999,406
Standing Rock
McIntosh
Dickey
$82,501
Sargent
Lake Traverse
0
25
50
100
150
200
Miles
Insured Value
$0
$1 - $9.9 million
$10 million - $99.9 million
$100 million - $499 million
$500 million or greater
Data Source: ND State Fire and Tornado Fund
Data Date: April 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, May 2010
BIG SKY
HAZARD MANAGEMENT

Primary education facilities also exist throughout the state. Often, these facilities have a smaller student population than the secondary institutions. The total number of school enrollees during the Fall of 2009 for public schools, Bureau of Indian Affairs (BIA)/grant schools, non-public schools, and state institution schools is shown in Table 4.2T. Note that the North Dakota State Fire and Tornado Fund maintains insurance policies for many school districts in the state; some larger districts, such as the Fargo School District, however, are not covered by the fund, so the usefulness of the data as it pertains to school districts is limited.

Table 4.2T North Dakota School Enrollments by County, Fall 2009

County	Number of Students (K-12)
North Dakota	*101,319*
Adams	283
Barnes	1,592
Benson	1,393
Billings	44
Bottineau	785
Bowman	551
Burke	239
Burleigh	12,495
Cass	21,479
Cavalier	540
Dickey	813
Divide	232
Dunn	437
Eddy	322
Emmons	588
Foster	529
Golden Valley	314
Grand Forks	8,658
Grant	291
Griggs	377
Hettinger	373
Kidder	400
LaMoure	625
Logan	331
McHenry	862
McIntosh	381
McKenzie	855
McLean	1,433
Mercer	1,251
Morton	4,331
Mountrail	1,433
Nelson	468
Oliver	196
Pembina	1,224
Pierce	674
Ramsey	1,967
Ransom	947
Renville	572
Richland	2,484
Rolette	3,205
Sargent	708
Sheridan	123
Sioux	1,031
Slope	21
Stark	3,749
Steele	260
Stutsman	2,838
Towner	281
Traill	1,331
Walsh	1,699
Ward	9,318
Wells	546
Williams	3,440

Source: North Dakota Department of Public Instruction, 2009.

Often, special population groups, such as children, the disabled, the elderly, and the incarcerated, require more attention and services during times of disaster. Their needs can be unique in terms of medical equipment, transportation, and staffing. Given their specialized needs, they are often more vulnerable during disasters, and their considerations require more critical attention. Table 4.2U lists the major special needs facilities in North Dakota that have not been otherwise identified as critical facilities.

Table 4.2U Large Special Needs Facilities in North Dakota

Facility	County
Missouri River Correctional Center	Burleigh
North Dakota State Developmental Center	Walsh
North Dakota State Hospital	Stutsman
North Dakota State Penitentiary	Burleigh
North Dakota Veterans Home	Ransom
North Dakota Youth Correctional Center	Morton

To facilitate the analysis of the vulnerability of critical facilities and infrastructure to the specific hazards, a summary has been developed and is shown in Table 4.2V. The number of Critical Infrastructure and Key Resource (CIKR) facilities was provided by the North Dakota Critical Infrastructure Program and is shown by sector in Table 4.2A.

Table 4.2V Critical Facilities and Infrastructure Summary by County

County	Critical Facilities and Infrastructure Summary Description
Adams	CIKR Facilities: Low (0-4 facilities)
Barnes	CIKR Facilities: Moderate (10-14 facilities) $1.6 million in National Guard Assets Valley City State University Interstate and Railroad Transportation Infrastructure
Benson*	CIKR Facilities: Low (0-4 facilities) Cankdeska Cikana Community College
Billings	CIKR Facilities: Low-Moderate (5-9 facilities) Interstate and Railroad Transportation Infrastructure
Bottineau	CIKR Facilities: Low-Moderate (5-9 facilities) Dakota College at Bottineau
Bowman	CIKR Facilities: Low-Moderate (5-9 facilities)
Burke	CIKR Facilities: Low-Moderate (5-9 facilities) Portal Oil Import Site
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab

Table 4.2V Critical Facilities and Infrastructure Summary by County (continued)

County	Critical Facilities and Infrastructure Summary Description
Burleigh (continued)	Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck United Tribes Technical College University of Mary Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Cavalier	CIKR Facilities: Low-Moderate (5-9 facilities) Langdon Wind Power Plant
Dickey	CIKR Facilities: Low-Moderate (5-9 facilities) Trinity Bible College
Divide	CIKR Facilities: Low-Moderate (5-9 facilities)
Dunn*	CIKR Facilities: Low (0-4 facilities)
Eddy*	CIKR Facilities: Low (0-4 facilities)
Emmons	CIKR Facilities: Low-Moderate (5-9 facilities)
Foster	CIKR Facilities: Low-Moderate (5-9 facilities) $2.6 million in National Guard Assets
Golden Valley	CIKR Facilities: Low (0-4 facilities) Interstate and Railroad Transportation Infrastructure
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota Grand Forks Airport Interstate and Railroad Transportation Infrastructure

Table 4.2V Critical Facilities and Infrastructure Summary by County (continued)

County	Critical Facilities and Infrastructure Summary Description
Grant	CIKR Facilities: Low-Moderate (5-9 facilities)
Griggs	CIKR Facilities: Low-Moderate (5-9 facilities)
Hettinger	CIKR Facilities: Low (0-4 facilities)
Kidder	CIKR Facilities: Low (0-4 facilities) Interstate and Railroad Transportation Infrastructure
LaMoure	CIKR Facilities: Low (0-4 facilities)
Logan	CIKR Facilities: Low (0-4 facilities)
McHenry	CIKR Facilities: Low (0-4 facilities)
McIntosh	CIKR Facilities: Low-Moderate (5-9 facilities)
McKenzie*	CIKR Facilities: Moderate (10-14 facilities)
McLean*	CIKR Facilities: Moderate (10-14 facilities) Coal Creek Power Plant Garrison Hydroelectric Power Plant
Mercer*	CIKR Facilities: Moderate (10-14 facilities) Great Plains Synfuels Plant Antelope Valley Power Plant Coyote Power Plant Garrison Hydroelectric Power Plant Leland Olds Power Plant Stanton Power Plant
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure
Mountrail*	CIKR Facilities: Low-Moderate (5-9 facilities) Fort Berthold Community College
Nelson*	CIKR Facilities: Low-Moderate (5-9 facilities)
Oliver	CIKR Facilities: Low-Moderate (5-9 facilities) Milton R. Young Power Plant
Pembina	CIKR Facilities: Moderate (10-14 facilities) Neche Oil Import Site Interstate and Railroad Transportation Infrastructure
Pierce	CIKR Facilities: Low-Moderate (5-9 facilities)
Ramsey*	CIKR Facilities: Moderate (10-14 facilities) $62.7 million in National Guard Assets Camp Grafton Lake Region State College Devils Lake Airport

Table 4.2V Critical Facilities and Infrastructure Summary by County (continued)

County	Critical Facilities and Infrastructure Summary Description
Ransom	CIKR Facilities: Low-Moderate (5-9 facilities) North Dakota Veterans Home
Renville	CIKR Facilities: Low (0-4 facilities)
Richland*	CIKR Facilities: Moderate-High (15-24 facilities) $10.8 million in National Guard Assets North Dakota State College of Science Interstate and Railroad Transportation Infrastructure
Rolette*	CIKR Facilities: Low-Moderate (5-9 facilities) Turtle Mountain Community College
Sargent*	CIKR Facilities: Low (0-4 facilities)
Sheridan	CIKR Facilities: Low (0-4 facilities)
Sioux*	CIKR Facilities: Low (0-4 facilities) Sitting Bull College
Slope	CIKR Facilities: Low (0-4 facilities)
Stark	CIKR Facilities: Moderate-High (15-24 facilities) Dickinson State University Dickinson Airport Interstate and Railroad Transportation Infrastructure
Steele	CIKR Facilities: Low (0-4 facilities)
Stutsman	CIKR Facilities: Moderate-High (15-24 facilities) $117.4 million in Local Government Facilities Jamestown College North Dakota State Hospital Jamestown Airport Interstate and Railroad Transportation Infrastructure
Towner	CIKR Facilities: Low (0-4 facilities)
Traill	CIKR Facilities: Moderate (10-14 facilities) Mayville State University Interstate and Railroad Transportation Infrastructure
Walsh	CIKR Facilities: Moderate (10-14 facilities) North Dakota State Developmental Center Interstate and Railroad Transportation Infrastructure
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport
Wells	CIKR Facilities: Low-Moderate (5-9 facilities)

Table 4.2V Critical Facilities and Infrastructure Summary by County (continued)

County	Critical Facilities and Infrastructure Summary Description
Williams	CIKR Facilities: Moderate-High (15-24 facilities) $129.3 million in Local Government Facilities Williston State College Williston Airport

* includes at least part of the reservation

4.3 Population

People are vulnerable to both natural and human-caused hazards. Based on 2009 population estimates, the State of North Dakota has a population of 646,844, ranked 48th in the nation. Table 4.3A lists the population and percent change since 2006 for the counties in North Dakota, including tribal areas. The trend was based on population changes from 2000-2006, 2006-2009, and 2008-2009. Map 4.7A in the New Development section shows the changes geographically. Table 4.3B lists the 2000 populations of the Indian Reservations. Map 4.3C shows the 2000 population by county, reservation populations, and cities over 10,000 people.

Table 4.3A North Dakota Population Statistics

County	2009 Population Estimate	Population Change from 2006-2009		Trend
North Dakota	*646,844*	*+10,073*	*1.6%*	*Recent Increases*
Adams	2,236	-69	-3.0%	Continued Decreases
Barnes	10,753	-141	-1.3%	Continued Decreases
Benson*	6,910	+17	0.2%	Continued Increases
Billings	827	+68	9.0%	Recent Increases
Bottineau	6,352	-125	-1.9%	Just Beginning to Increase
Bowman	3,028	+103	3.5%	Somewhat Steady
Burke	1,839	-50	-2.6%	Just Beginning to Increase
Burleigh	79,822	+4,149	5.5%	Continued Increases
Cass	143,339	+8,148	6.0%	Continued Increases
Cavalier	3,699	-310	-7.7%	Continued Decreases
Dickey	5,217	-168	-3.1%	Continued Decreases
Divide	1,961	-97	-4.7%	Continued Decreases
Dunn*	3,365	+60	1.8%	Recent Increases
Eddy*	2,288	-167	-6.8%	Continued Decreases
Emmons	3,398	-233	-6.4%	Continued Decreases
Foster	3,259	-260	-7.4%	Continued Decreases
Golden Valley	1,621	-39	-2.3%	Continued Decreases
Grand Forks	66,414	-707	-1.1%	Continued Decreases
Grant	2,337	-148	-6.0%	Continued Decreases
Griggs	2,346	-56	-2.3%	Just Beginning to Increase
Hettinger	2,343	-125	-5.1%	Just Beginning to Increase
Kidder	2,201	-184	-7.7%	Continued Decreases
LaMoure	3,908	-254	-6.1%	Continued Decreases
Logan	1,886	-65	-3.3%	Continued Decreases
McHenry	5,173	-184	-3.4%	Continued Decreases
McIntosh	2,582	-283	-9.9%	Continued Decreases
McKenzie*	5,799	304	5.5%	Recent Increases
McLean*	8,310	-36	-0.4%	Continued Decreases

Table 4.3A North Dakota Population Statistics (continued)

County	2009 Population Estimate	Population Change from 2006-2009		Trend
Mercer*	7,873	-106	-1.3%	Just Beginning to Increase
Morton	26,464	+951	3.7%	Continued Increases
Mountrail*	6,791	+403	6.3%	Recent Increases
Nelson*	3,129	-137	-4.2%	Continued Decreases
Oliver	1,643	-82	-4.8%	Continued Decreases
Pembina	7,392	-351	-4.5%	Continued Decreases
Pierce	3,990	-162	-3.9%	Continued Decreases
Ramsey	11,240	+13	0.1%	Somewhat Steady
Ransom	5,500	-196	-3.4%	Continued Decreases
Renville	2,227	-134	-5.7%	Just Beginning to Increase
Richland*	16,067	-666	-4.0%	Continued Decreases
Rolette*	13,797	+209	1.5%	Continued Increases
Sargent*	3,951	-182	-4.4%	Continued Decreases
Sheridan	1,228	-122	-9.0%	Continued Decreases
Sioux*	4,203	+46	1.1%	Continued Increases
Slope	649	-38	-5.5%	Continued Decreases
Stark	22,847	+751	3.4%	Recent Increases
Steele	1,747	-154	-8.1%	Continued Decreases
Stutsman	20,463	-269	-1.3%	Just Beginning to Increase
Towner	2,209	-184	-7.7%	Continued Decreases
Traill	7,868	-143	-1.8%	Continued Decreases
Walsh	10,798	-390	-3.5%	Continued Decreases
Ward*	57,012	+913	1.6%	Recent Increases
Wells	4,092	-224	-5.2%	Continued Decreases
Williams	20,451	+1,179	6.1%	Recent Increases

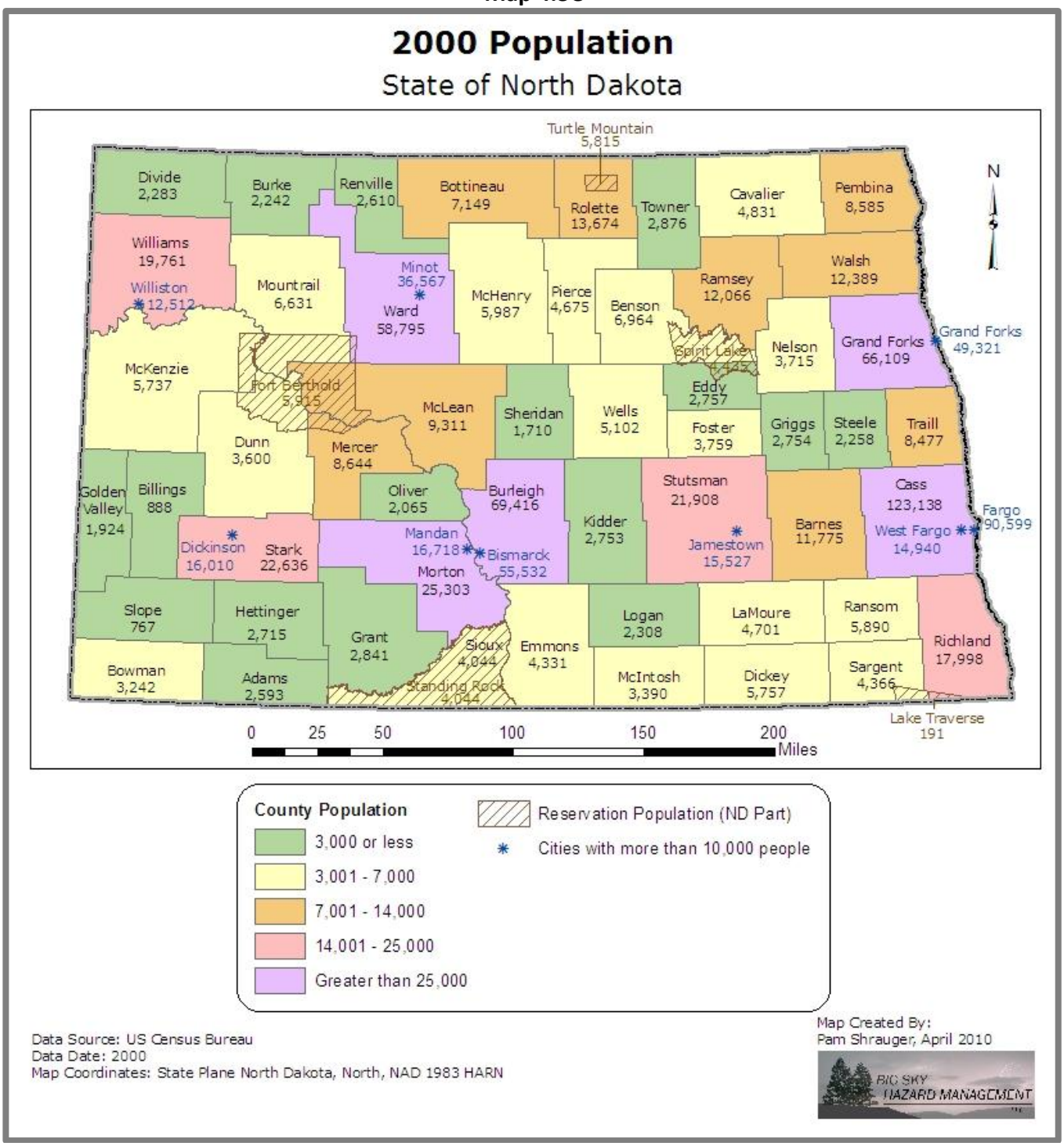
* includes at least part of the reservation population
Source: US Census Bureau, 2010a.

Table 4.3B North Dakota Reservation Population Statistics

Reservation	2000 Reservation Population
Lake Traverse – Sisseton-Wahpeton Sioux*	191
Spirit Lake – Dakotah Sioux	4,435
Standing Rock Sioux*	4,044
Fort Berthold – Three Affiliated Tribes – Mandan, Hidatsa, Arikara Nation	5,915
Turtle Mountain – Band of Chippewa	5,815 (plus 2,492 on off-reservation trust lands)

* includes only North Dakota parts of the reservation
Source: US Census Bureau, 2010a.

Map 4.3C


2000 Population
State of North Dakota
Turtle Mountain 5,815
Divide 2,283
Burke 2,242
Renville 2,610
Bottineau 7,149
Rolette 13,674
Towner 2,876
Cavalier 4,831
Pembina 8,585
Williams 19,761
Williston 12,512
Mountrail 6,631
Minot 36,567
Ward 58,795
McHenry 5,987
Pierce 4,675
Benson 6,964
Ramsey 12,066
Walsh 12,389
Spirit Lake
Nelson 3,715
Grand Forks 66,109
Grand Forks 49,321
McKenzie 5,737
Fort Berthold 5,915
McLean 9,311
Sheridan 1,710
Wells 5,102
Eddy 2,757
Foster 3,759
Griggs 2,754
Steele 2,258
Traill 8,477
Dunn 3,600
Mercer 8,644
Golden Valley 1,924
Billings 888
Oliver 2,065
Burleigh 69,416
Kidder 2,753
Stutsman 21,908
Jamestown 15,527
Barnes 11,775
Cass 123,138
West Fargo 14,940
Fargo 90,599
Dickinson 16,010
Stark 22,636
Mandan 16,718
Bismarck 55,532
Morton 25,303
Slope 767
Hettinger 2,715
Grant 2,841
Sioux 4,044
Standing Rock 4,044
Emmons 4,331
Logan 2,308
LaMoure 4,701
Ransom 5,890
Richland 17,998
Bowman 3,242
Adams 2,593
McIntosh 3,390
Dickey 5,757
Sargent 4,366
Lake Traverse 191
N
0 25 50 100 150 200 Miles
County Population
3,000 or less
3,001 - 7,000
7,001 - 14,000
14,001 - 25,000
Greater than 25,000
Reservation Population (ND Part)
Cities with more than 10,000 people
Data Source: US Census Bureau
Data Date: 2000
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, April 2010
BIG SKY
HAZARD MANAGEMENT

4.4 Buildings

Besides critical facilities and state-owned buildings, other structures such as residences and businesses in North Dakota are also threatened by natural and human-caused hazards. Table 4.4A shows the number of housing units, density, median year built, and median value by county in 2000. Map 4.4B shows the estimated housing exposure by county derived by multiplying the number of housing units by the median value of owner-occupied housing units. The total census estimated housing exposure in North Dakota is $19.78 billion. The median ages of housing units are shown in Map 4.4C.

HAZUS-MH MR2, loss estimation software developed by the Federal Emergency Management Agency, can also be used to quantify the values at risk, including residential and commercial, by county and is shown in Map 4.4D. The total HAZUS-MH estimated building exposure for North Dakota is $46.25 billion.

Table 4.4A North Dakota Housing Unit Statistics from 2000

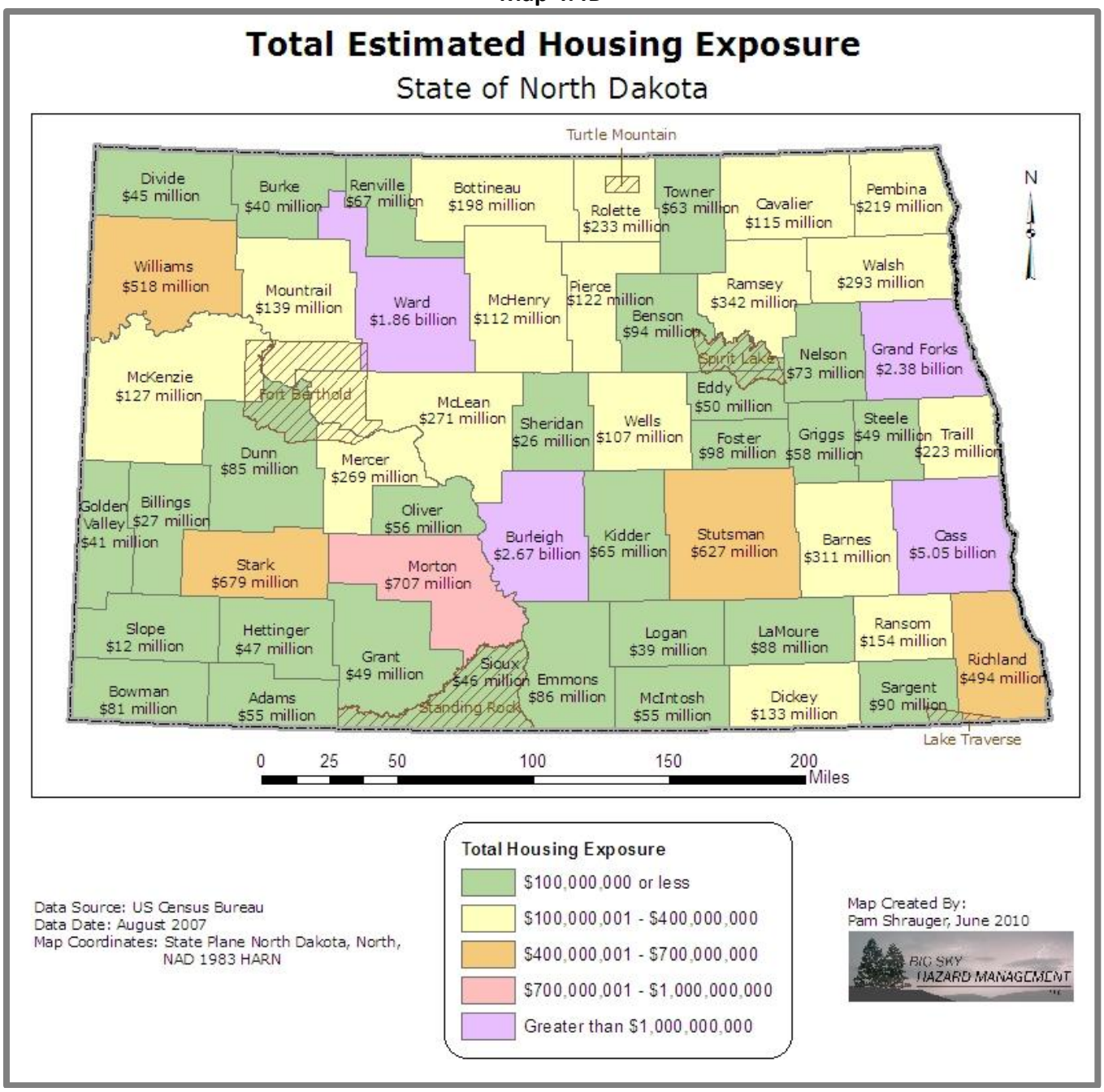
County	Number of Housing Units	Density (number of housing units per square mile)	Median Year Housing Unit Built	Median Value of Owner-Occupied Housing Units
North Dakota	*289,677*	*4.2*	*1970*	*$68,300*
Adams	1,416	1.4	1955	$38,800
Barnes	5,599	3.8	1956	$55,600
Benson*	2,932	2.1	1968	$32,200
Billings	529	0.5	1970	$50,800
Bottineau	4,409	2.6	1963	$44,900
Bowman	1,596	1.4	1963	$50,800
Burke	1,412	1.3	1946	$28,300
Burleigh	29,003	17.8	1975	$92,100
Cass	53,790	30.5	1976	$93,900
Cavalier	2,725	1.8	1961	$42,100
Dickey	2,656	2.3	1961	$50,100
Divide	1,469	1.2	1950	$30,900
Dunn*	1,965	1.0	1963	$43,500
Eddy*	1,418	2.3	1951	$35,000
Emmons	2,168	1.4	1954	$39,800
Foster	1,793	2.8	1962	$54,900
Golden Valley	973	1.0	1948	$42,000
Grand Forks	27,373	19.0	1971	$87,100
Grant	1,722	1.0	1959	$28,500
Griggs	1,521	2.1	1948	$37,900
Hettinger	1,419	1.3	1951	$33,100
Kidder	1,610	1.2	1962	$40,500
LaMoure	2,271	2.0	1951	$38,600
Logan	1,193	1.2	1953	$33,100

Table 4.4A North Dakota Housing Unit Statistics from 2000 (continued)

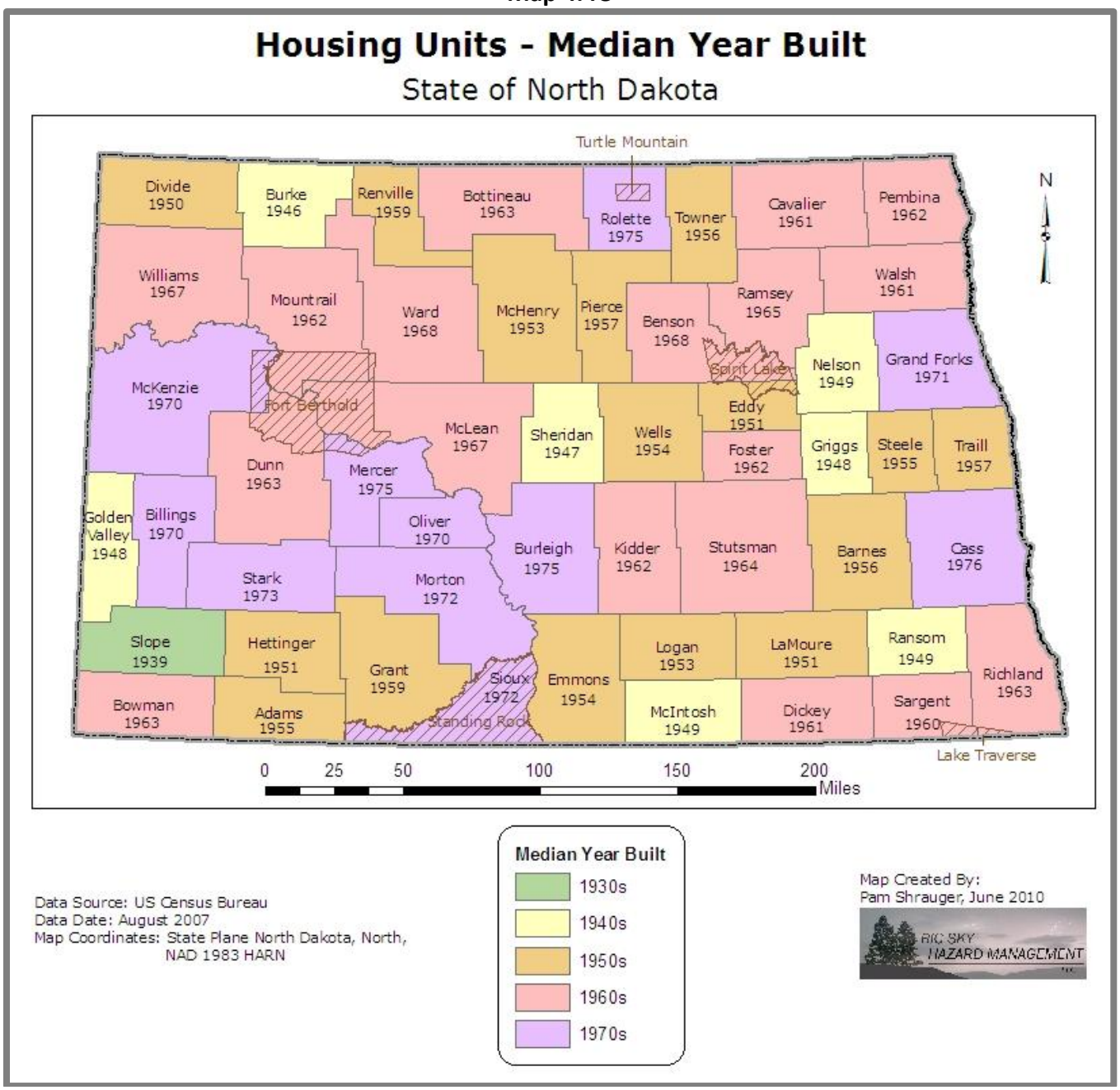
County	Number of Housing Units	Density (number of housing units per square mile)	Median Year Housing Unit Built	Median Value of Owner-Occupied Housing Units
McHenry	2,983	1.6	1953	$37,700
McIntosh	1,853	1.9	1949	$29,500
McKenzie*	2,719	1.0	1970	$46,800
McLean*	5,264	2.5	1967	$51,400
Mercer*	4,402	4.2	1975	$61,000
Morton	10,587	5.5	1972	$66,800
Mountrail*	3,438	1.9	1962	$40,500
Nelson*	2,014	2.1	1949	$36,000
Oliver	903	1.2	1970	$62,100
Pembina	4,115	3.7	1962	$53,200
Pierce	2,269	2.2	1957	$53,900
Ramsey*	5,729	4.8	1965	$59,700
Ransom	2,604	3.0	1949	$59,200
Renville	1,413	1.6	1959	$47,300
Richland*	7,575	5.3	1963	$65,200
Rolette*	5,027	5.6	1975	$46,300
Sargent*	2,016	2.3	1960	$44,700
Sheridan	924	1.0	1947	$27,800
Sioux*	1,216	1.1	1972	$37,500
Slope	451	0.4	1939	$25,700
Stark	9,722	7.3	1973	$69,800
Steele	1,231	1.7	1955	$39,800
Stutsman	9,817	4.4	1964	$63,900
Towner	1,558	1.5	1956	$40,300
Traill	3,708	4.3	1957	$60,200
Walsh	5,757	4.5	1961	$50,900
Ward*	25,097	12.5	1968	$74,200
Wells	2,643	2.1	1954	$40,500
Williams	9,680	4.7	1967	$53,500

* includes at least part of the reservation
Source: US Census Bureau, 2010a.

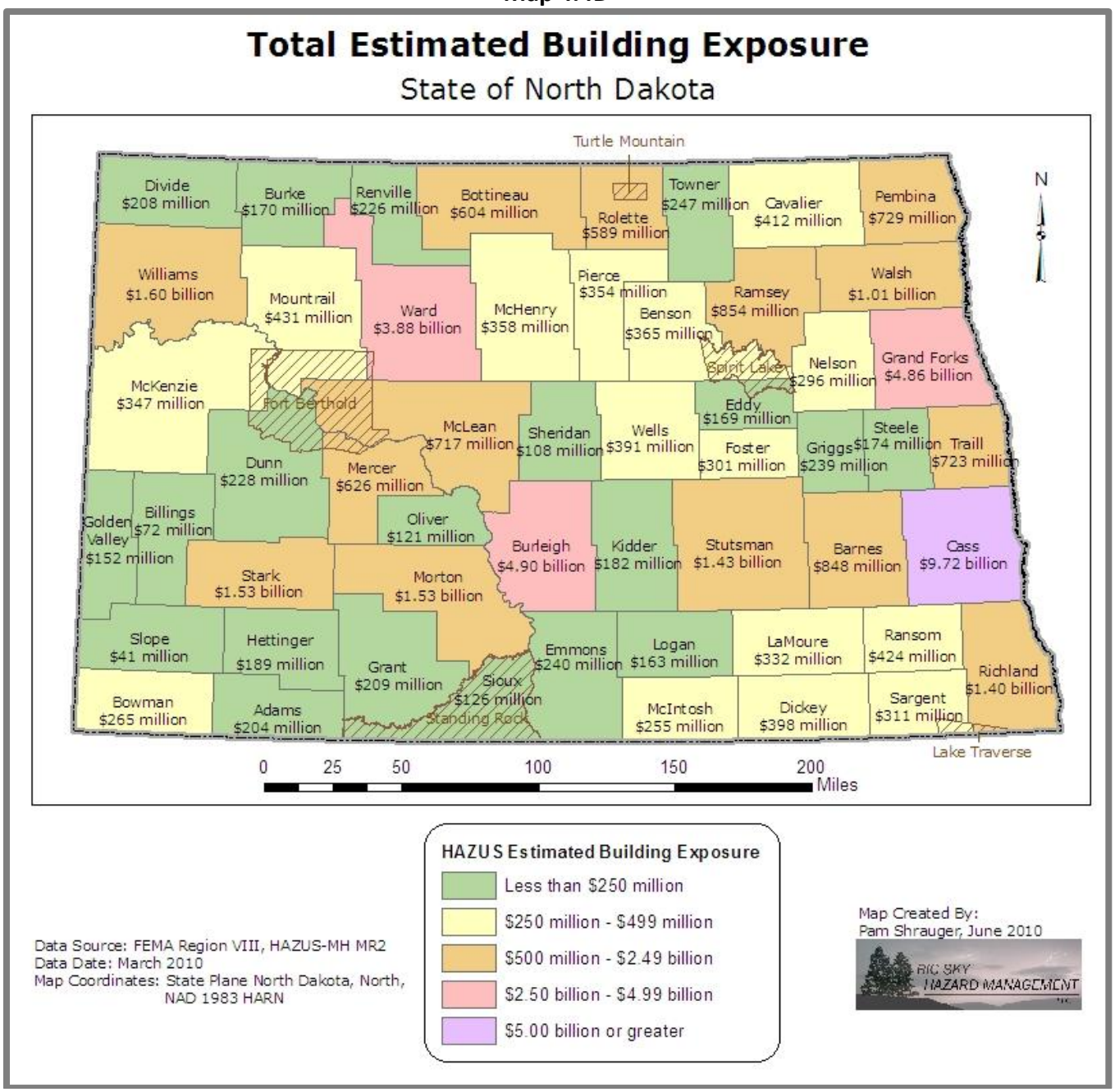
Map 4.4B


Total Estimated Housing Exposure
State of North Dakota
Turtle Mountain
Divide $45 million
Burke $40 million
Renville $67 million
Bottineau $198 million
Rolette $233 million
Towner $63 million
Cavalier $115 million
Pembina $219 million
Williams $518 million
Mountrail $139 million
Ward $1.86 billion
McHenry $112 million
Pierce $122 million
Benson $94 million
Ramsey $342 million
Walsh $293 million
Spirit Lake
Nelson $73 million
Grand Forks $2.38 billion
McKenzie $127 million
Fort Berthold
McLean $271 million
Sheridan $26 million
Wells $107 million
Eddy $50 million
Foster $98 million
Griggs $58 million
Steele $49 million
Traill $223 million
Dunn $85 million
Mercer $269 million
Golden Valley $41 million
Billings $27 million
Oliver $56 million
Burleigh $2.67 billion
Kidder $65 million
Stutsman $627 million
Barnes $311 million
Cass $5.05 billion
Stark $679 million
Morton $707 million
Slope $12 million
Hettinger $47 million
Grant $49 million
Sioux $46 million
Emmons $86 million
Logan $39 million
LaMoure $88 million
Ransom $154 million
Richland $494 million
Bowman $81 million
Adams $55 million
Standing Rock
McIntosh $55 million
Dickey $133 million
Sargent $90 million
Lake Traverse
N
0 25 50 100 150 200 Miles
Total Housing Exposure
$100,000,000 or less
$100,000,001 - $400,000,000
$400,000,001 - $700,000,000
$700,000,001 - $1,000,000,000
Greater than $1,000,000,000
Data Source: US Census Bureau
Data Date: August 2007
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

Map 4.4C


Housing Units - Median Year Built
State of North Dakota
Turtle Mountain
Divide 1950
Burke 1946
Renville 1959
Bottineau 1963
Rolette 1975
Towner 1956
Cavalier 1961
Pembina 1962
Williams 1967
Mountrail 1962
Ward 1968
McHenry 1953
Pierce 1957
Benson 1968
Ramsey 1965
Walsh 1961
Spirit Lake
Nelson 1949
Grand Forks 1971
McKenzie 1970
Fort Berthold
McLean 1967
Sheridan 1947
Wells 1954
Eddy 1951
Foster 1962
Griggs 1948
Steele 1955
Traill 1957
Dunn 1963
Mercer 1975
Golden Valley 1948
Billings 1970
Oliver 1970
Burleigh 1975
Kidder 1962
Stutsman 1964
Barnes 1956
Cass 1976
Stark 1973
Morton 1972
Slope 1939
Hettinger 1951
Grant 1959
Sioux 1972
Standing Rock
Emmons 1954
Logan 1953
LaMoure 1951
Ransom 1949
Richland 1963
Bowman 1963
Adams 1955
McIntosh 1949
Dickey 1961
Sargent 1960
Lake Traverse
N
0 25 50 100 150 200 Miles
Median Year Built
1930s
1940s
1950s
1960s
1970s
Data Source: US Census Bureau
Data Date: August 2007
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

Map 4.4D


Total Estimated Building Exposure
State of North Dakota
Turtle Mountain
Divide $208 million
Burke $170 million
Renville $226 million
Bottineau $604 million
Rolette $589 million
Towner $247 million
Cavalier $412 million
Pembina $729 million
Williams $1.60 billion
Mountrail $431 million
Ward $3.88 billion
McHenry $358 million
Pierce $354 million
Benson $365 million
Ramsey $854 million
Walsh $1.01 billion
Spirit Lake
Nelson $296 million
Grand Forks $4.86 billion
McKenzie $347 million
Fort Berthold
Eddy $169 million
McLean $717 million
Sheridan $108 million
Wells $391 million
Foster $301 million
Griggs $239 million
Steele $174 million
Traill $723 million
Dunn $228 million
Mercer $626 million
Golden Valley $152 million
Billings $72 million
Oliver $121 million
Burleigh $4.90 billion
Kidder $182 million
Stutsman $1.43 billion
Barnes $848 million
Cass $9.72 billion
Stark $1.53 billion
Morton $1.53 billion
Slope $41 million
Hettinger $189 million
Grant $209 million
Emmons $240 million
Logan $163 million
LaMoure $332 million
Ransom $424 million
Richland $1.40 billion
Sioux $126 million
Standing Rock
Bowman $265 million
Adams $204 million
McIntosh $255 million
Dickey $398 million
Sargent $311 million
Lake Traverse
N
0 25 50 100 150 200 Miles
HAZUS Estimated Building Exposure
Less than $250 million
$250 million - $499 million
$500 million - $2.49 billion
$2.50 billion - $4.99 billion
$5.00 billion or greater
Data Source: FEMA Region VIII, HAZUS-MH MR2
Data Date: March 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

4.5 Economic, Ecologic, Historic, and Social Values

Agriculture is the primary industry in North Dakota. Agricultural production comprises about 90 percent of the state's total land area. North Dakota leads the nation in the production of several crops such as barley, sunflower seeds, spring and durum wheat for processing, and farm-raised turkeys. (Wikipedia, 2010a) Table 4.5A and Map 4.5B show the market value of agricultural products sold as calculated in the 2007 agriculture census.

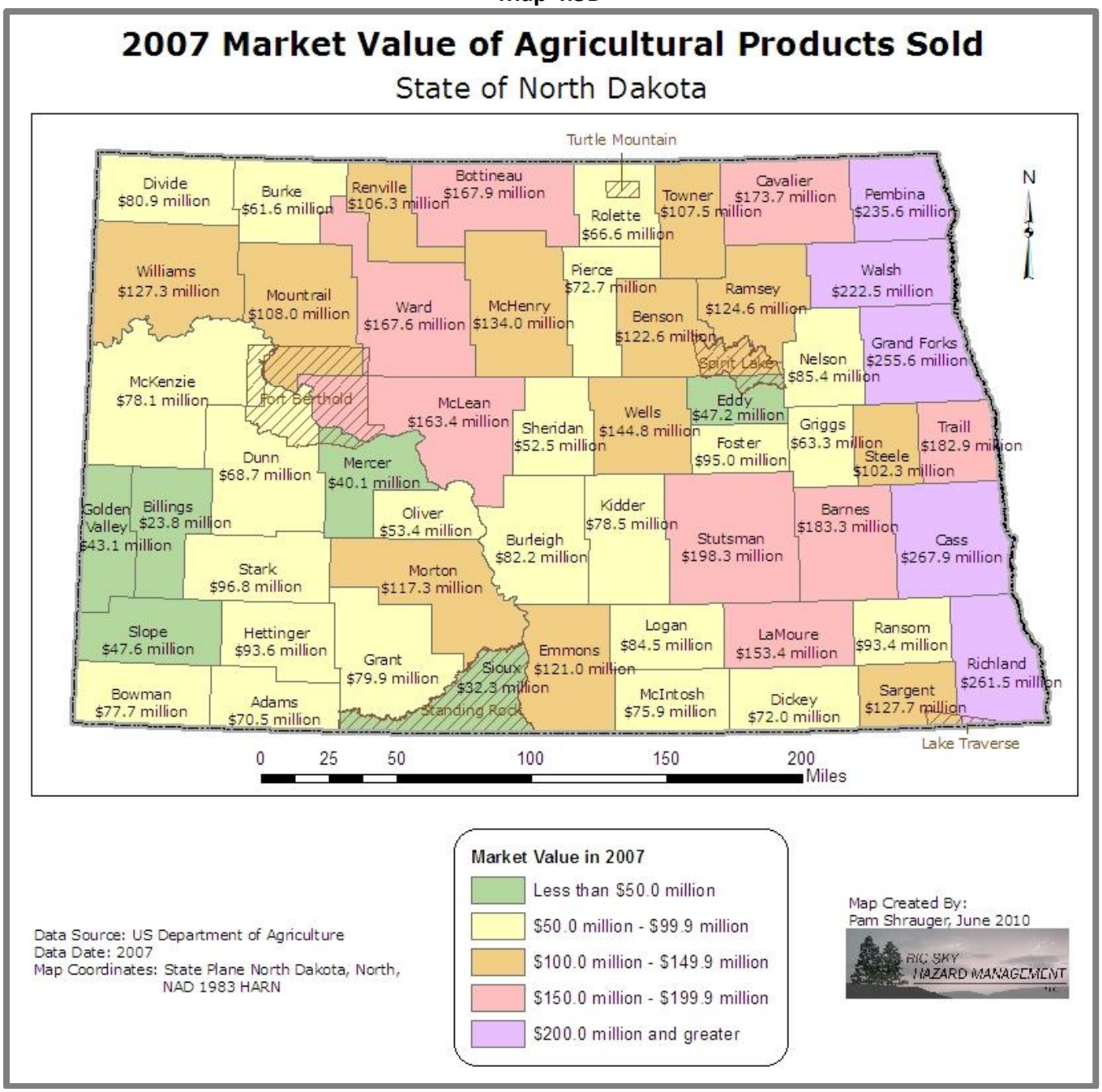
Table 4.5A North Dakota 2007 Market Value of Agricultural Products Sold

County	Market Value
North Dakota	*$6,084,219,000*
Adams	$70,542,000
Barnes	$183,261,000
Benson*	$122,569,000
Billings	$23,750,000
Bottineau	$167,882,000
Bowman	$77,682,000
Burke	$61,587,000
Burleigh	$82,236,000
Cass	$267,898,000
Cavalier	$173,738,000
Dickey	$,162,162,000
Divide	$80,927,000
Dunn*	$68,712,000
Eddy*	$47,231,000
Emmons	$120,954,000
Foster	$94,959,000
Golden Valley	$43,102,000
Grand Forks	$255,594,000
Grant	$79,870,000
Griggs	$63,305,000
Hettinger	$93,560,000
Kidder	$78,457,000
LaMoure	$153,395,000
Logan	$84,541,000
McHenry	$133,960,000
McIntosh	$75,862,000

County	Market Value
McKenzie*	$78,120,000
McLean*	$163,440,000
Mercer*	$40,068,000
Morton	$117,251,000
Mountrail*	$108,002,000
Nelson*	$85,369,000
Oliver	$53,389,000
Pembina	$235,621,000
Pierce	$72,713,000
Ramsey*	$124,570,000
Ransom	$93,358,000
Renville	$106,271,000
Richland*	$261,499,000
Rolette*	$66,616,000
Sargent*	$127,741,000
Sheridan	$52,488,000
Sioux*	$32,319,000
Slope	$47,645,000
Stark	$96,812,000
Steele	$102,344,000
Stutsman	$198,283,000
Towner	$107,472,000
Traill	$182,870,000
Walsh	$222,534,000
Ward*	$167,597,000
Wells	$144,758,000
Williams	$127,333,000

* includes at least part of the reservation
Source: US Department of Agriculture, 2007.

Map 4.5B


2007 Market Value of Agricultural Products Sold
State of North Dakota
Turtle Mountain
Divide $80.9 million
Burke $61.6 million
Renville $106.3 million
Bottineau $167.9 million
Rolette $66.6 million
Towner $107.5 million
Cavalier $173.7 million
Pembina $235.6 million
Williams $127.3 million
Mountrail $108.0 million
Ward $167.6 million
McHenry $134.0 million
Pierce $72.7 million
Benson $122.6 million
Ramsey $124.6 million
Walsh $222.5 million
Spirit Lake
Nelson $85.4 million
Grand Forks $255.6 million
McKenzie $78.1 million
Fort Berthold
McLean $163.4 million
Sheridan $52.5 million
Wells $144.8 million
Eddy $47.2 million
Foster $95.0 million
Griggs $63.3 million
Steele $102.3 million
Traill $182.9 million
Dunn $68.7 million
Mercer $40.1 million
Golden Valley $43.1 million
Billings $23.8 million
Oliver $53.4 million
Burleigh $82.2 million
Kidder $78.5 million
Stutsman $198.3 million
Barnes $183.3 million
Cass $267.9 million
Stark $96.8 million
Morton $117.3 million
Slope $47.6 million
Hettinger $93.6 million
Grant $79.9 million
Sioux $32.3 million
Standing Rock
Emmons $121.0 million
Logan $84.5 million
LaMoure $153.4 million
Ransom $93.4 million
Richland $261.5 million
Bowman $77.7 million
Adams $70.5 million
McIntosh $75.9 million
Dickey $72.0 million
Sargent $127.7 million
Lake Traverse
N
0 25 50 100 150 200 Miles
Market Value in 2007
Less than $50.0 million
$50.0 million - $99.9 million
$100.0 million - $149.9 million
$150.0 million - $199.9 million
$200.0 million and greater
Data Source: US Department of Agriculture
Data Date: 2007
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

In 2009, approximately 24 million acres in North Dakota were covered by crop insurance through the USDA Risk Management Agency, covering $4,090,153,747 in liabilities. (Risk Management Agency, 2009)

Besides agriculture, the two other major industries in North Dakota are petroleum and food processing. (Wikipedia, 2010a) Other sectors of the economy include mining, construction, manufacturing, health care, transportation, communications, utilities, wholesale trade, retail trade, professional and public services, finance, insurance, education, and real estate.

In 2008, the Gross Domestic Product for North Dakota was $31.208 billion, the lowest in the nation with the exception of Vermont. Despite national economic slowdowns, North Dakota had the fastest economic growth in 2008; the largest contributor was the agriculture, forestry, fishing, and hunting industry. (US Bureau of Economic Analysis, 2010) The per capita personal income and percentage of the population in poverty by county is shown in Table 4.5C and depicted in Map 4.5D.

Table 4.5C North Dakota Per Capita Personal Income and Poverty Statistics

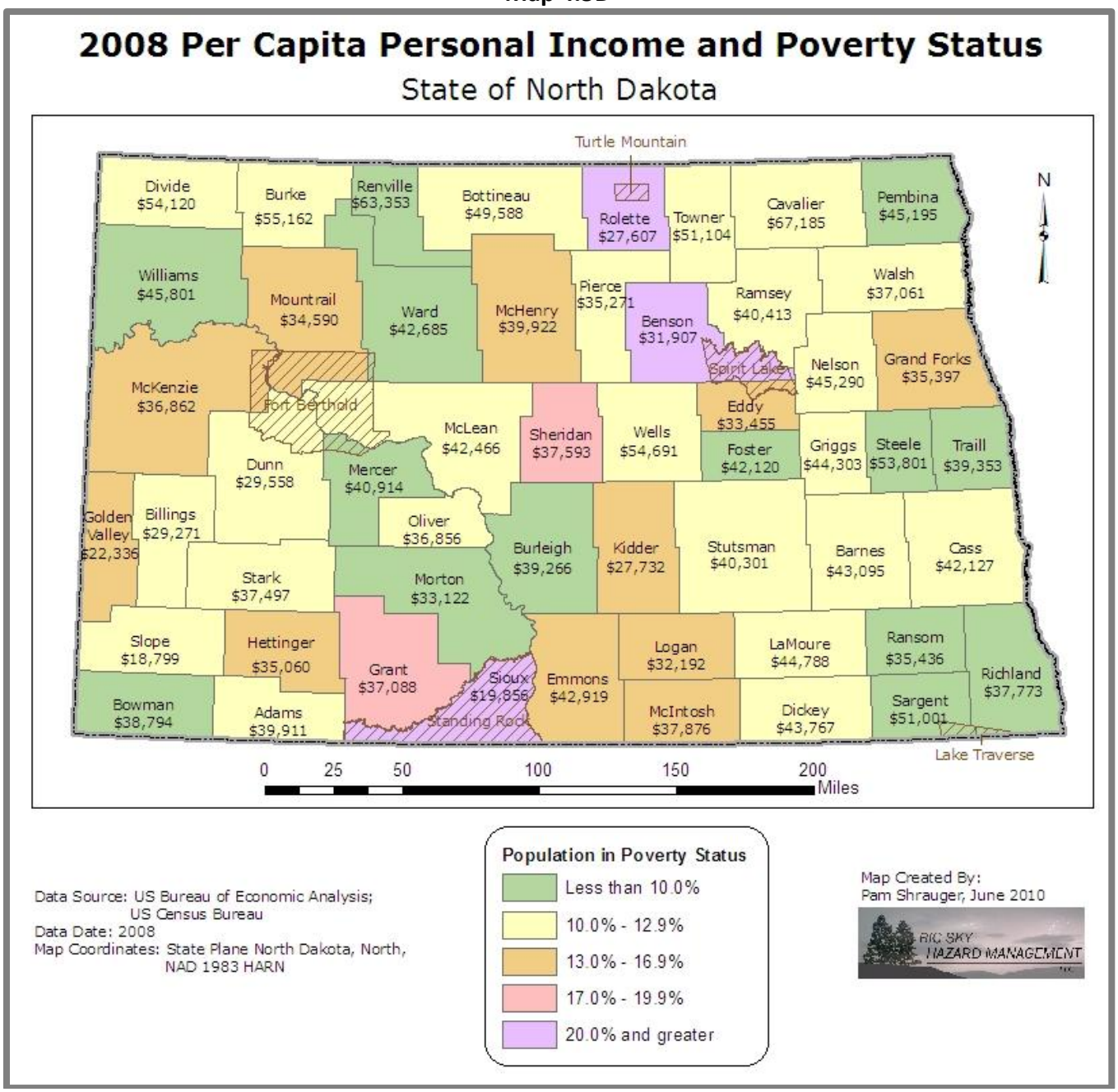
County	2008 Per Capita Personal Income	2008 Estimate of the Population in Poverty (percent)
North Dakota	*$39,874*	*11.5*
Adams	$39,911	11.1
Barnes	$43,095	11.7
Benson*	$31,907	27.9
Billings	$29,271	11.4
Bottineau	$49,588	11.6
Bowman	$38,794	8.2
Burke	$55,162	10.4
Burleigh	$39,266	8.9
Cass	$42,127	10.0
Cavalier	$67,185	10.9
Dickey	$43,767	12.9
Divide	$54,120	11.6
Dunn*	$29,558	12.2
Eddy*	$33,455	13.1
Emmons	$42,919	13.3
Foster	$42,120	9.0
Golden Valley	$22,336	13.2
Grand Forks	$35,397	15.2
Grant	$37,088	17.1
Griggs	$44,303	10.6
Hettinger	$35,060	13.1
Kidder	$27,732	14.3
LaMoure	$44,788	11.3

Table 4.5C North Dakota Per Capita Personal Income and Poverty Statistics (continued)

County	2008 Per Capita Personal Income	2008 Estimate of the Population in Poverty (percent)
Logan	$32,192	13.0
McHenry	$39,922	13.7
McIntosh	$37,876	13.1
McKenzie*	$36,862	14.4
McLean*	$42,466	11.1
Mercer*	$40,914	7.2
Morton	$33,122	9.5
Mountrail*	$34,590	14.0
Nelson*	$45,290	10.3
Oliver	$36,856	10.2
Pembina	$45,195	8.4
Pierce	$35,271	12.3
Ramsey*	$40,413	12.6
Ransom	$35,436	9.6
Renville	$63,353	8.8
Richland*	$37,773	9.3
Rolette*	$27,607	27.9
Sargent*	$51,001	7.1
Sheridan	$37,593	17.9
Sioux*	$19,856	37.8
Slope	$18,799	11.6
Stark	$37,497	10.2
Steele	$53,801	7.4
Stutsman	$40,301	11.6
Towner	$51,104	10.0
Traill	$39,353	8.6
Walsh	$37,061	11.0
Ward*	$42,685	9.8
Wells	$54,691	12.3
Williams	$45,801	9.9

* includes at least part of the reservation population
Sources: US Bureau of Economic Analysis, 2010; US Census Bureau, 2010a.

Map 4.5D


2008 Per Capita Personal Income and Poverty Status
State of North Dakota
Turtle Mountain
Divide $54,120
Burke $55,162
Renville $63,353
Bottineau $49,588
Rolette $27,607
Towner $51,104
Cavalier $67,185
Pembina $45,195
Williams $45,801
Mountrail $34,590
Ward $42,685
McHenry $39,922
Pierce $35,271
Benson $31,907
Ramsey $40,413
Walsh $37,061
Spirit Lake
Nelson $45,290
Grand Forks $35,397
McKenzie $36,862
Fort Berthold
Eddy $33,455
McLean $42,466
Sheridan $37,593
Wells $54,691
Foster $42,120
Griggs $44,303
Steele $53,801
Traill $39,353
Dunn $29,558
Mercer $40,914
Golden Valley $22,336
Billings $29,271
Oliver $36,856
Burleigh $39,266
Kidder $27,732
Stutsman $40,301
Barnes $43,095
Cass $42,127
Stark $37,497
Morton $33,122
Slope $18,799
Hettinger $35,060
Grant $37,088
Sioux $19,856
Standing Rock
Emmons $42,919
Logan $32,192
LaMoure $44,788
Ransom $35,436
Richland $37,773
Bowman $38,794
Adams $39,911
McIntosh $37,876
Dickey $43,767
Sargent $51,001
Lake Traverse
N
0 25 50 100 150 200 Miles
Population in Poverty Status
Less than 10.0%
10.0% - 12.9%
13.0% - 16.9%
17.0% - 19.9%
20.0% and greater
Data Source: US Bureau of Economic Analysis; US Census Bureau
Data Date: 2008
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

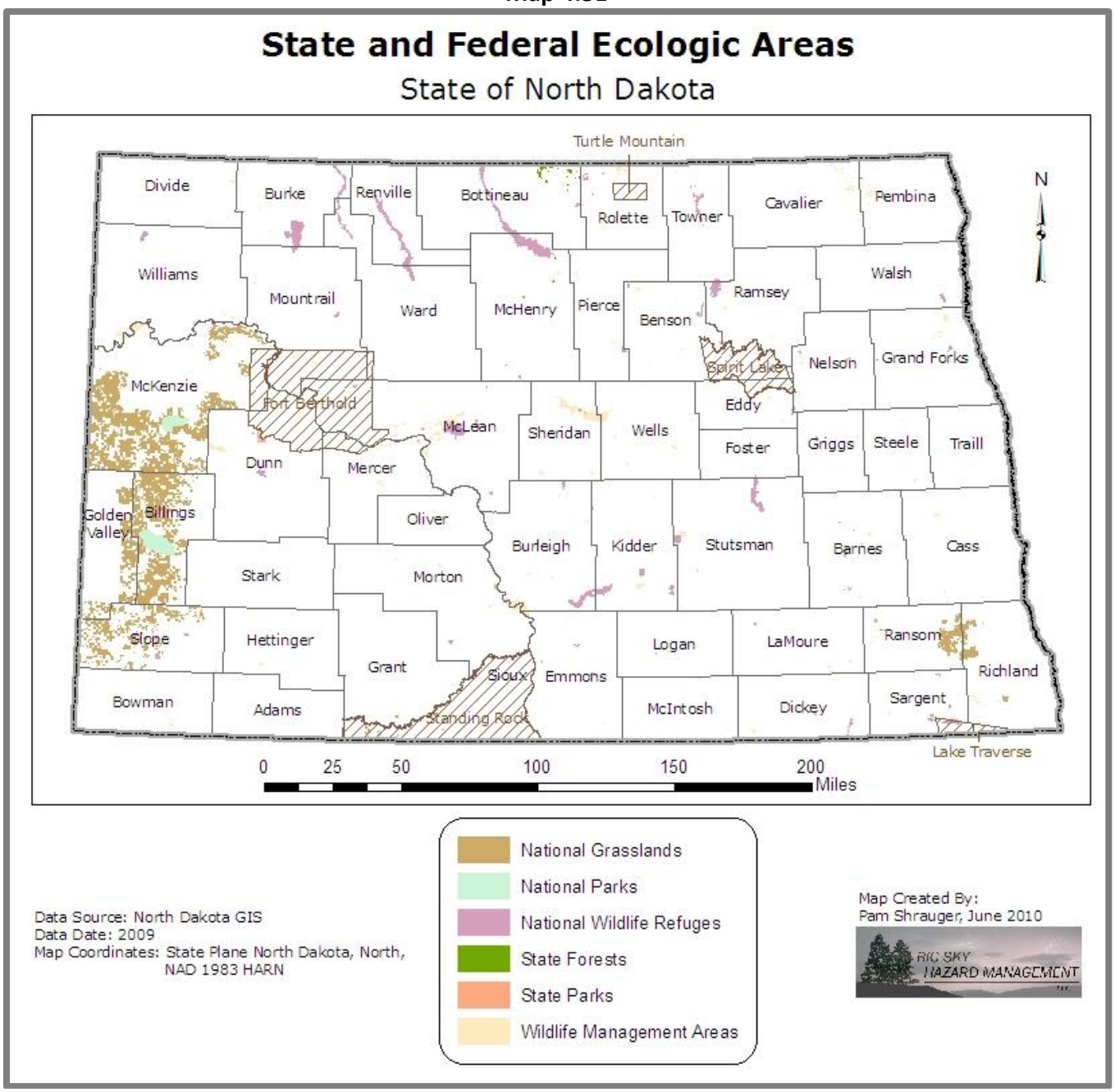
The ecological, historical, and social values of North Dakota each tie in to the quality of life for residents and visitors. Without these values, lives and property may not be threatened, but the way of life and connections to history and the environment could be disrupted. These values can have deep emotional meaning and investment.

Ecological values represent the relationship between organisms and their environment. For humans, these values include clean air, clean water, a sustainable way of life, and a healthy, natural environment including a diversity of species. Natural hazards, such as floods and wildfires, are usually part of a healthy ecosystem but often human caused hazards damage ecological values. Endangered species in North Dakota include the Whooping Crane, Pallid Sturgeon, Least Tern, Black-Footed Ferret, and Gray Wolf (endangered in western North Dakota and delisted in eastern North Dakota). Threatened species include the Piping Plover and Western Prairie Fringed Orchid. Candidate species in North Dakota are the Dakota Skipper and Greater Sage-Grouse. (US Fish and Wildlife Service, 2010) Areas of ecologic significance include Theodore Roosevelt National Park, the Dakota Prairie National Grasslands, 64 National Wildlife Refuges, 11 National Wetland Management Districts, one National Game Preserve, five State Nature Preserves, and five State Forests. Map 4.5E shows areas managed by selected federal and state agencies.

Historic values capture a piece of history and maintain a point in time. Historic values can include sites, buildings, documents, and other pieces that preserve times past and have value to people. North Dakota has approximately 400 resources listed in the National Register of Historic Places. (National Park Service, 2010) The National Register of Historic Places provides more detail on specific locations.

Social values are often not fixed locations or quantified but are important aspects of quality of life and interpersonal relationships. Examples of social values may include gatherings to promote community building, personal achievement, freedom from tyranny, the ability to communicate with others, pride in making the world a better place, and friendships. The realm of social values is only limited by the human imagination and usually relates to how a person feels. Disasters, both natural and human-caused, can disrupt important social activities and sometimes have lasting effects on society.

Map 4.5E


State and Federal Ecologic Areas
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
N
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
0
25
50
100
150
200
Miles
National Grasslands
National Parks
National Wildlife Refuges
State Forests
State Parks
Wildlife Management Areas
Data Source: North Dakota GIS
Data Date: 2009
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY
HAZARD MANAGEMENT

4.6 Land Use

Much of the land in North Dakota is devoted to agriculture. About 90 percent of the 70,655 square miles of land area is used for cropland, rangeland, or pastureland. The Red River Valley, with higher amounts of precipitation, consists of primarily croplands. The drier central and southwestern parts of the state have more livestock-based land uses. Natural resource extraction and energy production is another important land use, particularly in the western part of the state.

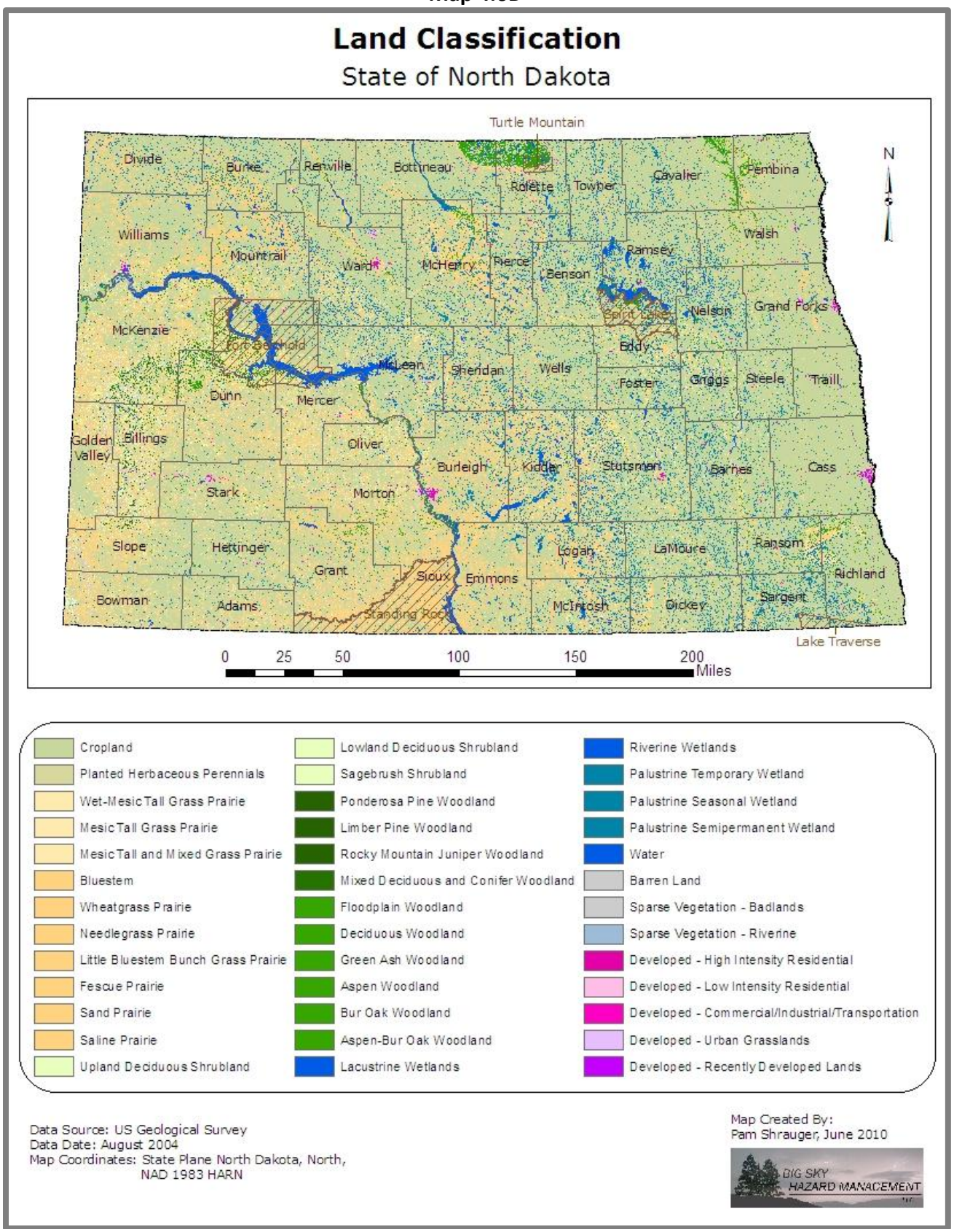
The state, with its agricultural economy, is primarily rural, however, several urban centers exist. The largest cities in North Dakota include Fargo, Bismarck, Grand Forks, and Minot. These cities make up the majority of the urban land area. Based on the gap analysis conducted by the US Geological Survey in 2004, North Dakota's land can be generally classified as shown in Table 4.6A. Map 4.6B shows the state's land cover and Map 4.6C shows the federal and state government land ownership.

Table 4.6A North Dakota Land Cover Summary

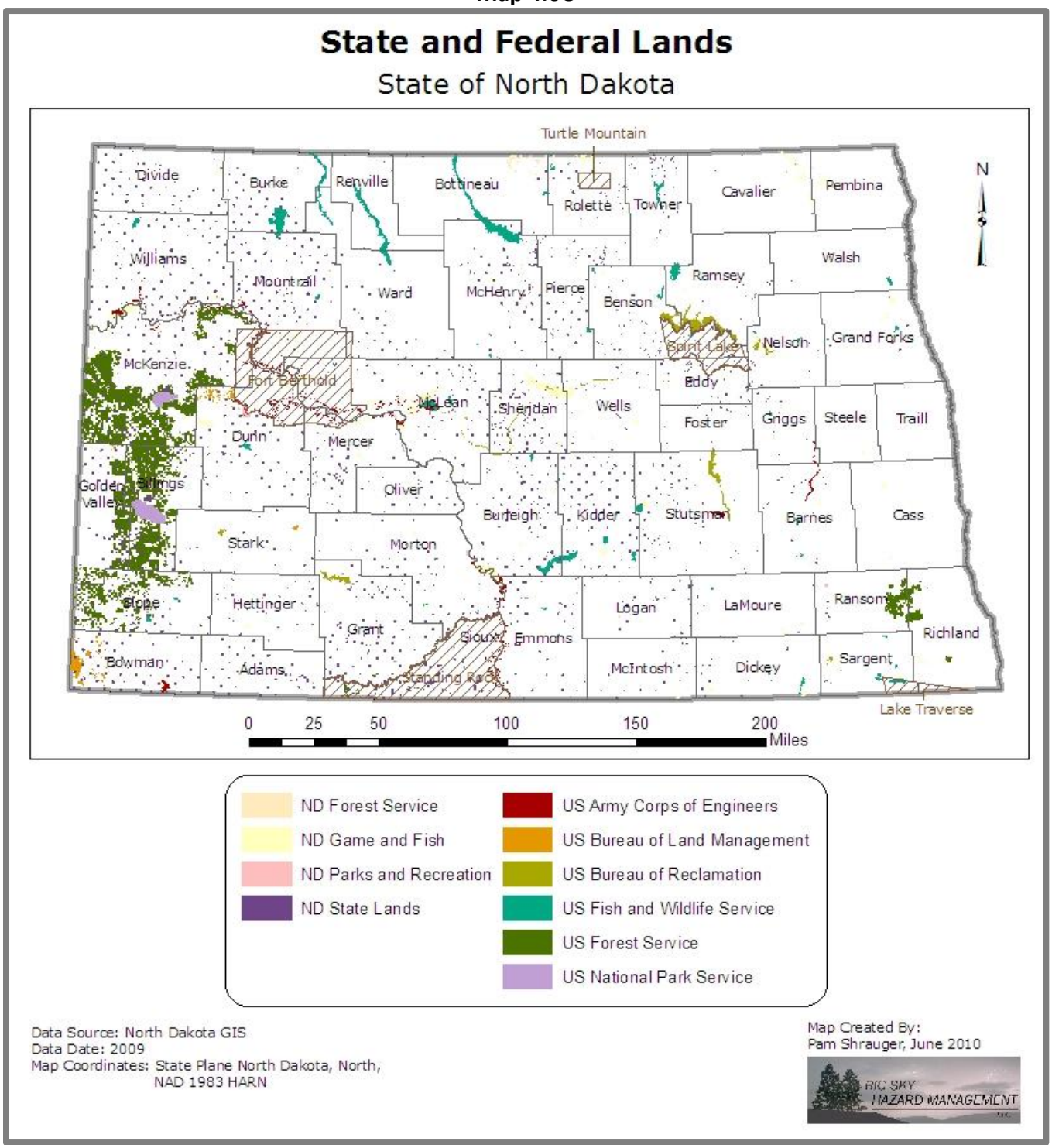
General Category	Area
Cropland	34,041 square miles
Prairie	13,777 square miles
Planted Herbaceous Perennials	11,793 square miles
Wetland	6,293 square miles
Shrubland	2,039 square miles
Woodland	1,654 square miles
Barren/Sparse Vegetation	732 square miles
Developed	368 square miles

Source: US Geological Survey, 2004a.

Map 4.6B


Land Classification
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Nelson
Grand Forks
McKenzie
Fort Berthold
Spirit Lake
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Cropland
Planted Herbaceous Perennials
Wet-Mesic Tall Grass Prairie
Mesic Tall Grass Prairie
Mesic Tall and Mixed Grass Prairie
Bluestem
Wheatgrass Prairie
Needlegrass Prairie
Little Bluestem Bunch Grass Prairie
Fescue Prairie
Sand Prairie
Saline Prairie
Upland Deciduous Shrubland
Lowland Deciduous Shrubland
Sagebrush Shrubland
Ponderosa Pine Woodland
Limber Pine Woodland
Rocky Mountain Juniper Woodland
Mixed Deciduous and Conifer Woodland
Floodplain Woodland
Deciduous Woodland
Green Ash Woodland
Aspen Woodland
Bur Oak Woodland
Aspen-Bur Oak Woodland
Lacustrine Wetlands
Riverine Wetlands
Palustrine Temporary Wetland
Palustrine Seasonal Wetland
Palustrine Semipermanent Wetland
Water
Barren Land
Sparse Vegetation - Badlands
Sparse Vegetation - Riverine
Developed - High Intensity Residential
Developed - Low Intensity Residential
Developed - Commercial/Industrial/Transportation
Developed - Urban Grasslands
Developed - Recently Developed Lands
Data Source: US Geological Survey
Data Date: August 2004
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

Map 4.6C


State and Federal Lands
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
N
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
0
25
50
100
150
200
Miles
ND Forest Service
ND Game and Fish
ND Parks and Recreation
ND State Lands
US Army Corps of Engineers
US Bureau of Land Management
US Bureau of Reclamation
US Fish and Wildlife Service
US Forest Service
US National Park Service
Data Source: North Dakota GIS
Data Date: 2009
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY
HAZARD MANAGEMENT

4.7 New Development

Table 4.3A in the population section shows the estimated population change by county from 2006 to 2009 and the general trend since 2000. Map 4.7A demonstrates this change geographically. As this demonstrates, the North Dakota population trend is people moving out of the rural areas and into the urban and new energy development areas. The tribal areas are also seeing moderate population growth.

Map 4.7A

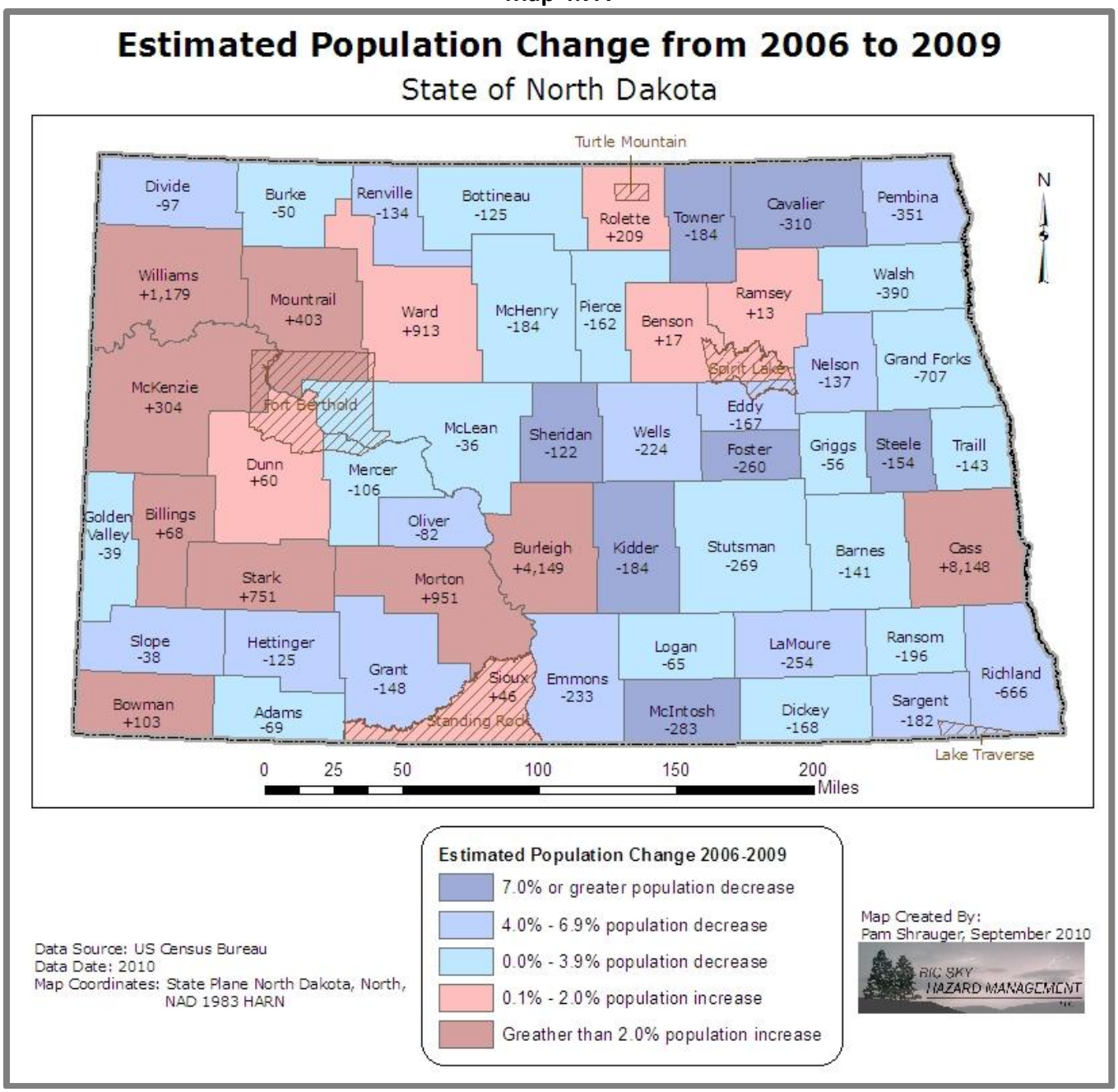


Table 4.7B shows the estimated number of new privately owned housing units authorized in North Dakota by unit type from 2005-2009. This table demonstrates the amount of development that has occurred in North Dakota over the past two plan revisions. This information is based on building permit data, so it is important to note that development in areas lacking a building permit system may not be included in these results.

Table 4.7B New Privately Owned Housing Units Authorized in North Dakota

Type	2005	2006	2007	2008	2009
1 Unit	2,367	2,297	2,194	1,888	1,704
2 Units	70	60	24	44	44
3 and 4 Units	140	126	125	39	43
5 Units or More	1,461	1,046	1,017	862	1,404
Number of Structures with 5 units or More	56	58	33	40	51
Total Number of Units	4,038	3,529	3,360	2,833	3,195

Note: Only areas with building permit systems are included. Additional new construction may be occurring in areas lacking building permit regulations.
Source: US Census Bureau, 2010b.

Table 4.7C shows the number of building permits approved from 2005-2009 by county. Note that development in areas lacking a building permit system may not be included in these results.

Table 4.7C New Privately Owned Residential Building Permits

County	2005	2006	2007	2008	2009	Total 2005-2009
North Dakota	*2,494*	*2,418*	*2,273*	*1,960*	*1,788*	*10,933*
Adams	3	8	6	5	1	23
Barnes	25	21	16	21	10	93
Benson	0	0	1	0	0	1
Billings	1	0	0	1	1	3
Bottineau	4	0	5	2	2	13
Bowman	1	3	6	5	5	20
Burke	3	0	1	2	3	9
Burleigh	516	553	514	450	362	2,395
Cass	1,026	840	809	616	592	3,883
Cavalier	1	1	7	3	2	14
Dickey	1	4	2	0	0	7
Divide	0	1	1	0	2	4
Dunn	4	8	5	4	3	24
Eddy	1	0	0	1	2	4
Emmons	1	2	2	2	2	9

Table 4.7C New Privately Owned Residential Building Permits (continued)

County	2005	2006	2007	2008	2009	Total 2005-2009
Foster	5	1	3	1	6	16
Golden Valley	2	3	1	1	1	8
Grand Forks	226	217	148	108	128	827
Grant	0	0	0	1	1	2
Griggs	0	0	0	0	0	0
Hettinger	1	0	0	0	0	1
Kidder	4	3	2	1	0	10
LaMoure	3	2	3	1	4	13
Logan	0	0	1	2	2	5
McHenry	5	8	3	12	13	41
McIntosh	10	1	1	2	0	14
McKenzie	1	8	2	0	20	31
McLean	20	50	42	24	21	157
Mercer	8	7	12	22	22	71
Morton	149	184	219	126	75	753
Mountrail	19	13	27	25	47	131
Nelson	2	2	2	0	1	7
Oliver	0	0	1	0	1	2
Pembina	1	1	4	3	0	9
Pierce	3	4	1	1	2	11
Ramsey	4	3	6	6	6	25
Ransom	5	2	3	0	0	10
Renville	2	1	1	1	1	6
Richland	36	48	41	20	16	161
Rolette	0	0	0	0	3	3
Sargent	15	14	7	9	4	49
Sheridan	1	7	3	1	4	16
Sioux	0	0	0	0	0	0
Slope	0	0	0	0	0	0
Stark	79	89	94	103	92	457
Steele	7	1	7	1	3	19
Stutsman	31	38	28	33	26	156
Towner	0	0	0	0	0	0
Traill	20	18	13	7	7	65
Walsh	6	8	9	5	4	32
Ward	188	165	142	195	208	898
Wells	1	1	3	0	2	7
Williams	53	78	69	137	81	418

Note: Only areas with building permit systems are included. Additional new construction may be occurring in areas lacking building permit regulations. Source: US Census Bureau, 2010b.

Table 4.7D shows the associated construction costs; these construction costs represent the increase in residential building exposure by county from 2005-2009 for those municipalities that have a building permit system.

Table 4.7D New Privately Owned Residential Construction Costs

County	2005	2006	2007	2008	2009	Total 2005-2009
North Dakota	*$457,789,126*	*$462,339,822*	*$445,615,216*	*$374,820,680*	*$349,803,355*	*$2,090,368,199*
Adams	$295,000	$1,191,000	$911,167	$753,334	$130,000	$3,280,501
Barnes	$3,572,084	$3,366,802	$2,781,054	$7,246,659	$1,955,000	$18,921,599
Benson	$0	$0	$75,000	$0	$0	$75,000
Billings	$250,000	$0	$0	$199,000	$199,000	$648,000
Bottineau	$540,000	$0	$1,694,000	$350,000	$500,000	$3,084,000
Bowman	$125,000	$348,000	$1,381,000	$1,062,500	$1,170,000	$4,086,500
Burke	$83,800	$0	$60,000	$260,000	$510,000	$913,800
Burleigh	$92,204,061	$109,764,812	$103,231,209	$93,911,221	$66,978,526	$466,089,829
Cass	$196,672,852	$159,060,609	$162,045,200	$113,419,650	$104,327,366	$735,525,677
Cavalier	$150,000	$250,000	$1,230,000	$550,000	$375,000	$2,555,000
Dickey	$130,000	$1,020,000	$250,000	$0	$0	$1,400,000
Divide	$0	$130,000	$200,000	$0	$405,000	$735,000
Dunn	$400,000	$1,540,000	$730,000	$520,000	$293,000	$3,483,000
Eddy	$185,000	$0	$0	$100,000	$549,000	$834,000
Emmons	$185,500	$275,000	$485,000	$450,000	$328,000	$1,723,500
Foster	$1,005,000	$125,000	$475,000	$125,000	$1,025,000	$2,755,000
Golden Valley	$63,000	$198,000	$31,500	$85,000	$200,000	$577,500
Grand Forks	$51,789,220	$63,302,943	$37,361,102	$37,177,104	$39,640,929	$229,271,298
Grant	$0	$0	$0	$100,000	$100,000	$200,000
Griggs	$0	$0	$0	$0	$0	$0
Hettinger	$200,000	$0	$0	$0	$0	$200,000
Kidder	$210,000	$157,500	$105,000	$52,500	$0	$525,000
LaMoure	$340,000	$265,000	$425,000	$200,000	$495,000	$1,725,000
Logan	$0	$0	$120,000	$500,000	$600,000	$1,220,000
McHenry	$642,212	$1,122,796	$458,496	$1,768,877	$2,177,150	$6,169,531
McIntosh	$1,161,000	$136,000	$136,000	$392,500	$0	$1,825,500
McKenzie	$160,000	$980,000	$200,000	$0	$2,622,000	$3,962,000
McLean	$2,525,667	$4,756,667	$6,566,500	$4,129,000	$3,240,000	$21,217,834
Mercer	$1,387,000	$1,030,000	$1,877,000	$3,690,000	$1,737,500	$9,721,500
Morton	$27,453,312	$23,743,682	$34,491,118	$24.017,840	$14,975,999	$100,664,975
Mountrail	$1,180,164	$1,180,768	$2,505,595	$9,081,552	$5,900,616	$19,848,695
Nelson	$170,000	$80,000	$170,000	$0	$100,000	$520,000
Oliver	$0	$0	$250,000	$0	$160,000	$410,000
Pembina	$95,000	$100,000	$740,000	$378,777	$0	$1,313,777
Pierce	$360,000	$575,000	$195,000	$250,000	$350,000	$1,730,000
Ramsey	$1,178,104	$459,586	$1,219,623	$1,081,567	$901,148	$4,840,028
Ransom	$671,000	$229,500	$628,000	$0	$0	$1,528,500
Renville	$100,000	$50,000	$50,000	$50,000	$50,000	$300,000
Richland	$5,859,593	$6,941,550	$6,203,444	$3,075,755	$3,606,875	$25,687,217
Rolette	$0	$0	$0	$0	$900,000	$900,000
Sargent	$2,994,000	$1,425,700	$660,317	$949,280	$437,850	$6,467,147
Sheridan	$40,000	$300,000	$177,215	$200,000	$128,000	$845,215

Table 4.7D New Privately Owned Residential Construction Costs (continued)

County	2005	2006	2007	2008	2009	Total 2005-2009
Sioux	$0	$0	$0	$0	$0	$0
Slope	$0	$0	$0	$0	$0	$0
Stark	$15,737,003	$15,990,961	$18,155,675	$22,050,649	$18,455,720	$90,390,008
Steele	$1,125,000	$102,110	$419,500	$75,000	$486,000	$2,207,610
Stutsman	$6,134,405	$8,038,691	$4,791,538	$6,658,756	$6,918,683	$32,542,073
Towner	$0	$0	$0	$0	$0	$0
Traill	$2,701,625	$2,492,000	$2,291,000	$1,057,000	$1,350,000	$9,891,625
Walsh	$770,773	$1,204,000	$1,737,712	$1,114,078	$578,339	$5,404,902
Ward	$31,237,948	$36,544,680	$28,412,210	$39,469,935	$39,944,172	$175,608,945
Wells	$38,000	$200,000	$315,000	$0	$398,000	$951,000
Williams	$5,666,803	$13,661,465	$19,373,041	$22,285,122	$24,604,482	$85,590,913

Note: Only areas with building permit systems are included. Additional new construction may be occurring in areas lacking building permit regulations.
Source: US Census Bureau, 2010b.

The construction costs listed in Table 4.7D increase the total exposure to the hazards in North Dakota; however, the vulnerability of the new construction depends on specifically where the development occurred and what regulations were in place locally to mitigate hazards. Jurisdictions issuing 10 or more new privately owned residential building permits in any year from 2004-2009 are shown in Table 4.7E.

Table 4.7E Places with New Privately Owned Residential Building Permits of 10 or More in One Year from 2004-2009

Place	County	2004	2005	2006	2007	2008	2009	Total 2004-2009
Barnes County, unincorporated	Barnes	17	16	15	11	8	4	71
Beulah	Mercer	5	4	5	4	17	13	48
Bismarck	Burleigh	298	244	294	292	278	219	1,625
Burleigh County, unincorporated	Burleigh	196	229	226	153	112	80	996
Casselton	Cass	18	16	9	9	6	13	71
Devils Lake	Ramsey	11	4	3	6	6	6	36
Dickinson	Stark	69	78	87	91	100	92	517
Fargo	Cass	469	501	482	460	411	367	2,690
Grand Forks	Grand Forks	232	195	200	109	90	110	936
Grand Forks County, unincorporated	Grand Forks	14	24	13	16	10	13	90
Harwood	Cass	4	0	22	3	4	0	33
Hillsboro	Traill	4	9	10	4	1	1	29
Horace	Cass	21	18	19	5	8	4	75
Jamestown	Stutsman	27	20	30	19	22	17	135
Kindred	Cass	1	7	5	11	7	1	32
Lincoln	Burleigh	53	43	32	69	60	63	320
Mandan	Morton	123	124	162	196	105	62	772
Mapleton	Cass	2	2	29	13	4	7	57

Table 4.7E Places with New Privately Owned Residential Building Permits of 10 or More in One Year from 2004-2009 (continued)

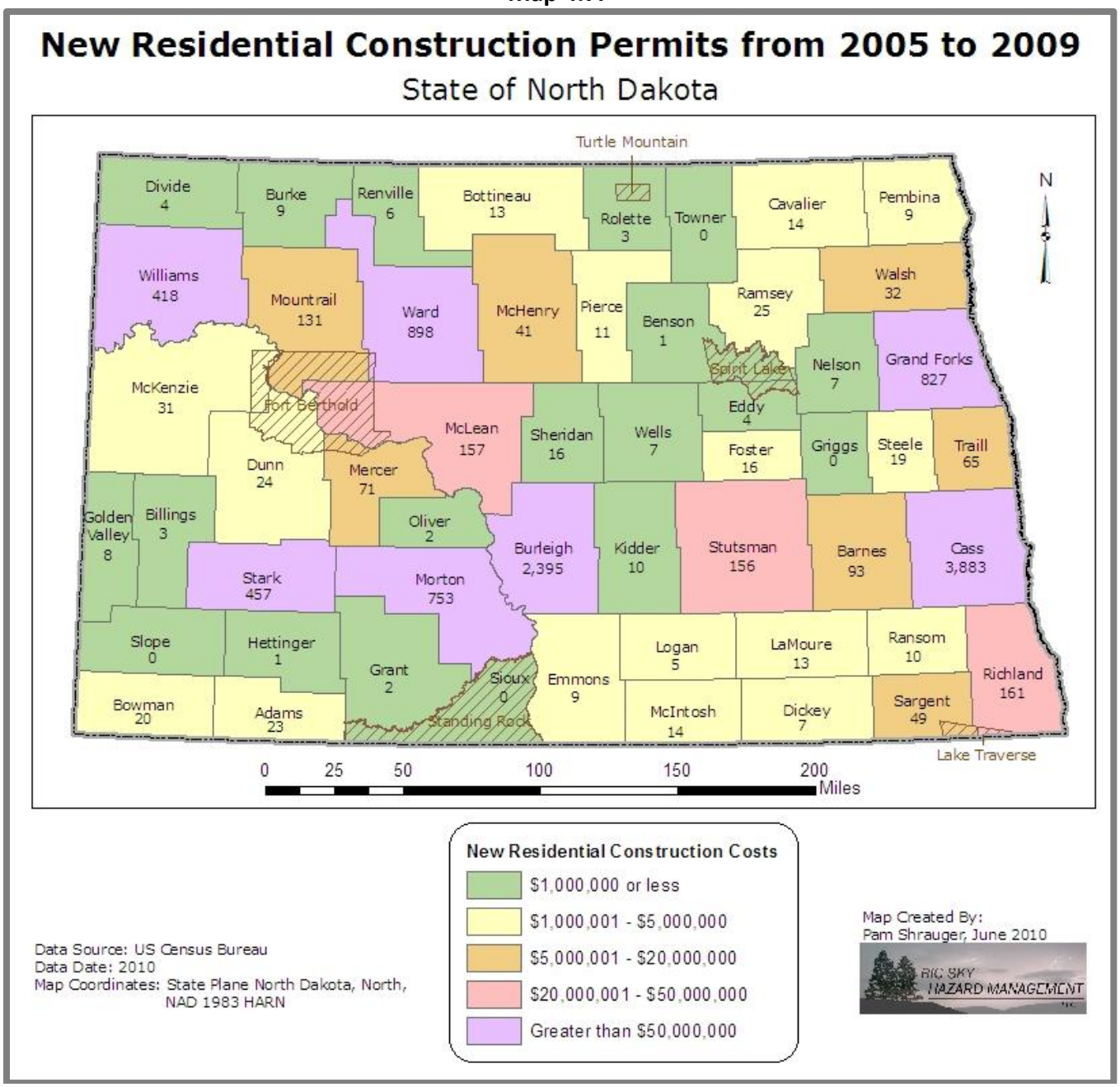
Place	County	2004	2005	2006	2007	2008	2009	Total 2004-2009
McHenry County, unincorporated	McHenry	9	4	7	3	6	12	41
McLean County, unincorporated	McLean	23	9	38	22	18	12	122
Minot	Ward	85	145	123	121	166	173	813
Morton County, unincorporated	Morton	20	23	20	22	21	13	119
Mountrail County, unincorporated	Mountrail	0	0	0	7	8	14	29
New Town	Mountrail	34	7	1	8	6	17	73
Northwood	Grand Forks	2	2	3	15	3	1	26
Stanley	Mountrail	5	3	4	6	6	12	36
Valley City	Barnes	7	7	6	5	13	6	44
Wahpeton	Richland	8	15	16	12	9	8	68
Ward County, unincorporated	Ward	25	33	35	13	19	15	140
Washburn	McLean	1	3	6	13	2	5	30
Watford City	McKenzie	1	1	8	2	0	20	32
West Fargo	Cass	671	463	254	292	159	185	2,024
Williams County, unincorporated	Williams	14	23	12	24	36	38	147
Williston	Williams	18	28	64	45	89	39	283

Only areas with building permit systems are included. Additional new construction may be occurring in areas lacking building permit regulations
Source: US Census Bureau, 2010b.

Of those jurisdictions listed in Table 4.7E, the communities seeing a surge in new residential development over the past three years include:

- Beulah
- Dickinson
- Kindred
- Lincoln
- McHenry County, unincorporated
- Minot
- Mountrail County, unincorporated
- Northwood
- Stanley
- Valley City
- Washburn
- Watford City
- Williams County, unincorporated
- Williston

Map 4.7F


New Residential Construction Permits from 2005 to 2009
State of North Dakota
Turtle Mountain
Divide 4
Burke 9
Renville 6
Bottineau 13
Rolette 3
Towner 0
Cavalier 14
Pembina 9
Williams 418
Mountrail 131
Ward 898
McHenry 41
Pierce 11
Benson 1
Ramsey 25
Walsh 32
Spirit Lake
Nelson 7
Grand Forks 827
McKenzie 31
Fort Berthold
McLean 157
Sheridan 16
Wells 7
Eddy 4
Foster 16
Griggs 0
Steele 19
Traill 65
Dunn 24
Mercer 71
Golden Valley 8
Billings 3
Oliver 2
Burleigh 2,395
Kidder 10
Stutsman 156
Barnes 93
Cass 3,883
Stark 457
Morton 753
Slope 0
Hettinger 1
Grant 2
Sioux 0
Standing Rock
Emmons 9
Logan 5
LaMoure 13
Ransom 10
Richland 161
Bowman 20
Adams 23
McIntosh 14
Dickey 7
Sargent 49
Lake Traverse
N
0 25 50 100 150 200 Miles
New Residential Construction Costs
$1,000,000 or less
$1,000,001 - $5,000,000
$5,000,001 - $20,000,000
$20,000,001 - $50,000,000
Greater than $50,000,000
Data Source: US Census Bureau
Data Date: 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

New development listed in local plans includes:

- An increase in development since 1999 south of Fargo along County Highway 17. (Cass County)
- Development in the Cities of Casselton, Horace, and Reile's Acres for the commuting population of the greater Fargo area. (Cass County)
- Since 2000, the City of Fargo has annexed approximately 550 acres per year and the City of West Fargo has annexed approximately 402 acres per year. (Cass County)
- Wind farms in the Strasburg and Hazelton areas. (Emmons County)
- Residential development along ND Highway 1804 and the Missouri River. (Emmons County)
- Recreational developments along the Oahe Reservoir and Missouri River. (Emmons County)
- Within the past ten years, the City of Carrington has supported several new businesses, including the Dakota Growers Pasta Company, Cannon Technologies, and Central City Marketing and Processing. Van Bedaf Dairy was also established near Carrington. (Foster County)
- New residential development has occurred in rural areas. (Grand Forks County)
- Numerous new development and construction throughout the City of Grand Forks; all development has met current city, state, and federal regulations. (Grand Forks County)
- In the Larimore area, a new Hoverson's bin and dryer site, new Larimore Bean Plant bins, a new pipeline pumping station, and modifications to the grain station in Arvilla. (Grand Forks County)
- In Manvel, a new building for repair and sale of fertilizer and spray equipment. (Grand Forks County)
- In Northwood, a tremendous amount of construction and redevelopment following the 2007 tornado. Over 170 building permits were issued. This development has had to meet new construction requirements, including the state building code. (Grand Forks County)
- In Thompson, a large addition to the elevator (a possible fire risk) and some new residential development, but no known hazards. (Grand Forks County)
- In 2009, a new storage facility was constructed in Mott. (Hettinger County)
- A new café and drug store. (Logan County)
- Some new development, primarily campgrounds and resorts, has occurred along the shores Devils Lake. These developments have occurred in township areas where regulations are minimal or non-existent and flooding is a concern. (Ramsey County)
- In Churchs Ferry, 3 new home sites that are not considered to be at specific risk from the identified hazards. (Ramsey County)
- In Devils Lake, approximately $7-8 million in new development occurs annually. This new development follows current regulations and is not considered at specific risk from the identified hazards. (Ramsey County)
- Housing developments have occurred in Enderlin and Lisbon. (Ransom County)
- Two new hog farms. (Towner County)
- Land being developed south of the City of Minot. (Ward County)

Despite the national economic slowdown in recent years, many North Dakota businesses and industries have been expanding. Table 4.7G highlights a few of the larger startups and expansions in the state over the past three years. The data for Table 4.7G was primarily collected through reports generated by the North Dakota Department of Commerce. Note that this data generally only covers manufacturers, food processors, information technology businesses, and other primary sector businesses and excludes

production agriculture, oil/gas exploration, local services, and other areas that may additionally be experiencing growth.

Table 4.7G Examples of Business Growth Announcements 2007-2009

City	County	Year	Cost	Description
		2008		New crude oil pipeline from Alberta, Canada to the Midwest through 218 miles of eastern North Dakota
Hettinger	Adams	2007	$171 million	New ethanol plant
Valley City	Barnes	2008		Wind farm start up
Oriska	Barnes	2009	$248 million	Wind farm expansion
Bottineau	Bottineau	2008	$2.7 million	Agriculture storage bin expansion
Gascoyne	Bowman	2008		Wind farm start up
Rhame	Bowman	2008	$48.75 million	Wind farm expansion
Scranton	Bowman	2008		Wind farm expansion
Regan	Burleigh	2009		Wind farm expansion
Wilton	Burleigh	2009	$88 million	Wind farm expansion
Casselton	Cass	2007	$240 million	New ethanol plant
Fargo	Cass	2007	$3 million	New meat processing plant
Fargo	Cass	2007	$35 million	Software publisher expansion
Fargo	Cass	2008	$18 million	Farm and construction machinery manufacturing expansion
Kindred	Cass	2008	$200 million	Soybean crushing and biodiesel plant start up
West Fargo	Cass	2008	$20 million	Metal manufacturing expansion
Fargo	Cass	2009	$1.7 million	Canvas and related product mills expansion
Fargo	Cass	2009	$10 million	Drug wholesaler expansion
Fargo	Cass	2009	$15 million	Metal services and steel manufacturing expansion
Fargo	Cass	2009	$3 million	New building for computer systems design services company
Fargo	Cass	2009	$1.7 million	Packaging and labeling services project expansion
Fargo	Cass	2009	$1.5 million	Packaging machinery manufacturing expansion
Nekoma	Cavalier	2008	$73 million	Wind farm expansion
Ellendale	Dickey	2008	$310 million	Wind farm expansion
Forbes	Dickey	2008	$381 million	Wind farm start up
Monango	Dickey	2008	$400 million	Wind farm start up
Grand Forks	Grand Forks	2008	$4 million	Concrete panel finishing facility expansion
Grand Forks	Grand Forks	2009	$1.5 million	Two new silos for dry pasta manufacturing
Wishek	McIntosh	2007	$1 million	Farm machinery and equipment manufacturing expansion
Wishek	McIntosh	2008		Wind farm start up
Watford City	McKenzie	2010	$350 million	Natural gas processing plant expansion
Underwood	McLean	2007	$20 million	New coal drying plant

Table 4.7G Examples of Business Growth Announcements 2007-2009 (continued)

City	County	Year	Cost	Description
New Salem	Morton	2008	$2 billion	Wind farm expansion
Mandan	Morton	2009	$2 million	Computer services expansion
Stanley	Mountrail	2008		Wind farm start up
Lakota	Nelson	2007	$171 million	New ethanol plant
Center	Oliver	2009	$180 million	Wind farm expansion
Wahpeton	Richland	2008	$3 million	Rubber and plastics manufacturing expansion
Wahpeton	Richland	2009	$4.2 million	Roasted nuts and peanut butter manufacturing expansion
Luverne	Steele	2009	$110 million	Wind farm expansion
Jamestown	Stutsman	2007	$1.8 million	Aircraft parts and equipment manufacturing expansion
Jamestown	Stutsman	2007	$1.785 million	Farm machinery and equipment manufacturing expansion
Jamestown	Stutsman	2007	$300 million	New power plant
Forest River	Walsh	2007	$12.5 million	New pig farrowing operation
Grafton	Walsh	2008	$10 million	Window and door manufacturing expansion
Minot	Ward	2007	$14.55 million	Computer programming services expansion
Berthold	Ward	2008		Wind farm start up
Donnybrook	Ward	2008		Wind farm expansion
Douglas	Ward	2008	$250 million	Wind farm expansion
Kenmare	Ward	2008		Wind farm start up
Minot	Ward	2008	$5 million	Grain and bean storage facility expansion
Minot	Ward	2008	$240 million	Wind farm expansion
Minot	Ward	2009	$9.74 million	Wind farm expansion
Harvey	Wells	2008		Flour milling expansion
Harvey	Wells	2009	$11 million	Flour milling expansion
Williston	Williams	2009	$2.6 million	Pea and lentil processing warehouse expansion
Williston	Williams	2009	$7.5 million	Pea and lentil processing plant start up

Source: North Dakota Department of Commerce, 2010a.

The oil industry of North Dakota has become very active in recent years. The Bakken Formation in northwest North Dakota has been the focus of most oil drilling and extraction growth since 2007. The number of wells drilled in the North Dakota Bakken Formation went from 300 wells in 2006 to 1,341 wells and producing nearly 50 million barrels in 2009. (North Dakota Oil and Gas Division, 2010) In 2010, drilling into the Three Forks Sanish Formation, below the Bakken Formation, began and could continue the exponential growth of this industry in the state.

4.8 Future Development

The way in which new development across the state occurs is important to disaster mitigation. Often, smart development is an inexpensive and effective way to reduce the impact of disasters on the communities. In contrast, new development in hazardous areas without provisions for hazard mitigation adds to the vulnerability of a community and ultimately can lead to more costly disasters.

Population trends in North Dakota have oscillated between decreasing and increasing since the 1940s. The early 2000s featured annual population net decreases across the state, but beginning in 2004, the trend shifted to slow population increases. Rural areas generally continue to see a decrease but most urban areas are increasing. Areas experiencing business and industrial growth are also reflecting the associated population increases.

Despite recent population gains, projections for future populations estimate that the overall trend will be population decreases through 2030. The North Dakota population projected for 2030 is 606,566 people, down 5.5% or 35,634 people from 2000. This puts North Dakota at the 50th rank, only ahead of the District of Columbia, for percent of population growth in United States from 2000 to 2030. (US Census Bureau, 2010a) Table 4.8A shows those counties expected to grow from 2005 to 2020.

Table 4.8A North Dakota Counties Expected to Experience Population Growth from 2005 to 2020

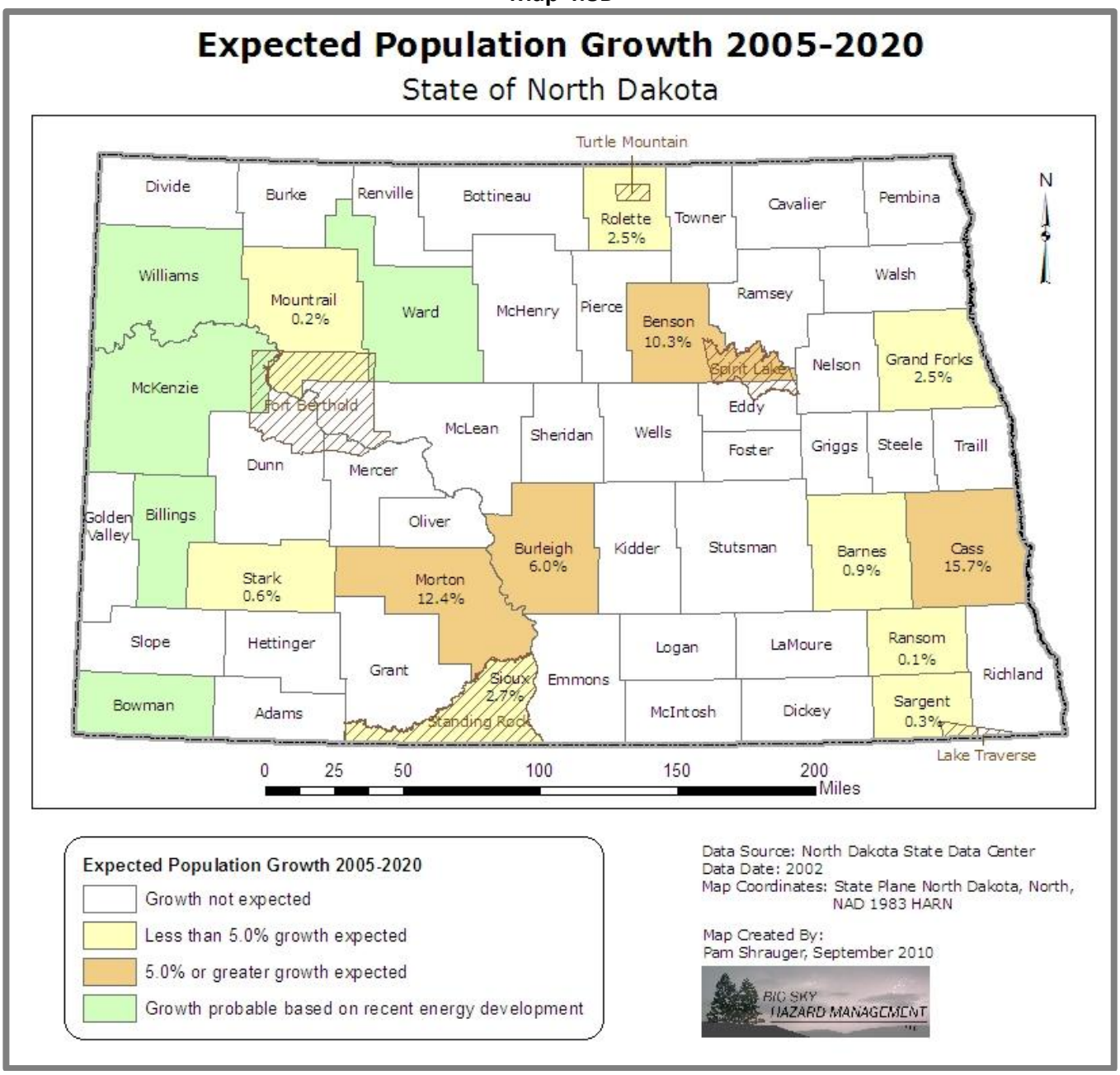
County	2005	2020	Projected 15-Year Increase
Barnes	11,574	11,675	0.9%
Benson	7,101	7,835	10.3%
Burleigh	70,524	74,727	6.0%
Cass	131,097	151,651	15.7%
Grand Forks	66,545	68,238	2.5%
Morton	26,272	29,521	12.4%
Mountrail	6,492	6,503	0.2%
Ransom	5,834	5,840	0.1%
Rolette	13,687	14,029	2.5%
Sargent	4,258	4,272	0.3%
Sioux	4,096	4,206	2.7%
Stark	22,220	22,360	0.6%

Source: North Dakota State Data Center, 2002.

Specifically related to recent energy (both wind and oil) discoveries and development, the following counties are likely to see growth that was not accounted for in the 2002 report:

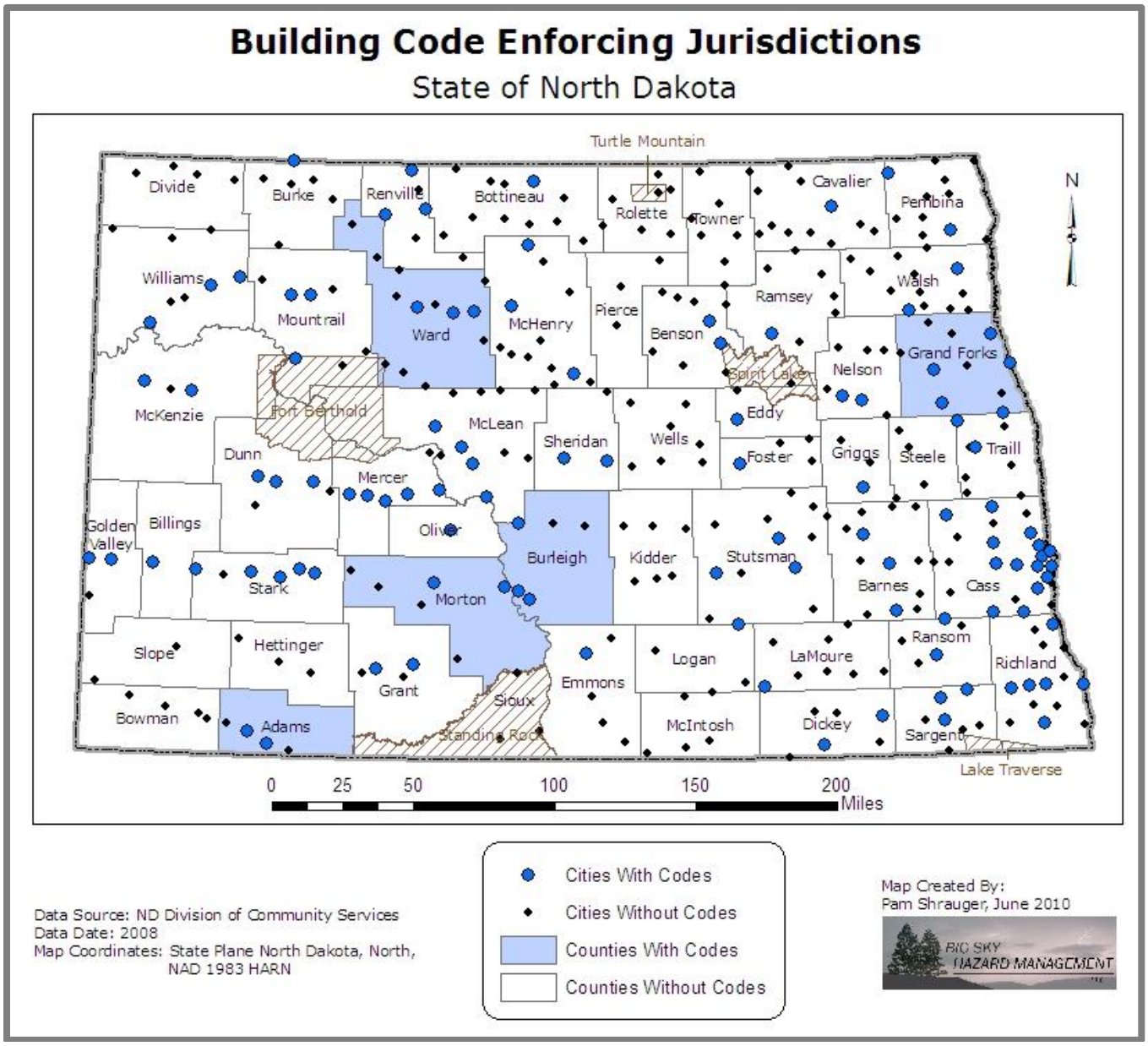
- Billings County
- Bowman County
- McKenzie County
- Ward County
- Williams County

Map 4.8B



Mechanisms currently in place in North Dakota to manage growth and new development include building codes, zoning, floodplain ordinances, master plans, and subdivision regulations. All of these mechanisms are at the local and tribal government discretion to adopt and enforce. North Dakota has a state building code, but it is still up to the communities to choose to adopt and enforce the codes. Map 4.8C shows the communities that have adopted the state building code. A significant limitation of this program is that communities may adopt the state building code but not enforce it. Therefore, simply adopting the code does not guarantee that new development and remodels meet current codes. Map 4.8D shows those communities that have a recognized flood hazard but do not have floodplain ordinances.

Map 4.8B


Building Code Enforcing Jurisdictions
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Grand Forks
Nelson
Spirit Lake
McKenzie
Fort Berthold
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Cities With Codes
Cities Without Codes
Counties With Codes
Counties Without Codes
Data Source: ND Division of Community Services
Data Date: 2008
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

Map 4.8C

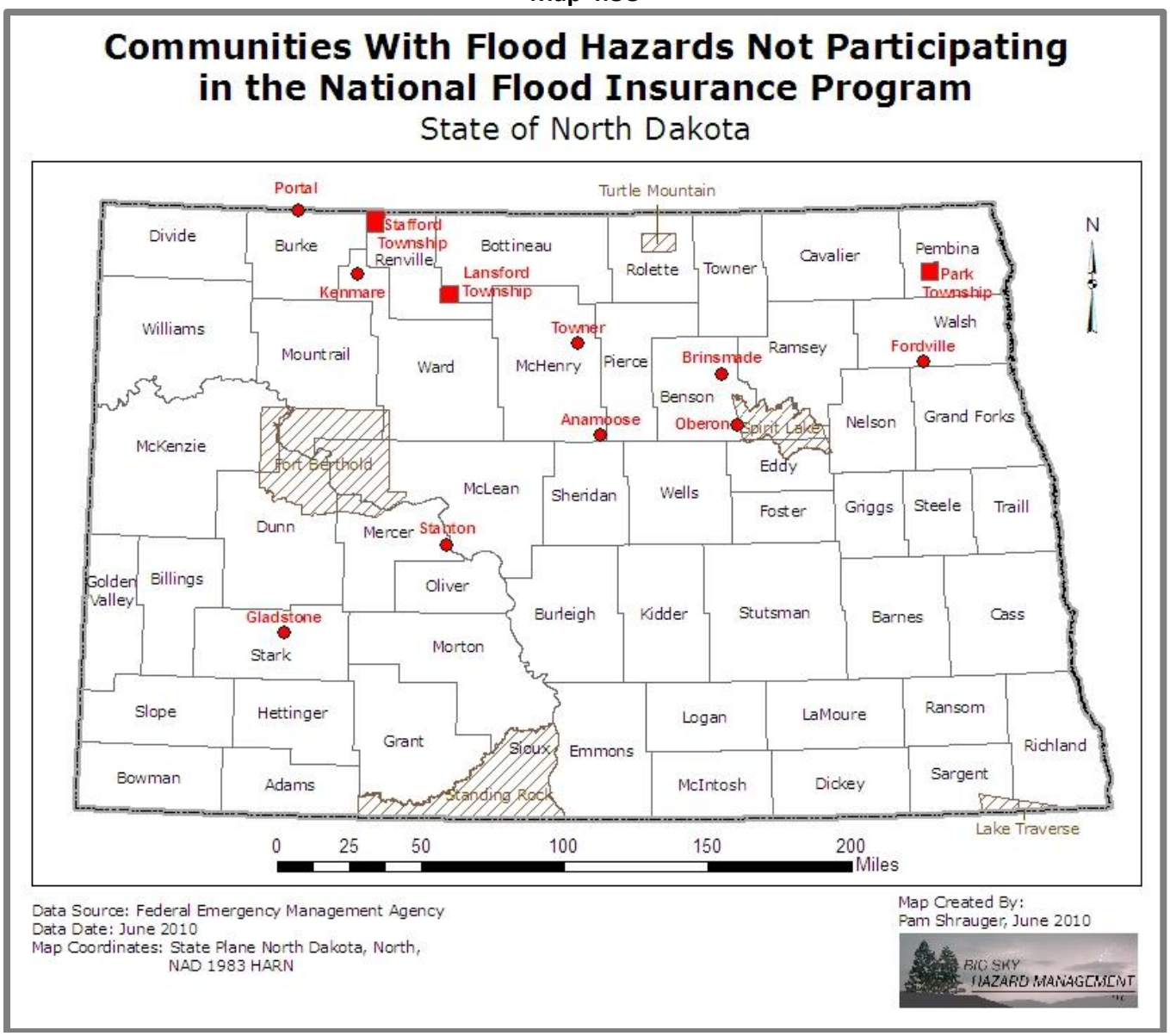

Communities With Flood Hazards Not Participating in the National Flood Insurance Program
State of North Dakota
Portal
Turtle Mountain
Divide
Burke
Stafford Township
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Park Township
Kenmare
Lansford Township
Williams
Mountrail
Ward
Towner
McHenry
Pierce
Brinsmade
Ramsey
Walsh
Fordville
Benson
Anamoose
Oberon
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Stanton
Golden Valley
Billings
Oliver
Gladstone
Stark
Burleigh
Kidder
Stutsman
Barnes
Cass
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Data Source: Federal Emergency Management Agency
Data Date: June 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

Table 4.8D lists the counties experiencing population growth from 2006-2009 and their building code and NFIP statuses.

Table 4.8D Growing Counties 2006-2009

Counties Experiencing Population Growth (2009 population estimate)	Jurisdictions Lacking Building Codes (2000 population)	Non-Participating NFIP Status (2000 population)
Benson (pop. 6,910)	City of Esmond (pop. 159) City of Knox (pop. 59) City of Leeds (pop. 464) City of Maddock (pop. 498) City of Oberon (pop. 81) City of Warwick (pop. 75) City of York (pop. 26) Township areas Reservation areas	City of Brinsmade (pop. 29) City of Oberon (pop. 81)
Billings (pop. 827)	Township areas	None
Bowman (pop. 3,028)	City of Bowman (pop. 1,600) City of Gascoyne (pop. 23) City of Rhame (pop. 189) City of Scranton (pop. 304) Township areas	None
Burleigh (pop. 79,822)	City of Regan (pop. 43) City of Wing (pop. 124)	None
Cass (pop. 143,339)	City of Alice (pop. 56) City of Arthur (pop. 402) City of Ayr (pop. 23) City of Briarwood (pop. 78) City of Buffalo (pop. 209) City of Davenport (pop. 261) City of Frontier (pop. 273) City of Grandin (pop. 181) City of Oxbow (pop. 248) City of Towner City (pop. 252) Township areas	None
Dunn (pop. 3,365)	City of Dodge (pop. 125) Township areas Reservation areas	None
McKenzie (pop. 5,799)	City of Arnegard (pop. 105) Township areas Reservation areas	None

Table 4.8D Growing Counties 2006-2009 (continued)

Counties Experiencing Population Growth (2009 population estimate)	Jurisdictions Lacking Building Codes (2000 population)	Non-Participating NFIP Status (2000 population)
Morton (pop. 26,464)	City of Almont (pop. 89) City of Flasher (pop. 285) City of Glen Ullin (pop. 865) City of Hebron (pop. 803)	None
Mountrail (pop. 6,791)	City of New Town (pop. 1,367) City of Palermo (pop. 77) City of Parshall (pop. 981) City of Plaza (pop. 167) City of White Earth (pop. 63) Township areas Reservation areas	None
Ramsey (pop. 11,240)	City of Brocket (pop. 65) City of Churchs Ferry (pop. 77) City of Crary (pop. 149) City of Edmore (pop. 256) City of Hampden (pop. 60) City of Lawton (pop. 42) City of Starkweather (pop. 157) Township areas	None
Rolette (pop. 13,797)	City of Dunseith (pop. 739) City of Mylo (pop. 19) City of Rolette (pop. 538) City of Rolla (pop. 1,417) City of St. John (pop. 358) Township areas Reservation areas	None
Sioux (pop. 4,203)	City of Fort Yates (pop. 228) City of Selfridge (pop. 223) City of Solen (pop. 86) Township areas Reservation areas	None
Stark (pop. 22,847)	City of South Heart (pop. 307) Township areas	City of Gladstone (pop. 248)
Ward (pop. 57,012)	City of Berthold (pop. 466) City of Burlington (pop. 1,096) City of Carpio (pop. 148) City of Donnybrook (pop. 90) City of Douglas (pop. 64) City of Kenmare (pop. 1,081)	City of Kenmare (pop. 1,081)

Table 4.8D Growing Counties 2006-2009 (continued)

Counties Experiencing Population Growth (2009 population estimate)	Jurisdictions Lacking Building Codes (2000 population)	Non-Participating NFIP Status (2000 population)
Ward (pop. 57,012) (continued)	City of Makoti (pop. 145) City of Ryder (pop. 92) City of Sawyer (pop. 377) Township areas Reservation areas	City of Kenmare (pop. 1,081)
Williams (pop. 20,451)	City of Alamo (pop. 51) City of Epping (pop. 79) City of Grenora (pop. 202) City of Springbrook (pop. 26) City of Wildrose (pop. 129) Township areas	None

Sources: US Census Bureau, 2010a; North Dakota Division of Community Services, 2008; Federal Emergency Management Agency, 2010e.

Potential future development identified in the local plans includes:

- Seasonal and year-round residential development, especially in those areas within an hour of Bismarck, due to the addition of a rural water system, especially along the Missouri River. (Emmons County)
- Feasibility study for five new feed mills in the state. (Foster County)
- A new fuel additive plant and kitty litter manufacturer. (Golden Valley County, expired plan)
- A natural gas pipeline. (Hettinger County)
- A new subdivision, Sunset First Addition, has been platted. (McHenry County)
- Three separate developments are in the works along Stump Lake, just south of Lakota - a 59-site campground and two housing subdivisions, one with six lots and the other with twelve. (Nelson County)
- Small parcels of land are being sold in the Sheyenne River Valley for homes and seasonal homes. (Ransom County)
- More farms that will help increase economic opportunities for farmers. (Towner County)
- High-speed Internet. (Traill County)
- New clean fuels refinery on the Fort Berthold Reservation near Makoti. (Ward County)

5. RISK ASSESSMENT / HAZARD PROFILES

5.1 Communicable Disease

Including Human, Animal, and Plant Diseases

5.1.1 Characteristics

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

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

Human epidemics may lead to quarantines, large-scale medical needs, and mass fatalities. Typically, the elderly, young children, and those with suppressed immune systems are 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-bourne 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.

Other disasters, such as those resulting in the loss or contamination of water supplies, may result in an increased probability of disease. In fact, following most major disasters, disease is a primary concern due to the lack of sanitation. More specifically, long-term power outages can lead to household food contamination, and flooded properties often develop mold or mildew toxins. Standing water frequently contains hazardous bacteria and chemicals.

Animal and plant diseases, particularly those that infect livestock or crops, can distress the agricultural community. Such diseases could lead to food shortages and negative economic impacts, depending on the animals or plants infected and the geographic extent of the disease. Of most concern are those diseases that spread rapidly and cause widespread economic losses.

5.1.2 History

Fortunately, North Dakota has not experienced any devastating disease outbreaks within its population in recent years. 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)

In 2003, 617 human cases of West Nile Virus were recorded in North Dakota; five people died. (North Dakota Department of Health, 2007) Fortunately, West Nile Virus is not especially deadly for humans, and a vaccine has been developed for horses.

The 2009-2010 influenza season was originally feared to be severe, but a total of 3,254 cases of influenza (primarily the H1N1 strain) were reported in the state with 102 hospitalizations and 4 deaths. (North Dakota Department of Health, 2010)

In 2005, a cow from North Dakota that tested positive for tuberculosis initiated an extensive investigation and testing to ensure the disease had not spread. (North Dakota State Board of Animal Health, 2010)

The total losses covered by crop insurance over the 10-year period from 2000-2009 from plant disease and mycotoxin in the state totaled $150,230,721, or about $15 million annually. (Risk Management Agency, 2010)

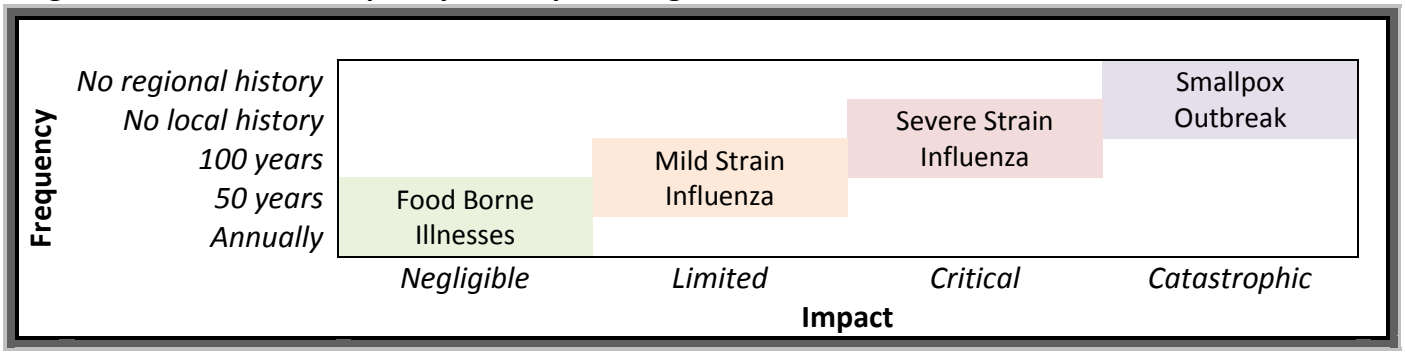
Table 5.1.2A North Dakota Communicable Disease Declared Disasters and Emergencies

Declaration	Location	Date	Magnitude	Casualties	Damages
None					

5.1.3 Probability and Magnitude

Figure 5.1.3A is a graphical representation of the range of events that can occur within the disease hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the communicable disease hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.1.3A Hazard Frequency and Impact Ranges



Quantifying the probability of a human epidemic affecting North Dakota presents challenges due to a limited history of outbreaks. Medical advances over the past fifty years prevent many disease outbreaks, yet the potential still remains. Much of the state is in a rural setting, and therefore, is somewhat isolated from the rapid spread of global diseases, however, international and domestic travel is so common that, like the Spanish Influenza Pandemic of 1918, North Dakotans would most likely be affected at some point. The urban areas and universities could see rapid spread of such diseases through their populations.

Approximately three human influenza pandemics have occurred over the past 100 years with one, the 1918 pandemic, severely affecting the United States. Animal and plant disease outbreaks are even harder to predict. Most global livestock diseases have been confined to specific countries due to strict import regulations.

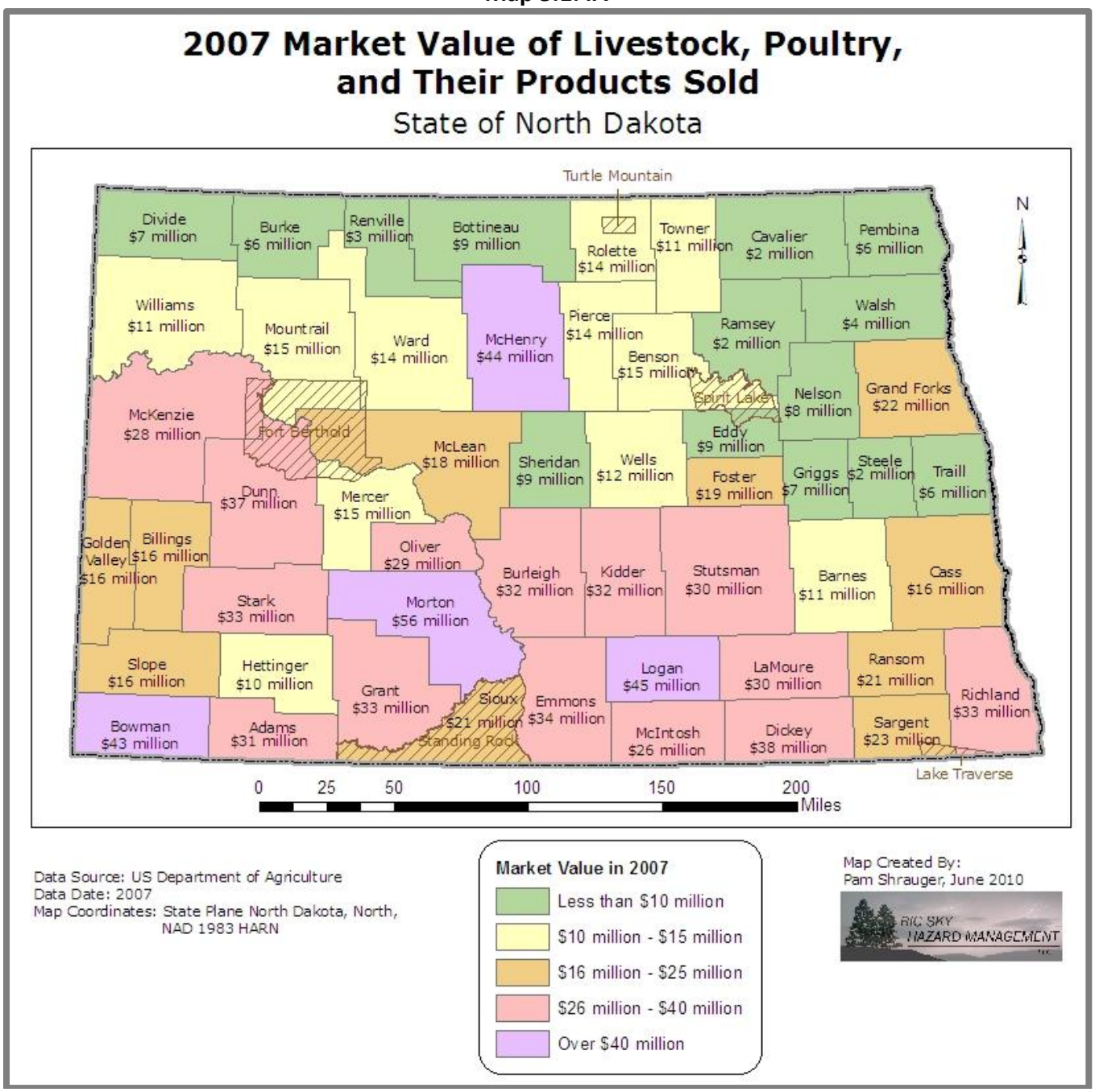
The magnitude of a communicable disease outbreak varies from every day disease occurrences to widespread infection. During the 1918 Influenza Pandemic, infection rates approached 28% in the United States. (Billings, 1997) Other pandemics produced infections rates as high as 35% of the total population. (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.

5.1.4 Mapping

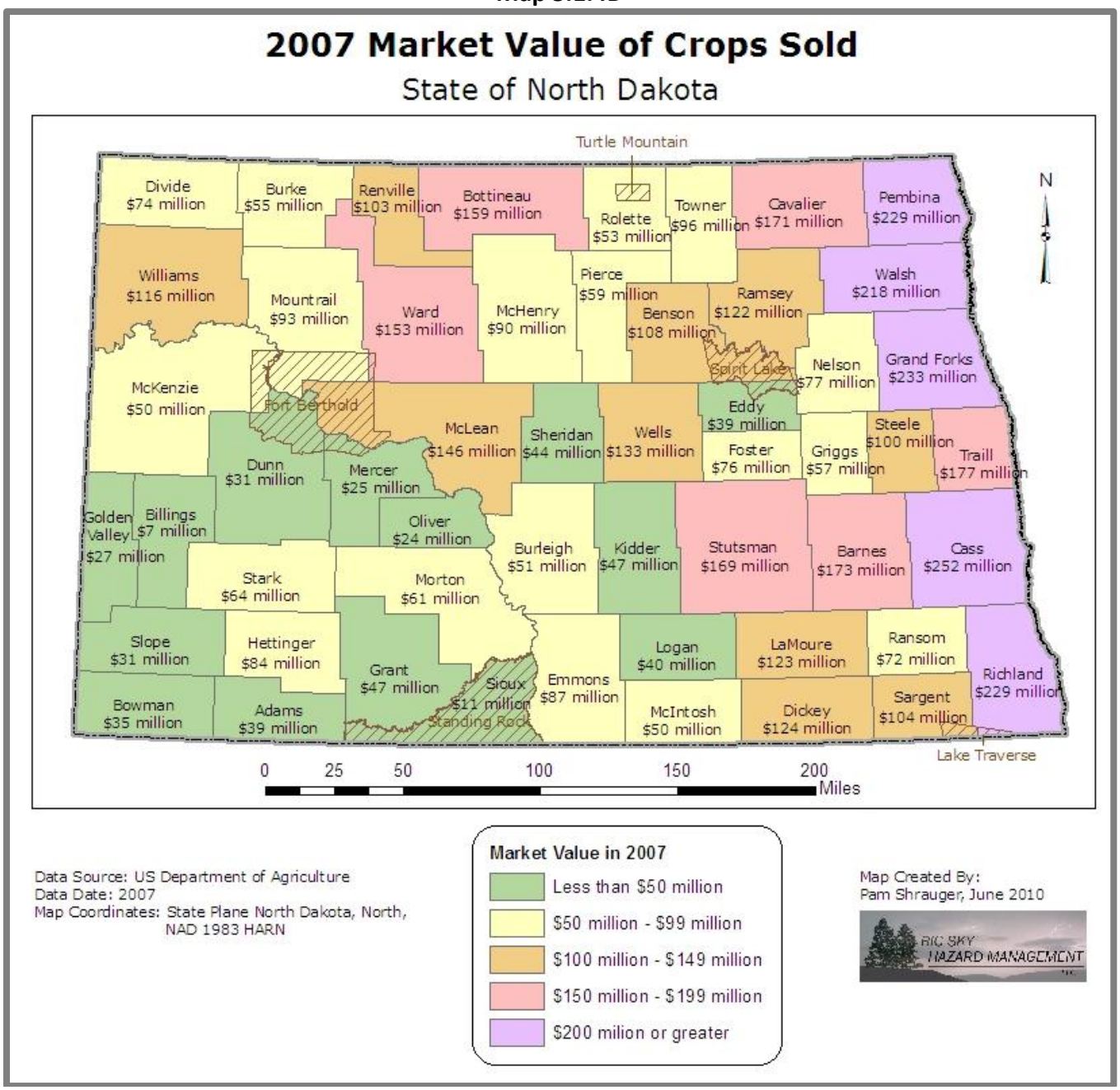
Map 4.3C in the population section shows the number of people at risk from communicable disease by county. Obviously, those areas with greater populations could see a larger number of communicable disease cases, however, all counties in the state are at some risk of communicable disease within their populations.

Map 5.1.4A shows the market value of livestock, poultry, and their products sold in 2007. Like people, the more livestock in the area, the more likely the economic impacts of a communicable disease outbreak in the livestock population will be felt. Map 5.1.4B shows the market value of crops sold in 2007 and demonstrates the economic vulnerability by county to crop diseases.

Map 5.1.4A


2007 Market Value of Livestock, Poultry, and Their Products Sold
State of North Dakota
Turtle Mountain
Divide $7 million
Burke $6 million
Renville $3 million
Bottineau $9 million
Rolette $14 million
Towner $11 million
Cavalier $2 million
Pembina $6 million
Williams $11 million
Mountrail $15 million
Ward $14 million
McHenry $44 million
Pierce $14 million
Benson $15 million
Ramsey $2 million
Walsh $4 million
Spirit Lake
Nelson $8 million
Grand Forks $22 million
McKenzie $28 million
Fort Berthold
McLean $18 million
Sheridan $9 million
Wells $12 million
Eddy $9 million
Foster $19 million
Griggs $7 million
Steele $2 million
Traill $6 million
Dunn $37 million
Mercer $15 million
Golden Valley $16 million
Billings $16 million
Oliver $29 million
Burleigh $32 million
Kidder $32 million
Stutsman $30 million
Barnes $11 million
Cass $16 million
Stark $33 million
Morton $56 million
Slope $16 million
Hettinger $10 million
Grant $33 million
Sioux $21 million
Standing Rock
Emmons $34 million
Logan $45 million
LaMoure $30 million
Ransom $21 million
Richland $33 million
Bowman $43 million
Adams $31 million
McIntosh $26 million
Dickey $38 million
Sargent $23 million
Lake Traverse
N
0 25 50 100 150 200 Miles
Data Source: US Department of Agriculture
Data Date: 2007
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Market Value in 2007
Less than $10 million
$10 million - $15 million
$16 million - $25 million
$26 million - $40 million
Over $40 million
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

Map 5.1.4B


2007 Market Value of Crops Sold
State of North Dakota
Turtle Mountain
Divide $74 million
Burke $55 million
Renville $103 million
Bottineau $159 million
Rolette $53 million
Towner $96 million
Cavalier $171 million
Pembina $229 million
Williams $116 million
Mountrail $93 million
Ward $153 million
McHenry $90 million
Pierce $59 million
Benson $108 million
Ramsey $122 million
Walsh $218 million
Spirit Lake
Nelson $77 million
Grand Forks $233 million
McKenzie $50 million
Fort Berthold
McLean $146 million
Sheridan $44 million
Wells $133 million
Eddy $39 million
Foster $76 million
Griggs $57 million
Steele $100 million
Traill $177 million
Dunn $31 million
Mercer $25 million
Golden Valley $27 million
Billings $7 million
Oliver $24 million
Burleigh $51 million
Kidder $47 million
Stutsman $169 million
Barnes $173 million
Cass $252 million
Stark $64 million
Morton $61 million
Slope $31 million
Hettinger $84 million
Grant $47 million
Sioux $11 million
Standing Rock
Emmons $87 million
Logan $40 million
LaMoure $123 million
Ransom $72 million
Richland $229 million
Bowman $35 million
Adams $39 million
McIntosh $50 million
Dickey $124 million
Sargent $104 million
Lake Traverse
N
0 25 50 100 150 200 Miles
Data Source: US Department of Agriculture
Data Date: 2007
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Market Value in 2007
Less than $50 million
$50 million - $99 million
$100 million - $149 million
$150 million - $199 million
$200 milion or greater
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

5.1.5 Vulnerabilities to Jurisdictions

Perhaps the most significant impact of communicable disease is to the population. Disease can spread rapidly through schools, health facilities, and communities. The entire state population of 646,844 plus visitors is at risk for contracting a communicable disease. The number of infections and fatalities in the state depends on the transmission and mortality rates. Using a general worst case estimate of 35% for the infection rate and a mortality rate (once infected) of 20%, as can be the case in an influenza pandemic, approximately 226,395 residents of North Dakota would be infected with about 45,279 fatal infections. As with any disease, age and other health conditions can be a contributing factor. The ability to control the spread of disease depends on the virulence of the disease, the time lapse before the onset of symptoms, the movement of the population, and the warning time involved. Vaccinations, anti-virals, quarantines, and other protective measures may also prevent the spread and impact of the disease.

The statewide economy relies heavily on the agriculture, health care, travel, and utility industries, and therefore, human or livestock diseases will 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 that 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.

Animal and plant diseases extending nationally would have an overarching effect on the national economy. More directly, though, North Dakota's economy relies heavily on the agricultural industry. The state had 31,970 farms covering 39.7 million acres with annual cash receipts totaling over $6 billion in 2007. With an animal disease, over 2 million head of livestock could be affected along with countless wild animals. A communicable livestock disease would negatively affect the agriculture economy and could also limit food supplies. The market value of crop sales in 2007 totaled over $5 billion and depending on the crop affected, severe crop losses could be seen, having a trickle-down effect on the food supply and/or agricultural feed. (US Department of Agriculture, 2007)

Communicable diseases, in most scenarios, would not affect historic values. The impact on ecological values is debatable since disease is a normal part of the ecosystem. Should a disease be especially severe for a particular species, however, that species could be eradicated from the state resulting in ecologic imbalances. Human diseases would most likely have the greatest impact on the social values. Quarantines in particular would disrupt social activities and reduce the quality of life for some. Hopefully, such disruptions would only be temporary.

Given the nature of communicable diseases, those jurisdictions with the highest human and livestock populations and crops are at greatest risk from communicable diseases. Table 5.1.5A summarizes the human, livestock, and crop risks. The human rating is based on population, livestock rating is based on the 2007 market value of livestock sales, crop rating is based on the 2007 market value of crop sales, and the overall rating is a combination of those three (with the human rating receiving double weight).

Table 5.1.5A Communicable Disease Risk to Jurisdictions

County	Human Rating	Livestock Rating	Crop Rating	Overall Rating	Hazard Rating in Local Plan	Additional Information from Local Plan
Adams	L	MH	L	Low-Moderate	NI	
Barnes	M	LM	MH	Moderate	C	
Benson*	LM	LM	M	Low-Moderate	NP	
Billings	L	M	L	Low	NI	
Bottineau	M	L	MH	Moderate	B	
Bowman	LM	H	L	Moderate	NI	
Burke	L	L	LM	Low	NI	
Burleigh	H	MH	LM	Moderate-High	NI	
Cass	H	M	H	High	NI	
Cavalier	LM	L	MH	Low-Moderate	NI	
Dickey	LM	MH	M	Moderate	NI	
Divide	L	L	LM	Low	NP	
Dunn*	LM	MH	L	Low-Moderate	NI	
Eddy*	L	L	L	Low	NI	
Emmons	LM	MH	LM	Moderate	A	
*Fort Berthold^*	*LM*	*M*	*LM*	*Low-Moderate*	*NP*	
Foster	LM	M	LM	Low-Moderate	B	
Golden Valley	L	M	L	Low	NI	
Grand Forks	H	M	H	High	B	4,689 fatalities 23,444 infections
Grant	L	MH	L	Low-Moderate	NI	
Griggs	L	L	LM	Low	NI	
Hettinger	L	LM	LM	Low	A	
Kidder	L	MH	L	Low-Moderate	NI	
*Lake Traverse^*	*L*	*M*	*MH*	*Low-Moderate*	*NP*	
LaMoure	LM	MH	M	Moderate	#4 of 12	
Logan	L	H	L	Low-Moderate	NL	
McHenry	LM	H	LM	Moderate	D	
McIntosh	LM	MH	LM	Moderate	NI	
McKenzie*	LM	MH	LM	Moderate	NP	
McLean*	M	M	M	Moderate	NL	
Mercer*	M	LM	L	Low-Moderate	A	
Morton	H	H	LM	High	NI	
Mountrail*	LM	LM	LM	Low-Moderate	NI	
Nelson*	LM	L	LM	Low-Moderate	NL	
Oliver	L	MH	L	Low-Moderate	NI	
Pembina	M	L	H	Moderate	NL	
Pierce	LM	LM	LM	Low-Moderate	NI	

Table 5.1.5A Communicable Disease Risk to Jurisdictions (continued)

County	Human Rating	Livestock Rating	Crop Rating	Overall Rating	Hazard Rating in Local Plan	Additional Information from Local Plan
Ramsey*	M	L	M	Moderate	C	783 fatalities 3,916 infections
Ransom	LM	M	LM	Low-Moderate	Medium	
Renville	L	L	M	Low	B	
Richland*	MH	MH	H	High	NI	
Rolette*	M	LM	LM	Moderate	NP	
Sargent*	LM	M	M	Moderate	NI	
Sheridan	L	L	L	Low	NP	
Sioux*	LM	M	L	Moderate	NP	
Slope	L	M	L	Low	NP	
Spirit Lake	*LM*	*LM*	*M*	*Low-Moderate*	*NP*	
*Standing Rock^*	*LM*	*M*	*L*	*Low-Moderate*	*NP*	
Stark	MH	MH	LM	Moderate-High	NP	
Steele	L	L	M	Low	NP	
Stutsman	MH	MH	MH	Moderate-High	D	
Towner	L	LM	LM	Low	C	
Traill	M	L	MH	Moderate	B	
*Turtle Mountain^*	*LM*	*LM*	*LM*	*Low-Moderate*	*NP*	
Walsh	M	L	H	Moderate	B	
Ward*	H	LM	MH	Moderate-High	NI	
Wells	LM	LM	M	Low-Moderate	NI	
Williams	H	LM	M	Moderate-High	NI	

H = high; MH = moderate-high; M = moderate; LM = low-moderate; L = low
NI = not identified in the local plan; NP = no local plan; NL = included in the local plan, but no classification listed
* includes at least part of the reservation population; ^ includes only North Dakota parts of the reservation
Sources: US Census Bureau, 2010a; US Department of Agriculture, 2007.

5.1.6 Vulnerabilities of State-Owned Buildings and Property

Vulnerabilities from communicable disease are often 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 state-owned 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.

5.1.7 Vulnerabilities of Critical Facilities and Infrastructure

The structural integrities of critical facilities in North Dakota are not threatened by communicable disease. Similar to state-owned buildings, should a facility become contaminated, clean-up costs could be expensive. 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 a 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.

Table 5.1.7A shows the critical facilities and infrastructure summary for the counties with a moderate-high or high disease rating. See Section 4.2 for more details.

Table 5.1.7A Critical Facilities and Infrastructure in Moderate-High and High Disease Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck United Tribes Technical College University of Mary Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure

Table 5.1.7A Critical Facilities and Infrastructure in Moderate-High and High Disease Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota Grand Forks Airport Interstate and Railroad Transportation Infrastructure
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure
Richland	CIKR Facilities: Moderate-High (15-24 facilities) $10.8 million in National Guard Assets North Dakota State College of Science Interstate and Railroad Transportation Infrastructure
Stark	CIKR Facilities: Moderate-High (15-24 facilities) Dickinson State University Dickinson Airport Interstate and Railroad Transportation Infrastructure
Stutsman	CIKR Facilities: Moderate-High (15-24 facilities) $117.4 million in Local Government Facilities Jamestown College North Dakota State Hospital Jamestown Airport Interstate and Railroad Transportation Infrastructure

Table 5.1.7A Critical Facilities and Infrastructure in Moderate-High and High Disease Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Ward	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport
Williams	CIKR Facilities: Moderate-High (15-24 facilities) $129.3 million in Local Government Facilities Williston State College Williston Airport

5.1.8 Vulnerabilities to New and Future Development

New structures and future development themselves would have little impact on the communicable disease vulnerabilities, unless in the rare case, the new structures were part of a lab dealing with biological agents. New residents and population, however, add to the total number of people threatened in North Dakota. See Section 4.3 for more details on postulated population changes. Theoretically, new development could reduce the amount of agriculture land available, and therefore, reduce the threats to livestock and crops from disease, but such changes would likely be minimal.

5.1.9 Data Limitations and Other Key Documents

Diseases are heavily studied and treated throughout the world. Vast quantities of technical information exist on specific diseases, yet how a new and emerging disease will behave in an untested population is always questionable. Therefore, determining specific vulnerabilities and potential losses from disease is difficult at best. For a human disease to have a major impact on North Dakota, it first has to enter the community and then spread. That starting point, how the disease progresses, and the preventative actions taken will determine the eventual outcome. The data and analysis are limited by these unknowns. Doctors, veterinarians, scientists, and health officials can provide more detailed information on specific diseases.

Other key documents related to the Communicable Disease hazard include:

- North Dakota Department of Health Pandemic Influenza Plan
- North Dakota Department of Health Public Health and Medical All-Hazards Plan
- North Dakota Emergency Operations Plan, Infectious Diseases Annex
- North Dakota Emergency Operations Plan, Animal Health Annex
- North Dakota Emergency Operations Plan, Plant Health Annex

5.2 Dam Failure

5.2.1 Characteristics

A dam is any artificial barrier, including appurtenant works, which impounds or diverts water. Dam failure is defined as a sudden, rapid, and uncontrolled release of impounded water that can create a potentially significant downstream hazard. The purpose of dams includes storage of water for irrigation, hydroelectric power generation, flood control, water supply, fire protection, recreation, and wildlife habitat.

Should a dam fail, the consequences can be devastating or minimal depending on the dam's characteristics and regional attributes. 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:

- *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.

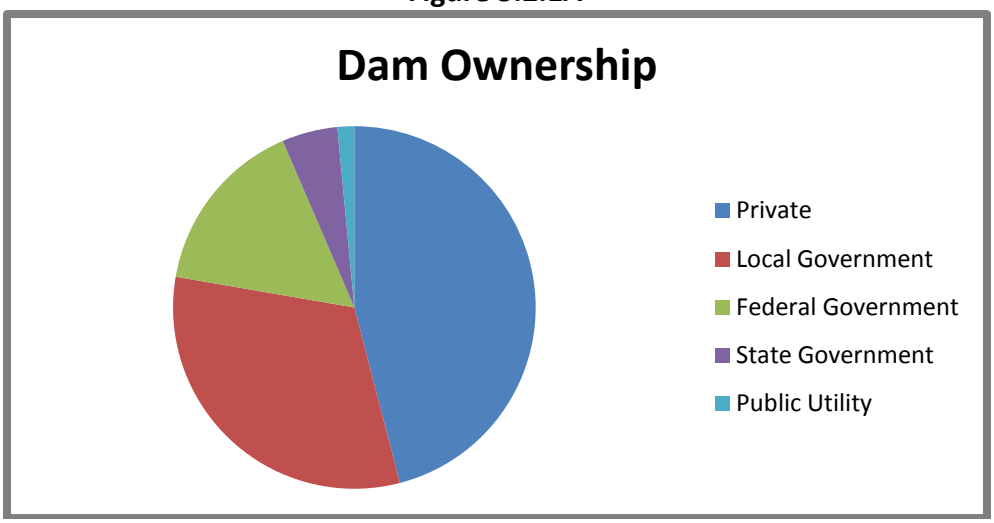
  Source: North Dakota State Engineer, 1985.

North Dakota has 866 dams listed in the most recently published National Inventory of Dams. The inventory lists all high and significant hazard dams and low hazard dams that exceed 25 feet in height and 15 acre-feet of storage or exceed 6 feet in height and 50 acre-feet of storage. Note that "medium" hazard dams as defined by the state correlate to "significant" hazard dams in the national inventory. In North Dakota, 29 dams are listed as high hazard, 98 are listed as significant hazard, 731 are listed as low hazard, and the remaining 8 are undetermined. (US Army Corps of Engineers, 2010a) The storage capacity of North Dakota dams range from the 18-24 million acre-feet of Lake Sakakawea behind Garrison Dam to dams of less than 15 acre-feet. The breakdown of dam ownership in the state is as follows:

- Private: 398 dams
- Local Government: 275 dams
- Federal Government: 137 dams
- State Government: 43 dams
- Public Utility: 13 dams

  Source: US Army Corps of Engineers, 2010a.

Figure 5.2.1A



Source: US Army Corps of Engineers, 2010a.

Table 5.2.1B lists the high hazard dams in North Dakota; all are earthen dams. Note that the North Dakota State Water Commission dam data varies somewhat from the National Inventory of Dams.

Table 5.2.1B High Hazard Dams in North Dakota

Dam Name	River	County	Owner
Baldhill Dam	Sheyenne River	Barnes	US Army Corps of Engineers
Beach Dam	Tributary of Beaver Creek	Golden Valley	City of Beach
Beulah Dam	Tributary of Knife Creek	Mercer	City of Beulah
Bowman Haley Dam	North Fork of Grand River	Bowman	US Army Corps of Engineers
Bylin Dam	North Branch of Forest River	Walsh	Walsh County WRD
Clausen Springs Dam	Spring Creek	Barnes	Barnes County WRD
Dickinson Dam	Heart River	Stark	US Bureau of Reclamation
English Coulee Dam	English Coulee	Grand Forks	Grand Forks County WRD
Garrison Dam	Missouri River	McLean	US Army Corps of Engineers
Heart Butte Dam	Heart River	Grant	US Bureau of Reclamation
Homme Dam	South Branch of Park River	Walsh	US Army Corps of Engineers
Hunter Dam	South Branch of Elm River	Cass	City of Hunter
Jackman Coulee Dam 2	Jackman Coulee	Burleigh	City of Bismarck
Jamestown Dam	James River	Stutsman	US Bureau of Reclamation
Lake Darling Dam	Souris River	Ward	US Fish & Wildlife Service
Lake Ilo Dam	Spring Creek	Dunn	US Fish & Wildlife Service
Larimore Dam	South Branch of Turtle River	Grand Forks	Grand Forks County WRD
Maple River Dam (T-180)	Tributary of Sheyenne/Maple Rivers	Cass	Maple River WRD
Maple River Dam	Maple River	Cass	Cass County Joint WRD
Matejcek Dam	Middle Branch of Forest River	Walsh	Walsh County WRD

Table 5.2.1B High Hazard Dams in North Dakota (continued)

Dam Name	River	County	Owner
McGregor Dam	Tributary of White Earth Creek	Williams	ND Game & Fish
Mott Watershed Dam	Tributary of Cannonball Creek	Hettinger	Hettinger County WRD
Nelson Lake Dam	Square Butte Creek	Oliver	Minnkota Power
Olson Dam	Tributary of Tongue River	Pembina	Pembina County WRD
Pipestem Dam	Pipestem Creek	Stutsman	US Army Corps of Engineers
Renwick Dam	Tongue River	Pembina	Pembina County WRD
Senator Young Dam	Tongue River	Cavalier	Pembina County WRD
Square Butte Dam 5	Tributary of Square Butte Creek	Oliver	Oliver and Morton Counties WRD
Sweetbriar Creek Dam	Sweetbriar Creek	Morton	Morton County Park Board and ND Game & Fish
Tioga Dam	Tributary of White Earth River	Williams	City of Tioga

Sources: US Army Corps of Engineers, 2007; North Dakota State Water Commission, 2007a; North Dakota State Water Commission, 2010c.

There are many potential causes for dam failure such as terrorism and earthquakes; however, the most common reasons are hydraulic inadequacy, seepage problems, and structural defects.

Hydraulic Failures

Hydraulic failures result from the uncontrolled flow of water over, around, and adjacent to the dam and the erosion action of the water on the dam and its foundation. Earthen dams are particularly susceptible to hydraulic failure since earthen material may erode relatively easily. A hydraulic failure may occur due to excessive spillway erosion and overtopping due to insufficient reservoir storage and insufficient spillway capacity. Hydraulic failures are typically associated with flood events. (North Dakota State Water Commission, 2007a)

Seepage Failures

All dams do 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 typically occur during the course of normal operations. (North Dakota State Water Commission, 2007a)

Structural Failures

Structural failures involve the rupture or movement of monolithic components of the dam and/or its foundation. Slope stability problems, such as slides, can be caused by a loss of strength of embankment materials due to infiltration of water into the embankment or loss of foundation support. Structure failures are also possible through concrete structures and spillway conduits. Wave action on the upstream slope or erosion at the downstream toe can affect the stability of the embankment. (North Dakota State Water Commission, 2007a)

Normally, these three general types of failures are interrelated and complex. For example, uncontrolled seepage may weaken the soil of an earthen dam and lead to an embankment failure. A structural failure may shorten the seepage path and lead to a "piping" failure. Surface erosion may lead to embankment failures. Time can also have an impact on dam integrity. Weathering, mechanical change, and the influence of chemical agents can affect a dam in the following ways:

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

Despite extensive dam safety laws, problems still exist with dams in North Dakota. Specifically, many high and medium hazard dams lack emergency actions plans. High hazard dams in North Dakota that lack emergency action plans (EAPs) include:

- Beach Dam (Owner: City of Beach) (Note: EAP not required)
- Beulah Dam (Owner: City of Beulah)
- Bylin Dam (Owner: Walsh County WRD)
- Clausen Springs Dam (Owner: Barnes County WRD)
- Hunter Dam (Owner: City of Hunter) (Note: EAP not required)
- Jackman Coulee Dam 2 (Owner: City of Bismarck) (Note: EAP not required)
- Maple River Dam (Owner: Cass County Joint WRD)
- Maple River Dam (T-180) (Owner: Maple River WRD)
- Square Butte Dam 5 (Owner: Oliver and Morton Counties WRD)
- Tioga Dam (Owner: City of Tioga)

Only 20 of 95 medium hazard dams have filed Emergency Action Plans with the state. Note that only 55 of the 95 total medium hazard dams are required to have an EAP. Additionally, as dams age, their structural integrity deteriorates; many dams lack proper maintenance and repairs. (North Dakota State Water Commission, 2007a; North Dakota State Water Commission, 2010c)

Another concern in some communities is the problem of "roads acting as dams." This characterization is not entirely accurate as most roads, with the exception of some around Devils Lake, are not holding back water for extended periods of time. During flood events, some roadways may hold back water, performing similar to a levee. Along the Red River valley, the Waffle Plan, designed by the University of North Dakota, intentionally retains water with roadways to slow the flow of water into the Red River during periods of flood. Terminology and concepts aside, the concern is that most roadways were not designed to retain water, and should the roadway wash out, the impacts could be similar to that of a small dam failure. Such events would likely have a low impact when compared to other possible dam failure and flood events. The current exceptions are roads acting as dams in the Devils Lake area; failure of some of these roadways could be more similar to that of a high hazard dam failure.

5.2.2 History

North Dakota does not have a history of dam failures causing a loss of life or significant damage. Those dams that have failed have had minimal impacts. Additionally, some dams have threatened to fail but mitigation and quick response have prevented those dams from catastrophic failure.

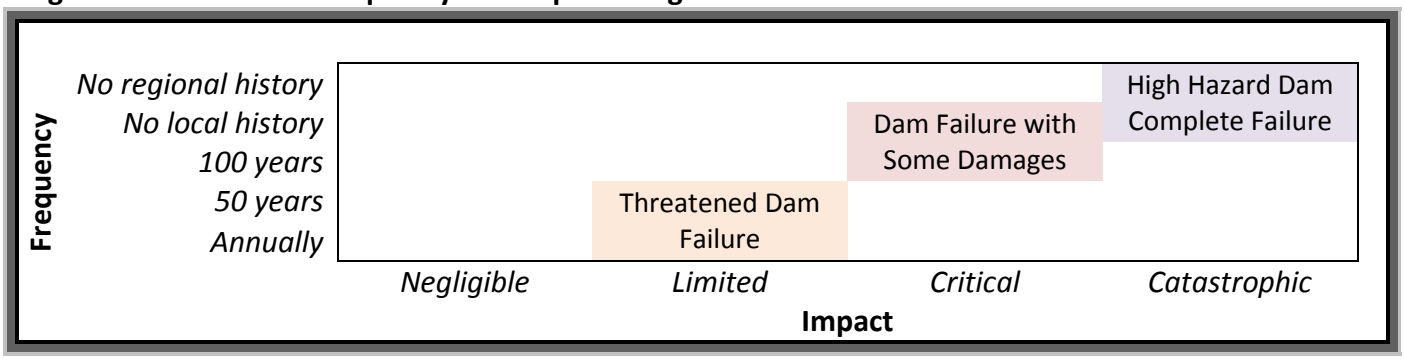
Table 5.2.2A North Dakota Dam Failure Declared Disasters and Emergencies

Declaration	Location	Date	Magnitude	Casualties	Damages
None					

5.2.3 Probability and Magnitude

Figure 5.2.3A is a graphical representation of the range of events that can occur within the dam failure hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the dam failure hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.2.3A Hazard Frequency and Impact Ranges



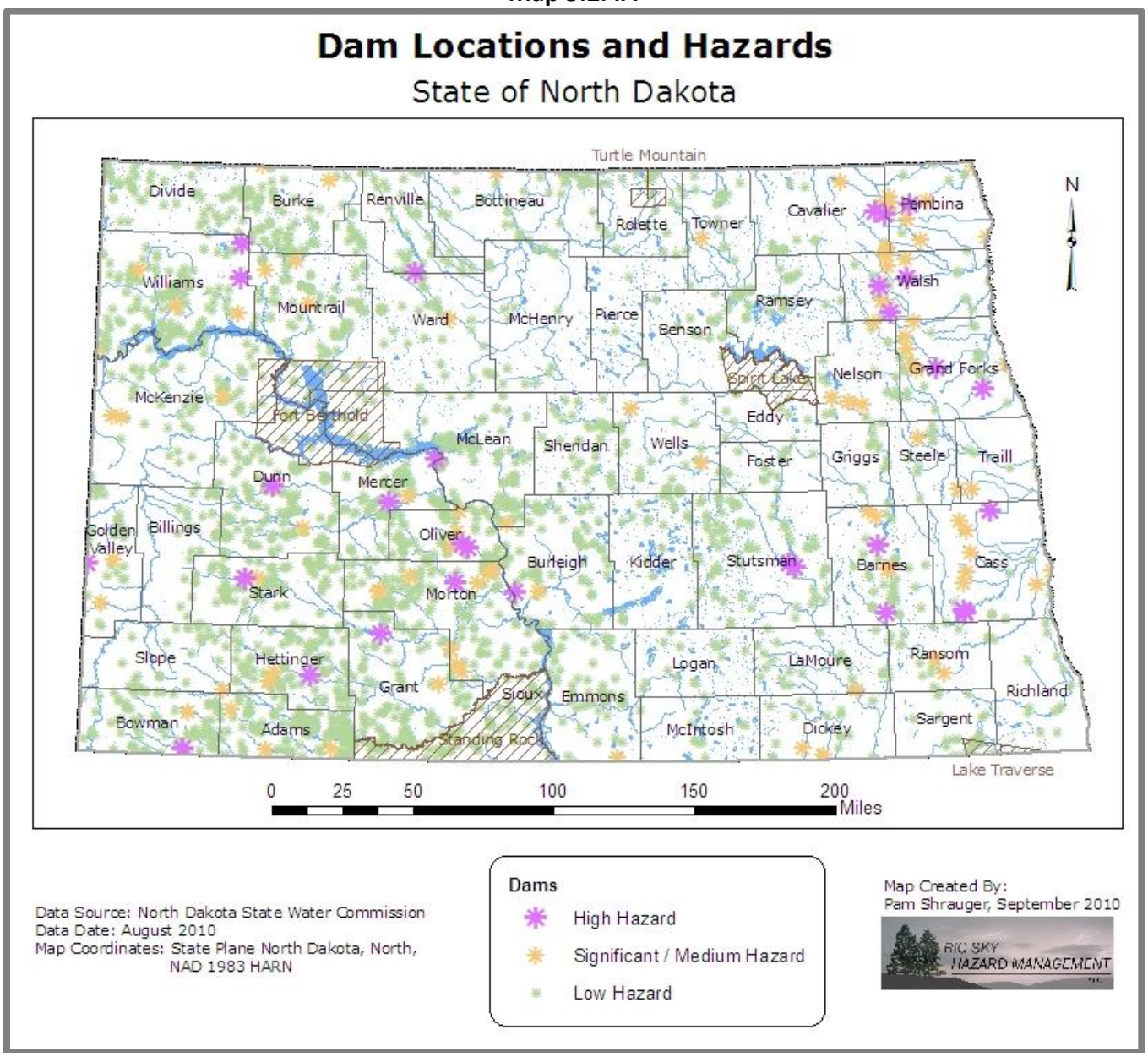
The dam failure probability is somewhat low based on a minimal history of significant events and the regular inspection and upkeep of the high hazard dams. Should a high or significant/medium hazard

dam fail, that event would be considered a high magnitude event. The loss of property, services, and even life could result.

5.2.4 Mapping

The locations of the dams in North Dakota and their associated hazard designations can be found in Map 5.2.4A.

Map 5.2.4A



5.2.5 Vulnerabilities to Jurisdictions

Threats to the jurisdictions from dam failure include the destruction of homes, businesses, and property, road washouts, loss of critical services, loss of economic values, and loss of life. Emergency action plans for the high hazard dams contain provisions for warning the public and those in the path of the rushing flood waters, however, the rapid movement of huge volumes of water being held by the dam may not allow for enough time in all cases. Table 5.2.5A lists the counties, their associated dam failure risk, and information from the local and tribal mitigation plans.

The criteria for the dam hazard ratings are as follows:

- High: These counties contain high hazard dams or are directly downstream of a high hazard dam that could cause significant damage in the county. The high hazard dam does not have an emergency action plan.
- Moderate-High: These counties contain high hazard dams or are directly downstream of a high hazard dam that could cause significant damage in the county. The high hazard dam does have an emergency action plan.
- Moderate: These counties are more distant from a high hazard dam but still have the potential for considerable damage, or the county has three or more significant/medium hazard dams.
- Low-Moderate: These counties, not meeting the previous criteria, have at least one significant/medium hazard dam.
- Low: These remaining counties have only low hazard dams, if any, and are not at significant risk from a dam in another county.

Table 5.2.5A Dam Failure Risk to Jurisdictions

County	Dam Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	Moderate	D	
Barnes	High	C	
Benson	Low	NP	
Billings	Low	D	
Bottineau	Low-Moderate	D	
Bowman	Moderate-High	B	
Burke	High	C	
Burleigh	High	B	
Cass	High	C	
Cavalier	Moderate-High	D	
Dickey	Low-Moderate	D	
Divide	Low	NP	
Dunn	Moderate-High	D	
Eddy	Low	C	
Emmons	Low-Moderate	D	
*Fort Berthold^*	*Low*	*NP*	
Foster	Low	D	

Table 5.2.5A Dam Failure Risk to Jurisdictions (continued)

County	Dam Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Golden Valley	High	D	
Grand Forks	Moderate-High	D	$602,007 building exposure to Larimore Dam $170,844,800 building exposure to English Coulee Dam
Grant	Moderate-High	D	
Griggs	Low	D	
Hettinger	Moderate-High	B	
Kidder	Low	D	
*Lake Traverse^*	*Low*	*NP*	
LaMoure	Moderate	#11 of 12	
Logan	Low	C	
McHenry	Moderate	C	
McIntosh	Low	D	
McKenzie	Moderate	NP	
McLean	Moderate-High	A	
Mercer	High	D	
Morton	Moderate-High	B	
Mountrail	High	D	
Nelson	Moderate	D	
Oliver	High	D	
Pembina	Moderate-High	C	
Pierce	Low	D	
Ramsey	Low	B*	$8,064,500 in residential losses
Ransom	High	High*	
Renville	Low	D	
Richland	Low	C	
Rolette	Low	NP	
Sargent	Low	D	
Sheridan	Low	NP	
Sioux	Low	NP	
Slope	Low-Moderate	NP	
Spirit Lake	*Low*	*NP*	
*Standing Rock^*	*Low*	*NP*	
Stark	Moderate-High	NP	
Steele	Low-Moderate	NP	
Stutsman	Moderate-High	D	
Towner	Low-Moderate	C	
Traill	Moderate	D	

Table 5.2.5A Dam Failure Risk to Jurisdictions (continued)

County	Dam Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
*Turtle Mountain^*	*Low*	*NP*	
Walsh	High	C	
Ward	Moderate-High	D	
Wells	Low-Moderate	C	
Williams	High	C	$187M in potential losses

NP = no local plan
^ includes only North Dakota parts of the reservation
*includes dike and/or embankment failure

5.2.6 Vulnerabilities of State-Owned Buildings and Property

The high hazard dams, by definition, have the potential to destroy property downstream, including state-owned property. Without specific point data depicting the locations of all state-owned buildings, assessing the vulnerability of a specific structure can only be done on a case-by-case basis. Table 5.2.6A lists the high and moderate-high hazard counties and their associated state-owned building values.

Table 5.2.6A State-Owned Buildings and Property in High and Moderate-High Hazard Dam Failure Areas

County	Dam Hazard	State-Owned Buildings and Property Value
Barnes	High	$14,693,312
Bowman	Moderate-High	$1,998,898
Burke	High	$544,962
Burleigh	High	$503,365,705
Cass	High	$28,273,708
Cavalier	Moderate-High	$992,067
Dunn	Moderate-High	$5,855,238
Golden Valley	High	$3,252,395
Grand Forks	Moderate-High	$29,476,803
Grant	Moderate-High	$624,568
Hettinger	Moderate-High	$6,366,548
McLean	Moderate-High	$11,911,596
Mercer	High	$7,513,050
Morton	Moderate-High	$32,213,621
Mountrail	High	$2,486,430
Oliver	High	$1,615,652
Pembina	Moderate-High	$7,183,745
Ransom	High	$19,359,463
Stark	Moderate-High	$20,236,882

Table 5.2.6A State-Owned Buildings and Property in High and Moderate-High Hazard Dam Failure Areas (continued)

County	Dam Hazard	State-Owned Buildings and Property Value
Stutsman	Moderate-High	$154,739,436
Walsh	High	$71,784,273
Ward	Moderate-High	$66,944,970
Williams	High	$12,107,293

5.2.7 Vulnerabilities of Critical Facilities and Infrastructure

Like state owned buildings, critical facilities and infrastructure may also be vulnerable to dam failure. More specifically, if in the inundation area, any building is susceptible to damages from flood waters. Other infrastructure, particularly the transportation network, is vulnerable to washouts. Table 5.2.7A shows the critical facilities and infrastructure summary for the counties with a high or moderate-high dam failure rating. See Section 4.2 for more details.

Table 5.2.7A Critical Facilities and Infrastructure in High and Moderate-High Hazard Dam Failure Counties

County	Critical Facilities and Infrastructure Summary Description
Barnes	CIKR Facilities: Moderate (10-14 facilities) $1.6 million in National Guard Assets Valley City State University Interstate and Railroad Transportation Infrastructure
Bowman	CIKR Facilities: Low-Moderate (5-9 facilities)
Burke	CIKR Facilities: Low-Moderate (5-9 facilities) Portal Oil Import Site
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck United Tribes Technical College University of Mary

Table 5.2.7A Critical Facilities and Infrastructure in High and Moderate-High Hazard Dam Failure Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Burleigh (continued)	Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Cavalier	CIKR Facilities: Low-Moderate (5-9 facilities) Langdon Wind Power Plant
Dunn*	CIKR Facilities: Low (0-4 facilities)
Golden Valley	CIKR Facilities: Low (0-4 facilities) Interstate and Railroad Transportation Infrastructure
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota Grand Forks Airport Interstate and Railroad Transportation Infrastructure
Grant	CIKR Facilities: Low-Moderate (5-9 facilities)
Hettinger	CIKR Facilities: Low (0-4 facilities)
McLean*	CIKR Facilities: Moderate (10-14 facilities) Coal Creek Power Plant Garrison Hydroelectric Power Plant
Mercer*	CIKR Facilities: Moderate (10-14 facilities) Great Plains Synfuels Plant Antelope Valley Power Plant Coyote Power Plant Garrison Hydroelectric Power Plant Leland Olds Power Plant Stanton Power Plant

Table 5.2.7A Critical Facilities and Infrastructure in High and Moderate-High Hazard Dam Failure Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure
Mountrail*	CIKR Facilities: Low-Moderate (5-9 facilities) Fort Berthold Community College
Oliver	CIKR Facilities: Low-Moderate (5-9 facilities) Milton R. Young Power Plant
Pembina	CIKR Facilities: Moderate (10-14 facilities) Neche Oil Import Site Interstate and Railroad Transportation Infrastructure
Ransom	CIKR Facilities: Low-Moderate (5-9 facilities) North Dakota Veterans Home
Stark	CIKR Facilities: Moderate-High (15-24 facilities) Dickinson State University Dickinson Airport Interstate and Railroad Transportation Infrastructure
Stutsman	CIKR Facilities: Moderate-High (15-24 facilities) $117.4 million in Local Government Facilities Jamestown College North Dakota State Hospital Jamestown Airport Interstate and Railroad Transportation Infrastructure
Walsh	CIKR Facilities: Moderate (10-14 facilities) North Dakota State Developmental Center Interstate and Railroad Transportation Infrastructure
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport
Williams	CIKR Facilities: Moderate-High (15-24 facilities) $129.3 million in Local Government Facilities Williston State College Williston Airport

* includes at least part of the reservation

5.2.8 Vulnerabilities to New and Future Development

New and future development in North Dakota is generally at risk from dam failures. No known state, tribal, or local laws prohibit or mitigate new development from taking place in dam inundation areas. The primary exceptions are those areas that are also within the designated floodplain. In many cases, dam flood waters will flow along floodways encompassing the floodplain, but often, the waters can extend far beyond the traditional floodplain areas. Therefore, the very highest hazard areas for dam failures, in the floodplain, are regulated in most cases; however, future development outside the floodplain may also be at risk should a large dam fail.

5.2.9 Data Limitations and Other Key Documents

Emergency action plans for and digital data outlining the inundation areas of all high hazard dams in the state would allow for better potential loss estimates. This analysis would provide more detailed figures on the number of structures and residences in the hazard area. Combined with digital point data for state-owned buildings and critical facilities and infrastructure, a more accurate estimate of potential losses could be derived. A listing of deficient dams based on state inspections would also allow for a current analysis of dam failure probabilities and establish a clearer prioritization scheme.

Other key documents related to the Dam Failure hazard include:

- Individual Dam Emergency Action Plans
- North Dakota Dam Design Handbook
- North Dakota Emergency Operations Plan, Dam Failure Annex

5.3 Drought

5.3.1 Characteristics

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. Recreation, energy development, and agricultural food processing economic sectors also rely heavily on the water supply and levels in the state. 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, 2010a)

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:

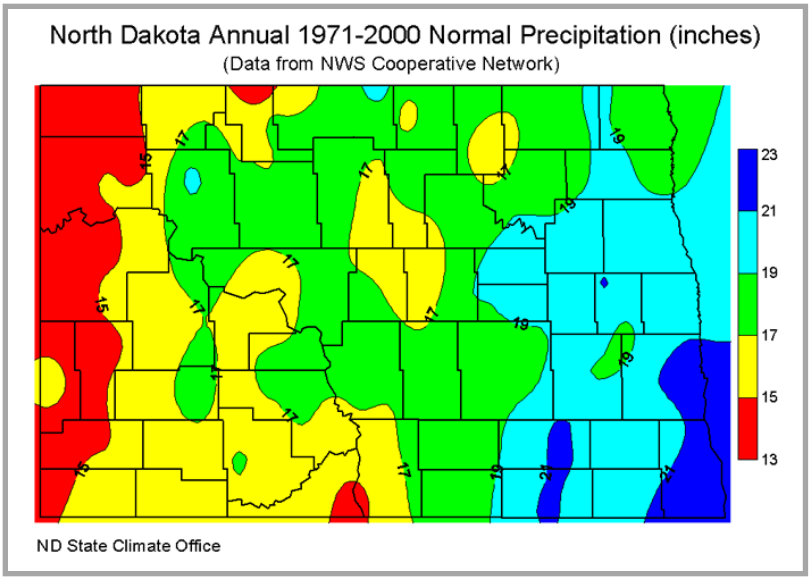
- *Meteorological drought* is usually an expression of precipitation's departure from normal over some period of time. These definitions are usually region-specific, and presumably based on a thorough understanding of regional climatology.
- *Agricultural drought* occurs when there isn't enough soil 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.
  Source: National Drought Mitigation Center, 2010a.

Annual precipitation in North Dakota ranges from 14 inches in the west to 21 inches in the southeast. About 75% of the annual precipitation occurs during the crop season from April to September. (High Plains Regional Climate 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.

Figure 5.3.1A



Source: North Dakota State Climate Office, 2010a.

A wide range of social and economic consequences normally occurs during a prolonged agricultural 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. Water supplies for industries such as food processing may become limited and threaten the continuity of operations. Eventually, public drinking water supplies could be affected, resulting in a more direct threat to lives. 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. Table 5.3.1B lists the more common indices and their use. Note that various response plans may address how these indices are used in response to a drought.

Table 5.3.1B Drought Indices

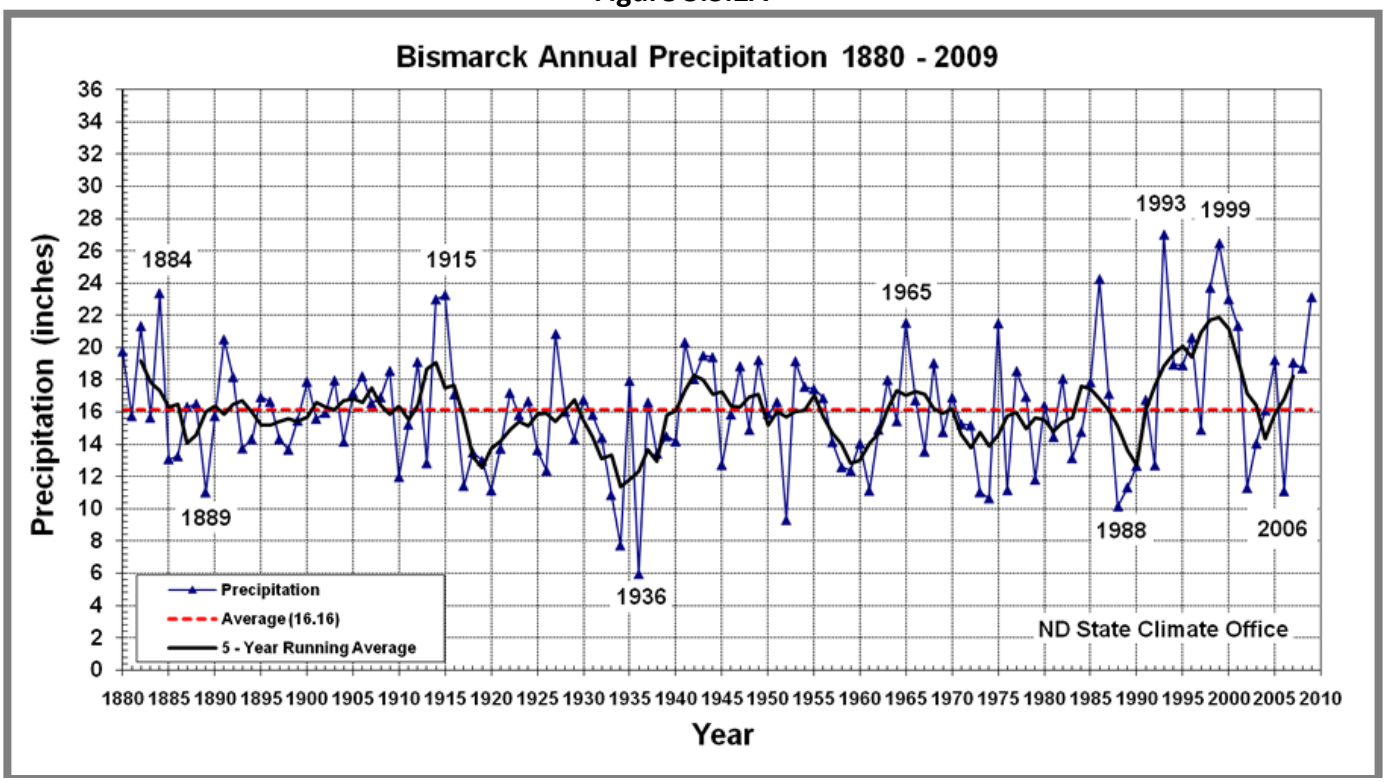
Index	Use
Percent of Normal	The percent of normal is a simple calculation well suited to the needs of television weathercasters and general audiences.
Standardized Precipitation Index (SPI)	The SPI is an index based on the probability of precipitation for any time scale.
Palmer Drought Severity Index (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.

Source: National Drought Mitigation Center, 2010a.

5.3.2 History

Paleoclimate studies show extreme periods of drought hundreds of years ago in the northern Great Plains including 200-370 A.D., 700-850 A.D., and 1000-1200 A.D. Compared to these periods over the past 2,000 years, the droughts since 1200 A.D. have been relatively wet and free of truly severe drought. (Laird et al, 1996) 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, and 2006. Figure 5.3.2A shows the annual precipitation records for Bismarck.

Figure 5.3.2A



Source: North Dakota State Climate Office, 2010b.

<u>1930s Dust Bowl</u>: 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.

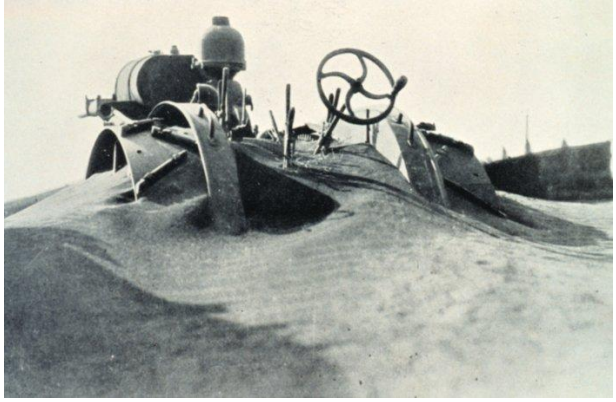


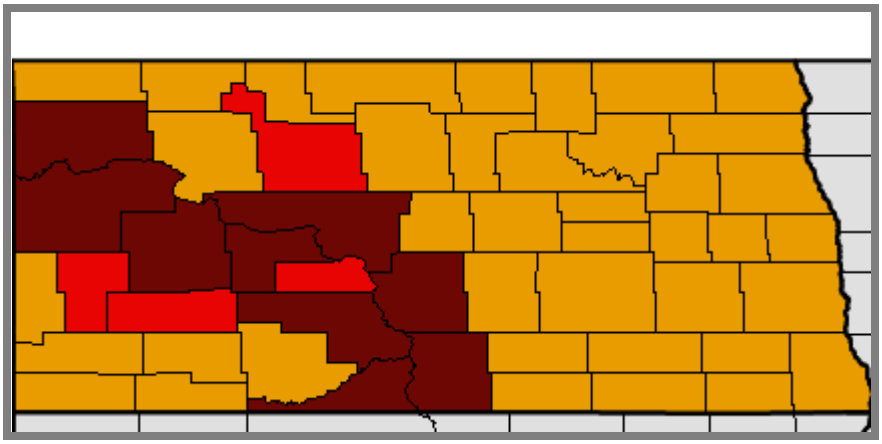
Figure 5.3.2B Dust buried farms and equipment, killed livestock, and caused human death and misery during the height of the Dust Bowl years. Source: National Weather Service, 1935.

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.

Figure 5.3.2C shows the drought impacts recorded by the National Drought Mitigation Center from July 1990 to June 2010. Most of the impacts were collected from local newspaper articles. Impact categories include agriculture, fire, water/energy, social, environment, and other.

Figure 5.3.2C Drought Impacts Recorded from July 1990 – June 2010



No reported impacts
4 - 21 reported impacts
22 - 39 reported impacts
40 - 57 reported impacts
58 - 75 reported impacts
76 - 94 reported impacts

Source: National Drought Mitigation Center, 2010b.

During the ten year period of 2000-2009, the USDA Risk Management Agency paid out $887,712,499 in crop insurance losses due to drought. (Risk Management Agency, 2010)

The Federal Emergency Management Agency's ability to utilize the President's Disaster Fund for drought relief to state and local interests is very limited in scope, however the US Department of Agriculture frequently declares agricultural disasters because of drought.

Table 5.3.2D North Dakota Drought Declared Disasters and Emergencies

Declaration	Location	Date	Magnitude	Casualties	Damages
DR 3016	North Dakota	1976	Presidential Emergency Declaration; Driest year in North Dakota since 1936	None	Unknown
State EO	North Dakota	1980	State Declared Drought Disaster	Unknown	Unknown
State EO	North Dakota	1981	State Declared Drought Disaster	Unknown	Unknown
State Request	North Dakota	1990	Governor's Request for USDA assistance for Adverse Weather/Drought	Unknown	Unknown
State EO	North Dakota	1993	State Declared Agricultural Emergency	Unknown	Unknown
State Request	North Dakota	2000	Governor's Request for USDA assistance for Dry and Flood Conditions	Unknown	Unknown
State Request	North Dakota	2002	Governor's Request for USDA assistance for Drought	Unknown	Unknown
State EO	North Dakota	2002	State Declared Drought Disaster	Unknown	Unknown
State EO	North Dakota	2003	State Declared Drought Emergency	Unknown	Unknown
State EO	North Dakota	2004	State Declared Agricultural Emergency/Drought Disaster	Unknown	Unknown
State EO	North Dakota	2005	State Declared Drought Disaster/Fire Danger Emergency	Unknown	Unknown
USDA S2198	Adams, Bowman, and Sioux Counties	January 1, 2005 through December 31, 2005	Also included impacts from hail, wildfires, high winds, excessive heat, and winter storms.	None	Unknown
USDA S2344	Adams, Emmons, McIntosh, and Sioux Counties	January 1, 2006 through December 31, 2006	Also included impacts from hail, insects, wildfires, high winds, excessive heat, and winter storms.	None	Unknown
USDA S3457	Adams, Bowman, Dickey, and McIntosh Counties	January 1, 2006 through December 31, 2006	Also included impacts from hail, insects, lightning, wildfires, high winds, excessive heat, and winter storms.	None	Unknown

Table 5.3.2D North Dakota Drought Declared Disasters and Emergencies (continued)

Declaration	Location	Date	Magnitude	Casualties	Damages
USDA S2388	Entire State of North Dakota	January 1, 2006 through December 31, 2006	Also included impacts from hail, high winds, excessive heat, winter storms, and excessive moisture.	None	Unknown
USDA S2392	Dickey and Sargent Counties	January 1, 2006 through December 31, 2006	Also included impacts from hail, insects, lightning, wildfires, high winds, excessive heat, and winter storms.	None	Unknown
USDA S2454	Divide and Williams Counties	January 1, 2006 through December 31, 2006	Also included impacts from hail, tornadoes, severe storms, wildfires, high winds, excessive heat, and winter storms.	None	Unknown
USDA S2457	McKenzie and Williams Counties	January 1, 2006 through December 31, 2006	Also included impacts from hail, insects, severe storms, wildfires, high winds, and excessive heat.	None	Unknown
USDA Secretarial	Entire State of North Dakota	January 1, 2007 through December 31, 2007	Also included impacts from frost, high temperatures, overland flooding, torrential rainfall, severe storms, hail, and high winds.	None	Unknown
USDA Secretarial	Bottineau, McHenry, McLean, Pierce, Renville, Sheridan, and Ward Counties	January 1, 2007 through December 31, 2007	Also included impacts from freeze and frost damage, high temperatures, hail, and high winds.	None	Unknown
USDA Secretarial	Bowman, Divide, Golden Valley, McKenzie, Slope, and Williams Counties	January 1, 2008 through December 31, 2008	Also included impacts from excessive heat, hail, severe storms, high winds, wildfires, and insects.	None	Unknown
USDA Secretarial	Entire State of North Dakota	January 1, 2008 through December 31, 2008	Also included impacts from frost, general lack of timely precipitation, high temperature, insect and disease pressure, heavy rainfall, overland flooding, hail, and high winds.	None	Unknown
USDA S2921	McKenzie and Williams Counties	January 1, 2009 through June 21, 2010	Also includes impacts from a cool and wet spring, late spring frosts, hail, excessive moisture at harvest, and weather related insect damage.	None	Unknown

Table 5.3.2D North Dakota Drought Declared Disasters and Emergencies (continued)

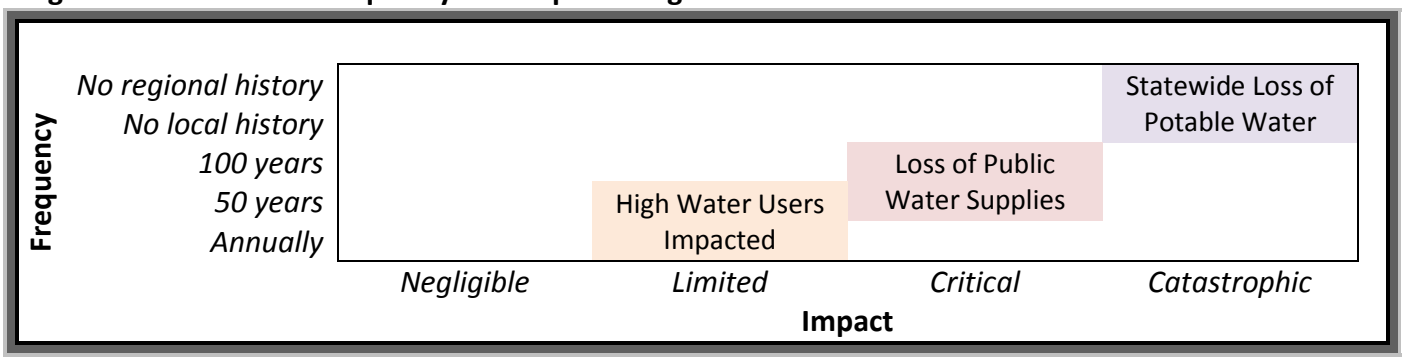
Declaration	Location	Date	Magnitude	Casualties	Damages
USDA S2942	42 counties in Central and Eastern North Dakota	January 1, 2009 through July 26, 2010	Also includes impacts from frost, cool temperatures, excessive rain, excessive late-season snowfall, flooding, ground saturation, hail, high winds, and weather related losses from insects and diseases.	None	Unknown
USDA S2982	Richland County	April 1, 2009 through November 8, 2010	Also includes impacts from excessive rain, flooding, flash flooding, unseasonably cool temperatures, frosts, and freezes.	None	Unknown

Sources: Federal Emergency Management Agency, 2007; Farm Service Agency, 2007; North Dakota Department of Emergency Services, 2007e; Farm Service Agency, 2010.

5.3.3 Probability and Magnitude

Figure 5.3.3A is a graphical representation of the range of events that can occur within the drought hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the drought hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.3.3A Hazard Frequency and Impact Ranges



The National Oceanic and Atmospheric Administration 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 of what we should expect in terms of the magnitude and duration of future droughts. For example, paleoclimatic data suggest that droughts as severe at the 1950s drought have occurred in central North America several times a 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. These data indicate 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 a 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 2% chance of occurring each decade. (National Oceanic and Atmospheric Administration, 2003)

5.3.4 Mapping

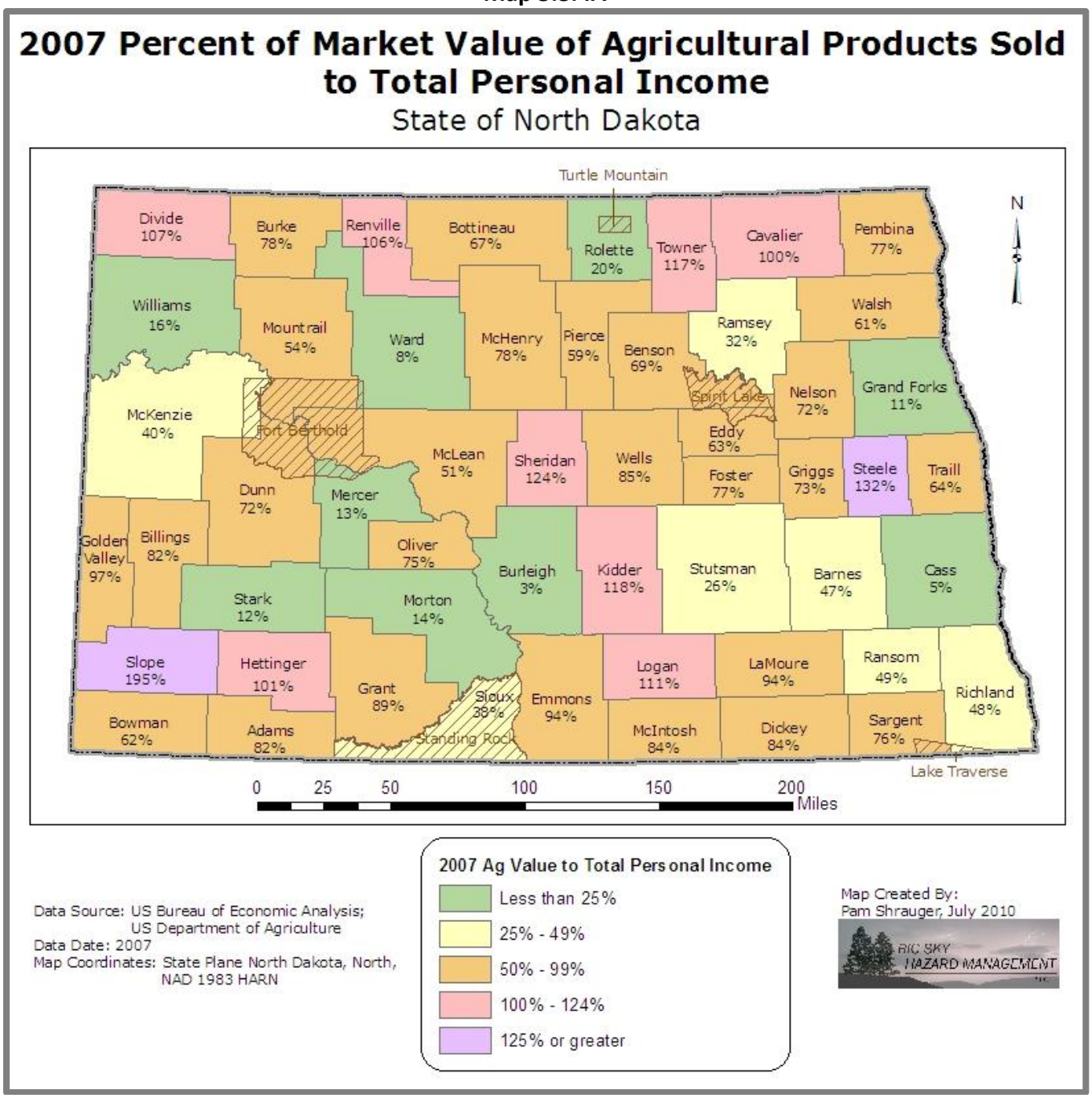
Drought is usually a regional hazard and any part of the state could be impacted in any given year. Mapping of the current drought status is published by the US Drought Monitor each Thursday at http://drought.unl.edu/dm. North Dakota also has an extensive network of ground monitoring wells and surface 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.

Figure 5.3.2C in the history section shows the recorded impacts from drought over the past 20 years. As this figure shows, the majority of the impacts are along the Missouri River, likely due to the importance of the river for recreation, power generation, and irrigation in the state. As a way to quantify the impact drought has on the agricultural community, Map 5.3.4A shows the percentage of the market value of agricultural products sold to its total personal income in 2007. The values in this map are not directly of much importance, however, those counties with higher percentages likely have a less diversified economy and rely more heavily and directly on agriculture economically. Both livestock and crop producers can see significantly diminished profits and damages from drought.

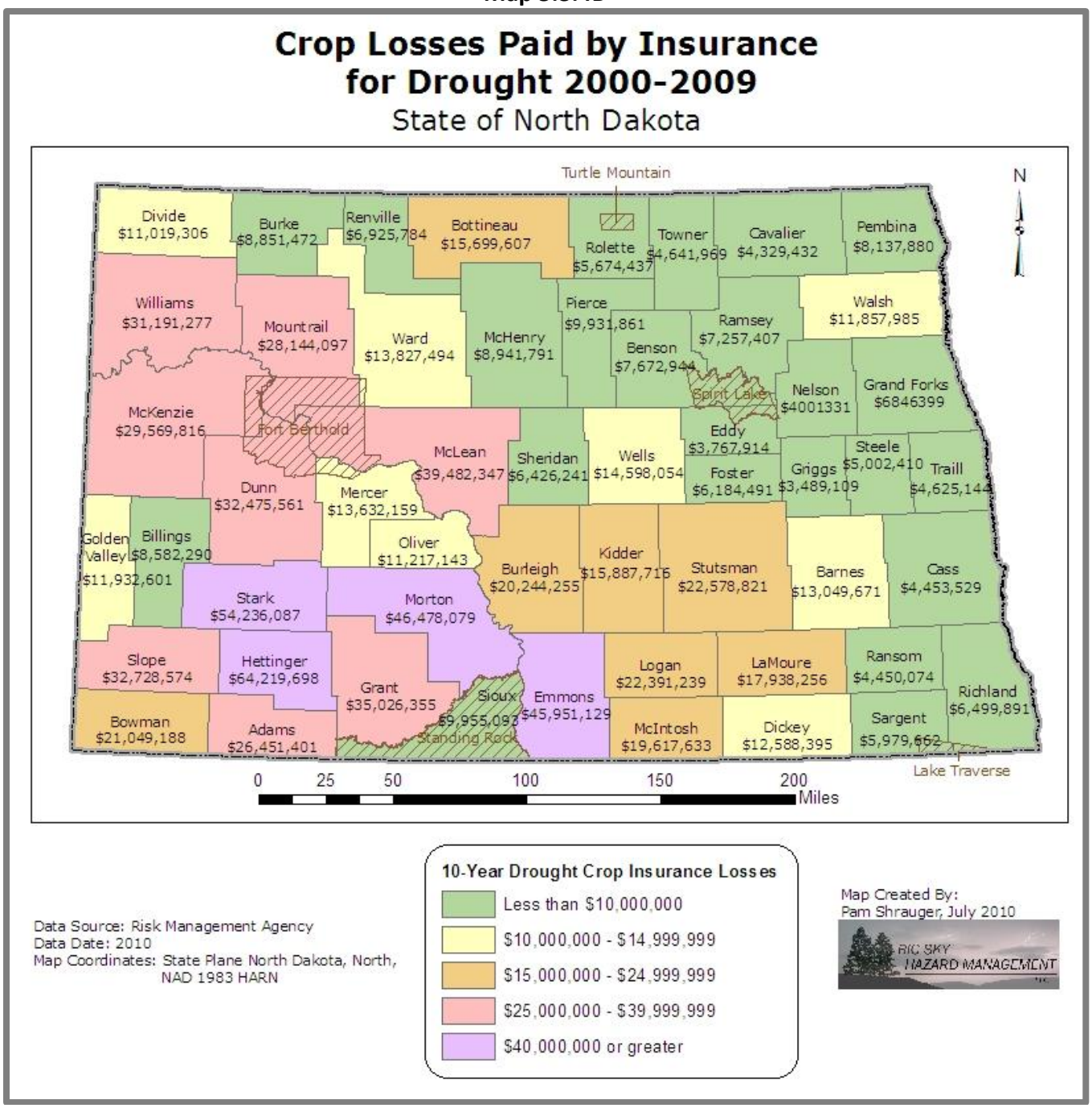
Map 5.3.4B shows the losses listed through the federal crop insurance program due to drought from 2000-2009. The total losses over the 10-year period in the state totaled $887,712,499, or about $89 million annually. Note that some crops such as forage, millet, oats, and rye do not have high insurance coverage rates, so additional non-quantifiable losses likely occurred. (Risk Management Agency, 2009; Risk Management Agency, 2010)

Map 5.3.4C shows the 37 largest water users in the state plus power plants based on data provided by the North Dakota State Water Commission. These water users can be significantly impacted by drought conditions due to their dependence on high volumes of water.

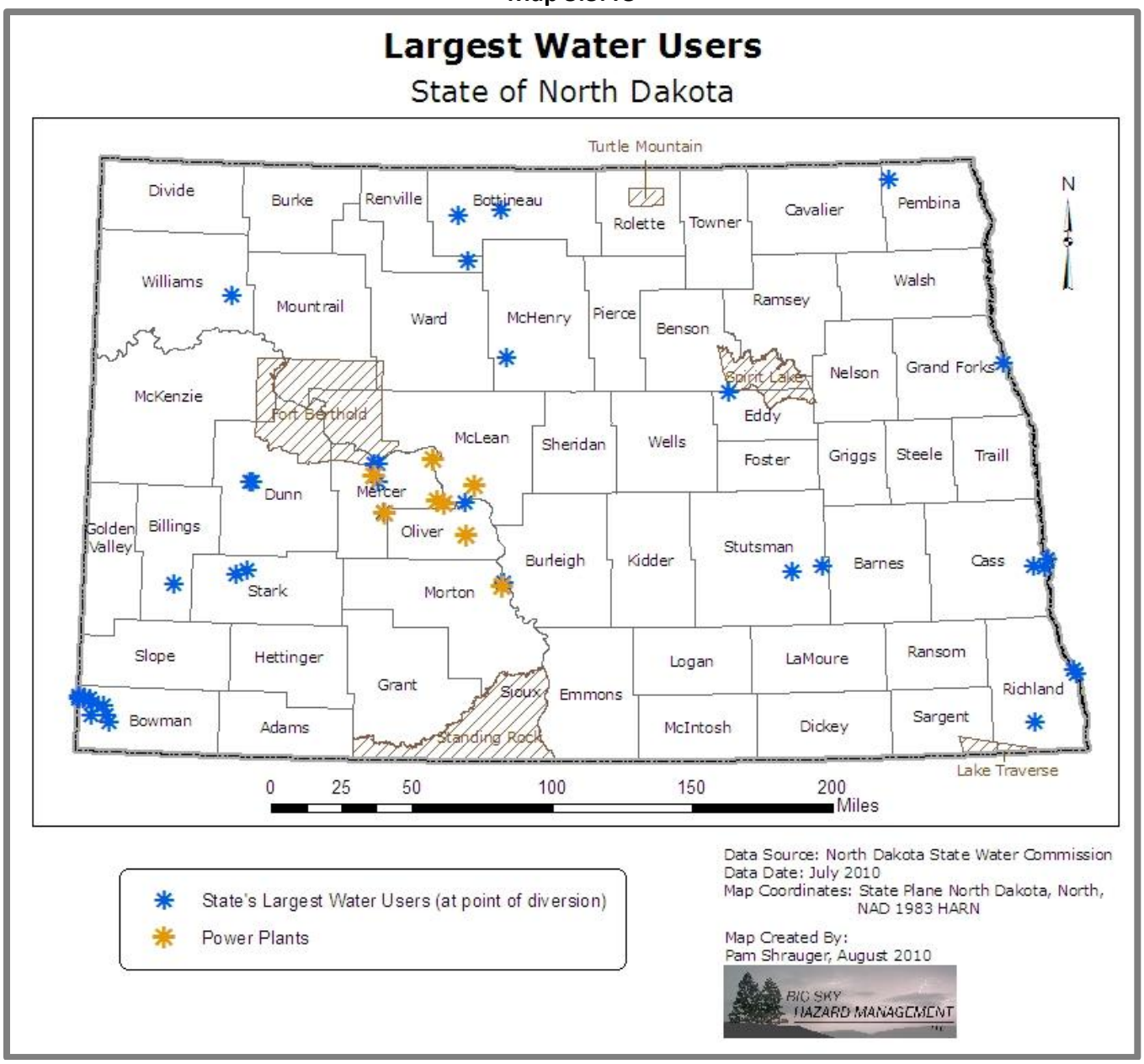
Map 5.3.4A


2007 Percent of Market Value of Agricultural Products Sold to Total Personal Income
State of North Dakota
Turtle Mountain
N
Divide 107%
Burke 78%
Renville 106%
Bottineau 67%
Rolette 20%
Towner 117%
Cavalier 100%
Pembina 77%
Williams 16%
Mountrail 54%
Ward 8%
McHenry 78%
Pierce 59%
Benson 69%
Ramsey 32%
Walsh 61%
Spirit Lake
Nelson 72%
Grand Forks 11%
McKenzie 40%
Fort Berthold
Eddy 63%
McLean 51%
Sheridan 124%
Wells 85%
Foster 77%
Griggs 73%
Steele 132%
Traill 64%
Dunn 72%
Mercer 13%
Golden Valley 97%
Billings 82%
Oliver 75%
Burleigh 3%
Kidder 118%
Stutsman 26%
Barnes 47%
Cass 5%
Stark 12%
Morton 14%
Slope 195%
Hettinger 101%
Grant 89%
Sioux 38%
Standing Rock
Emmons 94%
Logan 111%
LaMoure 94%
Ransom 49%
Richland 48%
Bowman 62%
Adams 82%
McIntosh 84%
Dickey 84%
Sargent 76%
Lake Traverse
0 25 50 100 150 200 Miles
2007 Ag Value to Total Personal Income
Less than 25%
25% - 49%
50% - 99%
100% - 124%
125% or greater
Data Source: US Bureau of Economic Analysis; US Department of Agriculture
Data Date: 2007
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, July 2010
BIG SKY HAZARD MANAGEMENT

Map 5.3.4B


Crop Losses Paid by Insurance
for Drought 2000-2009
State of North Dakota
Turtle Mountain
N
Divide $11,019,306
Burke $8,851,472
Renville $6,925,784
Bottineau $15,699,607
Rolette $5,674,437
Towner $4,641,969
Cavalier $4,329,432
Pembina $8,137,880
Williams $31,191,277
Mountrail $28,144,097
Ward $13,827,494
McHenry $8,941,791
Pierce $9,931,861
Benson $7,672,944
Ramsey $7,257,407
Walsh $11,857,985
Spirit Lake
Nelson $4001331
Grand Forks $6846399
McKenzie $29,569,816
Fort Berthold
McLean $39,482,347
Sheridan $6,426,241
Wells $14,598,054
Eddy $3,767,914
Foster $6,184,491
Griggs $3,489,109
Steele $5,002,410
Traill $4,625,144
Dunn $32,475,561
Mercer $13,632,159
Golden Valley $11,932,601
Billings $8,582,290
Oliver $11,217,143
Burleigh $20,244,255
Kidder $15,887,716
Stutsman $22,578,821
Barnes $13,049,671
Cass $4,453,529
Stark $54,236,087
Morton $46,478,079
Slope $32,728,574
Hettinger $64,219,698
Grant $35,026,355
Sioux $9,955,093
Standing Rock
Emmons $45,951,129
Logan $22,391,239
LaMoure $17,938,256
Ransom $4,450,074
Richland $6,499,891
Bowman $21,049,188
Adams $26,451,401
McIntosh $19,617,633
Dickey $12,588,395
Sargent $5,979,662
Lake Traverse
0 25 50 100 150 200 Miles
10-Year Drought Crop Insurance Losses
Less than $10,000,000
$10,000,000 - $14,999,999
$15,000,000 - $24,999,999
$25,000,000 - $39,999,999
$40,000,000 or greater
Data Source: Risk Management Agency
Data Date: 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, July 2010
BIG SKY
HAZARD MANAGEMENT

Map 5.3.4C


Largest Water Users
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
N
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Oliver
Golden Valley
Billings
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
0
25
50
100
150
200
Miles
State's Largest Water Users (at point of diversion)
Power Plants
Data Source: North Dakota State Water Commission
Data Date: July 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY
HAZARD MANAGEMENT

5.3.5 Vulnerabilities to Jurisdictions

Typically, the most profound impact of drought on the communities is to the economy. Important sectors of the North Dakota economy that can experience impacts from drought include agriculture, energy development/production, food processing, and tourism/recreation. Reduced precipitation or low irrigation supplies may damage crops and reduce the amount of feed available for livestock. Non-irrigated croplands and rangelands are most susceptible to moisture shortages. Irrigated agricultural lands do not feel the effects as quickly, but their yields can also be greatly reduced, particularly if irrigation supplies are rationed. With an agricultural market value of over $6 billion, drought can severely diminish profits for the roughly 32,000 farms and ranches in North Dakota. (US Department of Agriculture, 2007) Over the past 10 years, insured crop losses in North Dakota due to drought have averaged $89 million annually. (Risk Management Agency, 2010)

In the energy development/production sector, large amounts of water are needed to produce energy and products such as ethanol. For example, three to six gallons of water are needed to produce one gallon of ethanol. (North Dakota State Water Commission, 2009) Food processing similarly requires large amounts of water. Drought conditions can drastically reduce production and have a trickle-down effect on other elements of the economy. Water-based recreation has a less direct effect on the economy, but is an important factor when considering all impacts of drought. Those communities around the Missouri River reservoirs could see the greatest impacts.

Nationally, drought losses average about $6-8 billion annually with impacts primarily to agriculture, transportation, recreation, tourism, forestry, and energy sectors. Based on National Drought Mitigation Center research, drought losses typically range from $200 million to $1.24 billion annually in the Great Plains. These figures are based on crop losses, other direct and indirect losses, and many rough estimates and crude approximations. The National Climatic Data Center estimates the cost of the 1988 drought at $40 billion for the United States. The impacts of drought are so diffuse and far-reaching that financial estimates of loss are often difficult to quantify. (National Drought Mitigation Center, 2010a) Table 5.3.5A shows the types of losses that may occur with drought.

Table 5.3.5A Categories of Potential Drought Losses

Drought Type / Severity	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)

Table 5.3.5A Categories of Potential Drought Losses (continued)

Drought Type / Severity	Loss Type	Causes
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 - 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

Table 5.3.5A Categories of Potential Drought Losses (continued)

Drought Type / Severity	Loss Type	Causes
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 - 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, 2010a.

Table 5.3.5B lists the counties, their associated drought risk, and information from the local and tribal mitigation plans. The drought hazard rating for each jurisdiction was based on the dependence of the local economy on agriculture (including livestock and crops) and the number of high water users. Additional information on the hazard ratings in the local and tribal plans can be found in Section 3.6, Risk Assessment Methodologies.

Table 5.3.5B Drought Risk to Jurisdictions

Jurisdiction	Drought Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	Moderate	B	$41,000,000 estimated losses
Barnes	Low-Moderate	B	$2,335,037 structure and contents losses
Benson	Moderate	NP	
Billings	Moderate-High	C	
Bottineau	Moderate-High	B	$405,097 estimated losses
Bowman	Moderate-High	A	$115,000 estimated losses
Burke	Moderate	B	$100,000 estimated losses
Burleigh	Low	A	$3,461,731 critical facilities losses $27,735,841 residential losses
Cass	Low-Moderate	A	$2,442,955,373 estimated losses
Cavalier	Moderate-High	B	$481,000 estimated losses
Dickey	Moderate	B	
Divide	Moderate-High	NP	
Dunn	Moderate-High	B	
Eddy	Moderate	B	$21,000,000 estimated losses
Emmons	Moderate	A	
*Fort Berthold^*	*Moderate*	*NP*	
Foster	Moderate	B	$405,097 estimated losses
Golden Valley	Moderate	B	
Grand Forks	Low-Moderate	C	
Grant	Moderate	B	
Griggs	Moderate	B	$76,000 estimated losses
Hettinger	Moderate-High	A	
Kidder	Moderate-High	B	$87,000 estimated losses
*Lake Traverse^*	*Low-Moderate*	*NP*	
LaMoure	Moderate	#3 of 12	
Logan	Moderate-High	B	$49,484 estimated losses
McHenry	Moderate-High	B	$269,652 estimated losses
McIntosh	Moderate	B	$642,913 estimated losses
McKenzie	Low-Moderate	NP	
McLean	Moderate-High	B	
Mercer	Moderate	B	
Morton	Low-Moderate	B	

Table 5.3.5B Drought Risk to Jurisdictions (continued)

County	Drought Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Mountrail	Moderate	A	$172,000 estimated losses
Nelson	Moderate	B	$281,331 estimated losses
Oliver	Moderate-High	B	
Pembina	Moderate-High	B	$69,879,876 estimated losses
Pierce	Moderate	B	
Ramsey	Low-Moderate	C	
Ransom	Low-Moderate	High	
Renville	High	B	$155,768 estimated losses
Richland	Moderate	B	
Rolette	Low	NP	
Sargent	Moderate	B	$272,676 estimated losses
Sheridan	Moderate-High	NP	
Sioux	Low-Moderate	NP	
Slope	High	NP	
Spirit Lake	*Moderate*	*NP*	
*Standing Rock^*	*Low-Moderate*	*NP*	
Stark	Low-Moderate	NP	
Steele	High	NP	
Stutsman	Moderate	B	$287,163 estimated losses
Towner	Moderate-High	B	$117,364 estimated losses
Traill	Moderate	B	$405,097 estimated losses
*Turtle Mountain^*	*Low*	*NP*	
Walsh	Moderate	B	
Ward	Low	A	$2,429,041 estimated losses
Wells	Moderate	A	
Williams	Low-Moderate	B	$638,879 estimated losses

NP = no local plan
^ includes only North Dakota parts of the reservation

5.3.6 Vulnerabilities of State-Owned Buildings and Property

Drought typically does not have a direct impact on structures. The functionality of state-owned buildings may be reduced if public water supplies are lost.

5.3.7 Vulnerabilities of Critical Facilities and Infrastructure

Generally, critical facilities themselves are not physically threatened by drought. Critical infrastructure, particularly those systems that rely on water for operations, can be negatively affected by drought. Many surface water bodies in North Dakota have water supply intakes for municipal, industrial, and irrigation purposes. Low water levels can cause operations to cease and damages to systems can occur.

Such problems can have serious consequences for municipal water supplies, electric power generation, and other critical industries. The US Army Corps of Engineers maintains a database of water supply intakes along the Missouri River system, including information on what water elevations and flows begin to cause problems. (North Dakota State Water Commission, 2007b)

In addition to the importance of surface water supplies, ground water supplies can also be affected by drought, diminishing the water available from wells. Shallow wells may even dry up. Ninety percent of North Dakota community water systems depend on ground water for at least some of their drinking water. Sixty percent of all North Dakotans rely on ground water for their primary source of drinking water and that figure increases to ninety-seven percent for rural populations. (North Dakota Department of Health, 2005) Should a public water or sewer system be affected, the losses could total into the millions of dollars if equipment is damaged and outside water is shipped in. Individuals with residential wells may also be impacted. Individual ground water users may have additional information regarding the vulnerabilities of their specific ground water systems. The levels at which specific areas begin to experience ground water impacts depend on the local ground soil and water conditions and the depth of the well.

In 2007, the US Bureau of Reclamation and the Garrison Diversion Conservancy District developed an Environmental Impact Statement for the Red River Water Supply Project. Based on information contained in the report, studies predict that the present water supplies would be inadequate during a severe drought similar to one that occurred in the Red River Valley during the 1930s. For example, in 1934, there were nearly five consecutive months of zero flow in the Red River at Fargo. During such a shortage, it would take 1,200 truckloads of water per day to supply Fargo's basic indoor household water needs. That equates to a truckload of water arriving every minute around the clock for five months to meet the current water needs. (US Bureau of Reclamation, 2008)

Table 5.3.7A shows the critical facilities and infrastructure summary for the counties with a high or moderate-high drought rating. See Section 4.2 for more details.

Table 5.3.7A Critical Facilities and Infrastructure in High and Moderate-High Drought Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Billings	CIKR Facilities: Low-Moderate (5-9 facilities) Interstate and Railroad Transportation Infrastructure
Bottineau	CIKR Facilities: Low-Moderate (5-9 facilities) Dakota College at Bottineau
Bowman	CIKR Facilities: Low-Moderate (5-9 facilities)
Cavalier	CIKR Facilities: Low-Moderate (5-9 facilities) Langdon Wind Power Plant
Divide	CIKR Facilities: Low-Moderate (5-9 facilities)
Dunn*	CIKR Facilities: Low (0-4 facilities)
Hettinger	CIKR Facilities: Low (0-4 facilities)
Kidder	CIKR Facilities: Low (0-4 facilities) Interstate and Railroad Transportation Infrastructure

Table 5.3.7A Critical Facilities and Infrastructure in High and Moderate-High Drought Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Logan	CIKR Facilities: Low (0-4 facilities)
McHenry	CIKR Facilities: Low (0-4 facilities)
McLean*	CIKR Facilities: Moderate (10-14 facilities) Coal Creek Power Plant Garrison Hydroelectric Power Plant
Oliver	CIKR Facilities: Low-Moderate (5-9 facilities) Milton R. Young Power Plant
Pembina	CIKR Facilities: Moderate (10-14 facilities) Neche Oil Import Site Interstate and Railroad Transportation Infrastructure
Renville	CIKR Facilities: Low (0-4 facilities)
Sheridan	CIKR Facilities: Low (0-4 facilities)
Slope	CIKR Facilities: Low (0-4 facilities)
Steele	CIKR Facilities: Low (0-4 facilities)
Towner	CIKR Facilities: Low (0-4 facilities)

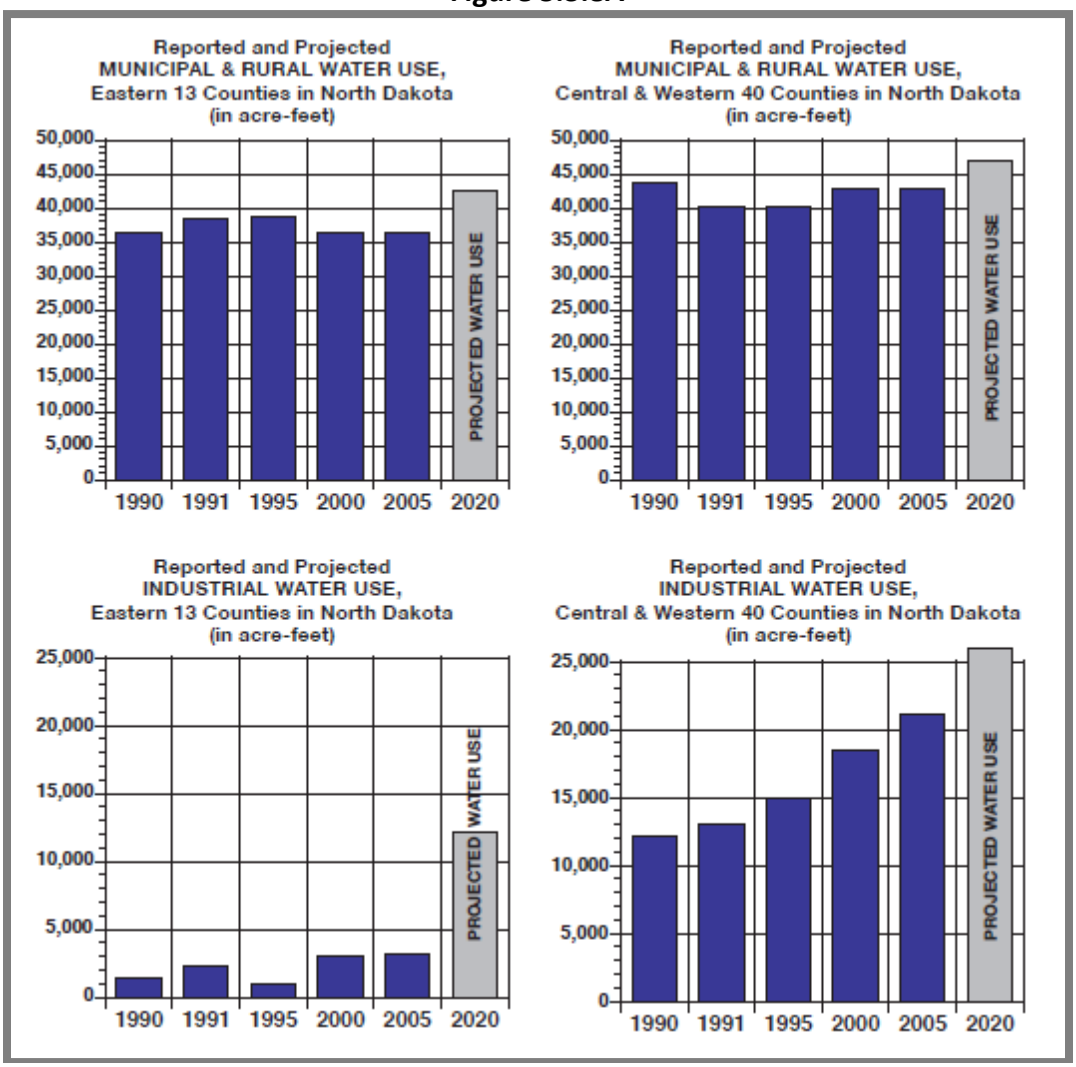
* includes at least part of the reservation

5.3.8 Vulnerabilities to New and Future Development

Future development's greatest impact on the drought hazard would possibly be to ground water resources. New water and sewer systems or significant well and septic sites could use up the water available or diminish water quality, particularly during periods of drought. Fortunately, public water systems are monitored by the North Dakota Department of Health, but individual wells and septic systems are not as strictly regulated. Therefore, future development could have an impact on the drought vulnerabilities. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties. See Section 4.8, Future Development, for more information on these indications and projections.

Industrial development, particularly in energy development, may lead to additional large water users and vulnerability. New ethanol plants are proposed in Dickey, Nelson, Stutsman, and Williams Counties. (North Dakota State Water Commission, 2009) Figure 5.3.8A shows the reported and projected municipal, rural, and industrial water uses.

Figure 5.3.8A



Source: North Dakota State Water Commission, 2009.

5.3.9 Data Limitations and Other Key Documents

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. An online database of historical USDA drought declarations and the associated losses would prove beneficial in documenting the effects of drought and directing mitigation activities.

Other key documents include:

- *Climatic and Hydrologic Aspects of the 1988-1992 Drought and the Effect on People and Resources of North Dakota*, North Dakota State Water Commission, 1994.
- North Dakota Drought Contingency Plan
- North Dakota Emergency Operations Plan, Drought Overview and Checklist

5.4 Flood

Including Riverine, Closed Basin, Ice Jam, and Flash Floods

5.4.1 Characteristics

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 groundwater flow system.

Flooding is an overflow of water on land not normally covered by water. 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, along closed basin lakes, in poor drainage areas, or in oversaturated soils.

Riverine flooding originates from a body of water, typically a river, creek, or stream, as water levels rise onto normally dry land. The riverine hazard areas may be mapped as part of the National Flood Insurance Program (NFIP). Under this program, an area is broken into zones to depict the level of flood hazard. Most commonly, the areas within the 100-year floodplain are considered the greatest risk. The 100-year floodplain 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 nearly three times more likely to be damaged by flood than a major fire. (Federal Emergency Management Agency, 2010a) 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.

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 snowpack. Another source of flooding occurs when heavy rain falls in such a short time that the soil cannot absorb it. Flooding is also caused when heavy rain falls over a prolonged period of time and the ground becomes saturated and cannot absorb the additional moisture fast enough. Unique to North Dakota is flooding due to closed basin circumstances; in a closed basin, surface water cannot flow naturally out of the basin as a river does (until a certain elevation is reached), and therefore, during wet periods, normally dry locations can fill in with water.

Flooding of the larger streams and rivers generally occurs during the spring with closed basin flooding occurring a few months later. The spring flood danger period is generally during March and April with closed basin flooding usually peaking in June, July, and August. 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. North Dakota's major rivers are characterized by large, average annual discharges; however, variations in flow during the year can be great with periods of no flow possible on most of the larger streams and rivers.

Flooding can also result from ice jamming or blockage along streams. Ice breaking up into pieces, called floes, moves along with the flowing rivers or streams. The ice floes can jam at curves, narrow places in the channel, structures, river/stream confluences, or where there is a sharp decrease in river bed gradient, creating an effective dam that produces water backup and overflow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. Types of ice jams include freezeup jams, breakup jams, or combinations of both. (US Army Corps of Engineers, 1994) When an ice jam releases, the effects downstream can be similar to that of a flash flood or dam failure.

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. Urbanization increases runoff two to six times more than natural terrain. (National Oceanic and Atmospheric Administration, 1992) The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's capability to remove it.

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

Overland flooding is usually related to riverine and urban flooding and high groundwater levels and occurs in areas outside of a defined river or stream. Examples include flooding that occurs when saturated soils do not allow water to drain or a levee is breached; roads and railroad beds can similarly cause overland flooding.

Hundreds of significant floods occur in the United States each year and kill an average of 93 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.

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. Floodplains in North Dakota are heavily developed with structures such as houses, roads, railroads, industrial sites, businesses, agricultural fields, and recreational facilities. Additionally, growth in the amount of hazardous materials that are being stored, used, and manufactured in the designated floodplains leads to the potential for contamination and complicates and increases the extent of damage caused by flooding. Many of these improvements are in conflict with nature's purpose for the floodway and floodplain. This development results in frequent and mounting flood losses. The effects of flooding depend upon the nature of the flood itself and the settlement pattern of the area inundated.

Flooding of land adjoining the normal course of a stream or river or a closed basin lake is a natural occurrence. If these floodplain areas were left in a natural state, the floods would not cause major damage. The economic attractiveness of vacant land has resulted in the development of some floodplain areas despite the risk. The urban, industrial, and agricultural encroachment on natural floodplain areas has increased the potential for dangerous flooding, and causes the flood waters to adversely affect land, which formerly was considered safe. The flood potential is increased because rainfall that used to soak into the ground or take several days to reach a stream or river via a natural drainage basin now quickly runs off streets, parking lots, rooftops, and tilled and ditched agricultural fields, through channels and pipes.

Many flood control dikes and levees in North Dakota have not been built to current standards. A majority of these facilities have been built under emergency conditions, with changing cross sections or elevations; some lack the necessary free board, many are not strong enough, have not been maintained properly, or other problems may exist.

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

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

Several areas of North Dakota are subject to periodic flooding conditions. They include the Red River Valley, the Devils Lake Basin, the Souris River Basin, and extensive areas in central and southwest portions of the state.

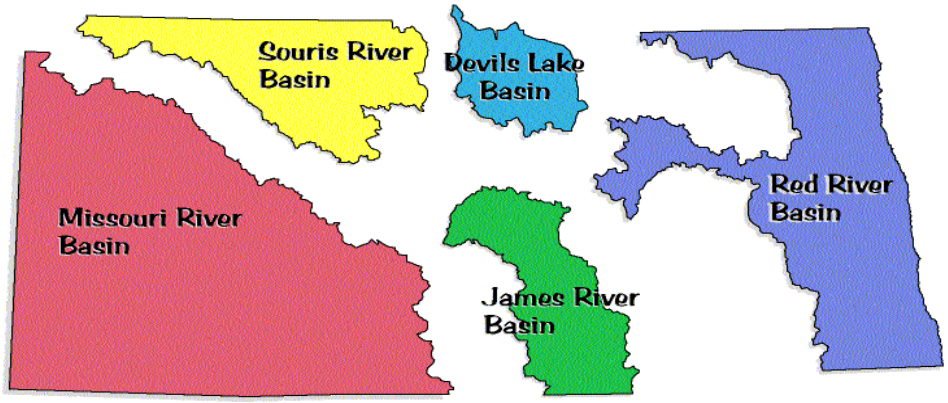
Major Drainage Basins

North Dakota is separated into two major drainage basins by a divide running from the northwest through the central and southeastern part of the state. The northeast portion of the divide falls generally within the Hudson Bay drainage, while the southwest part of the divide is drained by the Missouri River into the Gulf of Mexico.

The Missouri River drainage system includes the major basins of the Missouri and James Rivers. The area is characterized by a combination of glaciated terrain with badlands and landforms of eroded, soft, sedimentary bedrock in the southwest. The badlands are the colorful cliffs, canyons, gorges, ravines, and gullies that have been created by extensive wind and water erosion.

The Hudson Bay drainage includes the Souris and Red River systems plus the large, noncontributing, closed Devils Lake Basin. Glacial landforms and lake plains characterize this region of the state.
There are five major hydrologic subdivisions in North Dakota. These subdivisions are the Missouri River Basin, the James River Basin, the Red River Basin, the Devils Lake Basin, and the Souris River Basin. Figure 5.4.1A shows these basins.

Figure 5.4.1A
North Dakota Basins

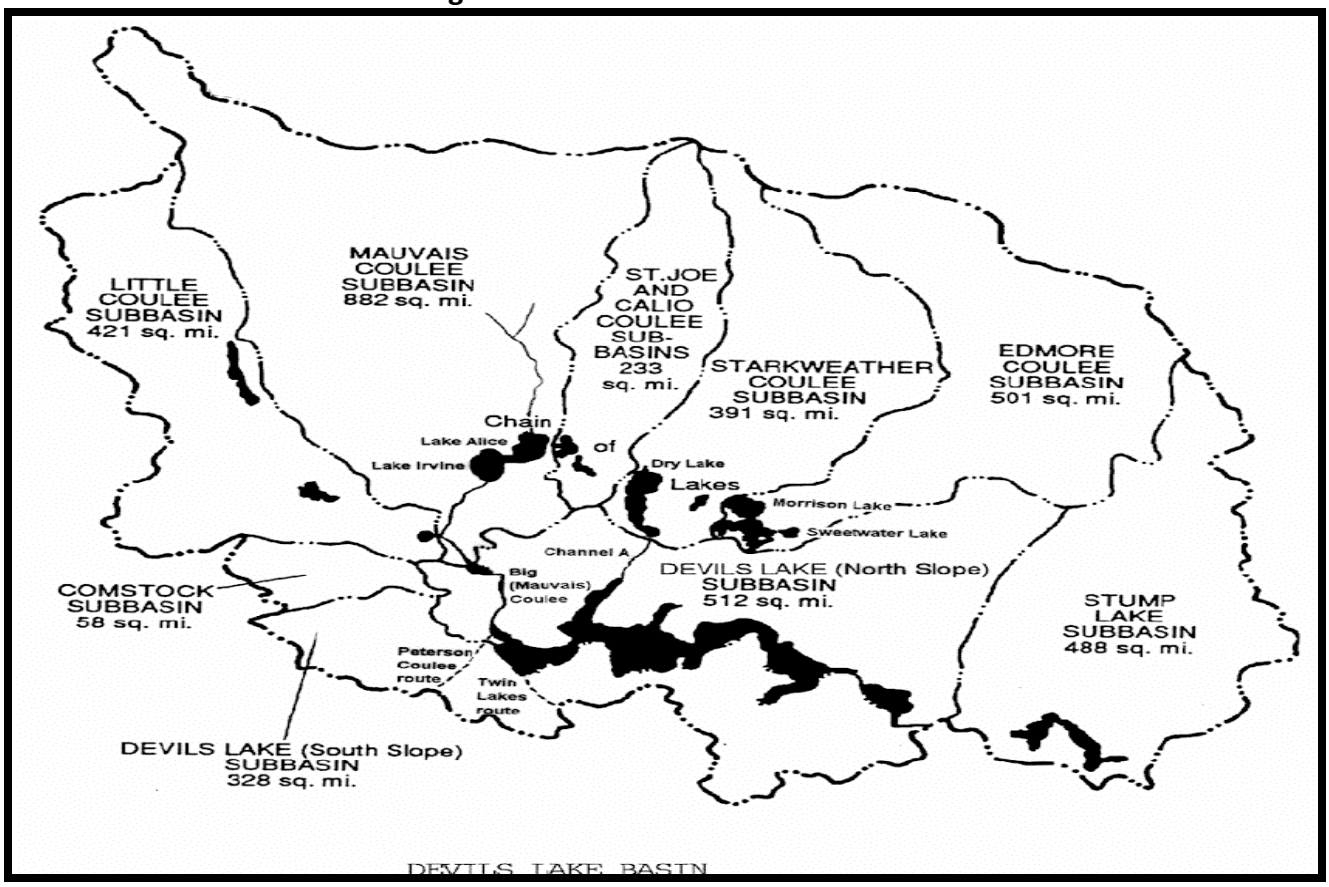


Source: North Dakota State Water Commission.

Devils Lake Basin

The Devils Lake Basin is a non-contributing sub-basin within the Red River drainage system. The Devils Lake Basin became a closed basin after the last continental ice sheets receded and southerly drainage to the Sheyenne River ceased. The drainage system of the basin is formed by chains of waterways and connecting lakes, with the majority of the water ultimately flowing into Devils Lake. Figure 5.4.1B shows the sub-basins within the Devils Lake Basin.

Figure 5.4.1B Devils Lake Sub-Basins



Source: US Army Corps of Engineers.

The water levels of Devils Lake fell 37.5 feet between 1867 and 1940. Since 1940, the trend has reversed. Between February 1993 and June 1999, the lake rose approximately 20 feet, thereby tripling the volume of water in the lake. The lake area expanded from 40,000 acres in 1993 to 82,200 acres in 1996. These increases created significant concerns from land and property owners in the area. In addition, as the lake level changes, so do water quality parameters. Lower water levels are generally associated with a very high total of dissolved solids. Devils Lake is the largest natural lake in North Dakota.

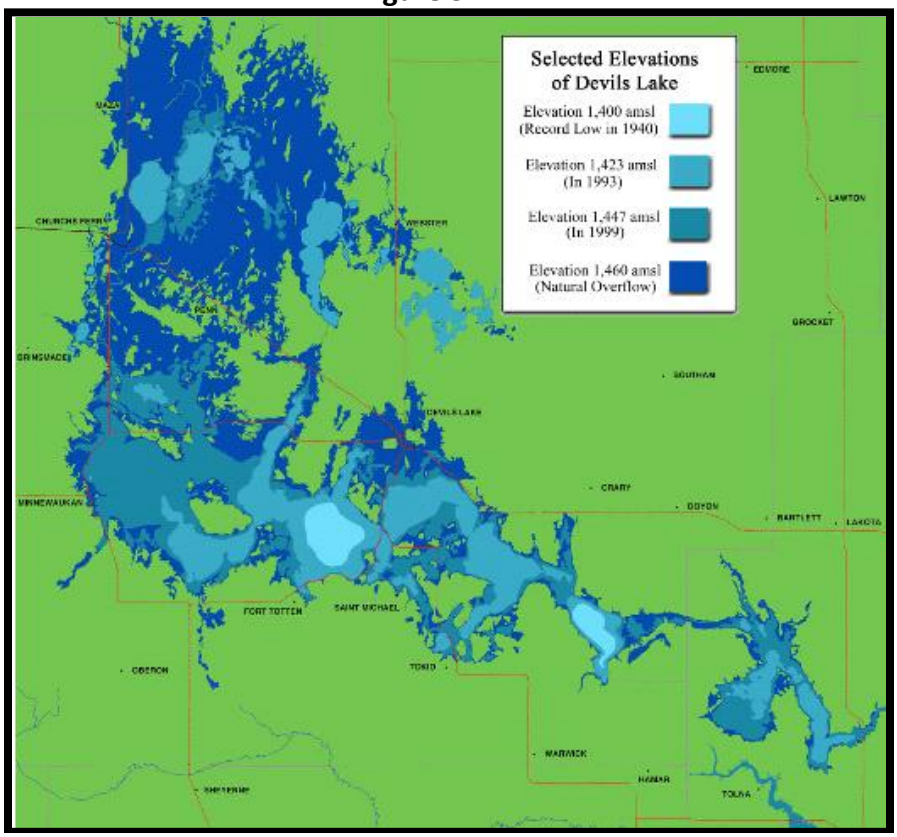
Figure 5.4.1C Devils Lake batters the Officers Club at Camp Grafton in 1995.
Source: Devils Lake Journal.

The basin's topography contributes greatly to the flood problems experienced in the area. Much of the region's land is rolling, but the general slope is relatively flat. Small streams, shallow lakes, and numerous wetland depressions are typical. Agricultural development is extensive and much of the flood damages are agricultural in nature. There are approximately 75,000 acres of floodplain in the basin.

The major flood problems in the Devils Lake Basin are because of poor natural drainage, frequent overland sheet flooding of agricultural lands, and flooding of some communities. The potential increase in the water level of the Devils Lake Basin presents a flood threat to substantial amounts of public, commercial, and private developments. On the other hand, low levels, especially on Devils Lake itself, have an extremely negative impact on the highly visible sport fishing industry that exists in the basin. Soil erosion is a serious problem contributing to sedimentation and nutrient enrichment of area streams and lakes. Agricultural drainage versus wetland preservation is also a major concern in the basin.

Even though Devils Lake is considered a closed basin, the lake does have a natural outlet into Stump Lake when lake levels reach 1,447' msl. Then, at 1,459' msl, the combined lakes flow into the Sheyenne River via the Tolna Coulee. (Ramsey County Emergency Management Office, 2005) If the lake continues to rise until the outflow balances the inflow, the elevation is estimated to be about 1,463' msl at the west end of the lake with an approximate surface area of 354,000 acres (553 square miles). (Federal Emergency Management Agency, 2006) Figure 5.4.1D shows the coverage of Devils Lake at various elevations.

Figure 5.4.1D



Source: North Dakota State Water Commission, 2010a.

Closed basin flooding is unique when compared to standard riverine flooding because river levels tend to rise rapidly and the flood has a duration of days to weeks, whereas, closed basin flooding like Devils Lake occurs relatively slowly and can last for years or indefinitely. The flood problems are compounded by wave action and ice movement on the lake. (Ramsey County, 2010)

As a part of a strategy for identifying a more permanent comprehensive solution to flooding in the Devils Lake Basin, a comprehensive risk assessment of known flooding potential was conducted in partnership by the Federal Emergency Management Agency and the State of North Dakota. The objective was to develop a product that is user-friendly, easily accessible to a wide range of users, and one that could be easily maintained and managed. Data consists of roads, structures, sewer systems, transmission lines, pump stations, treatment facilities and electric systems. Features of the risk assessment include a structure inventory, GIS overlays, infrastructure feature descriptions such as road names and utility ownership, one-foot contour elevations, aerial photography, lidar hill shade mapping, and zoom in and out capability. The Devils Lake Risk Assessment, completed in 2000, is now considered out-of-date, but current and future projects look to build upon the work that was done. This tool was most useful for identifying which infrastructure and private property was at greatest risk when lake levels rose.

Since 1994, structures around the expanding Devils Lake/Stump Lake system which carried flood insurance have qualified for demolition, salvage, or relocation through the waiver of flood insurance rules prior to August 2, 1999 and through the closed basin lake endorsement feature of the flood insurance policy since August 2, 1999. Structures imminently threatened by the waters of the Devils Lake/Stump Lake system can qualify for relocation though their effective flood policy in four select NFIP communities - Benson County, Minnewaukan, Devils Lake, and Creel Township. Over 150 structures have been removed from inundation from the Devils Lake/Stump Lake system through flood insurance and mitigation programs since 1994. (North Dakota State Water Commission, 2008) All of the acquisitions include deed restrictions. Within cities, a warranty deed and restricted covenant is placed on the property. In rural areas, an easement is generally used for the restriction on each property. These provisions keep new development from occurring on acquired lots.

Other actions taken within the basin include embankments, levees, and outlets, but to date, all of these types of actions have been only successful as temporary or partial mitigation measures.

James River Basin

The James River, the largest river in the basin, is a major tributary of the Missouri River. The principal tributary of the James River is Pipestem Creek. Other important tributaries to the James River include Maple, Beaver, Bone Hill, and Cottonwood Creeks. These creeks all drain the area to the west of the river, while Bear Creek is the only major east-side tributary.

Jamestown and Pipestem Dams, both just north of Jamestown, hold water throughout the year and provide flood protection to communities along the James River from Jamestown to the South Dakota state line. These dams provide over 90 percent flood damage reduction along the James River. The

river becomes permanent below these dams, but periods of no flow are not uncommon. Countless wetlands store water in the noncontributing portions of the basin.

Flooding has occurred in the basin. Major floods occurred in 1881, 1920, 1922, 1942, 1950, 1969, 1993-1997, 1999, and 2009. In addition, at least 17 minor floods are known to have taken place since 1881. Flooding in the James River Basin is most often caused by rapid runoff from relatively steep tributaries to the nearly flat main channel of the James River which may be obstructed along its route by small jams, log jams, vegetation, sediment deposits, and inadequate bridge capacities. It is not uncommon for tributary discharges to exceed the channel capacity of the James.

The major water problems in the James River Basin relate to periodic flooding of agricultural cropland, hay land, pasture, and several communities. Communities most severely affected include Jamestown, Carrington, Spiritwood Lake, Oakes, LaMoure, and Edgeley. A major issue within the basin is the controversy involving agricultural drainage versus wetland preservation. River channel obstructions and stream bank erosion exist in many areas along the James River below the Jamestown Dam.

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 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.

Flood losses occur primarily on the Missouri River's many smaller tributaries. Periodic flooding of agricultural land and some communities is a problem in the basin. Serious riverbank erosion is occurring along the Missouri River below Garrison Dam, along reaches of the Heart River, and also to archaeological sites along the Knife River. Erosion of topsoil has contributed to sedimentation and accelerated aging of many lakes and reservoirs throughout the basin. Ice jam flooding is relatively common and significant in the basin.

Red River Basin

The Red River Basin is the most populated basin of the state. The Red River is the principal river of the basin. It serves as the border between North Dakota and Minnesota and winds nearly 400 river miles from its origin at the confluence of the Otter Tail and Bois de Sioux Rivers at Wahpeton, North Dakota and Breckenridge, Minnesota, north to the Canadian border. The Red River continues to flow about 155 river miles to Lake Winnipeg in Manitoba. The valley through which the river flows is the flat lakebed of pre-historic Lake Agassiz. The very flat gradient causes widespread overland flooding when the channel capacity is exceeded. Other major North Dakota rivers in the basin include the Wild Rice, Sheyenne,

Maple, Elm, Goose, Turtle, Forest, Park, Pembina, and Tongue Rivers. The 506 river mile Sheyenne River is the longest river in North Dakota. Annual mean precipitation varies from 17 inches in the western portions of the basin to 22 inches in the southeastern portion. The Red River is unique in that it flows north. Therefore, in the spring, snow in the headwaters to the south melts first when areas downstream to the north are still frozen.

Flood control structures in the basin include the Lower Sheyenne Flood Diversion, Lake Ashtabula formed by Bald Hill Dam, the English Coulee Diversion, and the Maple River Dam.

The Red River Basin has suffered numerous major floods since the first recorded event in 1882. The Red River flows north through what was once the bottom of glacial Lake Agassiz and is now the most productive farmland in North Dakota. The flow of the Red River through this flat topography is extremely sluggish with such intricate meander curves that it takes 397 miles of channel to cover the 187 mile straight-line distance between Wahpeton and Pembina. As a result of the region's flat topography, extensive floodplain areas border the Red River and its tributaries. When a flood occurs, water overflows the banks of the river and its tributaries and moves overland, often affecting as many as two million acres.

Figure 5.4.1E The Obelisk at Grand Forks showing water-surface elevations of five major Red River floods.
Source: US Geological Survey, 2004c.

The major problem in the Red River Basin is the destructive, widespread urban and agricultural flooding by the Red River and its many tributaries. Because of the mild channel gradient of the Red River and the nearly level floodplain, flooding along the Red's main stem covers wide areas and can persist for many weeks. Soil erosion is a serious problem contributing to the loss of valuable topsoil and to the pollution of receiving lakes and streams by sediment and nutrient deposits. Illegal diking, inadequate storage of flood waters, and drainage maintenance are also problems within the basin. The Red River and many of its tributaries require snagging and clearing of dead trees to improve channel flow capacity. Flood damage to crops and pastures has been considerable. Often, major spring flooding causes delay in planting; thus, the growing season is cut short for appropriate crop maturation.

Since nearly 90 percent of the basin's land is used for agricultural purposes, flood damages often take the form of losses from delayed seeding or destruction of growing crops. North Dakota's largest urban center, Fargo, and third largest, Grand Forks, are both located on the Red River and have suffered from the recurring floods, as have Wahpeton and a number of smaller communities. Information derived from the Red River of the North Reconnaissance Report completed in 1980 by the Gulf South Research Institute indicated current and future average annual flood damages for the North Dakota portion of the

Red River Basin would increase over several of the following decades. (Gulf South Research Institute, 1980) As the subsequent decades showed, this prediction was accurate.

In many areas of the basin, protective diking has been a successful way to limit flood damages, although, indiscriminate private diking activities have fostered problems. Farm diking constructed along both sides of the Red River has become a particular problem, which has been contested in court. Some of the dikes on the North Dakota side were removed in 1987.

In order to find equitable solutions to the basin's many flood related problems, the various Water Resource Districts in 1978 pooled their efforts in the form of a Joint Powers Agreement. Improved cooperation and coordination fostered by this agreement aids the basin's residents in implementing measures that mitigate flood losses.

Since 1997, acquisition projects have been successful in removing properties from flood prone areas. Over 800 flood-damaged structures have been removed from the Red River Valley. The acquired land is then restricted with respect to future development. Studies such as the Red River Valley Losses Avoided Study and the HAZUS Analysis of Economic Losses and Losses Avoided – Fargo Region demonstrate the success of such programs. (North Dakota Department of Emergency Services, 2007a; Federal Emergency Management Agency 2010g) These studies are discussed in further detail in Section 7.5.8, Project Monitoring and Evaluation, and Appendix J in the 2006 and 2009 Mitigation Year in Review reports.

Souris River Basin

The main tributary in the Souris River Basin is the Souris River which originates in southeastern Saskatchewan. The basin drains portions of Saskatchewan, Montana, North Dakota, and Manitoba. The river length in North Dakota is 357 river miles. The channel of the Souris River follows a meandering course, averaging slightly less than 100 feet wide and 15 to 25 feet deep. Principal tributaries include the Des Lacs River, Moose Creek, Long Creek, Wintering River, Willow Creek, and Deep River.

Flood control projects in the basin include Lake Darling Reservoir and levees at Velva, Sawyer, and Minot. Another flood control project is the Souris River Basin Project, which consists of flood storage in the Alameda and Rafferty Dams in Saskatchewan, a gated spillway at Lake Darling, upgraded levees at Sawyer, Renville County Park, and six subdivisions between Burlington and Minot, structural and non-structural measures for rural residents along the Souris, modifications of US Fish & Wildlife structures in the upper Souris and J. Clark Salyer National Wildlife Refuge, and a flood warning system. Since 1936, Lake Darling Reservoir, owned and operated by the U.S. Fish and Wildlife Service, has been a major factor in reducing damages in the Souris River Valley by controlling several small floods.

Nearly every year, both the Souris River and the Des Lacs River overflow their banks. Most of these floods are small and short in duration causing only minor problems. Floods that result in more severe damages originate primarily from snowmelt in the Canadian portion of the Souris River Basin and have occurred eight times since 1969.

The one-half to one-mile wide valley along the river reach, between the upper Souris and J. Clark Salyer National Wildlife Refuge, usually sustains the basin's most significant flood losses. In most major floods, more than 90% of the dollar damages are incurred in Minot. Other areas are primarily affected by agricultural losses. River channel obstructions and stream bank erosion occur in many areas along the Souris River and its tributaries. Agricultural drainage versus wetland preservation is a controversial issue.

5.4.2 History

North Dakota's history is colored with many significant flood events. The summaries that follow are for the more significant flood events that have been recorded in the state.

1826 Red River Flood – This flood on the Red River occurred prior to the area being settled. Flood flows are estimated to have reached 144,000 cfs where Grand Forks now sits.

1897 Red River Flood – This flood is estimated to have reached a flood depth of 50.2 feet and a flow of 85,000 cfs at Grand Forks. Flooding on all tributaries between Grand Forks and Emerson, Manitoba was reported, and a "serious situation" developed at Grafton.

Figure 5.4.2A First Avenue South from 8th Street in Fargo during the flood of 1897. Photo by R.M. Stene.
Source: US Geological Survey, 2007.

March 1945 Red River Flood – US Geological Survey photos show that Fargo suffered serious flooding on March 20, 1945.

1950 Red River Flood – High soil moisture, frozen ground, snowmelt, ice jams, and precipitation all contributed to the spring 1950 flood along the Red River from Grand Forks north. More than 225 families were forced from their homes in Grand Forks and East Grand Forks.

April 1969 Flood – Snowmelt along the Des Lacs and Souris Rivers severely flooded Minot with an estimated $11 million in damages. Nearly a third of Minot was evacuated. Damages in the James River Basin were estimated at $16 million.

1975 Flood – Following a severe winter, the floods that followed cost North Dakota $1 billion in damages. This flood had two peaks, one in spring and one in summer.

April 1979 Red River Flood – Heavy snowpack and rapid snowmelt led to the 1979 flooding along the Red River. Heavy flooding caused much of Hillsboro in Traill County along the Goose River to be

evacuated. The Red River flood depth at Grand Forks reached 48.63 feet and flowed at 82,000 cfs. North Dakota damages were estimated at $64.8 million.

1989 Red River Flood – This flood was a result of heavy spring snowmelt combined with moderate spring rains. In Breckenridge, the river crested at 17.34 feet, and in Wahpeton at 17.84 feet. Approximately 103 homes in North Dakota were damaged, including 13 that sustained major damage. Bridges, roads, water systems, parks, golf courses, an airport, and a zoo were also damaged. Livestock from 80 farms sites were relocated. Power outages in Walsh County were reported. Twelve businesses suffered serious damages.

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. Moderate flooding occurred in the Red River basin, particularly along the Sheyenne River. Much of the state went from mild to severe drought in June to moist to extremely moist in July. Two flood-related deaths occurred. Homes and businesses (6,893 individuals registered for assistance), roads, bridges, culverts, parks, utilities, and public buildings were all damaged. Damages were estimated at $600 million ($500 million to agriculture, $80 million to the private sector, and $20 million to the public sector).

1994 Flood – Snowmelt and heavy thunderstorms coupled with still saturated soils from 1993 led to flooding in many parts of the state. Major impacts were to low-lying cropland, roads, and lake levels. Many homes suffered basement water seepage and septic tank failures.

1995 Flood – Continued moisture and a rapid snowmelt in March led to flooding during the spring of 1995. Damages to individual septic systems, municipal sewage systems, roads, and agriculture were reported. The City of Devils Lake was threatened by rising lake levels. The loss of cropland and delayed planting of about 1.8 million acres resulted in about $15 million in agricultural losses. Many ranchers had to sell livestock due to lost grazing lands. Damages to about 120 Federal Aid System (FAS) road sites were estimated at over $16 million.

1996 Flood – An early spring thaw in February, a refreeze period, and then an extremely rapid snowmelt in April led an ice build-up and subsequent flooding. Many roads and bridges were damaged. Storm drains, flood control facilities, sewer systems, and electric infrastructure were also damaged. The 1996 flood along the Red River was relatively minor compared to the flood the following year. The river reached 45.93 feet and 58,400 cfs at Grand Forks.

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, forcing many people from their homes. Hospitals began transferring patients to areas in North Dakota and Minnesota that were outside of the flood stricken region. On April 20-21, the Grand Forks levees broke, resulting in mass evacuation of city residents that had not previously left. The 1997 flooding of the Red River of the North was the costliest North Dakota flood disaster recorded. The flooding caused $3.7 billion in

economic losses. The flood depth on the Red River at Grand Forks reached 54.35 feet with a flow of 114,000 cfs. Many other rivers and streams in North Dakota were affected by ice jams and high water levels including the Knife River, Cannonball River, Little Missouri River, Heart River, James River, Beaver Creek, and Sheyenne River. All basins in the state were affected in some way. Dramatic rises continued in the Devils Lake basin. An estimated 60,000 people were evacuated during this catastrophic flood event. Substantially damaged homes exceeded 1,300 and an estimated 1,200 businesses in Grand Forks suffered direct losses, only 45 of which had flood insurance. The resultant structure fires destroyed several businesses and buildings in downtown Grand Forks. A total of 2,500 businesses received loans from the Small Business Administration totaling nearly $50 million. Public infrastructure such as streets, roads, highways, buildings, sewer systems, and water treatment facilities suffered significant losses. Even parts of Interstate 29 and 94 were inundated. Significant power and natural gas outages occurred. Losses to agriculture were also heavy with an estimated 120,000 head of cattle lost and direct and indirect crop losses of about $350 million. The emotional loss for many was significant. By late May 1997, 33,000 residents of the state had reported personal property damage. In Grand Forks alone, 34,100 tons of household debris and 92,225 tons of levee material had been removed by the end of May. This was a massive catastrophic statewide disaster, clearly the worst situation in the state's history in terms of anxiety, pain, and dollar loss.

1998 Flood – Excess groundwater and heavy snow led to the spring floods. The annual influx of moisture into the closed Devils Lake basin led to significant increases in lake levels that continued to threaten the surrounding communities. The Pembina River flooded following snowmelt and continued saturated soils. Much of the damage in 1998 was caused by overland sheet flooding. Damages to roads and sewer systems were common. High water tables increased the instances of mold and mildew growth in basements.

1999 Flood – Seven years of flooding and excessive soil moisture led to riverine and flash flooding during the spring of 1999. Roads, utilities, homes, and public facilities all suffered damages. Delayed crop planting hurt farmers.

June 12, 2000 Flash Floods - The Turtle River flooded after 15-20 inches of rain fell in its basin. The Turtle River at Manvel crested at 18 feet on June 17. Communities affected included Grand Forks County, Manvel, Gilby, and Nelson County. Property damages were estimated at $3 million as over 150 dwellings suffered major to minor damage. People had to be rescued when many roads washed out or were inundated. Two deaths and two injuries were reported. The drinking water supply in Gilby was temporarily lost. The Goose River also flooded covering some county roads with 1-5 feet of water. One-third of Grand Forks County's croplands, 270,000 acres were destroyed, with $31 million in crop losses reported. In Nelson County, 45 percent of the cropland was destroyed, resulting in an estimated $12 million in crop damage. Damages to Turtle River State Park were estimated at $500,000.

June 19, 2000 Flash Floods – Fargo received between 6.82 and 7.31 inches of rain within a 24-hour period. The heavy rain halted traffic, inundated storm sewers, and knocked out electricity and phones. Twenty thousand customers lost power when a power station was submerged and sump pumps ceased operating without power. Fifty-four percent of Fargo residents had water damage. At one point, fifty percent of the city streets were flooded. The major traffic arteries, Interstates 29 and 94, were flooded

and closed for several days. The bottom level of the Fargodome filled with 8-12 feet of water, and North Dakota State University had water in nearly all of its 88 buildings. The campus library had four feet of water in the periodical section. The Fargo flash food resulted in an estimated $10 billion in property damage. Amazingly, there were no fatalities or injuries reported.

Figure 5.4.2B USGS personnel measuring flood overflow at a bridge on the Red River near Thompson on April 15, 2001.
Source: US Geological Survey, 2007.

2001 Red River Flood – Heavy snowpack followed by rain in early April led to flooding in the Red River basin. The Red River crested at 44.80 feet at Fargo and 36.69 feet at Fargo. Significant damages and closures occurred on roads, streets, and bridges. Many homes north of West Fargo to Harwood and farmsteads in Great Bend were surrounded by water and 26 homes in the Burke addition (Grand Forks) were isolated. A section of temporary dike failed, flooding a golf course. The West Fargo airport was temporarily closed. Property damage was estimated at $10 million.

2001 Devils Lake Closed Basin Flood – Significant rises in lake levels since 1940 and even more rapid increases since 1993 continued to slowly cause losses in the Devils Lake Basin. In August 2001, the lake levels were at 1,448 feet, compared to 1,424 feet in 1993. In 2001 alone, $37.5 million was spent on highway construction due to flooded, damaged, and threatened roads and bridges. Utilities were similarly threatened. Parks around the lake, such as Grahams Island, Shelvers Grove, and Black Tiger Bay continued to suffer losses. Basement flooding continued and increased.

2002 Flash Floods – Heavy rainfall during June and July led to flash flooding in the northeastern part of the state and some riverine flooding along the Red River at Drayton and Oslo. Many streets, roads, highways, and even Interstate 29 were flooded and damaged or impassable. A section of the railroad tracks north of Hillsboro was washed out. Basement flooding occurred throughout the region, including in several University of North Dakota buildings. A few homes were threatened by high creek and coulee levels and crop losses were substantial.

2004 Red River Flood – Flooding occurred on many of the Red River tributaries, including the Forest, Goose, Park, Pembina, and Turtle Rivers. The entire community of Emerado was evacuated and 42 homes were damaged there, totaling about $705,000. The community of Hamilton was isolated due to overland flooding and roads needed to be cut to allow for water drainage. In Crystal, power and drinking water were lost and city streets were damaged resulting in about $600,000 in losses. The City of Grafton had nearly 100 homes with water, either through basements or sewer backups, causing about $1 million in damage. Highways, roads, and streets were closed due to flooding. Flooding of 26 homes occurred in Minto and 6 homes in Park River. In Walsh County, 100 miles of county/township roads were closed with nearly 400 road sites damaged, totaling about $2.4 million. Total property damages during the period were estimated at $4.2 million.

2006 Red River Flood – During this flood along the Red River and its tributaries, damages occurred to roads, homes, and businesses. The flood depth on the Red River at Grand Forks reached 47.88 feet with a flow of 72,700 cfs and 37.18 feet at Fargo. Along the Wild Rice River south of Fargo, 75 homes were threatened. West of Fargo near the confluence of the Maple and Sheyenne Rivers, several homes were surrounded by water. Near Lidgerwood, a retirement center was threatened. Temporary dikes were constructed throughout the Fargo and Wahpeton areas to protect structures. Interstate 29 was closed in several locations due to high water. Over 40 county roads and over 35 bridges were also closed. One person was killed. Because of mitigation efforts following the 1997 flood, losses were limited to around $7-8 million for state and local infrastructure and about $1 million for individual farm and home properties.

2007 Flash Floods – In June 2007, damages were reported to basements, culverts, roadbeds, and driveways following heavy thunderstorm rains. Flooding also led to substantial crop losses totaling about $3 million. Losses and road closures were primarily seen in Barnes, Bowman, Grant, Ransom, Richland, Sargent, and Stutsman Counties.

2009 Flood – Record-breaking winter and spring snowfall led to flooding throughout North Dakota with records broken in every major drainage basin in the state. The flood depth on the Red River at Fargo reached 40.82 feet, approximately the 500 year flood. Some of the flooding was river and stream related, while some was overland flooding away from rivers and streams. Ice jams were more numerous and severe than past years, including many in the Bismarck area that led to evacuations, road closures, and blasting of the ice jams. Valley City was evacuated when the sewer system there filled with backwater and failed. The North Dakota Air/Marine Operations Branch conducted 139 human rescues and 135 animal rescues. Over 430 homes were flooded, some completely destroyed, and many state, county, city, and township roads were damaged with several bridges washed out. Parts of Interstate 94 were closed for a time. Throughout the state, 17 dams were damaged. Property damage was estimated at $5.5 million. The flooding prevented an estimated 1.7 million acres from being planted with an estimated value of $490 million. Including losses from the harsh winter conditions and flooding, an estimated 78,000 calves, 19,100 cows, 180 horses, and 3,000 other farm and ranch animals perished at a cost of about $50 million with the impact on society much greater. The total cost of temporary levees, clean-up, and repairs was estimated to exceed $78 million. Total losses from the 2009 floods are estimated at $623 million, including over $184 million in federal disaster losses.

2009 Devils Lake Closed Basin Flood – The closed basin problems of Devils Lake continued and lake levels reached another modern day record in June 2009 of over 1,450 feet. New losses were estimated at $2.0 million.

June 15, 2009 Flash Floods – Heavy thunderstorm rains of over 10 inches in the greater Bismarck area led to significant flash flooding. Many homes suffered basement flooding, a flat roof of a bowling alley collapsed, and two schools were damaged. Many Bismarck city streets were flooded, including water damages to cars; Interstate 94 near Sterling had water over 1 foot deep flowing over it. Property damages were estimated at $2.8 million.

2010 Red River Flood – During the spring of 2010, flooding was forecast across the state but primarily in the Red River valley. The flood depth on the Red River at Fargo reached 36.99 feet. In the Fargo-Moorhead area alone, about 1.5 million sandbags were put in place to protect property. Several bridges over the Red River were closed, but no major damage was reported.

More details regarding successful and completed mitigation activities can be found in Section 7.5.8, Project Monitoring and Evaluation, and in Appendix J, Annual Reports.

Sources: State Historical Society of North Dakota, 2007; North Dakota Department of Emergency Services, 2007a; US Geological Survey, 2007; Minot Daily News, 1969; Interagency Hazard Mitigation Team Reports, varied dates; National Climatic Data Center, 2010; US Army Corps of Engineers, 2010b; Bismarck Tribune, 2010b.

Table 5.4.2D shows the flood, flash flood, and urban/small stream events from 2000 through 2009 by county from the National Climatic Data Center (NCDC). Note that the NCDC database often lists damages from riverine floods for a region rather than by county, and therefore, the listing of losses by county may not be highly accurate and may include losses in other locations. Also, note that additional events may have occurred but may not have been reported to the National Weather Service and listed in the database. Some events may be lacking a damage estimate.

The US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL) maintains a database of historic ice jams. Table 5.4.2E lists the number of ice jams by water year (October – September with the water year being that of the end of the period). Note that additional ice jams may have occurred but were not observed or recorded in the ice jam database.

Table 5.4.2D Flood, Flash Flood, and Urban/Small Stream Events 2000-2009

County	Number of Events Reported	Estimated Losses
North Dakota	*289*	*$141,473,000*
Adams	3	$204,000
Barnes	15	$4,010,000
Benson	44	$54,520,000
Billings	3	$350,000
Bottineau	10	$985,000
Bowman	4	$637,000
Burke	0	$0
Burleigh	14	$2,583,000
Cass	39	$130,963,000
Cavalier	13	$1,030,000
Dickey	7	$1,214,000
Divide	0	$0
Dunn	5	$370,000
Eddy	20	$215,000
Emmons	4	$1,063,000
Foster	3	$605,000
Golden Valley	5	$300,000
Grand Forks	38	$56,212,000
Grant	6	$467,000
Griggs	12	$265,000
Hettinger	4	$218,000
Kidder	5	$1,440,000
LaMoure	6	$2,498,000
Logan	3	$181,000
McHenry	8	$315,000
McIntosh	2	$127,000
McKenzie	2	$394,000
McLean	6	$650,000
Mercer	4	$848,000
Morton	8	$3,143,000
Mountrail	4	$702,000
Nelson	39	$68,135,000
Oliver	5	$187,000
Pembina	22	$1,873,000
Pierce	3	$296,000
Ramsey	41	$54,515,000
Ransom	26	$379,000
Renville	3	$55,000
Richland	56	$4,825,000
Rolette	9	$463,000
Sargent	34	$260,000
Sheridan	0	$0
Sioux	7	$568,000
Slope	1	$100,000
Stark	4	$380,000
Steele	14	$34,310,000
Stutsman	8	$1,300,000
Towner	15	$304,000
Traill	23	$34,748,000
Walsh	27	$4,080,000
Ward	9	$852,000
Wells	8	$2,550,000
Williams	1	$300,000

Source: National Climatic Data Center, 2010.

Table 5.4.2E North Dakota Ice Jams by Water Year

Water Year	Reports	Water Year	Reports
1990	0	2000	3
1991	0	2001	5
1992	0	2002	1
1993	0	2003	3
1994	6	2004	35
1995	7	2005	13
1996	16	2006	6
1997	39	2007	2
1998	3	2008	20
1999	6	2009	18

Source: US Army Corps of Engineers, 2010b.

Table 5.4.2F North Dakota Flood Declared Disasters and Emergencies

Declaration	Location	Date	Other Information	Casualties	Damages
DR 195	North Dakota	1965		Unknown	Unknown
DR 216	North Dakota	1966		Unknown	Unknown
DR 220	North Dakota	1966	Also included impacts from severe storms.	Unknown	Unknown
DR 256	North Dakota	1969		None	$27,000,000
DR 287	North Dakota	1970	Also included impacts from severe storms.	Unknown	Unknown
DR 335	North Dakota	1972	Also included impacts from severe storms.	Unknown	Unknown
DR 434	North Dakota	1974	Flooding from heavy rains and snowmelt.	Unknown	Unknown
DR 469	North Dakota	1975	Flooding from heavy rains and snowmelt.	Unknown	$1,000,000,000
DR 475	North Dakota	1975	Also included impacts from severe storms.	Unknown	Unknown
EM 3012	North Dakota	1976	Emergency declaration for "severe" flooding.	Unknown	Unknown
DR 501	North Dakota	1976		Unknown	Unknown
DR 554	North Dakota	1978	Flooding from ice jams and snowmelt. Also included impacts from storms.	Unknown	Unknown
DR 581	North Dakota	1979	Flooding from snowmelt. Also included impacts from storms.	Unknown	$64,800,000
DR 658	North Dakota	1982		Unknown	Unknown
DR 825	6 counties in Eastern North Dakota	March – April 1989	Approximately 103 homes in North Dakota were damaged, 13 with major damage.	None	$2,719,000*
DR 1001	39 counties mostly in Central and Eastern North Dakota	June – July 1993	Public Assistance and Individual Assistance Also included impacts from severe storms.	2 deaths	$48,446,044* $600,000,000 estimated total
DR 1032	25 counties mostly in Central North Dakota	March – July 1994	Public Assistance Also included impacts from severe storms.	1 death	$4,073,939*
DR 1050	32 counties in Central and Eastern North Dakota	March – May 1995	Public Assistance Flooding from ground saturation. Also included impacts from severe storms.	3 deaths 1 injury	$15,637,415* $102,000,000 estimated total

Table 5.4.2F North Dakota Flood Declared Disasters and Emergencies (continued)

Declaration	Location	Date	Other Information	Casualties	Damages
DR 1118	33 counties in Central and Eastern North Dakota	March 12 – June 21, 1996	Public Assistance	2 deaths	$13,348,768*
DR 1174	All 53 counties in North Dakota	February 28 – May 24, 1997	Public Assistance and Individual Assistance Also included impacts from severe storms.	7 deaths 2 injuries	$557,503,842* $3,700,000,000 estimated total
DR 1220	16 counties and 2 tribes in Eastern North Dakota	March 2 – July 18, 1998	Public Assistance and Individual Assistance Flooding from ground saturation.	None	$18,054,727*
DR 1279	34 counties and 3 tribes in Central and Eastern North Dakota	March 1 – July 19, 1999	Public Assistance and Individual Assistance Flooding from ground saturation. Also included impacts from severe storms, tornadoes, snow, ice, landslides, and mudslides.	None	$124,391,622*
DR 1334	26 counties and 3 tribes in Central and Eastern North Dakota	April 5 – August 12, 2000	Public Assistance and Individual Assistance Also included impacts from severe storms.	2 deaths	$91,944,041*
DR 1376	36 counties and 2 tribes mostly in Central and Eastern North Dakota	March 1 – July 31, 2001	Public Assistance	3 injuries	$27,858,168*
DR 1431	5 counties and 1 tribe in Eastern North Dakota	June 8 – August 11, 2002	Public Assistance Also included impacts from severe storms and tornadoes.	5 injuries	$1,266,549*
State EO	North Dakota	2003	State Declared Flood and Severe Summer Weather Disaster	Unknown	Unknown
DR 1515	19 counties and 2 tribes in Northern North Dakota	March 26 – June 14, 2004	Public Assistance Flooding from ground saturation. Also included impacts from severe storms.	None	$7,459,705*
DR 1597	26 counties and 3 tribes mostly in Northern and Eastern North Dakota	June 1 – July 7, 2005	Public Assistance Flooding from ground saturation. Also included impacts from severe storms.	None	$20,350,276*
DR 1645	11 counties and 1 tribe in Eastern North Dakota	March 30 – April 30, 2006	Public Assistance Flooding from ground saturation. Also included impacts from severe storms.	2 deaths	$10,388,198*
DR 1713	13 counties mostly in Southeastern North Dakota	June 2 – June 18, 2007	Public Assistance Also included impacts from severe storms.	None	$4,375,932*
DR 1829	48 counties and 4 tribes	March 13 – August 10, 2009	Public Assistance and Individual Assistance Also included impacts from severe storms.	2 deaths 50 injuries	$184,696,371* $623,000,000 estimated total

Table 5.4.2F North Dakota Flood Declared Disasters and Emergencies (continued)

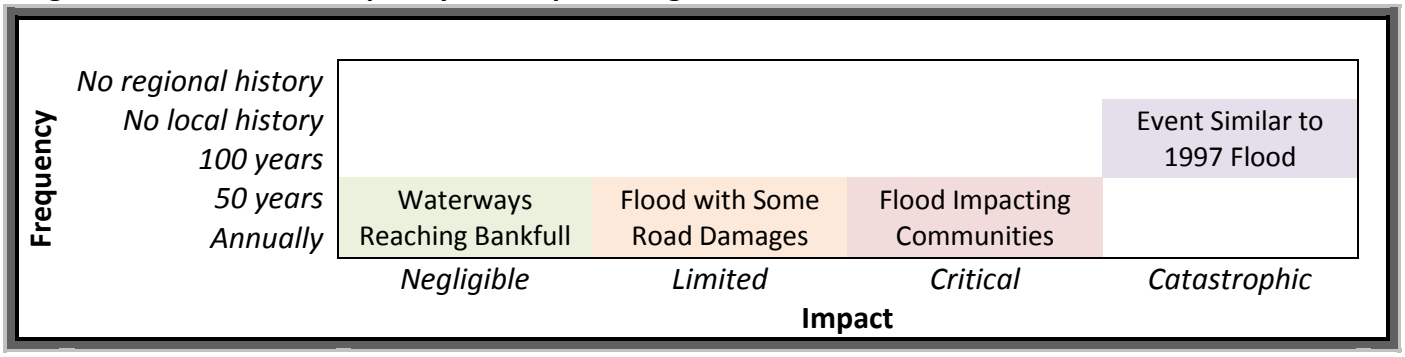
Declaration	Location	Date	Other Information	Casualties	Damages
EM 3309	18 counties and 1 tribe mostly in Eastern and Central North Dakota	February 26 – April 30, 2010	Emergency Protective Measures	None	$4,312,500*^
DR 1907	29 counties and 1 tribe mostly in Eastern North Dakota	February 26 - July 15, 2010	Public Assistance	None	$6,221,213*^

* Federal Share (includes Individual and Family Grant, Disaster Housing, Manufactured Housing, Crisis Counseling Immediate and Regular Programs, Disaster Unemployment Assistance, Hazard Mitigation Grant Program, Public Assistance, FEMA Mission Assignments, and SBA Home, Business, and Economic Injury Loans).
^ preliminary numbers, subject to change.
Sources: Federal Emergency Management Agency, 2007; North Dakota Department of Emergency Services, 2007b; National Climatic Data Center, 2010; Interagency Hazard Mitigation Team Reports, varied dates; North Dakota Department of Emergency Services, 2007e; ; North Dakota Department of Emergency Services, 2010c.

5.4.3 Probability and Magnitude

Figure 5.4.3A is a graphical representation of the range of events that can occur within the flood hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the flood hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.4.3A Hazard Frequency and Impact Ranges



Floodplain mapping through the National Flood Insurance Program geographically demonstrates the 100-year riverine flood probability. The 100-year floodplain has a 1% probability of being exceeded in any given year. The National Flood Insurance Program, the North Dakota State Water Commission, and local floodplain administrators maintain and consult these maps.

Considering the extensive history of flooding in North Dakota, this history will be used to express the probability and magnitude of floods in the state. Table 5.4.3B shows this data. Since the federal share of the Presidential disaster declarations only represents a small portion of the total damage, the federal

share was multiplied by a factor of 10 to approximate the total losses where a total estimate is not known.

Table 5.4.3B North Dakota Flood Occurrences

Flood Type	History	Recurrence	Annual Losses	Typical Impacts
Riverine	17 major events over 22 years totaling an estimated $8.21 billion	1 event every 1-2 years	$373,000,000	Roads Bridges Sewer Systems Homes Businesses Public Facilities Electricity Agriculture
Flash	289 events over 10 years totaling $141 million	25-30 events per year	$14,000,000	Roads Homes Businesses Agriculture
Ice Jam	106 events over 10 years	10-11 events per year	Unknown	Roads Homes Businesses Agriculture

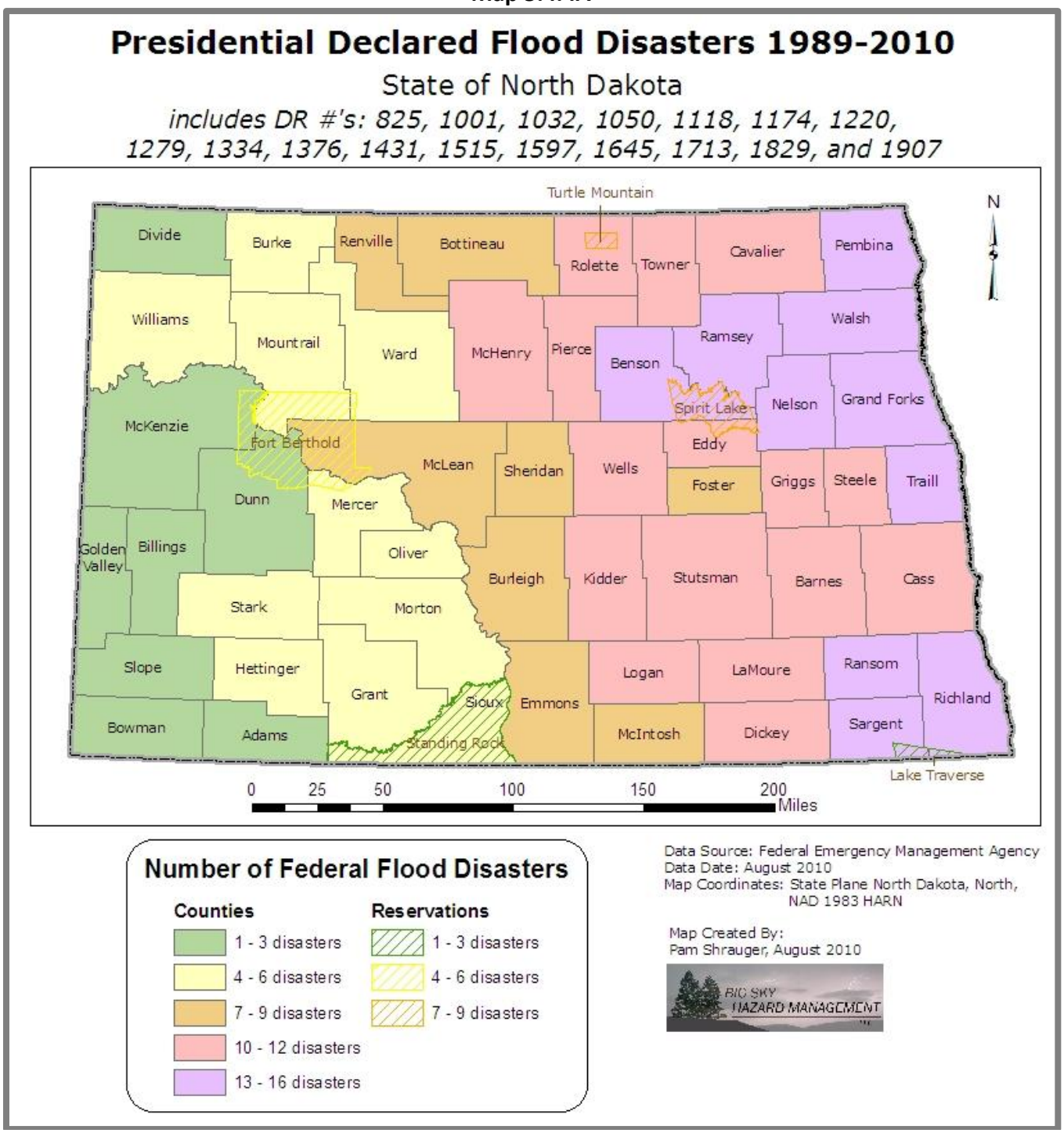
For flooding, the 500-year events represent the worst-case scenarios. Detailed mapping of the 500-year hazard areas do not exist for all parts of North Dakota, however, such an event would likely cause significant problems. Damages to structures, infrastructure, and the economy could be expected in areas that have never flooded in recorded history.

5.4.4 Mapping

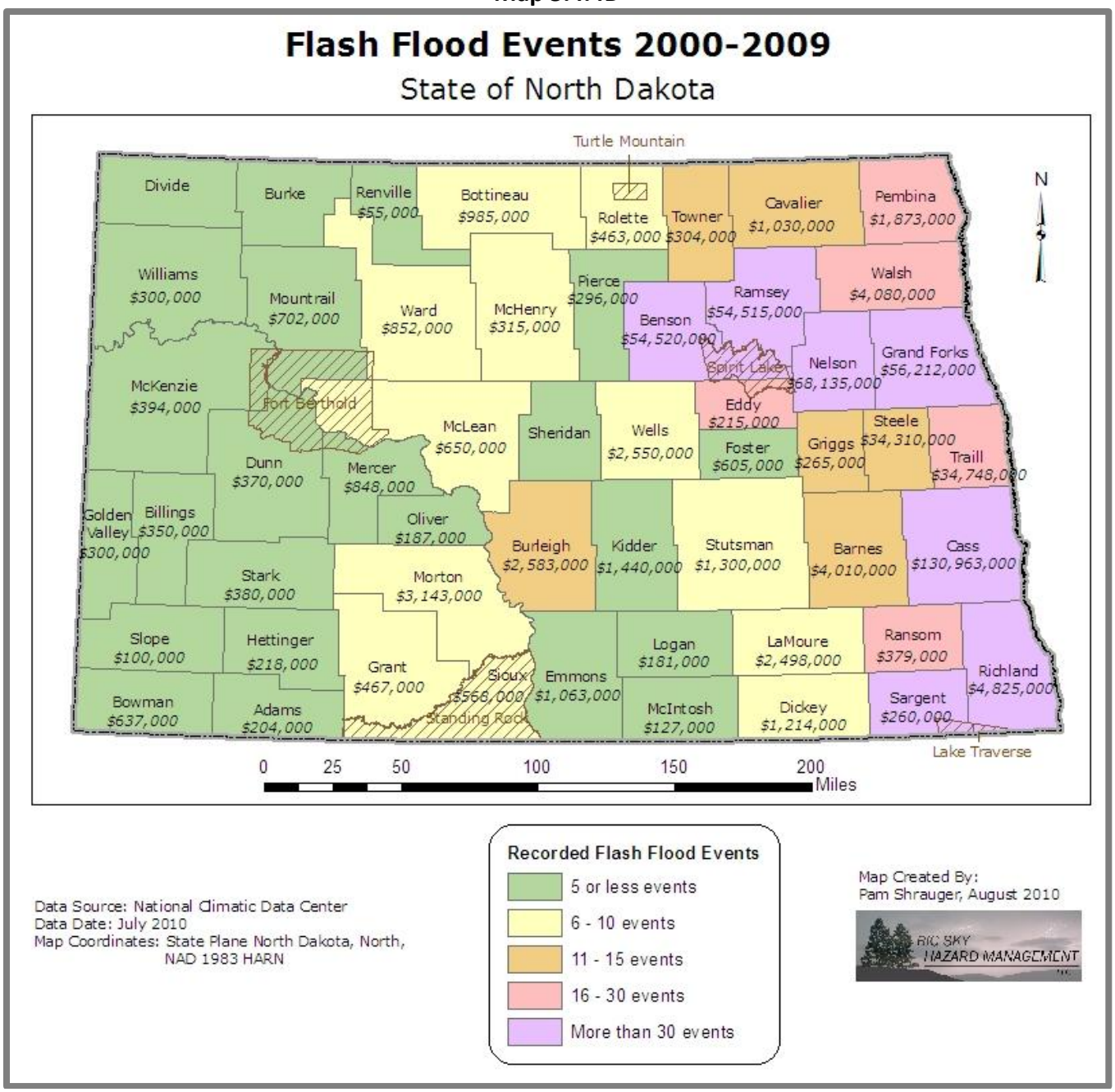
Typically, as part of the National Flood Insurance Program assessment, the Federal Emergency Management Agency (FEMA) conducts a Flood Insurance Study (FIS) to identify the community's risk levels. The Flood Insurance Study includes statistical data for river flows, rainfall, topographic surveys, and hydrologic and hydraulic analyses. After examining the FIS data, FEMA creates Flood Insurance Rate Maps (FIRMs) delineating the different areas of flood risk. Land areas that are at high risk for flooding are called Special Flood Hazard Areas (SFHAs), or floodplains. Paper copies of the maps for communities in North Dakota can be ordered from the Federal Emergency Management Agency. These maps generally have much more detail than can be depicted or analyzed on the statewide scale. Some communities in the state have digital FIRMs (DFIRMs) that have incorporated improved analysis methods and technologies into the digitized floodplain map. Upon the full conversion of FIRMs to DFIRMs, the digital data can be used for improved statewide flood analyses; however, remember that some areas of the state that are not mapped or are mapped as outside the 100-year floodplain may still be at risk from flooding.

Other information can also be used to depict the flood hazard statewide. Map 5.4.4A shows the number of Presidential flood disasters declared by county since 1989. Note that disasters declared for tribal reservations were not listed until 1998. Map 5.4.4B shows the number of reported flash flood and urban/small stream events from 2000-2009. The US Army Corps of Engineers CRREL website has mapping of current and historic ice jam events. Map 5.4.4C shows the results of loss estimation modeling conducted by FEMA in 2010. Map 5.4.4D shows the flood insurance coverage by county. Comparing the historical occurrence and estimated losses to the insurance coverage clearly shows that some of the most hazardous areas have very little insurance coverage. However, since 2007, 196 new jurisdictions now have policy holders and the number of policies has nearly tripled across the state with 8,131 new policies, likely due to the 2009 flood event. Map 5.4.4E shows the number of repetitive loss structures by county.

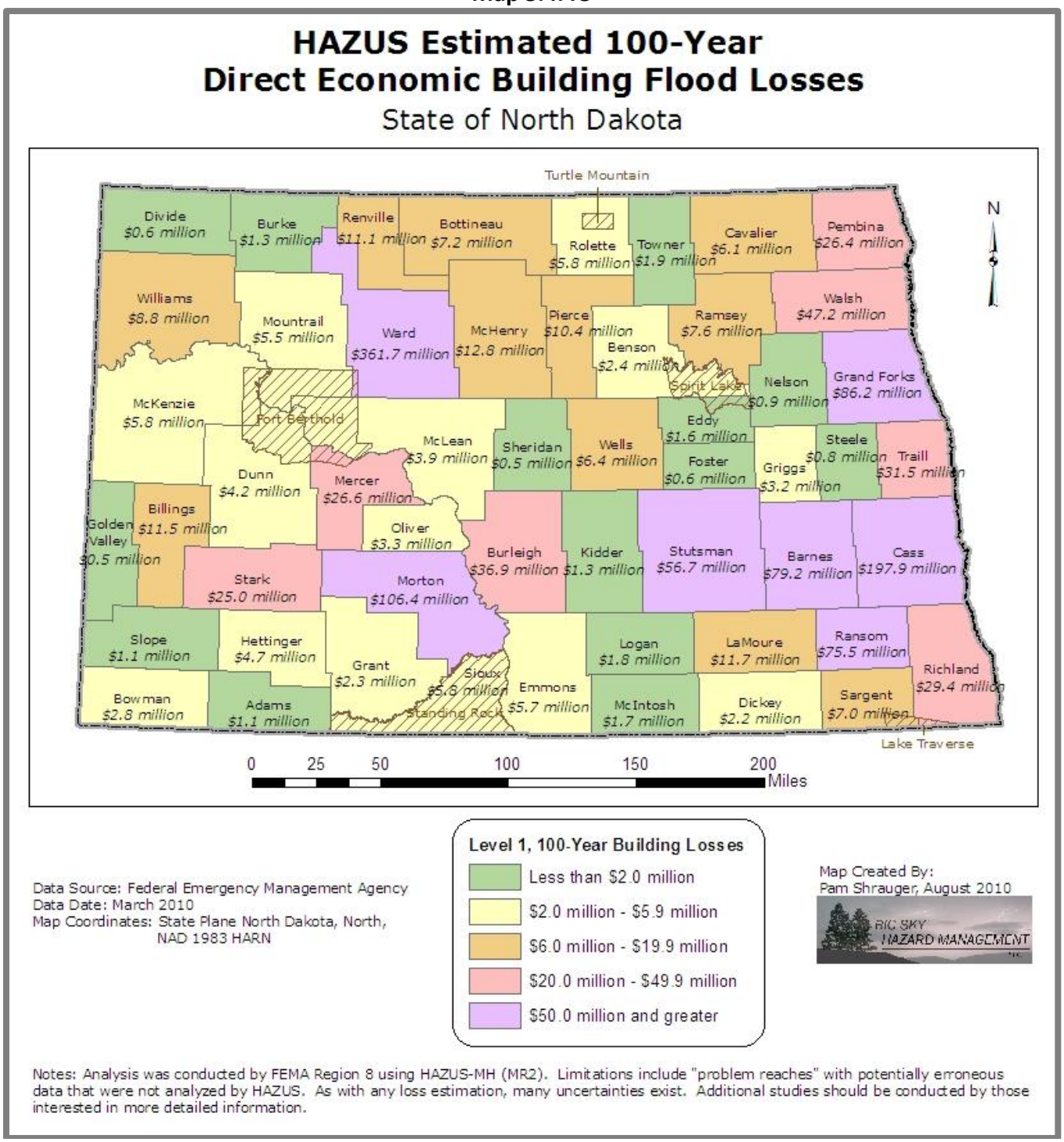
Map 5.4.4A


Presidential Declared Flood Disasters 1989-2010
State of North Dakota
includes DR #'s: 825, 1001, 1032, 1050, 1118, 1174, 1220, 1279, 1334, 1376, 1431, 1515, 1597, 1645, 1713, 1829, and 1907
Turtle Mountain
N
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
0 25 50 100 150 200 Miles
Number of Federal Flood Disasters
Counties
1 - 3 disasters
4 - 6 disasters
7 - 9 disasters
10 - 12 disasters
13 - 16 disasters
Reservations
1 - 3 disasters
4 - 6 disasters
7 - 9 disasters
Data Source: Federal Emergency Management Agency
Data Date: August 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY HAZARD MANAGEMENT

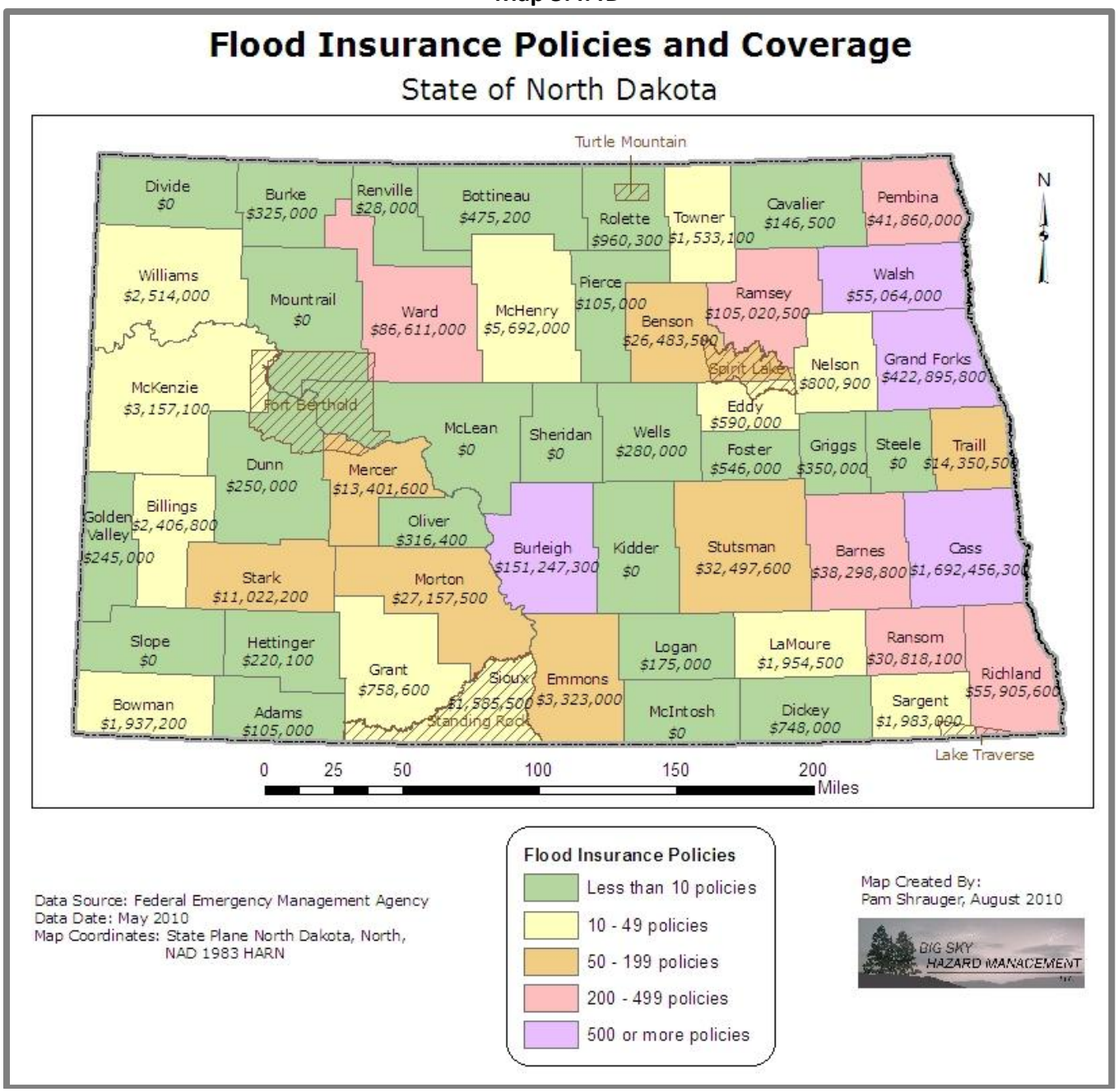
Map 5.4.4B


Flash Flood Events 2000-2009
State of North Dakota
Turtle Mountain
Divide
Burke
Renville $55,000
Bottineau $985,000
Rolette $463,000
Towner $304,000
Cavalier $1,030,000
Pembina $1,873,000
Williams $300,000
Mountrail $702,000
Ward $852,000
McHenry $315,000
Pierce $296,000
Benson $54,520,000
Ramsey $54,515,000
Walsh $4,080,000
Spirit Lake
Nelson $68,135,000
Grand Forks $56,212,000
McKenzie $394,000
Fort Berthold
McLean $650,000
Sheridan
Wells $2,550,000
Eddy $215,000
Foster $605,000
Griggs $265,000
Steele $34,310,000
Traill $34,748,000
Dunn $370,000
Mercer $848,000
Golden Valley $300,000
Billings $350,000
Oliver $187,000
Burleigh $2,583,000
Kidder $1,440,000
Stutsman $1,300,000
Barnes $4,010,000
Cass $130,963,000
Stark $380,000
Morton $3,143,000
Slope $100,000
Hettinger $218,000
Grant $467,000
Sioux $566,000
Standing Rock
Emmons $1,063,000
Logan $181,000
LaMoure $2,498,000
Ransom $379,000
Richland $4,825,000
Bowman $637,000
Adams $204,000
McIntosh $127,000
Dickey $1,214,000
Sargent $260,000
Lake Traverse
N
0 25 50 100 150 200 Miles
Recorded Flash Flood Events
5 or less events
6 - 10 events
11 - 15 events
16 - 30 events
More than 30 events
Data Source: National Climatic Data Center
Data Date: July 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY HAZARD MANAGEMENT

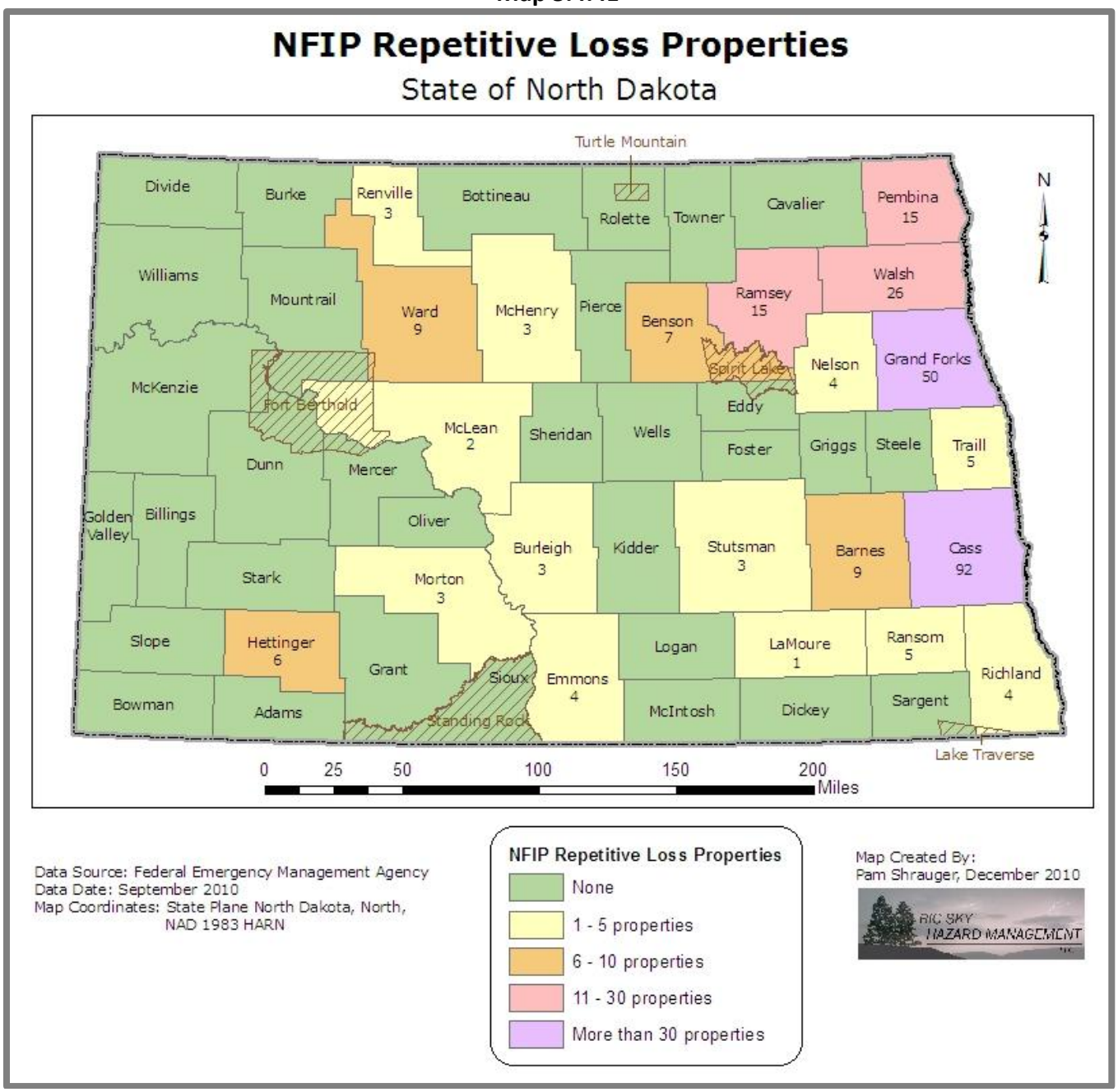
Map 5.4.4C


HAZUS Estimated 100-Year
Direct Economic Building Flood Losses
State of North Dakota
Turtle Mountain
Divide $0.6 million
Burke $1.3 million
Renville $11.1 million
Bottineau $7.2 million
Rolette $5.8 million
Towner $1.9 million
Cavalier $6.1 million
Pembina $26.4 million
Williams $8.8 million
Mountrail $5.5 million
Ward $361.7 million
McHenry $12.8 million
Pierce $10.4 million
Benson $2.4 million
Ramsey $7.6 million
Walsh $47.2 million
Spirit Lake
Nelson $0.9 million
Grand Forks $86.2 million
McKenzie $5.8 million
Fort Berthold
McLean $3.9 million
Sheridan $0.5 million
Wells $6.4 million
Eddy $1.6 million
Foster $0.6 million
Griggs $3.2 million
Steele $0.8 million
Traill $31.5 million
Dunn $4.2 million
Mercer $26.6 million
Billings $11.5 million
Golden Valley $0.5 million
Oliver $3.3 million
Burleigh $36.9 million
Kidder $1.3 million
Stutsman $56.7 million
Barnes $79.2 million
Cass $197.9 million
Stark $25.0 million
Morton $106.4 million
Slope $1.1 million
Hettinger $4.7 million
Grant $2.3 million
Sioux $5.6 million
Standing Rock
Emmons $5.7 million
Logan $1.8 million
LaMoure $11.7 million
Ransom $75.5 million
Richland $29.4 million
Bowman $2.8 million
Adams $1.1 million
McIntosh $1.7 million
Dickey $2.2 million
Sargent $7.0 million
Lake Traverse
N
0 25 50 100 150 200 Miles
Level 1, 100-Year Building Losses
Less than $2.0 million
$2.0 million - $5.9 million
$6.0 million - $19.9 million
$20.0 million - $49.9 million
$50.0 million and greater
Data Source: Federal Emergency Management Agency
Data Date: March 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY HAZARD MANAGEMENT
Notes: Analysis was conducted by FEMA Region 8 using HAZUS-MH (MR2). Limitations include "problem reaches" with potentially erroneous data that were not analyzed by HAZUS. As with any loss estimation, many uncertainties exist. Additional studies should be conducted by those interested in more detailed information.

Map 5.4.4D


Flood Insurance Policies and Coverage
State of North Dakota
Turtle Mountain
Divide $0
Burke $325,000
Renville $28,000
Bottineau $475,200
Rolette $960,300
Towner $1,533,100
Cavalier $146,500
Pembina $41,860,000
Williams $2,514,000
Mountrail $0
Ward $86,611,000
McHenry $5,692,000
Pierce $105,000
Benson $26,483,500
Ramsey $105,020,500
Walsh $55,064,000
Spirit Lake
Nelson $800,900
Grand Forks $422,895,800
McKenzie $3,157,100
Fort Berthold
Eddy $590,000
McLean $0
Sheridan $0
Wells $280,000
Foster $546,000
Griggs $350,000
Steele $0
Traill $14,350,500
Dunn $250,000
Mercer $13,401,600
Billings $2,406,800
Golden Valley $245,000
Oliver $316,400
Burleigh $151,247,300
Kidder $0
Stutsman $32,497,600
Barnes $38,298,800
Cass $1,692,456,300
Stark $11,022,200
Morton $27,157,500
Slope $0
Hettinger $220,100
Grant $758,600
Sioux $1,585,500
Standing Rock
Emmons $3,323,000
Logan $175,000
LaMoure $1,954,500
Ransom $30,818,100
Richland $55,905,600
Bowman $1,937,200
Adams $105,000
McIntosh $0
Dickey $748,000
Sargent $1,983,000
Lake Traverse
N
0 25 50 100 150 200 Miles
Flood Insurance Policies
Less than 10 policies
10 - 49 policies
50 - 199 policies
200 - 499 policies
500 or more policies
Data Source: Federal Emergency Management Agency
Data Date: May 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY HAZARD MANAGEMENT

Map 5.4.4E


NFIP Repetitive Loss Properties
State of North Dakota
Turtle Mountain
Divide
Burke
Renville 3
Bottineau
Rolette
Towner
Cavalier
Pembina 15
N
Williams
Mountrail
Ward 9
McHenry 3
Pierce
Benson 7
Ramsey 15
Walsh 26
Spirit Lake
Nelson 4
Grand Forks 50
McKenzie
Fort Berthold
Eddy
McLean 2
Sheridan
Wells
Foster
Griggs
Steele
Traill 5
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh 3
Kidder
Stutsman 3
Barnes 9
Cass 92
Stark
Morton 3
Slope
Hettinger 6
Grant
Sioux
Emmons 4
Logan
LaMoure 1
Ransom 5
Richland 4
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
0 25 50 100 150 200 Miles
Data Source: Federal Emergency Management Agency
Data Date: September 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
NFIP Repetitive Loss Properties
None
1 - 5 properties
6 - 10 properties
11 - 30 properties
More than 30 properties
Map Created By:
Pam Shrauger, December 2010
BIG SKY HAZARD MANAGEMENT

5.4.5 Vulnerabilities to Jurisdictions

As history has shown, essentially all jurisdictions in North Dakota are at risk from flood damages. The damages can be to private property such as homes, businesses, and utility infrastructure, public property such as government owned facilities, roads, and infrastructure, and the economy through agricultural and business disruption losses. These losses can vary from flood to flood and county to county.

Slow-rising riverine floods usually have a fair amount of warning time and allow people to evacuate from the hazard areas. Flash floods and ice jam floods may not have lengthy lead times. Heavy rains can quickly inundate areas not typically prone to flooding, roads can washout and become a hazard to vehicle occupants, normally dry channels may fill up with rushing waters, and ice jam breakups can cause rapidly rising waters along rivers, creeks, and streams. All jurisdictions in North Dakota are at risk from flood deaths. Throughout the United States, an average of 93 people die each year from floods, based on the 30-year history from 1980-2009. (National Weather Service, 2010b) According to state disaster reports, a total of 29 people have died from floods in North Dakota since 1993 leading to an average of two deaths per year in the state from flood.

Flooding regularly affects the agricultural areas of North Dakota. Much of the most productive croplands are along rivers and creeks in the more lush parts of the state. Such flooding may reduce profits and delay the beginning of the planting season. Should an extreme flood event occur over a wide area, the economy of the affected area could be seriously affected. Flood events can cut off customer access to businesses as well as close businesses for repairs. The closure of key roadways may additionally have an impact on commerce.

Dirty floodwaters often contaminate or destroy everything they touch. Historic values have been lost during flood events. In fact, the North Dakota State Fire and Tornado Fund paid $18,519 to the Grand Forks County Historical Society for flood losses. (North Dakota State Fire and Tornado Fund, 2010) Road washouts could disrupt social values as activities are cancelled and travel is limited. Floods are an important part of the health of rivers and streams and therefore should not significantly affect ecological values, unless large quantities of toxins are released into the floodwaters. Maintaining and restoring natural systems help mitigate the impact of flood events on the built environment. Floods change the natural environment and hydrology of the affected area. High water can be beneficial to the natural processes within a floodplain and can benefit riparian areas.

Table 5.4.5A lists the counties, their associated flood risk, and information from the local and tribal mitigation plans. The flood hazard was determined based on the history of Presidential disasters and the HAZUS estimated 100-year flood losses. Adjustments were made for jurisdictions prone to closed basin flooding.

Table 5.4.5A Flood Risk to Jurisdictions

County	Flood Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	Low	C	$42,9000,000 estimated losses
Barnes	High	A	$49,205,901 estimated structure and contents losses
Benson	High	NP	
Billings	Low-Moderate	C	
Bottineau	Moderate	B	$24,873,236 estimated losses
Bowman	Low-Moderate	C	$17,000,000 estimated losses
Burke	Low-Moderate	B	$6,100,000 estimated losses
Burleigh	Moderate-High	B	$82,956,512 critical facilities losses $305,094,252 residential losses
Cass	High	B/C	$2,913,406,986 estimated losses
Cavalier	Moderate-High	C	$19,000,000 estimated losses
Dickey	Moderate	C	
Divide	Low	NP	
Dunn	Low-Moderate	C	
Eddy	Moderate	C	$38,000,000 estimated losses
Emmons	Moderate	B	
*Fort Berthold^*	*Low-Moderate*	*NP*	
Foster	Low-Moderate	B	$24,873,236 estimated losses
Golden Valley	Low	D	
Grand Forks	High	A	$67,558,400 building exposure to 100-year flood
Grant	Low-Moderate	C	
Griggs	Moderate	B	$7,000,000 estimated losses
Hettinger	Low-Moderate	A	
Kidder	Moderate	C	$12,000,000 estimated losses
*Lake Traverse^*	*Moderate*	*NP*	
LaMoure	Moderate-High	#6 of 12	
Logan	Moderate	A	$5,171,688 estimated losses
McHenry	Moderate-High	A	$15,500,723 estimated losses
McIntosh	Low-Moderate	B	$17,179,219 estimated losses
McKenzie	Low-Moderate	NP	
McLean	Moderate	A	
Mercer	Moderate	B	
Morton	Moderate-High	A	
Mountrail	Low-Moderate	B	$8,500,000 estimated losses
Nelson	Moderate-High	B	$16,631,787 estimated losses
Oliver	Low-Moderate	B	
Pembina	High	A	$93,491,440 estimated losses

Table 5.4.5A Flood Risk to Jurisdictions (continued)

County	Flood Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Pierce	Moderate-High	B	
Ramsey	High	A	Hundreds of millions of dollars in property losses
Ransom	High	Medium	
Renville	Moderate	B	$56,298,231 estimated losses
Richland	High	B	
Rolette	Moderate	NP	
Sargent	Moderate-High	C	$18,805,133 estimated losses
Sheridan	Low-Moderate	NP	
Sioux	Low-Moderate	NP	
Slope	Low	NP	
Spirit Lake	*High*	*NP*	
*Standing Rock^*	*Low-Moderate*	*NP*	
Stark	Moderate	NP	
Steele	Moderate	NP	
Stutsman	High	B	$146,611,612 estimated losses
Towner	Moderate	A	$11,998,259 estimated losses
Traill	High	B	$24,873,236 estimated losses
*Turtle Mountain^*	*Moderate*	*NP*	
Walsh	High	A	
Ward	Moderate-High	B	$376,814,181 estimated losses
Wells	Moderate-High	B	
Williams	Moderate	A	$26,585,512 estimated losses

NP = no local plan
^ includes only North Dakota parts of the reservation

National Flood Insurance Program

The National Flood Insurance Program offers flood insurance to homeowners and businesses within a jurisdiction if that jurisdiction adopts and enforces standards for construction in the floodplain or does not have an identified flood hazard. As of May 31, 2010, North Dakota had 12,985 policies in force insuring a value of $2,838,601,500 as shown in Map 5.4.4D. The comparison of flood risk and insurance coverage indicates which areas are most at risk for substantial, uninsured flood losses in the future. Since 1978, the National Flood Insurance Program has paid over $156 million in flood insurance claims.

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. 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. (Federal Emergency Management Agency, 2010d) Table 5.4.5B shows the number of repetitive loss properties by county as of September 30, 2010. North Dakota has a total of 269 repetitive loss properties plus 1 severe repetitive loss property in Cass County that has had 8 losses for a total of $156,053 in insurance payments. (North Dakota Department of Emergency Services, 2010b)

Table 5.4.5B North Dakota Repetitive Loss Properties as of September 30, 2010

County	Number of Repetitive Loss Properties
Adams	0
Barnes	9
Benson	7
Billings	0
Bottineau	0
Bowman	0
Burke	0
Burleigh	3
Cass	92
Cavalier	0
Dickey	0
Divide	0
Dunn	0
Eddy	0
Emmons	4
*Fort Berthold^*	*0*
Foster	0
Golden Valley	0
Grand Forks	50
Grant	0
Griggs	0
Hettinger	6
Kidder	0
*Lake Traverse^*	*0*
LaMoure	1
Logan	0
McHenry	3
McIntosh	0
McKenzie	0
McLean	2

County	Number of Repetitive Loss Properties
Mercer	0
Morton	3
Mountrail	0
Nelson	4
Oliver	0
Pembina	15
Pierce	0
Ramsey	15
Ransom	5
Renville	3
Richland	4
Rolette	0
Sargent	0
Sheridan	0
Sioux	0
Slope	0
Spirit Lake	*0*
*Standing Rock^*	*0*
Stark	0
Steele	0
Stutsman	3
Towner	0
Traill	5
*Turtle Mountain^*	*0*
Walsh	26
Ward	9
Wells	0
Williams	0

Source: North Dakota Department of Emergency Services, 2010b.

Mitigation activities across the state, particularly acquisitions in the Red River Valley and the Devils Lake Basin have reduced the vulnerabilities to structures. Over 1,000 structures have been acquired through the various mitigation programs. These acquisitions and associated deed restrictions permanently reduce the jurisdictional vulnerabilities. More work can certainly be done to further reduce vulnerabilities, but the changes in development and land use because of acquisitions positively affects the loss estimates for the area. More details on the acquisition projects can be found in Section 7.5.8, Project Monitoring and Evaluation, and Appendix J in the Mitigation Year in Review reports.

5.4.6 Vulnerabilities of State-Owned Buildings and Property

Like most structures, state-owned buildings and property are certainly vulnerable to floods. The type of property damage caused by flood events depends on the depth and velocity of the floodwaters. Faster moving floodwaters can wash buildings off their foundations and sweep cars downstream. Extensive damage can be caused by basement flooding. Most flood damage is caused by water saturating materials susceptible to loss such as wood, insulation, wallboard, fabric, furnishings, floor coverings, and appliances. FEMA's Benefit-Cost Analysis Module determines damage percentages for various building types. Table 5.4.6A shows the estimated percentages of building and contents losses from flooding at depths of one foot, three feet, and six feet.

Table 5.4.6A Flood Building and Contents Loss Estimation Percentages

	Flood Depth		
Structure Type	**1 foot**	**3 feet**	**6 feet**
One Story No Basement	14% Building Damage 21% Contents Damage	27% Building Damage 40.5% Contents Damage	40% Building Damage 60% Contents Damage
Two Story No Basement	9% Building Damage 13.5% Contents Damage	18% Building Damage 27% Contents Damage	24% Building Damage 36% Contents Damage
One or Two Story with Basement	15% Building Damage 22.5% Contents Damage	23% Building Damage 34.5% Contents Damage	38% Building Damage 57% Contents Damage
Manufactured Unit	44% Building Damage 66% Contents Damage	73% Building Damage 90% Contents Damage	81% Building Damage 90% Contents Damage

Source: Federal Emergency Management Agency, 2001.

The North Dakota State Fire and Tornado Fund insures the state owned buildings and property. Table 5.4.6B lists the claims paid by the fund due to flood.

Table 5.4.6B Flood Claims on State-Owned Buildings and Property since 1989

County	Amount Paid
North Dakota	*$150,572*
Bottineau	$4,722
Burleigh	$123,428
Cass	$3,200
Grand Forks	$5,029
Morton	$4,193
Stutsman	$10,000

Source: North Dakota State Fire and Tornado Fund, 2010.

5.4.7 Vulnerabilities of Critical Facilities and Infrastructure

Damage to public water and sewer systems, transportation networks, electric infrastructure, and flood control facilities can hinder the ability of the government to deliver services. Drinking water, surface water, and wastewater services are provided by a variety of entities throughout the state. During flood events, the infrastructure that supports the water service providers can be damaged and sometimes destroyed. Well contamination may also occur during significant floods. Sewer systems such as municipal facilities and individual septic systems frequently suffer damages.

Road infrastructure is particularly vulnerable to flooding. Road and culvert washouts are common with heavy runoff. Federal, state, county, city, and township governments all have a stake in protecting roads from flood damage. Road networks often traverse floodplain and floodway areas. Bridges are key points of concern during flood events because they are important links in road networks and provide watercourse crossings. Scour critical bridges are especially vulnerable during periods of flooding. Section 4.2, Critical Facilities and Infrastructure, contains the number of scour critical bridges by county in more detail. Bridges can also be obstructions in watercourses, inhibiting the flow of water during flood events.

Other critical facilities that support government services and private utilities may also be located in flood hazard areas. Damages to such facilities may seriously disrupt emergency and essential services. Table 5.4.7A shows the flood claims paid on critical facilities and infrastructure by the State Fire and Tornado Fund.

Table 5.4.7B shows the critical facilities and infrastructure summary for the counties with a high or moderate-high flood rating. See Section 4.2 for more details.

Table 5.4.7A Flood Claims Paid on Critical Facilities Insured by the State since 1989

County	Local Government	Adjutant General	State University System	School Districts	Total
North Dakota	*$1,335,212*	*$6,744*	*$1,460,504*	*$41,411*	*$2,843,871*
Barnes	$5,064	$0	$8,095	$0	$13,159
Benson	$0	$0	$0	$666	$ 666
Bottineau	$1,193	$0	$0	$0	$1,193
Burleigh	$7,750	$5,494	$0	$2,032	$15,276
Cass	$25,514	$0	$14,811*	$0	$40,325
Grand Forks	$1,154,483	$0	$1,399,408	$1,735	$2,555,626
Kidder	$11,140	$0	$0	$0	$11,140
LaMoure	$10,000	$0	$0	$0	$10,000
McHenry	$0	$0	$0	$8,335	$8,335
Mountrail	$0	$0	$0	$8,268	$8,268
Nelson	$1,191	$0	$0	$0	$1,191

Table 5.4.7A Flood Claims Paid on Critical Facilities Insured by the State since 1989 (continued)

County	Local Government	Adjutant General	State University System	School Districts	Total
Pembina	$87,238	$0	$0	$617	$87,855
Ramsey	$13,750	$1,250	$9,178	$0	$24,178
Ransom	$0	$0	$0	$10,000	$10,000
Renville	$0	$0	$0	$1,110	$1,110
Richland	$1,445	$0	$23,062	$6,678	$31,185
Rolette	$0	$0	$0	$1,970	$1,970
Stutsman	$16,444	$0	$0	$0	$16,444
Traill	$0	$0	$5,950	$0	$5,950

Source: North Dakota State Fire and Tornado Fund, 2010.
* These claims do not appear to include losses from the 2000 Fargo flood event at North Dakota State University.

Table 5.4.7B Critical Facilities and Infrastructure in High and Moderate-High Flood Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Barnes	CIKR Facilities: Moderate (10-14 facilities) $1.6 million in National Guard Assets Valley City State University Interstate and Railroad Transportation Infrastructure
Benson*	CIKR Facilities: Low (0-4 facilities) Cankdeska Cikana Community College
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck United Tribes Technical College University of Mary Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure

Table 5.4.7B Critical Facilities and Infrastructure in High and Moderate-High Flood Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Cavalier	CIKR Facilities: Low-Moderate (5-9 facilities) Langdon Wind Power Plant
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota Grand Forks Airport Interstate and Railroad Transportation Infrastructure
LaMoure	CIKR Facilities: Low (0-4 facilities)
McHenry	CIKR Facilities: Low (0-4 facilities)
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure
Nelson*	CIKR Facilities: Low-Moderate (5-9 facilities)
Pembina	CIKR Facilities: Moderate (10-14 facilities) Neche Oil Import Site Interstate and Railroad Transportation Infrastructure
Pierce	CIKR Facilities: Low-Moderate (5-9 facilities)
Ramsey*	CIKR Facilities: Moderate (10-14 facilities) $62.7 million in National Guard Assets Camp Grafton Lake Region State College Devils Lake Airport
Ransom	CIKR Facilities: Low-Moderate (5-9 facilities) North Dakota Veterans Home

Table 5.4.7B Critical Facilities and Infrastructure in High and Moderate-High Flood Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Richland*	CIKR Facilities: Moderate-High (15-24 facilities) $10.8 million in National Guard Assets North Dakota State College of Science Interstate and Railroad Transportation Infrastructure
Sargent*	CIKR Facilities: Low (0-4 facilities)
Stutsman	CIKR Facilities: Moderate-High (15-24 facilities) $117.4 million in Local Government Facilities Jamestown College North Dakota State Hospital Jamestown Airport Interstate and Railroad Transportation Infrastructure
Traill	CIKR Facilities: Moderate (10-14 facilities) Mayville State University Interstate and Railroad Transportation Infrastructure
Walsh	CIKR Facilities: Moderate (10-14 facilities) North Dakota State Developmental Center Interstate and Railroad Transportation Infrastructure
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport
Wells	CIKR Facilities: Low-Moderate (5-9 facilities)

* includes at least part of the reservation

5.4.8 Vulnerabilities to New and Future Development

The National Flood Insurance Program is an insurance program that requires communities to adopt and enforce floodplain management ordinances in order for property owners to purchase federally backed insurance. These ordinances provide some measure of protection for new construction and significant renovations in the floodplain. Unrestricted development may occur in areas prone to flooding but not mapped and in those communities lacking floodplain management ordinances. Communities not participating in the National Flood Insurance Program with identified flood hazards include:

- City of Anamoose (McHenry County)
- City of Brinsmade (Benson County)
- City of Fordville (Walsh County)
- City of Gladstone (Stark County)
- City of Kenmare (Ward County)

- Lansford Township (Bottineau County)
- City of Oberon (Benson County)
- Park Township (Pembina County)
- City of Portal (Burke County)
- Stafford Township (Renville County)
- City of Stanton (Mercer County)
- City of Towner (McHenry County)

Source: Federal Emergency Management Agency, 2010e.

Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties; all but Billings, Bowman, McKenzie, Mountrail, Rolette, Sioux, Stark, and Williams Counties have a high or moderate-high high flood hazard rating. Therefore, places such as Brinsmade, Kenmare, and Oberon, located in high or moderate-high risk counties, are experiencing or are expected to experience growth, and are lacking adequate floodplain management ordinances, have a high potential for new or future development in high flood hazard areas.

Additionally, through the tacit approval of local government, redevelopment is occurring on the north shore of Devils Lake at elevations which could be inundated by an impending revised 1% chance flood event for the Devils Lake/Stump Lake system. (North Dakota State Water Commission, 2008)

North Dakota has two communities, the City of Fargo and the City of Grand Forks, that participate in the Community Rating System (CRS) of the National Flood Insurance Program (NFIP). CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities exceeding minimum NFIP requirements in areas such as public information, mapping and regulations, flood damage reduction, and flood preparedness. In return, the communities receive discounts on their flood insurance premiums. Fargo is a Class 7 (15% discount for SFHA) and Grand Forks is a Class 5 (25% discount for SFHA). (Federal Emergency Management Agency, 2010f)

5.4.9 Data Limitations and Other Key Documents

The continued development of digital mapping of the FIRMs in North Dakota allow for more detailed analyses of the flood risk in North Dakota. Understanding the areas at most probable risk will allow for smarter development and protection of the people in the state. Hydrologists can provide more information and outlooks on the flood hazard.

Other key documents related to the flood hazard include:

- Devils Lake Risk Assessment
- North Dakota Emergency Operations Plan, Flood Annex
- North Dakota Water Development Reports
- North Dakota NFIP Map Modernization Plan
- The Floods of 1997: A Special Report
- The Red River of the North Flood Disaster, 10 Years Later
- Interagency Hazard Mitigation Team Reports

5.5 Geologic Hazards

Including Landslides, Earthquakes, and Other Geologic / Mining Hazards

5.5.1 Characteristics

Geologic hazards in North Dakota usually do not cause severe damage, as other hazards may, but the potential exists for the occasional landslide, earthquake, or mine collapse that causes some loss.

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, 2004b) 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, 2004b)

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, 2004b)

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, 2010a)

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. Urbanization has artificially accelerated riverbank slumping and instability through activities such as placing homes and structures too close to the riverbank in a way that adds pressure to the bank and increases soil hydration through increased storm water runoff, using irrigation systems that saturate the soil and decrease its strength, adding weight to the riverbank with structures, retaining walls, and riprap, and planting shallow-rooted vegetation. Minimizing these types of activities and placing structures away from riverbanks can mitigate some, but not all, riverbank slumping. (Cass County, 2010)

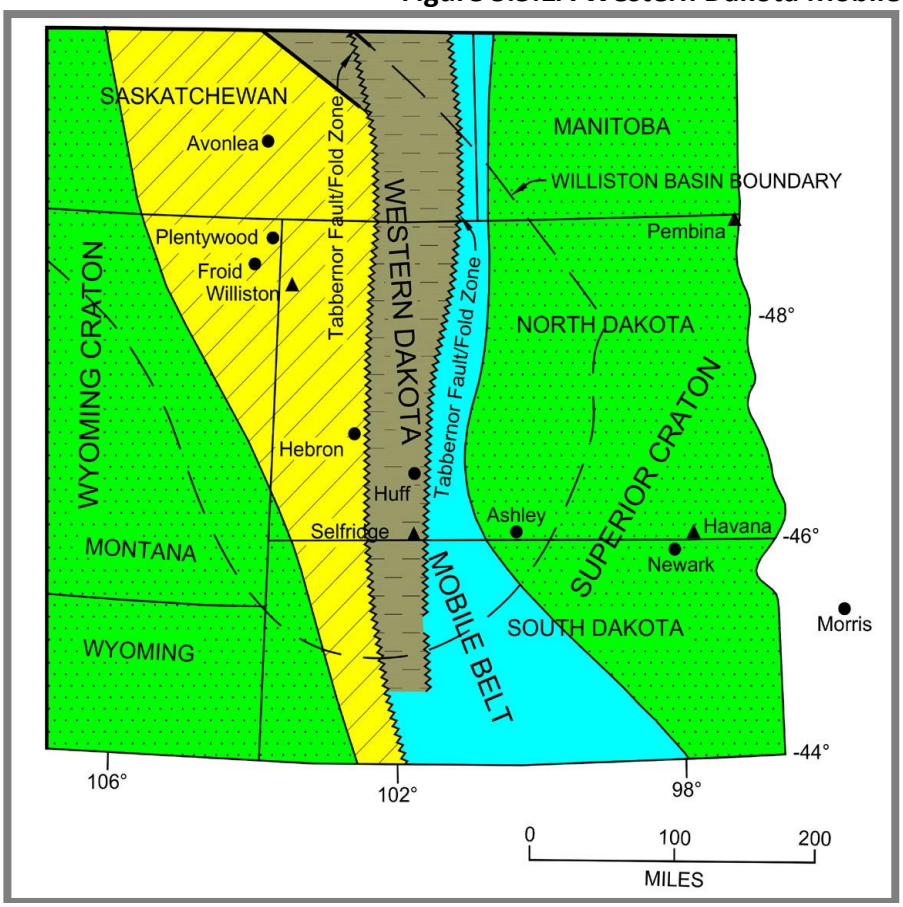
Earthquake

An earthquake is the sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth's surface. Huge plates slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free, thus, producing an earthquake. (US Geological Survey, 1997)

North Dakota is not an area known for its earthquake activity, however, hundreds of miles to the west in the Rocky Mountains is the Intermountain Seismic Belt and to the southeast is the New Madrid Seismic Zone. Neither of these areas are close enough to cause significant damages in the state, however, relatively small earthquakes may occur in areas not recognized for regular earthquake activity. One area, termed the Western Dakota Mobile Belt, may have two deeply buried faults, the Tabbernor Fault and Thompson Boundary Fault; both are postulated and may be capable of producing small to moderate earthquakes. The area is shown in Figure 5.5.1A. (North Dakota Geological Survey, 2007)

Geologists primarily measure earthquake severity in two ways: by magnitude and by intensity. Magnitude is based on the area of the fault plane and the amount of slip. The intensity is based on how strong the shock is felt and the degree of damage at a given location. The most commonly used scales are the Richter magnitude scale, moment magnitude scale, and modified Mercalli intensity scale. (National Earthquake Hazards Reduction Program, 2010)

Figure 5.5.1A Western Dakota Mobile Belt



Map showing the main basement geologic structures in North Dakota and the surrounding area. The map shows the major Precambrian Structural provinces (Superior Craton, Western Dakota Mobile Belt, and Wyoming Craton). Two deep faults, the Thompson Boundary Fault and the Tabbernor Fault/Fold Zone, extend north-south through the Western Dakota Mobile Belt in western North Dakota. All of these features are deeply buried beneath younger materials throughout the area.

Localities where earthquakes have occurred are noted on the map (round dots). Additionally, earthquakes have been reported felt at the locations shown by triangles.

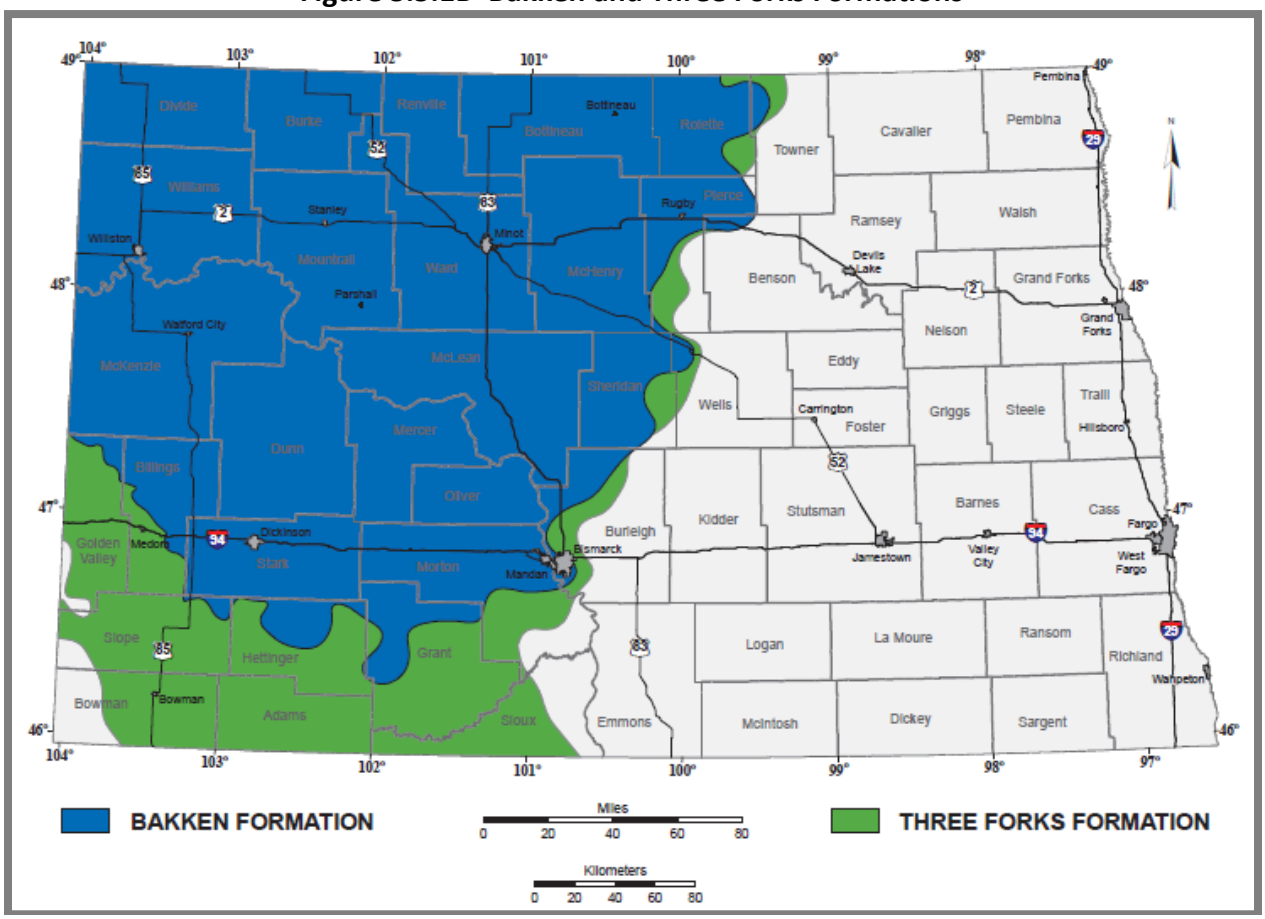
All of the features shown on the map are buried beneath younger materials throughout the area and, because they are hidden and cannot be studied directly, the map is speculative. Other structural maps of the area, compiled by other geologists, differ from this one in various ways.

Source: North Dakota Geological Survey, 2007.

Other Geologic / Mining Hazards

North Dakota does have expansive soils, including clay with swelling potential, but the impacts of such are generally limited to a small scale; good building practices generally mitigate damages from expansive soils. North Dakota has a minimal land subsidence hazard, usually only related to mining activities, which is typically recognized and mitigated. Most mine, drilling, and energy production disasters do not cause significant losses to area communities and are limited to occupational hazards but collapses, fires, and explosions are all possible. Given the abundance of mining activity in North Dakota, the potential for a disaster related to mining hazards exists. Figure 5.5.1B shows the Bakken and Three Forks Formations, areas favored for continued oil development. Projections estimate an oil well on every section within the oil fields served by the Bakken, Three Forks, and Sanish Formations over the next six years.

Figure 5.5.1B Bakken and Three Forks Formations



Source: North Dakota Department of Mineral Resources, 2010.

5.5.2 History

Most geologic events in North Dakota go unnoticed or result in very little physical damage. Most landslide damages that do occur are to transportation infrastructure and lead to impacts such as road closures, detours, and road repairs. Occasionally, structures are involved. Some of the more notable landslide events in North Dakota include:

- Slope failures along North Dakota Highway 22 in western North Dakota.
- Slope failures on Riverview Drive in Valley City.
- Slope failures along the Red River near Drayton.
- Closure of Highway 85 in west-central North Dakota.
- 1997 – Highway 1806 was closed north of Fort Abraham State Park after a landslide.
- A total of 12 homes were lost to landslides in Valley City in 1993, 1997, 1999, 2000, and 2001.
- March 25, 2010 – A train derailed when an embankment failed south of Washburn in McLean County. One railroad worker was killed and another was injured.

Sources: Bismarck Tribune, 2010a; North Dakota Geological Survey, 2010a; North Dakota Geological Survey, 2010b; Barnes County, 2010.

Earthquakes have been felt in North Dakota but usually do not result in damages. Table 5.5.2A list the earthquakes recorded in the state and nearby.

Table 5.5.2A North Dakota and Area Earthquakes

Location	Date	Magnitude / Impacts
Southeastern North Dakota	1872	
Pembina	1900	
Avonlea, Saskatchewan	05/16/1909	5.5 magnitude Broke dishes and windows, Cracked plaster and masonry
Williston	08/08/1915	3.7 estimated magnitude, IV intensity
Hebron	04/30/1927	3.2 estimated magnitude, III intensity
Havana	1934	
Williston	10/26/1946	3.7 estimated magnitude, IV intensity
Selfridge	05/14/1947	3.7 estimated magnitude, IV intensity
Huff	07/08/1968	4.4 magnitude, IV intensity
Morris, MN	1975	
Grenora	03/09/1982	3.3 magnitude, III intensity
Morris, MN	1993	
Grenora	11/11/1998	3.5 magnitude, IV intensity
Goodrich	11/15/2008	2.6 magnitude, II intensity
Grenora	01/03/2009	1.5 magnitude, I intensity

Source: North Dakota Geological Survey, 2007; North Dakota Geological Survey, 2010c.

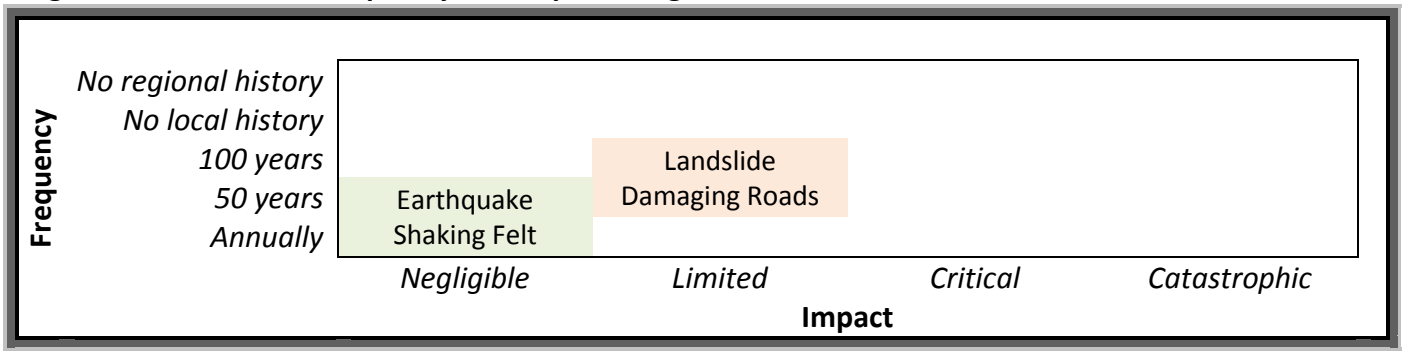
Table 5.5.2B North Dakota Geologic Hazards Declared Disasters and Emergencies

Declaration	Location	Date	Magnitude	Casualties	Damages
None					

5.5.3 Probability and Magnitude

Figure 5.5.3A is a graphical representation of the range of events that can occur within the geologic hazards. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the geologic hazards. Section 3.6 defines the impact categories and provides additional information.

Figure 5.5.3A Hazard Frequency and Impact Ranges



Earthquake experts use probabilities when determining the seismicity of an area. Peak horizontal acceleration is the maximum horizontal acceleration experienced by a particle during the course of the earthquake motion. When acceleration acts on a physical body, the body experiences the acceleration as a force. Gravity is a commonly known force of nature, and therefore, the units of acceleration are measured in terms of g, the acceleration due to gravity. The peak ground acceleration with a 2% probability of exceedance in 50 years in North Dakota is less than 10%g. (US Geological Survey, 2008) To make sense of these values, at 9.2%g-18%g, the earthquake is felt by all with many frightened. Some heavy furniture is moved with a few instances of fallen plaster. Damage is considered slight. (Qamar, 2008)

5.5.4 Mapping

An ongoing project at the North Dakota Geological Survey is the identification and mapping of landslide areas of the state. Map 5.5.4A shows the areas that have been mapped to date. Although incomplete, this mapping generally depicts the more hazardous parts of the state.

Map 5.5.4C shows the peak horizontal acceleration (as a percentage of gravity) that has a 2% probability of exceedance in 50 years. As a measure of how hard the ground shakes, the higher the value, the greater the hazard; however, when viewed on the national scale, the North Dakota values are very low. Table 5.5.4B portrays the expected impacts under these accelerations.

Map 5.5.4A

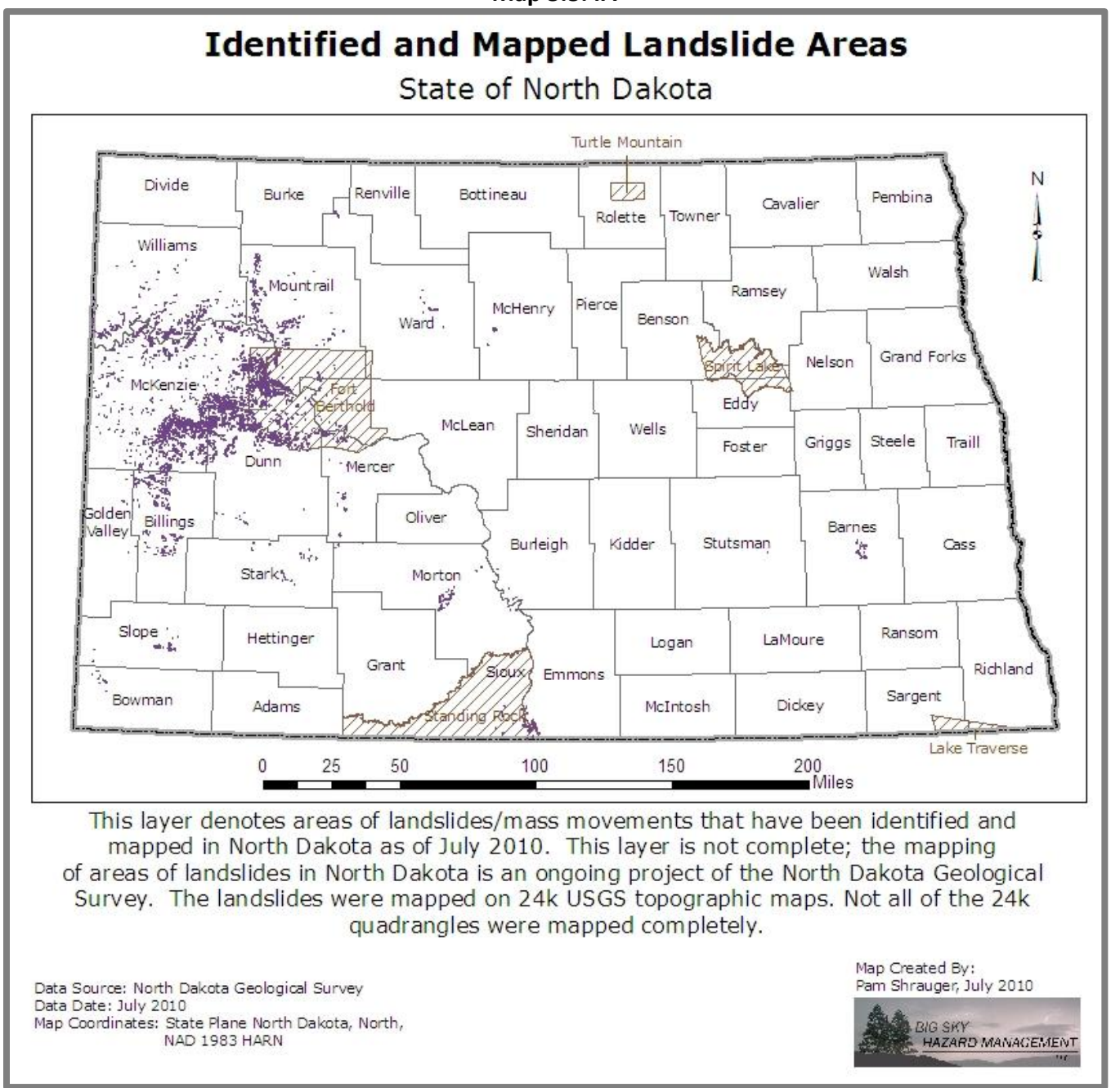
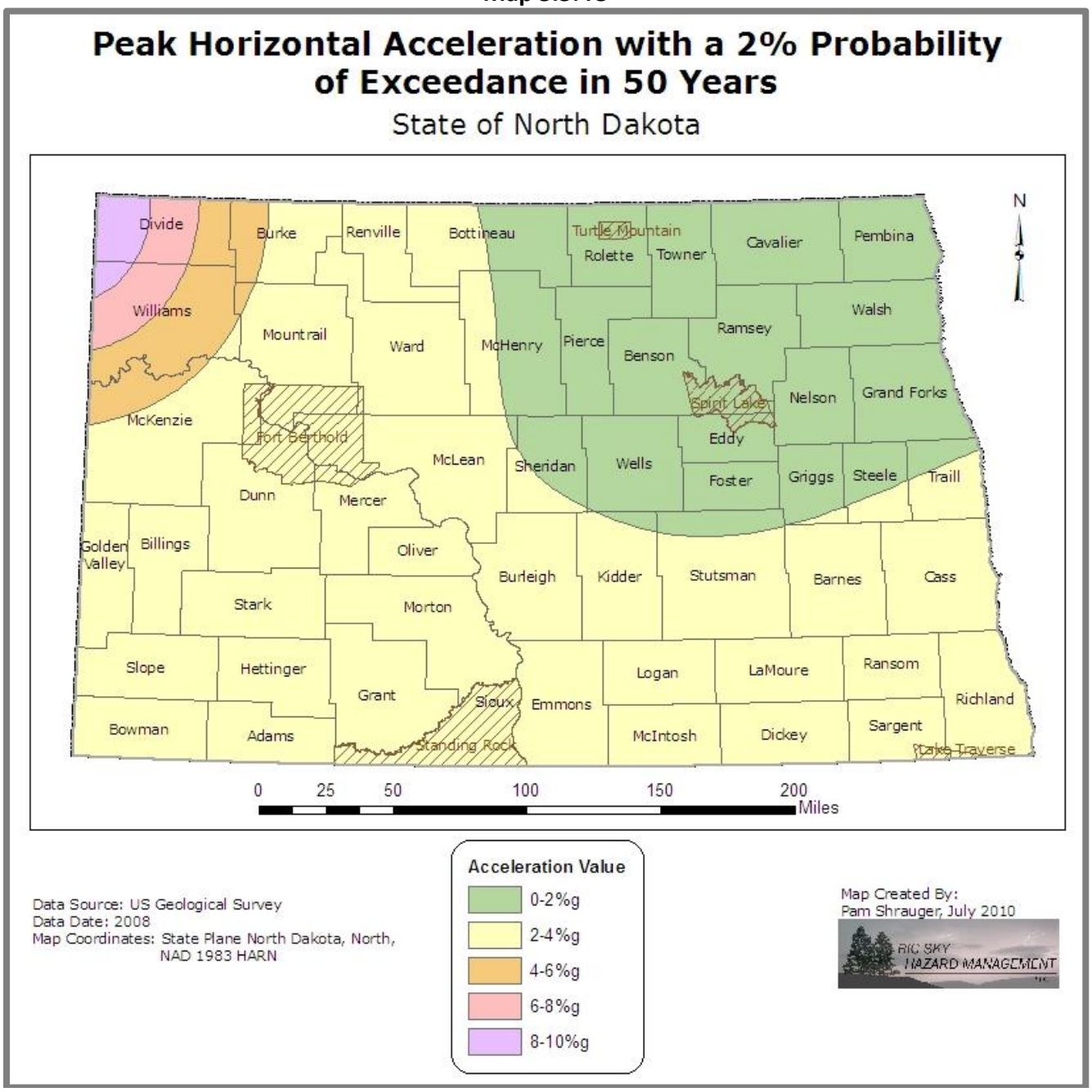

Identified and Mapped Landslide Areas
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
This layer denotes areas of landslides/mass movements that have been identified and mapped in North Dakota as of July 2010. This layer is not complete; the mapping of areas of landslides in North Dakota is an ongoing project of the North Dakota Geological Survey. The landslides were mapped on 24k USGS topographic maps. Not all of the 24k quadrangles were mapped completely.
Data Source: North Dakota Geological Survey
Data Date: July 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, July 2010
BIG SKY HAZARD MANAGEMENT

Table 5.5.4B Expected Impacts from Peak Horizontal Accelerations

Acceleration	Perceived Shaking	Potential Damage
<0.17%g	Not Felt	None
0.17%g – 1.4%g	Weak	None
1.4 %g – 3.9%g	Light	None
3.9%g – 9.2%g	Moderate	Very Light
9.2%g - 18%g	Strong	Light

Source: Pacific Northwest Seismic Network, 2010.

Map 5.5.4C



5.5.5 Vulnerabilities to Jurisdictions

The primary threats to jurisdictions from the geologic hazards are to county, city, and township road systems and potentially structures. Landslide poses the greatest threat of the geologic hazards. Roadways may crumble or be buried following a landslide. Should buildings be located in such areas, losses could occur. The potential for significant earthquake losses in North Dakota is marginal.

Table 5.5.5A demonstrates the geologic hazard by jurisdiction. Note that even though an area may be designated as high hazard, given the low frequency and low impact generally seen with these events, geologic hazards may not be a primary concern for the area.

Given the incompleteness of the landslide data, the hazard ratings are only broken into three levels:

- High – several areas of the county have identified landslide hazard areas
- Moderate – isolated areas of the county have identified landslide hazard areas
- Low – none of the county has identified landslide hazard areas

The earthquake rating was based on the potential peak horizontal acceleration with a 2% probability of exceedance in 50 years as follows:

- High – 8-10%g
- Moderate-High – 6-8%g
- Moderate – 4-6%g
- Low-Moderate – 2-4%g
- Low – 0-2%g

The overall geologic hazards rating is based on the combination of the landslide and earthquake hazards, with more weight given to the landslide hazard.

Table 5.5.5A Geologic Hazards Risk to Jurisdictions

County	Landslide Rating	Earthquake Rating	Overall Rating	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	L	LM	Low	NI	
Barnes	M	LM	Moderate	D*	
Benson	L	L	Low	NP	
Billings	H	LM	Moderate-High	NI	
Bottineau	L	LM	Low	NI	
Bowman	M	LM	Moderate	NI	
Burke	L	M	Low-Moderate	NI	
Burleigh	M	LM	Moderate	NI	
Cass	L	LM	Low	NI	
Cavalier	L	L	Low	NI	
Dickey	L	LM	Low	NI	
Divide	L	H	Moderate	NP	

Table 5.5.5A Geologic Hazards Risk to Jurisdictions (continued)

County	Landslide Rating	Earthquake Rating	Overall Rating	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Dunn	H	LM	Moderate-High	NI	
Eddy	L	L	Low	NI	
Emmons	M	LM	Moderate	NI	
*Fort Berthold^*	*H*	*LM*	*Moderate-High*	*NP*	
Foster	L	L	Low	NI	
Golden Valley	M	LM	Moderate	NP	
Grand Forks	L	L	Low	NI	
Grant	L	LM	Low	NI	
Griggs	L	LM	Low	NI	
Hettinger	L	LM	Low	NI	
Kidder	L	LM	Low	NI	
*Lake Traverse^*	*L*	*LM*	*Low*	*NP*	
LaMoure	L	LM	Low	NI	
Logan	L	LM	Low	NI	
McHenry	M	LM	Moderate	NI	
McIntosh	L	LM	Low	NI	
McKenzie	H	M	Moderate-High	NP	
McLean	M	LM	Moderate	NI	
Mercer	M	LM	Moderate	NI	
Morton	M	LM	Moderate	NI	
Mountrail	H	M	Moderate-High	NI	
Nelson	L	L	Low	NI	
Oliver	L	LM	Low	NI	
Pembina	L	L	Low	NI	
Pierce	L	L	Low	NI	
Ramsey	L	L	Low	NI	
Ransom	L	LM	Low	Medium~	
Renville	L	LM	Low	NI	
Richland	L	LM	Low	NI	
Rolette	L	L	Low	NP	
Sargent	L	LM	Low	NI	
Sheridan	L	LM	Low	NP	
Sioux	M	LM	Moderate	NP	
Slope	M	LM	Moderate	NP	
Spirit Lake	*L*	*L*	*Low*	*NP*	
*Standing Rock^*	*M*	*LM*	*Moderate*	*NP*	
Stark	M	LM	Moderate	NP	
Steele	L	LM	Low	NP	

Table 5.5.5A Geologic Hazards Risk to Jurisdictions (continued)

County	Landslide Rating	Earthquake Rating	Overall Rating	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Stutsman	M	LM	Moderate	NI	
Towner	L	L	Low	NI	
Traill	L	LM	Low	NI	
*Turtle Mountain^*	*L*	*L*	*Low*	*NP*	
Walsh	L	L	Low	NI	
Ward	M	LM	Moderate	NI	
Wells	L	L	Low	NI	
Williams	H	H	High	NI	

H = high; MH = moderate-high; M = moderate; LM = low-moderate; L = low
NI = not identified in the local plan; NP = no local plan
^ includes only North Dakota parts of the reservation
* landslide only
~ riverbank erosion only

5.5.6 Vulnerabilities of State-Owned Buildings and Property

State-owned buildings and property are generally not at risk from the geologic hazards. Hazards such as landslide are considered when such facilities are constructed, and none of the existing facilities are known to be at risk.

5.5.7 Vulnerabilities of Critical Facilities and Infrastructure

Most critical facilities and infrastructure in North Dakota are likely located outside of geologic hazard areas, such as landslide. The primary exception may be transportation infrastructure. Table 5.5.7A summarizes the critical facilities and infrastructure in the high or moderate-high risk counties. Most of these jurisdictions have US highways, state highways, and railways that may be at risk.

Table 5.5.7A Critical Facilities and Infrastructure in High or Moderate-High Geologic Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Billings	CIKR Facilities: Low-Moderate (5-9 facilities) Interstate and Railroad Transportation Infrastructure
Dunn*	CIKR Facilities: Low (0-4 facilities)
McKenzie*	CIKR Facilities: Moderate (10-14 facilities)
Mountrail*	CIKR Facilities: Low-Moderate (5-9 facilities) Fort Berthold Community College
Williams	CIKR Facilities: Moderate-High (15-24 facilities) $129.3 million in Local Government Facilities Williston State College Williston Airport

* includes at least part of the reservation

5.5.8 Vulnerabilities to New and Future Development

New and future development may be vulnerable to geologic hazards. Specific to landslide, most land use regulations in the state do not directly address the landslide hazard, however, some may restrict development on excessive slopes and soil types that are inherently more prone to landslides. Earthquake losses can often be mitigated through building codes. Those jurisdictions lacking building code regulations and enforcement would be more likely to see development that is vulnerable to earthquakes. Table 5.5.8A demonstrates the new and future development activities in the high and moderate-high geologic hazard jurisdictions. See Section 4.7, New Development, for additional information regarding the limitations of the building permit data.

Table 5.5.8A New and Future Development in High and Moderate-High Geologic Hazard Jurisdictions

County	Residential Building Permits 2005-2009	Residential Construction Costs 2005-2009	Business Growth 2007-2009	Population Growth Expected?	Building Codes?
Billings	3	$648,000		Yes	1 city
Dunn	24	$3,483,000		No	3 cities
McKenzie	31	$3,962,000	Natural gas processing plant expansion	Yes	2 cities
Mountrail	131	$19,848,695	Wind farm start up	Yes	3 cities
Williams	418	$85,590,913	Pea and lentil processing warehouse expansion and plant start up	Yes	3 cities

5.5.9 Data Limitations and Other Key Documents

Geologic hazards, particularly landslide hazard areas, are commonly influenced by local factors and are difficult to analyze at the statewide level. Continued study by the North Dakota Geological Survey should aid in identifying those areas at greatest risk and potentially in need of mitigation action.

Other key documents related to the geologic hazards include:

- North Dakota Emergency Operations Plan

5.6 Hazardous Material Release

5.6.1 Characteristics

Hazardous materials are any substances posing an unreasonable risk to safety and health, the environment, and the property of North Dakota citizens. The term "hazardous materials" envelops a vast array of products, from the relatively innocuous types, such as creosote, to highly toxic or poisonous types, such as polychlorinated biphenyls (PCBs) and phosgene gas. The severity of potential hazards caused by these materials is varied, but the primary reason for the designation is their risk to public safety.

Categories of hazardous materials include:

- Explosives (Class 1)
- Gases (Class 2)
- Flammable and combustible liquids (Class 3)
- Flammable solids, spontaneously combustible materials, and water-reactive substances (Class 4)
- Oxidizing substances and organic peroxides (Class 5)
- Toxic/poisonous substances and infectious substances (Class 6)
- Radioactive materials (Class 7)
- Corrosive substances (Class 8)
- Miscellaneous hazardous materials/products, substances, or organisms (Class 9)

Source: US Department of Transportation, 2008.

Hazardous material incidents are categorized as uncontrolled releases occurring during transportation or at a stationary facility. Although the listed hazardous materials are classified essentially the same in both transportation and stationary incidents, the US Department of Transportation is responsible for determining hazardous materials associated with transportation, including pipelines, and the US Environmental Protection Agency (EPA) determines which materials are considered hazardous in stationary releases.

The United States' economy is the largest in the world, and to expand its competitive edge, durable and non-durable goods must not only satisfy a global consumer market, but must be produced more efficiently. Unfortunately, many materials used to power the economy are, by nature, hazardous to public safety. Billions of tons of hazardous materials are transported, stored, and used each year. Improper use and improper stationary storage create a definite threat. Millions of shipments of hazardous materials move throughout the US each year via the highway, rail, and air transportation systems. Collisions, other types of accidents, equipment malfunction, and improperly engineered containers are inherent risks that pose a threat of release.

The economy of North Dakota is based on agriculture, light manufacturing, coal mining, and petroleum and natural gas extraction. All of these businesses and industries rely on the production, use, storage, and transportation of hazardous materials. In North Dakota, explosives are used principally in mineral extraction, construction, and seismic work. Traffic accidents pose the greatest threat of incidents involving explosives. Flammable liquids, solids, and gases are produced and transported intrastate and

interstate via the highway, railroad, and pipeline systems, constituting a danger to public safety. One jurisdiction in west central North Dakota has one of the largest coal gasification plants in the world. This plant alone has forty-two hazardous materials that are used, stored, or produced. One product produced is anhydrous ammonia (fertilizer), a hazardous material used by most farmers in North Dakota. The State of North Dakota has over 7,300 miles of hazardous liquid and gas pipelines. (US Department of Transportation, 2010) Nuclear fuels are not produced or used but may be transported in North Dakota. Radioactive isotopes are used in the medical profession and are classified as a hazardous material and a hazardous waste. According the Environmental Protection Agency's (EPA) Envirofacts database, North Dakota has 2,239 facilities regulated by the EPA. (US Environmental Protection Agency, 2010)

Hazardous materials releases often are viewed in a worst case scenario. Some have resulted in the loss of several lives and contamination of soils, rivers, lakes, streams, underground water supplies, and fish and wildlife habitat; however, the majority of incidents involve small spills and releases requiring little response or recovery action. The problem for decision-makers at all levels of government is to create a safe system for the use, storage, and transportation of hazardous materials while expanding the economic viability.

Other significant hazardous material concerns are the hazardous by-products from the production of the drug methamphetamine. This drug is easily "cooked" up using readily available hazardous materials in clandestine labs. These labs may then be contaminated with a variety of toxic chemicals such as methanol, ether, benzene, methylene chloride, trichloroethane, toluene, muriatic acid, sodium hydroxide, anhydrous ammonia, and red phosphorus.

Hazardous material releases occur for a variety of reasons but are often initiated by a transportation accident. Almost any hazard that destroys infrastructure can lead to a hazardous material release. For example, floods can wash out bridges or roadways and infiltrate storage facilities and ultimately cause a hazardous material release. Strong winds, poor visibilities, or slippery roadways may also instigate such an accident. Hazardous material releases can also be intentional as is the case with a terrorist act or a domestic incident such as a methamphetamine lab. Hazardous material releases during any disaster will most certainly compound the complexity of the event.

The continued development of new oil fields, particularly in the western part of the state, creates additional risk from both new stationary facilities and the associated increase in hazardous material transportation in the area. New and proposed pipelines associated with oil and gas development pose additional threats in parts of the state. As of March 2010, North Dakota had 4,744 oil wells producing, and in July 2010, about 137 active drilling rigs. (North Dakota Oil and Gas Division, 2010) Projections estimate an oil well on every section within the oil fields served by the Bakken, Three Forks, and Sanish Formations over the next six years.

5.6.2 History

The history of hazardous material releases in North Dakota range from small household leaks to large releases from train derailments. Table 5.6.2C quantifies the 486 incidents reported to North Dakota Department of Emergency Services from March 2003 through August 2010 by county. Note that this

database was determined to be more representative than that of the National Response Center used in a previous plan version. Both databases are limited in that they do not contain all local hazardous condition responses but do contain many relatively minor, non-catastrophic releases.

Perhaps the most significant hazardous material release in North Dakota's history was the January 2002 anhydrous ammonia release near Minot. An excerpt from the associated National Transportation Safety Board report follows.

Figure 5.6.2A The January 18, 2002 derailment scene near Minot. Source: National Transportation Safety Board, 2004.

"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 ½ 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." (National Transportation Safety Board, 2004)

Figure 5.6.2B Fire photo taken by Gilby Fire and Rescue.

Other significant hazardous material releases in North Dakota include the 2008 South Fargo natural gas explosion that injured 4 people, the 1989 chemical fire near Grand Forks, the 1987 agricultural chemical warehouse fire in Minot that forced the evacuation of 10,000 people, and the 1985 uranium oxide spill near Bowdon.

Table 5.6.2C Hazardous Material Releases March 2003 – August 2010

County	Number of Reported Incidents	County	Number of Reported Incidents
Adams	0	McLean	9
Barnes	9	Mercer	39
Benson	2	Morton	27
Billings	37	Mountrail	12
Bottineau	13	Nelson	1
Bowman	18	Oliver	3
Burke	7	Pembina	11
Burleigh	6	Pierce	1
Cass	25	Ramsey	9
Cavalier	2	Ransom	6
Dickey	4	Renville	7
Divide	2	Richland	18
Dunn	8	Rolette	2
Eddy	3	Sargent	3
Emmons	2	Sheridan	3
Foster	4	Sioux	2
Golden Valley	5	Slope	1
Grand Forks	25	Stark	21
Grant	1	Steele	1
Griggs	2	Stutsman	9
Hettinger	0	Towner	1
Kidder	2	Traill	4
LaMoure	5	Walsh	7
Logan	1	Ward	14
McHenry	8	Wells	9
McIntosh	3	Williams	44
McKenzie	32		

Source: North Dakota Department of Emergency Services, 2010d.
Note: Incidents that occurred on county lines are listed more than once.

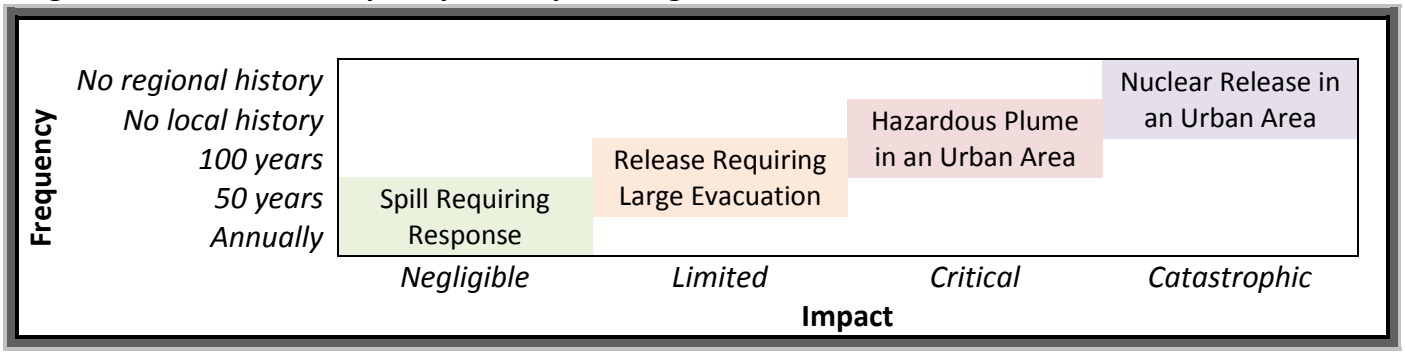
Table 5.6.2D North Dakota Hazardous Material Release Declared Disasters and Emergencies

Declaration	Location	Date	Magnitude	Casualties	Damages
None					

5.6.3 Probability and Magnitude

Figure 5.6.3A is a graphical representation of the range of events that can occur within the hazardous material release hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the hazardous material release hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.6.3A Hazard Frequency and Impact Ranges

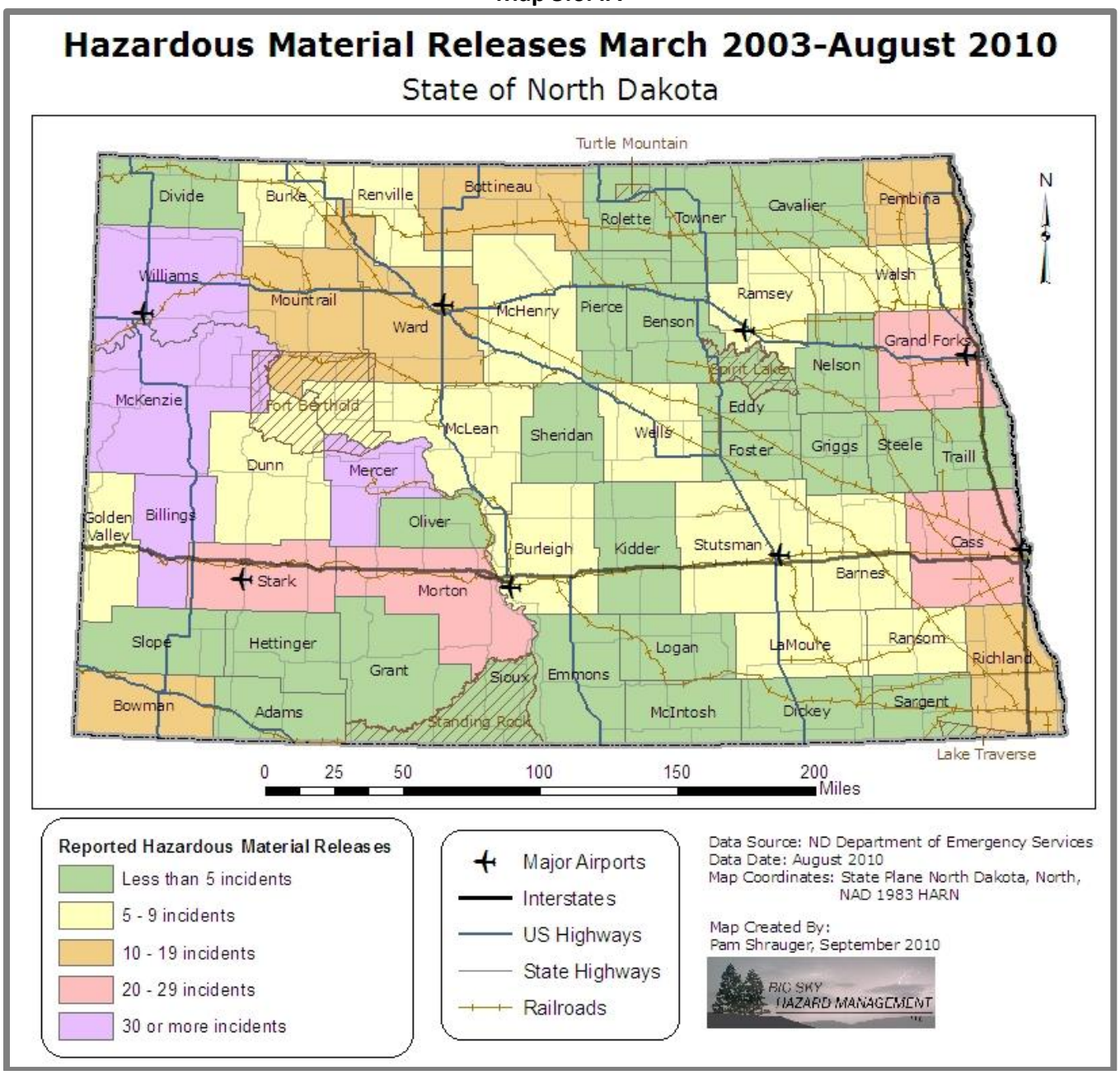


During the 7.5 year period of March 2003 – August 2010, 486 hazardous material releases were reported to the North Dakota Department of Emergency Services. Based on this dataset, on average, 65 incidents can be expected annually in North Dakota. North Dakota averages about 1-2 significant pipeline incidents per year. (US Department of Transportation, 2010) Major incidents requiring large scale evacuations and causing mass fatalities or injuries are possible as the historical record indicates.

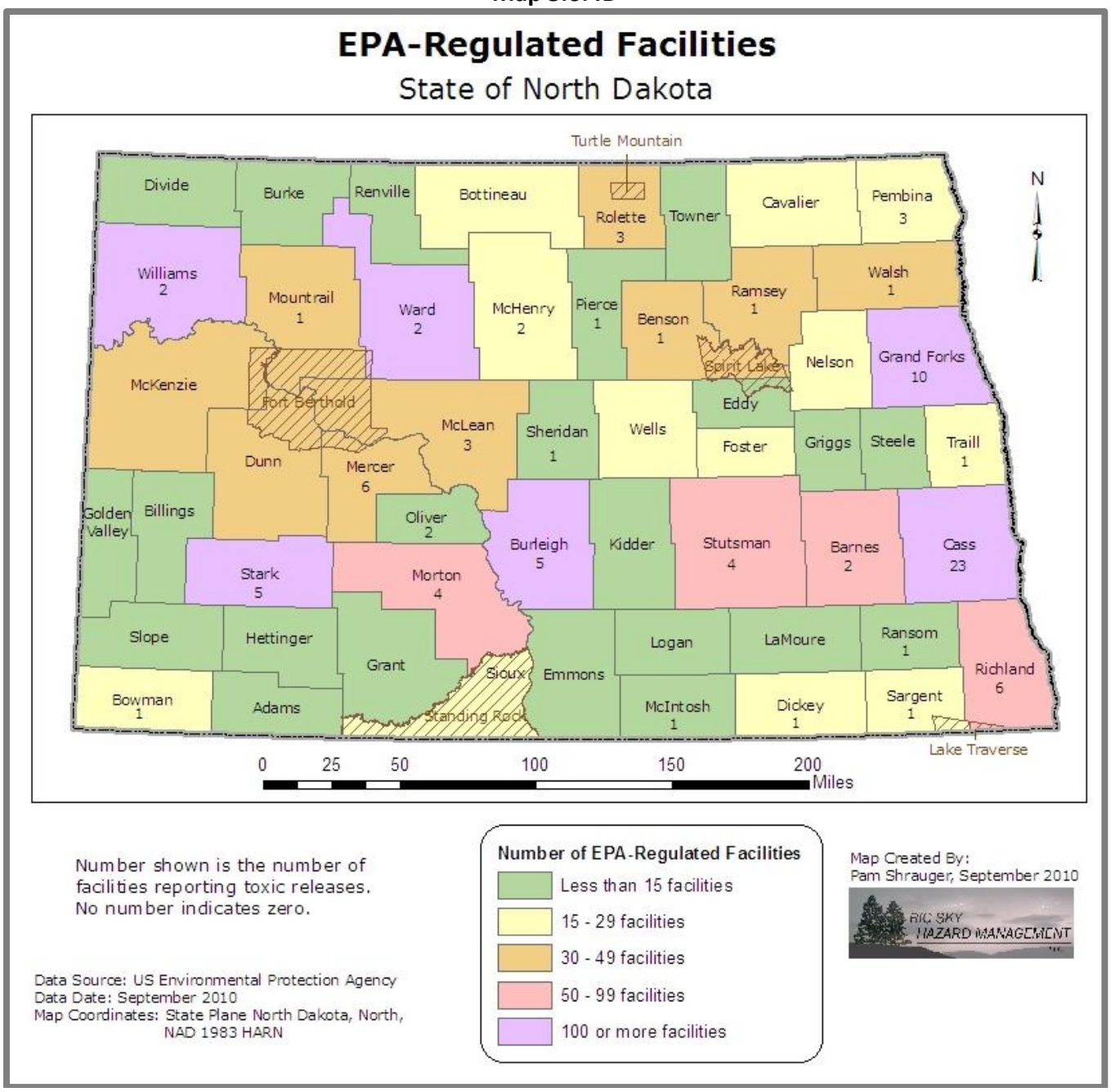
5.6.4 Mapping

Hazardous material incidents can happen anywhere, but the most likely locations are at fixed facilities producing, housing, or using hazardous materials or along the interstate, railroad, and pipeline infrastructure. Map 5.6.4A shows the historical occurrences by county and also the transportation infrastructure in the state. Map 5.6.4B shows the total number of Environmental Protection Agency (EPA)-regulated facilities and the number of those facilities that have reported toxic releases according to the EPA's Envirofacts database.

Map 5.6.4A


Hazardous Material Releases March 2003-August 2010
State of North Dakota
Turtle Mountain
N
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Grand Forks
Spirit Lake
Nelson
McKenzie
Fort Berthold
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Cass
Barnes
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
0
25
50
100
150
200
Miles
Reported Hazardous Material Releases
Less than 5 incidents
5 - 9 incidents
10 - 19 incidents
20 - 29 incidents
30 or more incidents
Major Airports
Interstates
US Highways
State Highways
Railroads
Data Source: ND Department of Emergency Services
Data Date: August 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, September 2010
BIG SKY HAZARD MANAGEMENT

Map 5.6.4B


EPA-Regulated Facilities
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
3
Towner
Cavalier
Pembina
3
N
Williams
2
Mountrail
1
Ward
2
McHenry
2
Pierce
1
Benson
1
Ramsey
1
Walsh
1
Spirit Lake
Nelson
Grand Forks
10
McKenzie
Fort Berthold
Eddy
McLean
3
Sheridan
1
Wells
Foster
Griggs
Steele
Traill
1
Dunn
Mercer
6
Golden Valley
Billings
Oliver
2
Burleigh
5
Kidder
Stutsman
4
Barnes
2
Cass
23
Stark
5
Morton
4
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
1
Richland
6
Bowman
1
Adams
Standing Rock
McIntosh
1
Dickey
1
Sargent
1
Lake Traverse
0
25
50
100
150
200
Miles
Number shown is the number of facilities reporting toxic releases. No number indicates zero.
Number of EPA-Regulated Facilities
Less than 15 facilities
15 - 29 facilities
30 - 49 facilities
50 - 99 facilities
100 or more facilities
Map Created By:
Pam Shrauger, September 2010
BIG SKY
HAZARD MANAGEMENT
Data Source: US Environmental Protection Agency
Data Date: September 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN

5.6.5 Vulnerabilities to Jurisdictions

The population impacts are often greater than the structural impacts during a hazardous material release. Depending on the material, the health impacts to humans can be long and short term. A hazardous material release could have a greater impact on those areas with higher population concentrations such as cities, special needs facilities, and businesses rather than more rural areas. In a hazardous material release, those in the immediate isolation area would have little to no warning, whereas, the population further away in the dispersion path may have some time to evacuate, depending on the weather conditions, material released, and public notification.

Vulnerabilities to public water supplies also threaten jurisdictions, and contamination could come from sources outside of North Dakota. Surface waters, such as rivers and reservoirs, and underground aquifers used as drinking water sources could each be threatened by releases from fixed facilities, pipelines, and transportation. A single incident that affects a regional water system could have an impact on many counties and cities.

Significant losses can also occur to the environment and other ecological values. Clean-up efforts may mitigate the effects, but some losses may occur. Sensitive habitats could be damaged or air and water quality reduced.

Table 5.6.5A shows the overall hazardous material release hazard by county. The county hazard ratings were determined based on the historical occurrence and transportation infrastructure. The transportation infrastructure rating as follows was then adjusted either up or down based on the historical occurrence, if necessary:

- High: Jurisdiction has a major airport, interstate, and railroad infrastructure.
- Moderate-High: Jurisdiction has a major airport or interstate and railroad infrastructure.
- Moderate: Jurisdiction has railroad infrastructure and US highways.
- Low-Moderate: Jurisdiction has railroad infrastructure or US highways.
- Low: Jurisdiction has only state highways.

Table 5.6.5A Hazardous Material Release Risk to Jurisdictions

County	Hazardous Material Release Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	Low-Moderate	C	
Barnes	Moderate	B	
Benson	Low-Moderate	NP	
Billings	High	C	
Bottineau	Moderate	B	
Bowman	Moderate	B	
Burke	Moderate	D	
Burleigh	Moderate-High	B	
Cass	High	B	

Table 5.6.5A Hazardous Material Release Risk to Jurisdictions (continued)

County	Hazardous Material Release Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Cavalier	Low	B	
Dickey	Low-Moderate	C	
Divide	Low-Moderate	NP	
Dunn	Low	C	
Eddy	Low-Moderate	C	
Emmons	Low-Moderate	C	
*Fort Berthold^*	*Low-Moderate*	*NP*	
Foster	Low-Moderate	B	
Golden Valley	Moderate	C	
Grand Forks	High	B	Billions of dollars in building exposure and tens of thousands of residents within 5 miles of the railroad main lines
Grant	Low	D	
Griggs	Low	C	
Hettinger	Low	C	
Kidder	Moderate	B	
*Lake Traverse^*	*Low*	*NP*	
LaMoure	Moderate	#10 of 12	
Logan	Low	B	
McHenry	Moderate	B	
McIntosh	Low	B	
McKenzie	Moderate-High	NP	
McLean	Moderate	B	
Mercer	Moderate-High	B	
Morton	Moderate-High	B	
Mountrail	Moderate	C	
Nelson	Low-Moderate	B	
Oliver	Low	B	
Pembina	Moderate-High	B	
Pierce	Low-Moderate	C	
Ramsey	Moderate	B	8,606 people within 5 miles of railroad main line; Up to millions of dollars in structure losses
Ransom	Low-Moderate	Medium	
Renville	Moderate	B	
Richland	Moderate-High	B	
Rolette	Low-Moderate	NP	
Sargent	Low	C	

Table 5.6.5A Hazardous Material Release Risk to Jurisdictions (continued)

County	Hazardous Material Release Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Sheridan	Low	NP	
Sioux	Low	NP	
Slope	Low	NP	
Spirit Lake	*Low*	*NP*	
*Standing Rock^*	*Low*	*NP*	
Stark	High	NP	
Steele	Low	NP	
Stutsman	Moderate-High	B	
Towner	Low-Moderate	B	
Traill	Moderate	B	
*Turtle Mountain^*	*Low*	*NP*	
Walsh	Moderate	B	
Ward	Moderate-High	B	
Wells	Moderate	C	
Williams	High	B	

NP = no local plan
^ includes only North Dakota parts of the reservation

5.6.6 Vulnerabilities of State-Owned Buildings and Property

Since hazardous material releases can occur virtually anywhere, all state-owned buildings and property are at risk. Fortunately, unless an explosion is present with the release, structures are typically not damaged in a hazardous materials release. Therefore, the risk to state-owned buildings and property is low, however, those facilities in close proximity to a fixed facility containing hazardous materials, an interstate, a pipeline, or a railroad are at an enhanced risk. North Dakota State Fire and Tornado Fund data indicates $11,609 in state-owned building insurance claims for explosions since 1989; all claims were in Stutsman County. (North Dakota State Fire and Tornado Fund, 2010)

5.6.7 Vulnerabilities of Critical Facilities and Infrastructure

Similar to state-owned buildings and property, critical facilities and infrastructure are at risk from hazardous material releases. Those in close proximity to hazardous fixed facilities and transportation, pipeline, or utility infrastructure are at greatest risk. Much of the vulnerability depends on specifically where a release occurs in proximity to the critical facilities and infrastructure. Should a hazardous material release affect one of the critical facilities, the level of emergency services available could be reduced. A release near a special needs facility may present unique evacuation challenges. Table 5.6.7A shows the explosion losses recorded by the North Dakota State Fire and Tornado Fund.

Table 5.6.7A Explosion Claims Paid on Critical Facilities Insured by the State since 1989

County	Local Government	University System	School Districts
North Dakota	*$128,228*	*$137,886*	*$28,260*
Benson	$0	$0	$279
Dickey	$2,472	$0	$0
Grand Forks	$0	$137,886	$0
Kidder	$0	$0	$831
Ramsey	$0	$0	$26,113
Stark	$0	$0	$292
Steele	$1,747	$0	$0
Walsh	$60,618	$0	$745
Ward	$10,575	$0	$0
Williams	$52,816	$0	$0

Source: North Dakota State Fire and Tornado Fund, 2010.

Most hazardous material releases do not usually have an effect on infrastructure, particularly underground infrastructure. Some critical infrastructure uses hazardous materials to operate such as chlorine for water treatment and PCBs for electric transformers. Similarly, contamination of the water supply may be treated like a hazardous material release. Propane and fuel oil, necessary fuels for heating, can also be hazardous if released during their delivery due to their explosive potential. Transportation may be limited if a key roadway or railway is blocked by an incident.

Table 5.6.7B shows the critical facilities and infrastructure summary for the counties with a high or moderate-high hazardous material release rating. See Section 4.2 for more details.

Table 5.6.7B Critical Facilities and Infrastructure in High and Moderate-High Hazardous Material Release Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Billings	CIKR Facilities: Low-Moderate (5-9 facilities) Interstate and Railroad Transportation Infrastructure
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College

Table 5.6.7B Critical Facilities and Infrastructure in High and Moderate-High Hazardous Material Release Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Burleigh (continued)	Rasmussen College – Bismarck United Tribes Technical College University of Mary Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota Grand Forks Airport Interstate and Railroad Transportation Infrastructure
McKenzie*	CIKR Facilities: Moderate (10-14 facilities)
Mercer*	CIKR Facilities: Moderate (10-14 facilities) Great Plains Synfuels Plant Antelope Valley Power Plant Coyote Power Plant Garrison Hydroelectric Power Plant Leland Olds Power Plant Stanton Power Plant
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure

Table 5.6.7B Critical Facilities and Infrastructure in High and Moderate-High Hazardous Material Release Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Pembina	CIKR Facilities: Moderate (10-14 facilities) Neche Oil Import Site Interstate and Railroad Transportation Infrastructure
Richland*	CIKR Facilities: Moderate-High (15-24 facilities) $10.8 million in National Guard Assets North Dakota State College of Science Interstate and Railroad Transportation Infrastructure
Stark	CIKR Facilities: Moderate-High (15-24 facilities) Dickinson State University Dickinson Airport Interstate and Railroad Transportation Infrastructure
Stutsman	CIKR Facilities: Moderate-High (15-24 facilities) $117.4 million in Local Government Facilities Jamestown College North Dakota State Hospital Jamestown Airport Interstate and Railroad Transportation Infrastructure
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport
Williams	CIKR Facilities: Moderate-High (15-24 facilities) $129.3 million in Local Government Facilities Williston State College Williston Airport

* includes at least part of the reservation

5.6.8 Vulnerabilities to New and Future Development

North Dakota, particularly the western part of the state, is rich in natural resources; the development of industries related to the natural resources continues and will likely increase with recent oil discoveries. Projections estimate an oil well on every section within the oil fields served by the Bakken, Three Forks, and Sanish Formations over the next six years. New pipelines associated with the recent energy developments in the state and region are being constructed and are likely in the future.

New development may increase the number of people and facilities exposed to hazardous material releases. These industries are regulated for air and water emissions, but unless local ordinances prohibit

or regulate such development, the potential for hazardous material releases could increase through future development. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties.

5.6.9 Data Limitations and Other Key Documents

Understanding when, where, and what substances are mostly likely to be released in a hazardous materials incident is the greatest limitation in analyzing this hazard. Hazardous substances pass through North Dakota daily without incident. With so many possibilities and sources for hazardous materials releases in the state, fully describing how a release may occur and what areas would be affected is not possible. A study of the number and types of hazardous materials using the highways and railroads in the state would improve this profile, as would GIS mapping of the pipelines traversing the state. The various hazardous materials response teams in North Dakota, the state fire marshal, and the local fire departments could provide more details on specific types of materials and probable scenarios.

Other key documents related to the Hazardous Material Release hazard include:

- North Dakota Emergency Operations Plan, Hazardous Materials Annex

5.7 Homeland Security Incident

5.7.1 Characteristics

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

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

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

Bioterrorism is the use of biological agents, such as Anthrax, Ricin, and Smallpox, to infect the population, plants, or animals with disease. The impacts of bioterrorism could be similar to those discussed in the Communicable Disease Hazard Profile, Section 5.1, with the primary exception that the infection of the population was intentionally caused.

Radiological/nuclear terrorism involves the use of radiological dispersal devices, nuclear weapons, or nuclear facilities to attack the population. Exposure to radiation can cause radiation sickness, long-term illness, and even death. Terrorism experts fear the use of explosive and radiological devices in the form of a "dirty bomb" to attack the population. A "dirty bomb" is a low-tech, easily assembled and transported device made up of simple explosives combined with a suitable radioactive agent. As with chemical and biological events, radiological incidents present contamination challenges for first responders. North Dakota is also home to United States intercontinental ballistic missiles located in silos around Minot Air Force Base. (Wikipedia, 2010b) These missiles contain nuclear material and could be

hazardous if accidentally or intentionally damaged or tampered; however, these systems contain a very high level of security and protection by the US Air Force.

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

Civil unrest and violence typically occur on a smaller scale than terrorism when large groups, organizations, or distraught individuals take action with potentially disastrous or disruptive results. Civil unrest can result following a disaster that creates panic in the community. Forms of civil unrest can range from groups blocking sidewalks, roadways, and buildings to mobs rioting and looting to gang activity. Civil unrest may be spontaneous, as when a mob erupts into violence, or they may be planned, as when a demonstration or protest intentionally interferes with another individual's or group's lawful business. Other forms of violence that threaten communities across the country include irrational individuals killing others in schools, workplaces, and essentially anywhere. These types of incidents typically do not escalate to the traditional definition of a disaster, but can have significant impacts on the community and require additional resources to manage.

Most times, homeland security incidents, both domestic and international, are driven by a terrorist group or hate organization. Occasionally, individuals, as was the case in the Oklahoma City bombing, perform independent acts. Usually, the perpetrators have an underlying belief that drives the act. Table 5.7.1A lists several, but not all, types of organizations existing in the United States that could initiate a homeland security incident. According to the Southern Poverty Law Center Intelligence Project, a White Nationalist group, the Frontline Aryans, have an active cell in Minot. (Southern Poverty Law Center, 2010)

Table 5.7.1A Types of Domestic Hate and Terrorist Organizations and Movements

Type	Description
Anti-Gay	These groups go beyond mere disagreement with homosexuality by subjecting gays and lesbians to campaigns of personal vilification.
Anti-Immigrant	These groups generally attack immigrants as individuals, rather than merely disagreeing with immigration policy. Some have close ties to white supremacist ideas, groups, and individuals.
Black Separatists	They typically oppose integration and racial intermarriage, and they want separate institutions, or even a separate nation, for blacks. Most forms of black separatism are strongly anti-white and anti-Semitic.
Christian Identity	This religion asserts that whites, not Jews, are the true Israelites favored by God in the Bible. For decades, Identity has been one of the most influential ideologies for the white supremacist movement.
Ecoterrorism	These groups aim to end the exploitation of animals and the destruction of the environment, typically by causing damage to the operations of companies in related industries or terrorizing executives and employees of these and associated companies.

Table 5.7.1A Types of Domestic Hate and Terrorist Organizations and Movements (continued)

Type	Description
General Hate	These groups espouse a variety of hateful doctrines, and this type generally captures those groups not included in another category.
Holocaust Denial	These groups insist that Nazi Germany did not engage in a conscious attempt to commit genocide against European Jews.
Ku Klux Klan	This organization, with its long history of violence, is the most infamous, and oldest, American hate group. Although black Americans have typically been the Klan's primary target, it has also attacked Jews, immigrants, homosexuals, and, until recently, Catholics.
Militia	This movement consists of right-wing extremist, armed, paramilitary groups with an anti-government, conspiracy-oriented ideology, often with a prominent focus on firearms.
Neo-Confederate	Many groups celebrate traditional Southern culture and the Civil War's dramatic conflict between the Union and the Confederacy, but some groups go further and embrace racist attitudes towards blacks, and in some cases, white separatism.
Neo-Nazi	These groups share a hatred for Jews and a love for Adolf Hitler and Nazi Germany. While they also hate other minorities, homosexuals, and even sometimes Christians, they perceive "the Jew" as their cardinal enemy, and trace social problems to a Jewish conspiracy that supposedly controls governments, financial institutions, and the media.
Racist Music	These groups are typically white power music labels that record, publish, and distribute racist music in a variety of genres.
Racist Skinhead	These groups form a particularly violent element of the white supremacist movement. Racist Skinheads often operate in small "crews" that move from city to city with some regularity.
Racist Traditionalist Catholic	These organizations embrace anti-Semitism and the theology is typically rejected by the Vatican and mainstream Catholics in general.
Sovereign Citizen	These groups embrace anti-government ideologies and some have white supremacist elements. They often believe that all existing government in the United States is illegitimate and seek to restore an idealized, minimalist government that never actually existed.
Tax Protest	These anti-government groups believe that income taxes are illegitimate and often engage in tax evasion activities and sometimes violence.
White Nationalist	These groups espouse white supremacist or white separatist ideologies, often focusing on the alleged inferiority of non-whites.

Sources: Southern Poverty Law Center, 2010; Anti-Defamation League, 2010.

More specific to North Dakota is the Little Shell Pembina Band. Law enforcement officers and public officials around the country are encountering members of a new and active anti-government extremist group that calls itself the "Little Shell Pembina Band of North America." Members of the group claim that they belong to a "sovereign" Native American tribe and therefore are not subject to laws and regulations; in reality, the "Little Shell Pembina Band" is part of the anti-government "sovereign citizen"

movement. Its members' activities range from driving with unlawful license plates to perpetrating insurance fraud schemes to tax evasion. The group is primarily based in North Dakota and Washington, but members can be found across the nation. The group has split into two competing factions, but each use the same name. (North Dakota Department of Emergency Services, 2007d; Anti-Defamation League, 2010)

An important factor in the consideration of homeland security incidents both locally and nationally is the sparsely populated international border with Canada along North Dakota's northern boundary. Individuals linked to terrorist organizations have been known to attempt entry into the country through such areas, and North Dakota is not immune to these risks and threats.

The only limitations of homeland security incidents are the human imagination and motivations, therefore, any hazard that can be "created" can be the result of terrorism or civil unrest. For example, terrorists can compromise a dam, leading to catastrophic dam failure. Other hazards that people can initiate given the appropriate materials and motivation include communicable disease, transportation accidents, hazardous material releases, utility or communications failures, and wildland fires; all can be intentionally triggered.

5.7.2 History

North Dakota is not immune to homeland security incidents. In many cases, past threats that have been thwarted are not publicly distributed, however, examples of relatively minor incidents that have occurred in North Dakota include:

February 13, 1983 - Federal law enforcement officers went to Medina, to arrest Gordon Kahl on a Texas warrant. Kahl farmed in Heaton, north of Medina. He was a decorated war veteran and a tax protester who had served time for refusing to pay his taxes. The warrant accused him of violating his probation. On the morning of February 13, Gordon Kahl, his wife, Joan, his son Yorie Kahl, and two friends David Broer and Scott Faul, gathered at Dr. Clarence Martin's clinic in Medina to talk right-wing politics. After the meeting, Kahl's group headed north out of Medina, toward home. They met a roadblock. Gordon and Yorie Kahl, Faul, and Broer got out of their cars. There was a brief verbal confrontation and gunfire erupted. Marshal Kenneth Muir and Deputy Marshal Robert Cheshire died. Two additional law enforcement officers and Yorie Kahl were hurt. Gordon Kahl vanished. Authorities caught up with him in June of 1983 near Smithville, Arkansas, where he died in a shootout and fire. Yorie Kahl and Faul are serving life sentences in the murders.

January 22, 1995 - A lone vandal cut 19 underground telephone cables at five Fargo locations. The sabotage disrupted service to more than 20,000 US West customers in Fargo and northwestern Minnesota for several days. Damage was estimated at $1 million. Fargo police traced the vandalism to Michael Damron, then a 31-year-old North Dakota State University electrical engineering student. On January 24, Damron fled Fargo after refusing to let police search his apartment. A search later turned up the gas-powered saw Damron used to cut the lines, a notebook listing plans for the sabotage, a map marked with the sites of the cut lines, and a list of possible getaways, including "motorized hang glider, dirt bike, golf cart, scuba-diving equipment." Damron remained at large for nearly two years before FBI

agents caught him in Iowa. His bail was set at $1 million when he returned to Fargo. Damron was sentenced to 10 years in prison in 1997 after he plead guilty to cutting the phone lines and to possessing stolen electronic equipment.

January 2005 - Twenty-nine-year-old Chad Reinhardt was hired by Farstad Oil Company in Minot in 2004 as a warehouse worker. Reinhardt is believed to have set fire to the warehouse to try to destroy evidence in an investigation into whether he made improper charges on a corporate credit card. Reinhardt pleaded guilty to arson and burglary in May of 2005. The Farstad Oil Company had to move its staff and warehouse. Reinhardt was sentenced to nine years in prison for starting the fire that caused millions of dollars in damages.

August 19, 2005 – A police officer was shot and two public buildings were set on fire in Cavalier when police officers attempted to serve a restraining order to a North Dakota farmer. James Thorlakson, a Hensel farmer fled after shooting Cavalier Police Chief Ken Wolf and setting the Pembina County courthouse and law enforcement center on fire. The drama started at approximately 4 p.m. when county officers attempted to serve Thorlakson with a protection order. He reportedly was armed and refused to be served. He then fired on officers and escaped. The firefighters said the blazes were started with cans of gasoline thrown through glass doors into the entryways of the two buildings. The law enforcement center suffered minor damage and the prisoners had to be relocated. A standoff lasted for several hours before he was captured. The Grand Forks SWAT team and at least one helicopter assisted during the operation. Cavalier residents and businesses were told to lock their doors and stay inside. Road blocks were set up around the courthouse and in two rural areas, including Thorlakson's home. Thorlakson was captured at about 10:45 p.m.

Source: North Dakota Department of Emergency Services, 2007d.

Within North Dakota, recent hate incident as reported by the Southern Poverty Law Center include:

April-May 2008 - A Jewish student at the University of North Dakota was harassed by a group of student using racial slurs and obscenities. Five swastikas in four months were drawn on a building on campus.

October 2004 – A mosque was vandalized in Fargo.

Source: Southern Poverty Law Center, 2010.

In 1933, a violent strike erupted at the new North Dakota Capitol construction site and required help from the North Dakota National Guard. (State Historical Society of North Dakota, 2007)

On a broader scale, significant terrorist acts occurring in the United States since 1950 include:

January 27-29, 1975 – In New York City, a bomb at a Wall Street bar killed 4 and injured 60. Two days later, a bomb exploded in a US Department of State bathroom. A domestic terrorist organization claimed responsibility.

August 3, 1977 – Two bombs were left at offices in New York City, killing one person and injuring eight; one building housed US Department of Defense personnel. The bombs were planted by members of the Armed Forces of National Liberation (FALN), a Puerto Rican pro-independence organization.

February 26, 1993 – A bombing in the parking area of the World Trade Center killed 6 and wounded about 1,000. The bombing was organized by the foreign terrorist organization, Al Qaeda.

April 19, 1995 – Domestic terrorist Timothy McVeigh blew up the Alfred P. Murrah Federal Building in Oklahoma City, killing 168 people and injuring hundreds more.

September 11, 2001 – Four commercial planes hijacked by 19 members of the Al Qaeda terrorist organization were intentionally crashed into buildings; two planes hit the World Trade Center buildings in New York City, one into the Pentagon outside Washington, DC, and one into a field in Pennsylvania after passengers stormed the cockpit. Nearly 3,000 people were killed.

October 2001 – Letters containing the deadly anthrax bacterium were mailed to members of Congress and television networks. One person died. The perpetrator was believed to be a United States Army Medical Research Institute of Infectious Diseases researcher.

Source: National Memorial Institute for the Prevention of Terrorism, 2007.

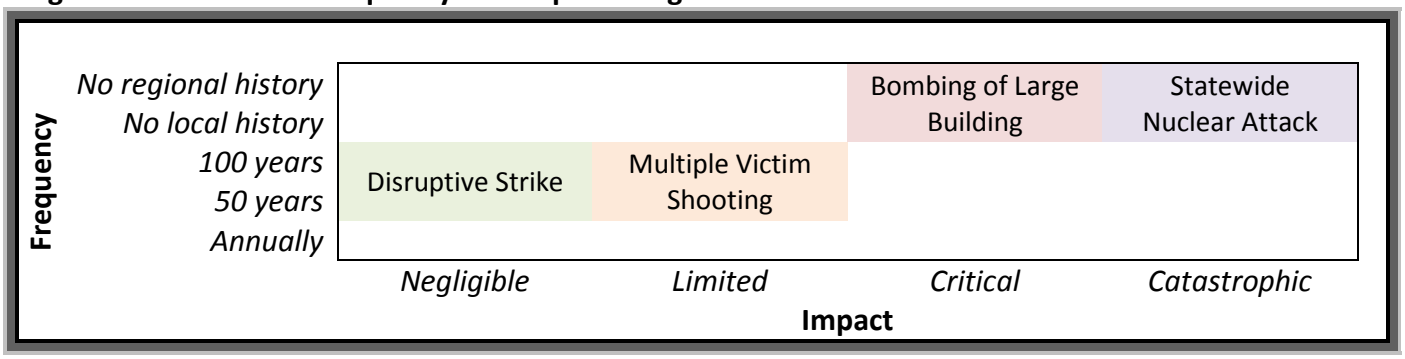
Table 5.7.2A North Dakota Homeland Security Declared Disasters and Emergencies

Declaration	Location	Date	Other Information	Casualties	Damages
None					

5.7.3 Probability and Magnitude

Figure 5.7.3A is a graphical representation of the range of events that can occur within the homeland security incident hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the homeland security incident hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.7.3A Hazard Frequency and Impact Ranges



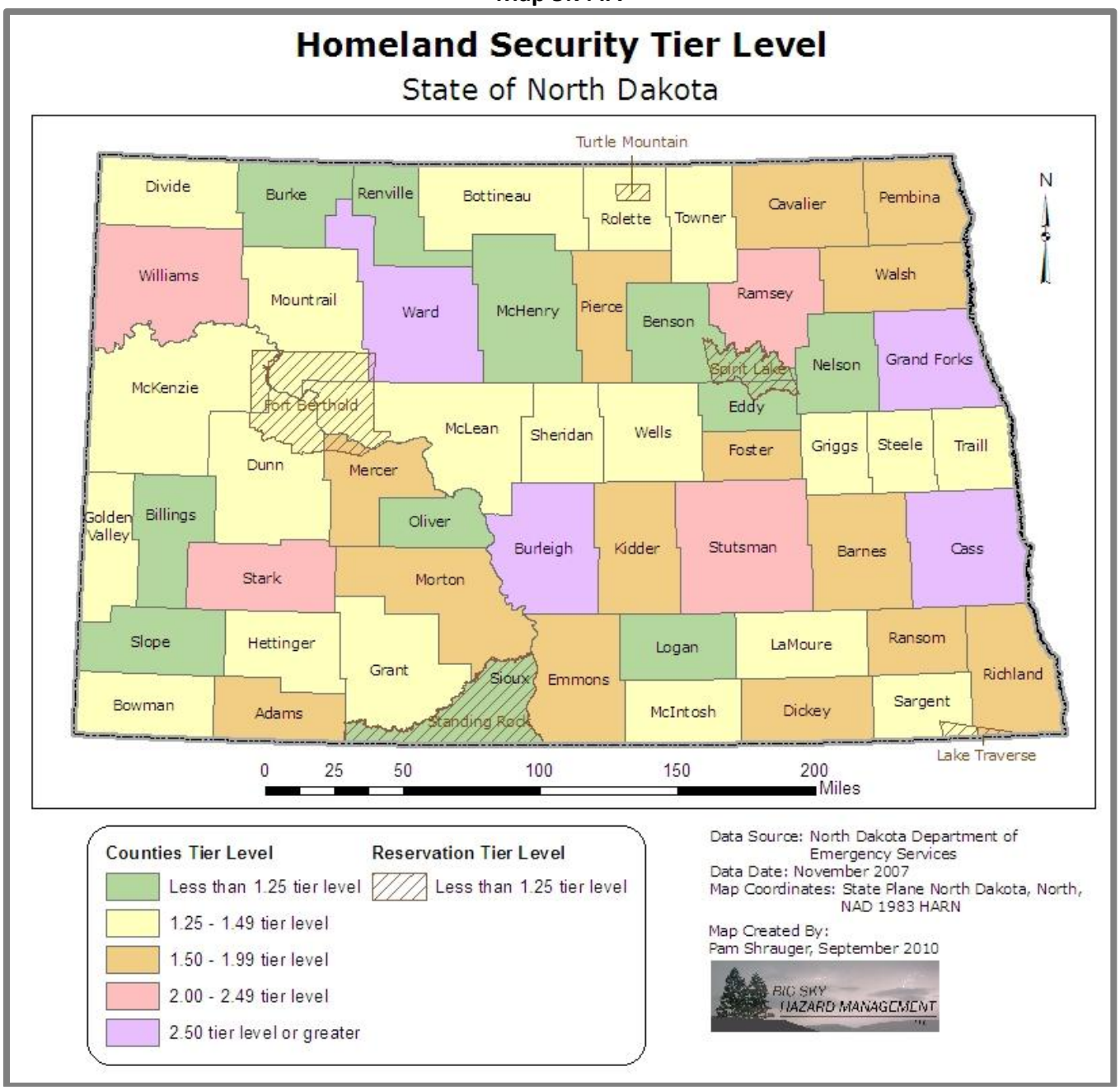
The probability of a homeland security incident affecting North Dakota directly is difficult to determine. Nothing in the state is considered a specific terrorist target, nor is it an area at high risk for civil unrest; however, the missiles, military presence, and energy facilities make parts of the state possible targets. As with any area, a shooting by a disgruntled employee or student is also possible. A large scale attack cannot be ruled out, and therefore, a small probability exists. Of greater probability is a terrorist attack that has an indirect effect on the state through its economy. The September 11th terrorist attacks in New York, Washington, and Pennsylvania had a significant impact on the national economy and required the activation of many local and state resources. Another attack could have a similar effect. Such an attack in another part of the country has a greater probability than a direct attack within North Dakota, but even the probability of such an attack elsewhere is unknown and is the subject of much debate.

An attack on the United States that collapses the national economy, agricultural economy, or requires warfare and the drafting of soldiers is considered a high magnitude event. On a smaller but very significant scale would be an attack on a facility such as a school or business involving shooters, homemade bombs, or the taking of hostages. Schools and universities across the country have struggled with similar events, and therefore, such an incident is possible anywhere in North Dakota.

5.7.4 Mapping

In 2002, each county and tribe conducted a homeland security risk assessment, including the threat, vulnerability, and an optional agricultural vulnerability assessment for their jurisdiction. The jurisdictional working groups were able to use planning factors to provide a numerical focus for homeland security scenarios. Shortfalls or gaps discovered during the assessment process target specific resources required to respond to homeland security incidents. These “tiers” measure the ability of the county or tribe to respond to a homeland security incident. The assumption is that those jurisdictions with a higher ability to respond are also at higher risk due to a larger population base and more commercial and industrial values at risk. This assumption may not be entirely accurate, but is the best basis available for the jurisdictional ratings. Following a review of the information in 2010, the determination was that the information for the purposes of this plan is still accurate. Map 5.7.4A shows the tier levels for each jurisdiction.

Map 5.7.4A


Homeland Security Tier Level
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Counties Tier Level
Less than 1.25 tier level
1.25 - 1.49 tier level
1.50 - 1.99 tier level
2.00 - 2.49 tier level
2.50 tier level or greater
Reservation Tier Level
Less than 1.25 tier level
Data Source: North Dakota Department of Emergency Services
Data Date: November 2007
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, September 2010
BIG SKY HAZARD MANAGEMENT

5.7.5 Vulnerabilities to Jurisdictions

The effects of homeland security incidents are usually felt by the population. During attacks and times of unrest, the greatest risk is to human lives. Terrorists typically try to make a dramatic statement that will generate media interest. Attacking the population through a large loss of life is a common tactic. Depending on the type of attack, casualties could be light or encompass much of an urban population.

Terrorist attacks generally have a damaging effect the economy. Any time the public's safety is compromised, more people stay home until they are more confident in their safety. Therefore, depending on the type of attack and remaining threat, the tourism and travel industries may be affected. Additionally, attacks on the national informational or financial infrastructure could lead to significant declines in the national economy. Specific to North Dakota, attacks on agriculture could lead to substantial direct losses in the state. Attacks in the United States, like the September 11, 2001 attacks, would likely have a damaging effect on the national economy.

Ecological values could be harmed if a damaging chemical, biological, or radioactive agent is used. Additionally, social values can be affected with any sort of homeland security incident, particularly one that occurs locally. Community members may not feel safe and may have lasting emotional impacts.

The homeland security "tiers" described and mapped in Section 5.7.4 are the basis for the homeland security incident hazard ratings by jurisdiction in Table 5.7.5A.

Table 5.7.5A Homeland Security Incident Risk to Jurisdictions

County	Homeland Security Incident Hazard	Hazard Rating in Local/Tribal Plan*	Additional Information from Local/Tribal Plan
Adams	Moderate	D/D	
Barnes	Moderate	C	
Benson	Low	NP	
Billings	Low	D/D	
Bottineau	Low-Moderate	C	
Bowman	Low-Moderate	C/D	
Burke	Low	C/C	
Burleigh	High	B/B	
Cass	High	B/C/D	
Cavalier	Moderate	D/C	
Dickey	Moderate	D/C	
Divide	Low-Moderate	NP	
Dunn	Low-Moderate	D/C	
Eddy	Low	D/C	
Emmons	Moderate	D/C	
*Fort Berthold^*	*Low-Moderate*	*NP*	
Foster	Moderate	C	

Table 5.7.5A Homeland Security Incident Risk to Jurisdictions (continued)

County	Homeland Security Incident Hazard	Hazard Rating in Local/Tribal Plan*	Additional Information from Local/Tribal Plan
Golden Valley	Low-Moderate	C/D	
Grand Forks	High	D	
Grant	Low-Moderate	C/D	
Griggs	Low-Moderate	D/C	
Hettinger	Low-Moderate	C	
Kidder	Moderate	D/B	
*Lake Traverse^*	*Low-Moderate*	*NP*	
LaMoure	Low-Moderate	#12 of 12	
Logan	Low	C	
McHenry	Low	C	
McIntosh	Low-Moderate	C/C	
McKenzie	Low-Moderate	NP	
McLean	Low-Moderate	B	
Mercer	Moderate	C/D	
Morton	Moderate	C/D	
Mountrail	Low-Moderate	C/B	
Nelson	Low	C	
Oliver	Low	C/D	
Pembina	Moderate	C	
Pierce	Moderate	D/C	
Ramsey	Moderate-High	D	
Ransom	Moderate	Medium	
Renville	Low	C	
Richland	Moderate	C/B	
Rolette	Low-Moderate	NP	
Sargent	Low-Moderate	C/D	
Sheridan	Low-Moderate	NP	
Sioux	Low	NP	
Slope	Low	NP	
Spirit Lake	*Low*	*NP*	
*Standing Rock^*	*Low*	*NP*	
Stark	Moderate-High	NP	
Steele	Low-Moderate	NP	
Stutsman	Moderate-High	C	
Towner	Low-Moderate	C	
Traill	Low-Moderate	C	
*Turtle Mountain^*	*Low-Moderate*	*NP*	
Walsh	Moderate	C	

Table 5.7.5A Homeland Security Incident Risk to Jurisdictions (continued)

County	Homeland Security Incident Hazard	Hazard Rating in Local/Tribal Plan*	Additional Information from Local/Tribal Plan
Ward	High	B/C	
Wells	Low-Moderate	D/D	
Williams	Moderate-High	D/D	

NP = no local plan
* Many of the local plans have both a civil disorder/terrorism hazard and a national security hazard. Both classifications are listed respectively.
^ includes only North Dakota parts of the reservation

5.7.6 Vulnerabilities of State-Owned Buildings and Property

State-owned buildings and property are at risk from homeland security incidents. Government facilities can become targets if an individual or group disagrees with actions they associate with the facility. Certainly, some state-owned buildings and property may be more vulnerable to incidents than others due to the activities performed at the facility or the level of security at the building. Table 4.1A and Map 4.1C in the State-Owned Buildings and Property section shows the insured values of state-owned buildings and property by county. The North Dakota State Fire and Tornado Fund maintains records of insurance claims paid for a variety of reasons. Although none are directly related to a homeland security incident, Table 5.7.6A shows the losses to state-owned buildings and property from vandalism and theft.

Table 5.7.6A State-Owned Building and Property Insurance Claims Paid for Vandalism and Theft since 1989

County	Amount Paid
North Dakota	*$85,290*
Barnes	$2,206
Bottineau	$5,398
Burleigh	$53,089
Grand Forks	$2,828
Morton	$8,306
Ramsey	$939
Stutsman	$11,319
Ward	$1,205

Source: North Dakota State Fire and Tornado Fund, 2010.

5.7.7 Vulnerabilities of Critical Facilities and Infrastructure

Critical facilities and infrastructure play prominent roles in North Dakota. Often, terrorists target facilities that are highly important for government services and community stability. Threat data is not specific enough to identify what facilities are most vulnerable, therefore, all critical facilities and infrastructure are considered to have some risk. Given the rural nature of the state, a major terrorist attack making a direct impact in North Dakota is not expected, however, it could happen. Perhaps the

greatest threat to the communities is a disgruntled student, employee, or resident threatening others with violence. The extreme example of a bomb, depending on its size, could cause structural losses to critical facilities or infrastructure. Table 5.7.7A shows the losses paid for vandalism and theft at critical facilities.

Table 5.7.7A Vandalism and Theft Claims Paid on Critical Facilities Insured by the State since 1989

County	Local Government	Adjutant General	University System	School Districts	Total
North Dakota	*$277,189*	*$0*	*$201,897*	*$1,090,459*	*$1,569,545*
Adams	$0	$0	$0	$2,394	$2,394
Barnes	$9,695	$0	$3,474	$11,859	$25,028
Benson	$2,126	$0	$0	$7,351	$9,477
Billings	$0	$0	$0	$400	$400
Bottineau	$7,948	$0	$45	$6,613	$14,606
Bowman	$1,700	$0	$0	$684	$2,384
Burke	$0	$0	$0	$0	$0
Burleigh	$15,736	$0	$12,077	$115,250	$143,063
Cass	$34,900	$0	$83,516	$21,329	$139,745
Cavalier	$110	$0	$0	$1,676	$1,786
Dickey	$231	$0	$0	$6,835	$7,066
Divide	$423	$0	$0	$748	$1,171
Dunn	$619	$0	$0	$5,960	$6,579
Eddy	$4,390	$0	$0	$11,544	$15,934
Emmons	$2,527	$0	$0	$10,068	$12,595
Foster	$1,127	$0	$0	$12,824	$13,951
Golden Valley	$0	$0	$0	$30,984	$30,984
Grand Forks	$12,607	$0	$84,081	$24,873	$121,561
Grant	$8,636	$0	$0	$11,527	$20,163
Griggs	$4,511	$0	$0	$0	$4,511
Hettinger	$579	$0	$0	$0	$579
Kidder	$866	$0	$0	$7,765	$8,631
LaMoure	$2,468	$0	$0	$10,272	$12,740
Logan	$0	$0	$0	$3,023	$3,023
McHenry	$1,772	$0	$0	$37,043	$38,815
McIntosh	$0	$0	$0	$17,590	$17,590
McKenzie	$6,008	$0	$0	$18,192	$24,200
McLean	$5,492	$0	$0	$16,343	$21,835
Mercer	$14,391	$0	$0	$187,521	$201,912
Morton	$3,404	$0	$0	$33,604	$37,008
Mountrail	$5,186	$0	$0	$43,781	$48,967
Nelson	$7,899	$0	$0	$427	$8,326
Oliver	$5,873	$0	$0	$1,846	$7,719

Table 5.7.7A Vandalism and Theft Claims Paid on Critical Facilities Insured by the State since 1989 (continued)

County	Local Government	Adjutant General	University System	School Districts	Total
Pembina	$8,188	$0	$0	$11,359	$19,547
Pierce	$0	$0	$0	$2,080	$2,080
Ramsey	$1,730	$0	$8,394	$8,093	$18,217
Ransom	$5,139	$0	$0	$7,799	$12,938
Renville	$0	$0	$0	$12,700	$12,700
Richland	$9,557	$0	$5,549	$43,296	$58,402
Rolette	$4,415	$0	$0	$73,355	$77,770
Sargent	$576	$0	$0	$7,267	$7,843
Sheridan	$286	$0	$0	$281	$567
Sioux	$7,558	$0	$0	$14,921	$22,479
Slope	$0	$0	$0	$692	$692
Stark	$21,203	$0	$734	$47,642	$69,579
Steele	$680	$0	$0	$573	$1,253
Stutsman	$19,952	$0	$0	$13,299	$33,251
Towner	$667	$0	$0	$5,784	$6,451
Traill	$2,069	$0	$0	$5,155	$7,224
Walsh	$9,032	$0	$0	$62,629	$71,661
Ward	$20,025	$0	$4,027	$29,510	$53,562
Wells	$264	$0	$0	$8,514	$8,778
Williams	$4,624	$0	$0	$75,184	$79,808

Source: North Dakota State Fire and Tornado Fund, 2010.

Homeland security officials emphasize that potential targets include our nation's delicate infrastructure. The state does have missile sites, large electric and natural gas production facilities, major electric transmission lines, hydroelectric dams, and pipelines at risk. Should an attack occur, parts of North Dakota could lose electricity, telephone, or internet services. More localized incidents could disrupt water or sewer services. Other attacks could limit fuel, natural gas, or propane supplies and affect transportation and heating capabilities.

Table 5.7.7B shows the critical facilities and infrastructure summary for the counties with a high or moderate-high homeland security incident rating. See Section 4.2 for more details.

Table 5.7.7B Critical Facilities and Infrastructure in High and Moderate-High Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck United Tribes Technical College University of Mary Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota Grand Forks Airport Interstate and Railroad Transportation Infrastructure
Ramsey*	CIKR Facilities: Moderate (10-14 facilities) $62.7 million in National Guard Assets Camp Grafton Lake Region State College Devils Lake Airport

Table 5.7.7B Critical Facilities and Infrastructure in High and Moderate-High Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Stark	CIKR Facilities: Moderate-High (15-24 facilities) Dickinson State University Dickinson Airport Interstate and Railroad Transportation Infrastructure
Stutsman	CIKR Facilities: Moderate-High (15-24 facilities) $117.4 million in Local Government Facilities Jamestown College North Dakota State Hospital Jamestown Airport Interstate and Railroad Transportation Infrastructure
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport

* includes at least part of the reservation

5.7.8 Vulnerabilities to New and Future Development

Development should have little to no impact on the homeland security incident hazard, except for the increase in population and the associated increase in the potential for life and property losses should an event occur. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties. Some industries, such as nuclear technologies, are carefully regulated to protect the infrastructure, however, others are not, and losses are possible if the privately or publicly owned facilities and infrastructure are not adequately protected.

5.7.9 Data Limitations and Other Key Documents

Since homeland security incidents are such isolated events and little history exists on the effects to North Dakota, the probability and vulnerabilities are difficult to quantify. Therefore, generalities were made to estimate the potential losses. Given the uncertain nature of this hazard, facility managers and private individuals can only be encouraged to identify their security weaknesses and address them internally.

Other key documents related to the Homeland Security Incident hazard include:

- North Dakota Emergency Operations Plan, Terrorism Annex

5.8 Shortage or Outage of Critical Materials or Infrastructure

5.8.1 Characteristics

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

The disruption of the critical material supply system, whether caused by natural or human-caused disasters, global conflict, or embargoes, could severely diminish existing supplies, thereby threatening the immediate and long term health, safety, and well-being of North Dakota citizens.

Examples of shortages or outages of critical material or infrastructure include:

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

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

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

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

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

5.8.2 History

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% of motor gasoline and 4% 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 and prepared to activate the State Emergency Operations Plan, which would have allowed them to exercise control over existing supplies, making sure the needs of all citizens were addressed. 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. State officials monitored the situation and were prepared to activate the State Emergency Operations Plan to exercise

controls over phosphate supplies. Much the same as during the anti-freeze shortage, specific actions were not required, but State Agriculture Department officials monitored distribution of farm fertilizers to ensure adequate supplies. Agriculture officials monitor fertilizer supplies on a yearly basis to ensure that timely actions are implemented to avert a shortage.

2009-2010 Winter Electric Outages – Two devastating storms caused severe and prolonged electric outages in rural areas. One cooperative, Mor-Gran-Sou Electric, headquartered in Flasher, lost over 500 miles of line with over 10,000 downed poles. Some customers were out of power for nearly one month. (North Dakota Association of Rural Electric Cooperatives, 2010)

Table 5.8.2A North Dakota Shortage or Outage of Critical Materials or Infrastructure Declared Disasters and Emergencies

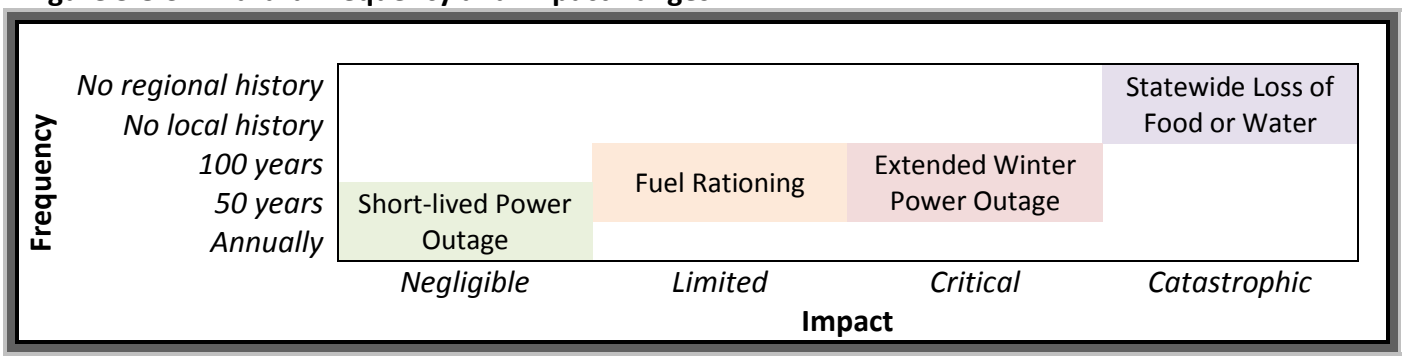
Declaration	Location	Date	Magnitude	Casualties	Damages
State EO	North Dakota	1998	State Declared Critical Shortage of Livestock Feed	Unknown	Unknown

Source: North Dakota Department of Emergency Services, 2007e.

5.8.3 Probability and Magnitude

Figure 5.8.3A is a graphical representation of the range of events that can occur within the shortage or outage of critical materials or infrastructure hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the shortage or outage of critical materials or infrastructure hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.8.3A Hazard Frequency and Impact Ranges



Power outages of some magnitude are an annual event in most all areas. The probability of a more widespread, prolonged event is less certain but is more frequent 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.

Possibly the most significant outage scenario for North Dakota is the loss of electricity for a week or more during a particularly cold winter spell. Without generators, an extended power outage could additionally lead to the loss of running water, sewer services, and the ability to heat buildings. Any equipment such as medical equipment, computers, and cell phones requiring power to run would eventually be incapacitated. Those facilities with generators would still be able to use appliances, equipment, and heating systems, however, community water and sewer services may not be available. Such a long term outage could lead to emergency sheltering and necessitate the activation of other emergency resources. Fuel and other material shortages would primarily affect the economy.

5.8.4 Mapping

Essentially all jurisdictions rely on critical materials and infrastructure in some fashion. Table 4.2H and Map 4.2J in the Critical Facilities and Infrastructure Section show the dependence of the counties on the various home heating fuels and Map 4.3C shows the population at risk. Mapping of utility and communications infrastructure is maintained by the individual services providers. The North Dakota Public Service Commission maintains lists of providers of public utilities in the state for electricity, natural gas, and telecommunications.

5.8.5 Vulnerabilities to Jurisdictions

Over the past 100 years, the population has become more dependent on the nation's infrastructure. Heat, running water, sanitation, communications, grocery stores, and pharmacies all require electricity, and without these services in the long term, the population may suffer. Propane, natural gas, fuel oil, and electricity are critical for heat, especially during the cold winter months. Approximately, 111,000 people in North Dakota rely on natural gas for heat, 40,000 rely on propane, 74,000 rely on electric heat, and 24,000 rely on fuel oil/kerosene (see Section 4.2). Personal and commercial food supplies may spoil during extended power outages. Telephone services are needed to call 911 for emergency assistance. Water is needed for cooking, cleaning, and drinking, and sewer is needed for sanitation. Grocery stores are the most common means of distributing the nation's food supply and pharmacies deliver medications. Each is important for health and safety. Without these services, emergency resources may be needed. Emergency supplies can often hold the populations over temporarily but may take some time before arriving, in which case, individuals may need to rely on their own personal supplies.

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.

Social values such as going from one place to another could be disrupted by a fuel shortage or transportation closure. Other social events may be cancelled due to the reliance on the utility services.

Otherwise, ecological and historical values would remain unaffected. The ratings provided in Table 5.8.5A reflect the population at risk, and therefore, the number of people that would be affected should a shortage or outage occur. The ratings are "low" for populations less than 3,000, "low-moderate" for populations of 3,001 to 7,000, "moderate" for populations of 7,001 to 14,000, "moderate-high" for populations of 14,001 to 25,000, and "high" for populations of greater than 25,000. Determining the probability that a shortage or outage will occur in a given area is not practical or feasible.

Table 5.8.5A Shortage or Outage of Critical Materials or Infrastructure Risk to Jurisdictions

County	Shortage or Outage of Critical Materials or Infrastructure Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	Low	C	
Barnes	Moderate	B	
Benson	Low-Moderate	NP	
Billings	Low	D	
Bottineau	Moderate	D	
Bowman	Low-Moderate	B	
Burke	Low	C	
Burleigh	High	B	
Cass	High	C	
Cavalier	Low-Moderate	D	
Dickey	Low-Moderate	B	
Divide	Low	NP	
Dunn	Low-Moderate	D	
Eddy	Low	D	
Emmons	Low-Moderate	B	
*Fort Berthold^*	*Low-Moderate*	*NP*	
Foster	Low-Moderate	D	
Golden Valley	Low	C	
Grand Forks	High	B	
Grant	Low	C	
Griggs	Low	D	
Hettinger	Low	B	
Kidder	Low	D	
*Lake Traverse^*	*Low*	*NP*	
LaMoure	Low-Moderate	#2 of 12	
Logan	Low	B	
McHenry	Low-Moderate	B	
McIntosh	Low-Moderate	B	
McKenzie	Low-Moderate	NP	
McLean	Moderate	D	
Mercer	Moderate	D	
Morton	High	B	

Table 5.8.5A Shortage or Outage of Critical Materials or Infrastructure Risk to Jurisdictions (continued)

County	Shortage or Outage of Critical Materials or Infrastructure Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Mountrail	Low-Moderate	B	
Nelson	Low-Moderate	D	
Oliver	Low	D	
Pembina	Moderate	B	
Pierce	Low-Moderate	C	
Ramsey	Moderate	B	
Ransom	Low-Moderate	Low	
Renville	Low	D	
Richland	Moderate-High	B	
Rolette	Moderate	NP	
Sargent	Low-Moderate	C	
Sheridan	Low	NP	
Sioux	Low-Moderate	NP	
Slope	Low	NP	
Spirit Lake	*Low-Moderate*	*NP*	
*Standing Rock^*	*Low-Moderate*	*NP*	
Stark	Moderate-High	NP	
Steele	Low	NP	
Stutsman	Moderate-High	D	
Towner	Low	B	
Traill	Moderate	D	
*Turtle Mountain^*	*Low-Moderate*	*NP*	
Walsh	Moderate	B	
Ward	High	C	
Wells	Low-Moderate	D	
Williams	Moderate-High	D	

NP = no local plan
^ includes only North Dakota parts of the reservation

5.8.6 Vulnerabilities of State-Owned Buildings and Property

State-owned buildings could be without heat during a utility outage or flooded with sewer backups. During cold weather, structures without heat may be uninhabitable for a time. Generally, structures are not directly affected by critical material or infrastructure shortages or outages, but in some cases, direct damages may result.

5.8.7 Vulnerabilities of Critical Facilities and Infrastructure

Critical material or infrastructure outages do not often affect structures, however, an electric outage during winter could result in frozen and burst water pipes, causing water damage within the interiors of critical facilities. A propane, natural gas, or fuel oil outage could produce similar results. The failure of a sewer lift station could lead to a system back-up, and structures without sewer backflow valves could experience damages from sewer backwater; other structures could be flooded by overflowing sewage.

Utility or communication disruptions could also limit the ability to provide emergency services. For example, the medical facilities require electricity and water for certain types of medical equipment to work. Gas station pumps may not operate without electricity, and therefore, emergency vehicles may not have enough fuel during long term outages. Communications are vital to effective emergency operations and the lack of communication capabilities may significantly affect the abilities of emergency response organizations. Special needs facilities may need to move occupants to alternate locations due their dependence on local utilities.

Infrastructure supports utility and communication services. Therefore, outages or failures are often related to problems with the infrastructure. Minor damages or problems may indicate a short-term outage whereas large-scale damages may suggest a long term outage. Many services rely on other utilities to operate. For example, the water supply pumps and sewer lift stations both require electricity to continue operations. One or both may go down during long-term electric outages. Propane, oil, and gasoline refills require the transportation network to be open since deliveries are done by truck. This interdependency can lead to more complex utility outage problems.

Table 5.8.7A shows the critical facilities and infrastructure summary for the counties with a high or moderate-high shortage or outage of critical materials or infrastructure rating.

Table 5.8.7A Critical Facilities and Infrastructure in High or Moderate-High Shortage or Outage of Critical Materials or Infrastructure Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck

Table 5.8.7A Critical Facilities and Infrastructure in High or Moderate-High Shortage or Outage of Critical Materials or Infrastructure Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Burleigh (continued)	United Tribes Technical College University of Mary Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota Grand Forks Airport Interstate and Railroad Transportation Infrastructure
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure
Richland*	CIKR Facilities: Moderate-High (15-24 facilities) $10.8 million in National Guard Assets North Dakota State College of Science Interstate and Railroad Transportation Infrastructure
Stark	CIKR Facilities: Moderate-High (15-24 facilities) Dickinson State University Dickinson Airport Interstate and Railroad Transportation Infrastructure

Table 5.8.7A Critical Facilities and Infrastructure in High or Moderate-High Shortage or Outage of Critical Materials or Infrastructure Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Stutsman	CIKR Facilities: Moderate-High (15-24 facilities) $117.4 million in Local Government Facilities Jamestown College North Dakota State Hospital Jamestown Airport Interstate and Railroad Transportation Infrastructure
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport
Williams	CIKR Facilities: Moderate-High (15-24 facilities) $129.3 million in Local Government Facilities Williston State College Williston Airport

* includes at least part of the reservation

5.8.8 Vulnerabilities to New and Future Development

New and future development is not expected to have significant impacts on the shortage or outage of critical materials or infrastructure hazard. Increased populations add to the challenges of managing a long term utility outage but would not increase the damages necessarily. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties.

5.8.9 Data Limitations and Other Key Documents

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. Studies of each of the critical facilities would allow for a more in-depth discussion of their vulnerabilities, however, such data would likely be kept internal for security purposes. A record of the significant critical material or infrastructure outages and shortages in the state and the associated impacts could help pinpoint vulnerable times and locations.

Other key documents related to the Shortage or Outage of Critical Materials or Infrastructure hazard include:

- North Dakota Emergency Operations Plan, Shortage of Critical Materials Annex

5.9 Summer Storm

including Tornadoes, Hail, Downbursts, Strong Winds, and Lightning

5.9.1 Characteristics

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 (see Section 5.4 for more information on this hazard). Strong winds, hail, and tornadoes are also dangers associated with some thunderstorms.

Figure 5.9.1A Tornadoes in Bismarck on November 1, 2000.

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 inch 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

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 areas. 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.

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.

Tornado

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 of 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.

Figure 5.9.1B Turtle Lake Tornado on July 28, 1996

Development Stage

Mature State (F1)

Dissipation Stage

Source: National Weather Service, 2007a.

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, 2007c) In 2006, enhancements to this scale resulted in more accurate categorizations of damage and the associated wind speeds. Both scales are shown in Table 5.9.1C.

Table 5.9.1C Tornado Scales

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

Sources: Storm Prediction Center, 2007.

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, however, 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 hailfalls include the hailstone sizes (average and maximum), number of hailstones per unit area, hail hardness, 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 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)

Downbursts and Strong Winds

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

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

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

Lightning

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.

Most summer storms occur during the hot summer months and may be associated with other summer hazards. Lightning in thunderstorms may spark wildfires. When coupled with strong winds, these fires can quickly spread. Slow-moving thunderstorms often trigger flash floods due to the extended duration of the heavy rainfall. The heavy rain, hail, strong winds, and tornadoes in summer storms may become problematic for ground and air travelers. Such conditions can cause accidents and could even possibly lead to a hazardous material release. Should winds be strong enough, they can take down power and communication infrastructure and lead to long-term outages. Severe thunderstorms associated with the passage of a strong cold front may usher in cooler temperatures and relieve extreme heat and drought conditions.

5.9.2 History

Between January 1995 and December 2009, North Dakota experienced 6,690 reported severe thunderstorm and tornado events. These storms resulted in a crudely estimated combined total of $764 million in property damage, $369 million in crop damage, 4 deaths, and 82 injuries. (National Climatic Data Center, 2010)

Reports of severe thunderstorms and tornadoes are collected from trained spotters by the local National Weather Service (NWS) offices in Bismarck and Grand Forks. These records are archived by the National Climatic Data Center. Since official records can only indicate events that have been reported to the National Weather Service, events are often underreported in rural area and areas lacking trained spotters. The North Dakota Atmospheric Resources Board also collects hail data, both severe and non-severe, from an established spotter network.

Tornado

Figure 5.9.2A November 1, 2000 Tornado 8 miles northwest of Bismarck.
Source: Pat Whitlock, K0TVS.

In June 2000 (and supplemented by information provided in 2010), the Bismarck office of the National Weather Service published a statistical report on tornadoes in North Dakota. These statistics indicated that during the period of 1950 to 2009, North Dakota received an average of 22 reported tornadoes annually, and has ranged from only two reported tornadoes in some years to an annual high of 61 reported tornadoes in 1999. (National Weather Service, 2010a) 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. 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. The county with the largest number of reported tornadoes (Cass with 82 tornadoes) also has the largest population.

Table 5.9.2B lists the North Dakota tornadoes that were classified using the Fujita or Enhanced Fujita scale during the period 1950 to 2009. Notice that about 9 out of 10 tornadoes in the state were either an F0/EF0 or F1/EF1, however, an F3/EF3 or higher tornado occurs roughly annually. Table 5.9.2C shows the tornadoes in North Dakota that have caused fatalities.

Table 5.9.2B Fujita Scale Statistics for North Dakota Tornadoes 1950-2009

Magnitude	Number of Recorded Tornadoes	Average Frequency
F0/EF0	757	15 per year
F1/EF1	303	6 per year
F2/EF2	117	2 per year
F3/EF3	37	1 every 1.4 years
F4/EF4	11	1 every 4.5 years
F5/EF5	3	1 every 17 years

Source: National Climatic Data Center, 2010.

Table 5.9.2C Deadly Tornadoes in North Dakota 1950-2009

Location	Date	Magnitude	Fatalities	Injuries
Burleigh and Kidder Counties	July 1, 1952	F4	1 fatality	25 injuries
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	13 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

Source: National Climatic Data Center, 2010.

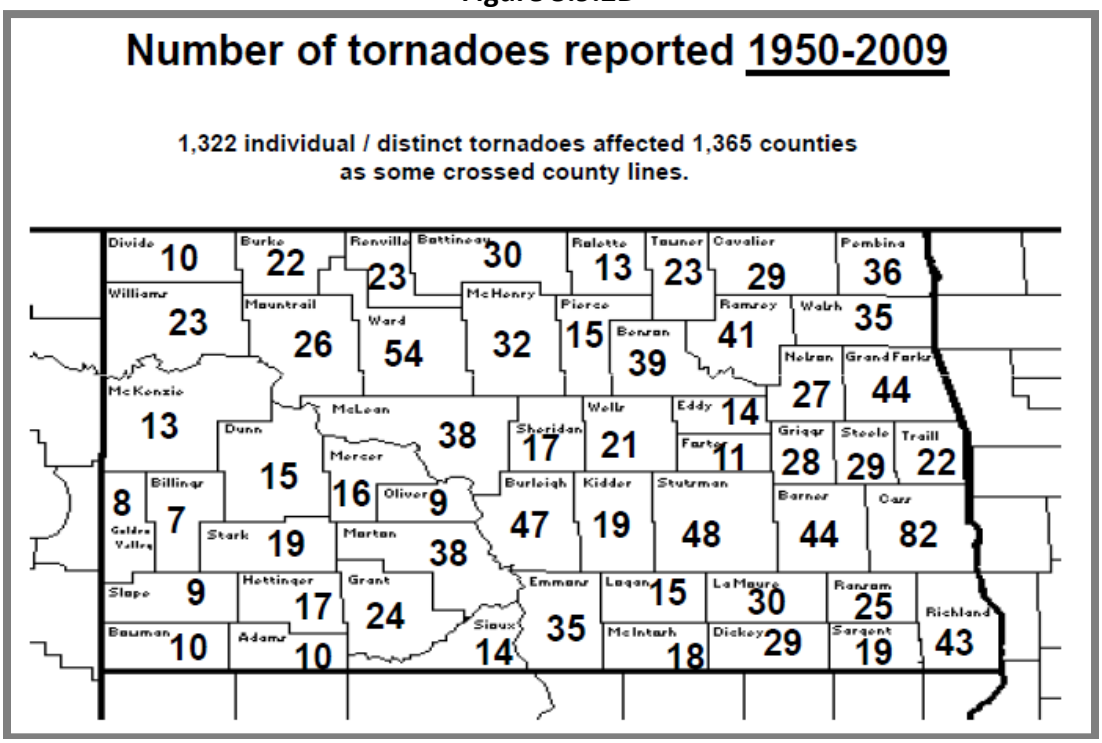
Figure 5.9.2D shows the number of reported tornadoes and Figures 5.9.2E and 5.9.2F show the strongest tornadoes reported by county from 1950-2009. During the 15-year period from January 1995 to December 2009, 542 tornadoes were reported in North Dakota with an estimated $91,888,000 in property damage, $5,860,000 in crop damage, 2 deaths, and 34 injuries. Most of the injuries occurred to those inside their homes, outside, or driving a vehicle. (National Climatic Data Center, 2010) The total federal crop insurance program losses in the state due to tornadoes from 2000 through 2009 totaled $142,349, or about $14,235 annually. (Risk Management Agency, 2010)

The longest tornado track in North Dakota was 47.5 miles. This tornado occurred on May 5, 1964 and moved across parts of Emmons, McIntosh, and Logan Counties. The widest tornado path was 6,000 feet, over a mile wide, and it occurred in Bottineau County on June 26, 1986.

The most destructive tornado in North Dakota history occurred in Fargo during the evening of June 20, 1957. This tornado outbreak consisted of five different tornadoes, each taking its turn on the ground as the storm traveled 27.4 miles across Cass County and into Clay County, Minnesota. The tornadoes were 1,500 feet wide and the one that hit Fargo was classified as an F5 (winds of 261-318 mph). There were 13 fatalities, 103 injuries, and over 1,300 homes were badly damaged or destroyed.

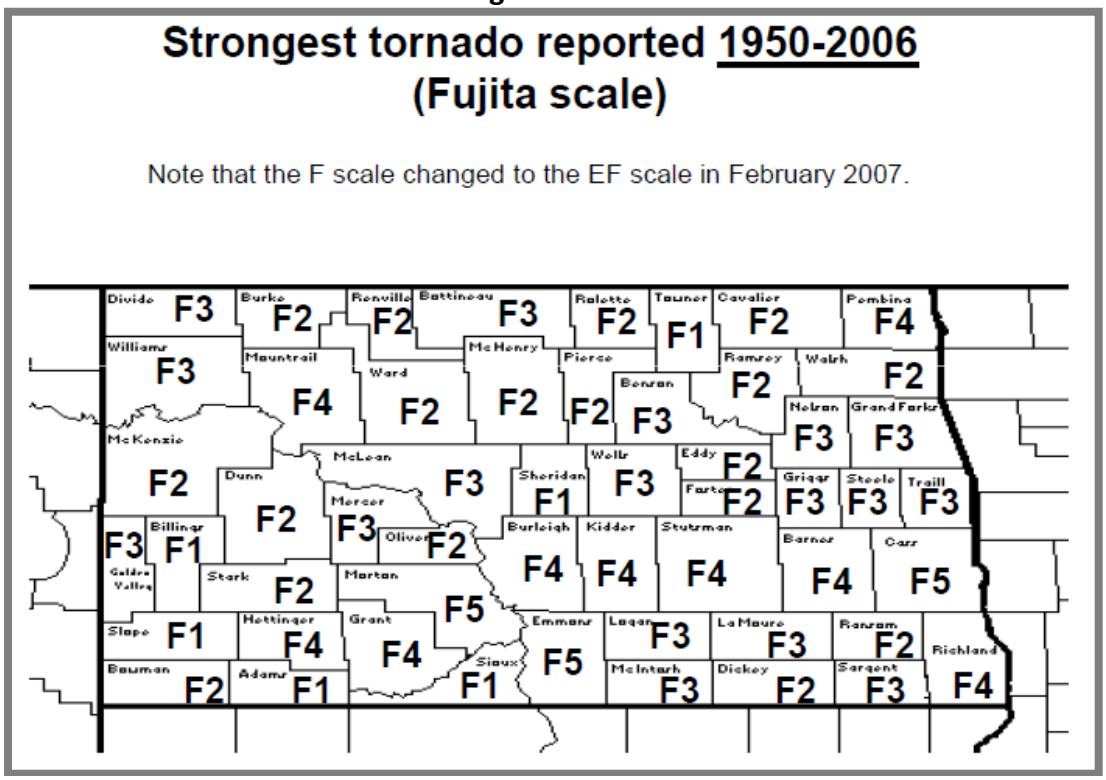
On August 26, 2007, a tornado impacted the community of Northwood in Grand Forks County. Two mobile home parks were destroyed, one person was killed, and 18 were injured. Approximately 90 percent of the 500 homes in Northwood were damaged with about 100 uninhabitable. Businesses and municipal buildings also suffered heavy losses. Damages were estimated at about $50 million. (Grand Forks County, 2009)

Figure 5.9.2D



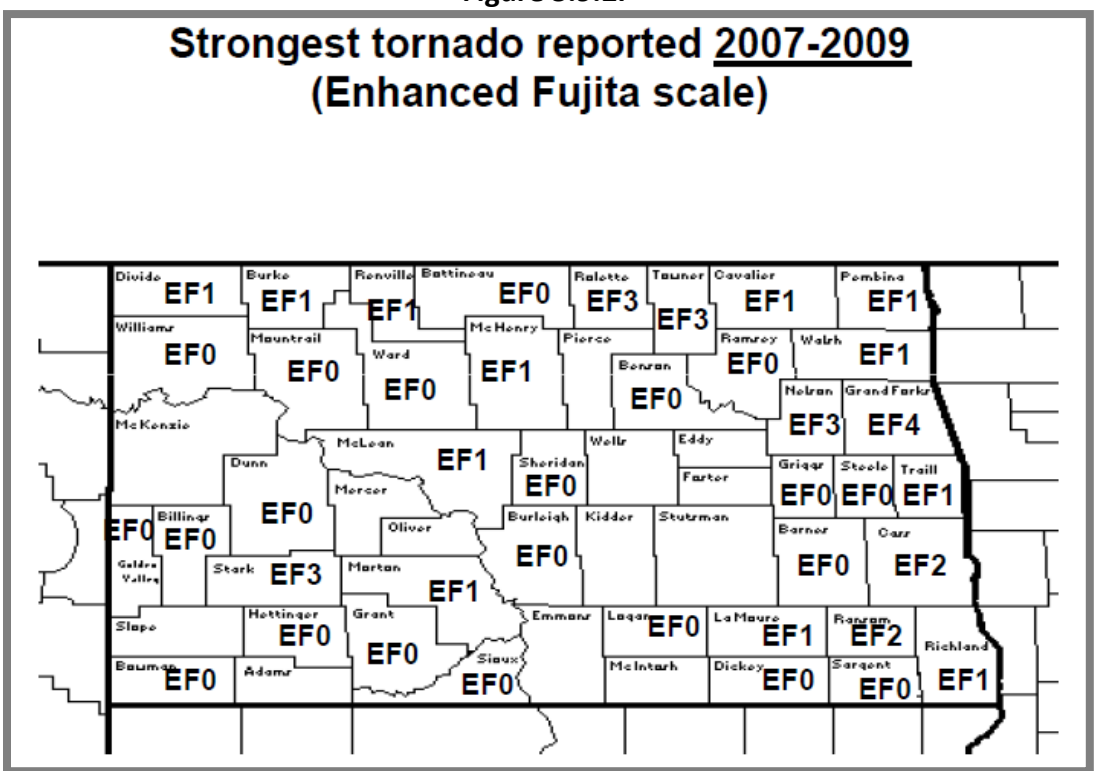
Source: National Weather Service, 2010a.

Figure 5.9.2E



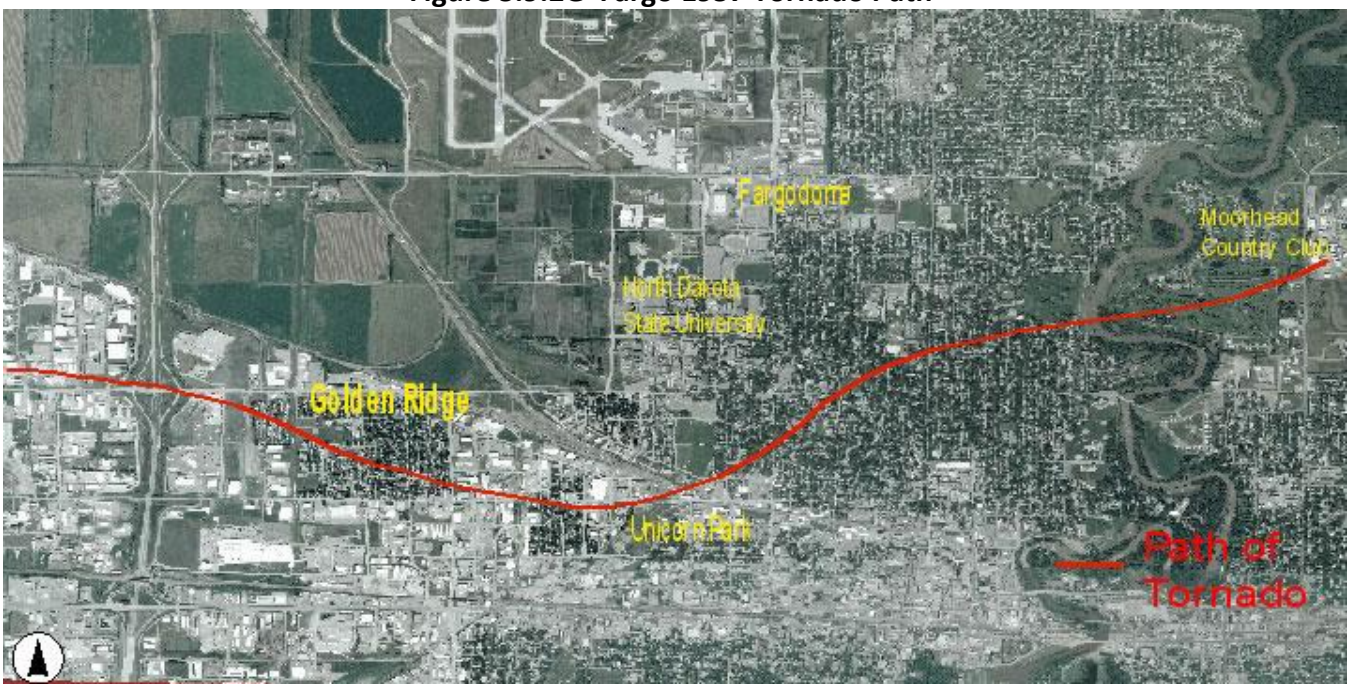
Source: National Weather Service, 2010a.

Figure 5.9.2F



Source: National Weather Service, 2010a.

Figure 5.9.2G Fargo 1957 Tornado Path



Source: National Weather Service, 2007b.

Hail

Hail damage has been reported in every county in North Dakota. Twenty-one counties have reported hail up to 4.5" in diameter between 1950 and 2009. Figure 5.9.2H shows the maximum hail size reported by county from 1950-2009. During the 15-year period from January 1995 to December 2009, 4,257 severe hail events were reported in North Dakota with an estimated $457,455,000 in property damage, $176,085,000 in crop damage, and 20 injuries. Note that the number of severe hail events over the period does not take into account the 2010 switch from 0.75 inch diameter to 1 inch diameter severe criteria. Most of the injuries occurred to those outdoors such as golfers and hikers and those driving through storms that received broken windshields. (National Climatic Data Center, 2010)

The North Dakota Atmospheric Resource Board has a volunteer observer network that has been recording rain and hail since 1977. On average, about 800 observers statewide record rain and hail reports during the months of April –September. During that 34-year timeframe (1977-2010), nearly 12,000 hail reports (not all severe) have been recorded and entered into their database. The high-density network increases the chances of observing a hail event; even still, their network may have missed thousands of hail occurrences when hail fell and no one was there to observe it. (North Dakota State Water Commission, 2010b)

The total federal crop insurance program losses in the state due to hail from 2000 through 2009 totaled $406,813,930, or about $40.7 million annually. (Risk Management Agency, 2010) Note that cloud modifications over the past ten years may have reduced hail damage to crops in the western part of the state. Studies in North Dakota have shown a 45% reduction in crop-hail damage. (Sell and Leistritz, 1998) Counties currently participating in the cloud modification program include Bowman, McKenzie, Mountrail, Ward, Williams, and part of Slope.

In August 1995, a severe thunderstorm moved through Ward County in the early morning hours injuring three people. Hail the size of walnuts to grapefruit did extensive damage to crops and property. A camper-bus convention was occurring at the time with extensive damage done to campers ranging in value up to $500,000. Many wheat crops that were at or near maturity were completely destroyed with no hope of any harvest. The storm resulted in $40 million in property damage and $10 million in crop damage. (National Climatic Data Center, 2010)

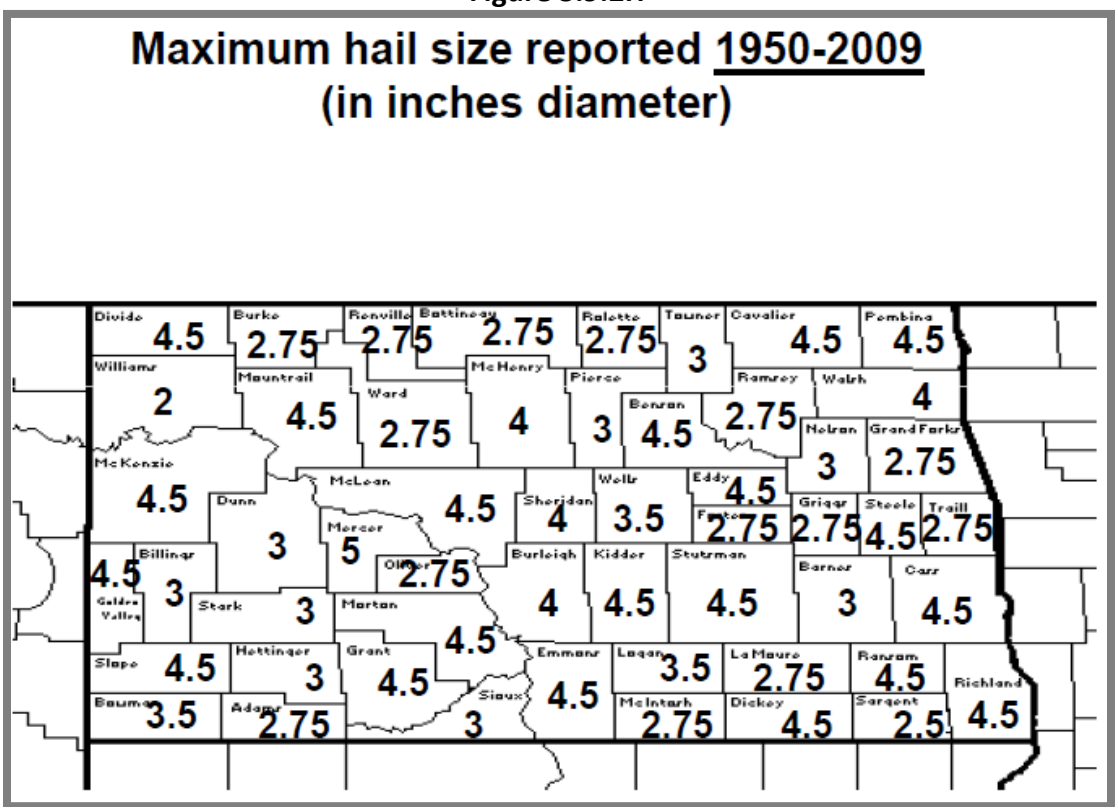
In June 2001, a hailstorm caused an estimated $230 million in property damage in Burleigh and Morton Counties; an estimated 57,000 insurance claims were filed. (North Dakota Insurance Department, 2007) This hailstorm affected the urban Bismarck and Mandan areas. As the most damaging hailstorm in the 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, 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, 2010) The Hettinger area also suffered similar damage. Property damage was estimated at over $100 million to insured property; over 20,000 insurance claims were filed. (North Dakota Insurance Department, 2007)

Baseball sized hail fell in the Fargo area during a late season severe thunderstorm in September 2007. Insurance data indicates approximately 14,000 property insurance claims were made following the storm totaling $43.4 million. (North Dakota Insurance Department, 2007)

Figure 5.9.2H



Source: National Weather Service, 2010a.

Downbursts and Strong Winds

Severe winds are not uncommon during the summer months in North Dakota. Between January 1995 and December 2009, 76 reports of non-tornadic wind speeds of over 100 mph were recorded, the highest of which occurred in Slope County in September 1997 with a wind speed of 143 mph. (National Climatic Data Center, 2010) Figure 5.9.2J shows the maximum recorded wind speeds by county from 1950-2009. Between January 1995 and December 2009, North Dakota experienced a reported 1,891 severe thunderstorm wind events, resulting an estimated $214,940,000 in property damage, $185,448,000 in crop damage, 2 deaths, and 28 injuries. 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. The total federal crop insurance program losses in the state due to wind from 2000 through 2009 totaled $26,371,879, or about $2.6 million annually. (Risk Management Agency, 2010)

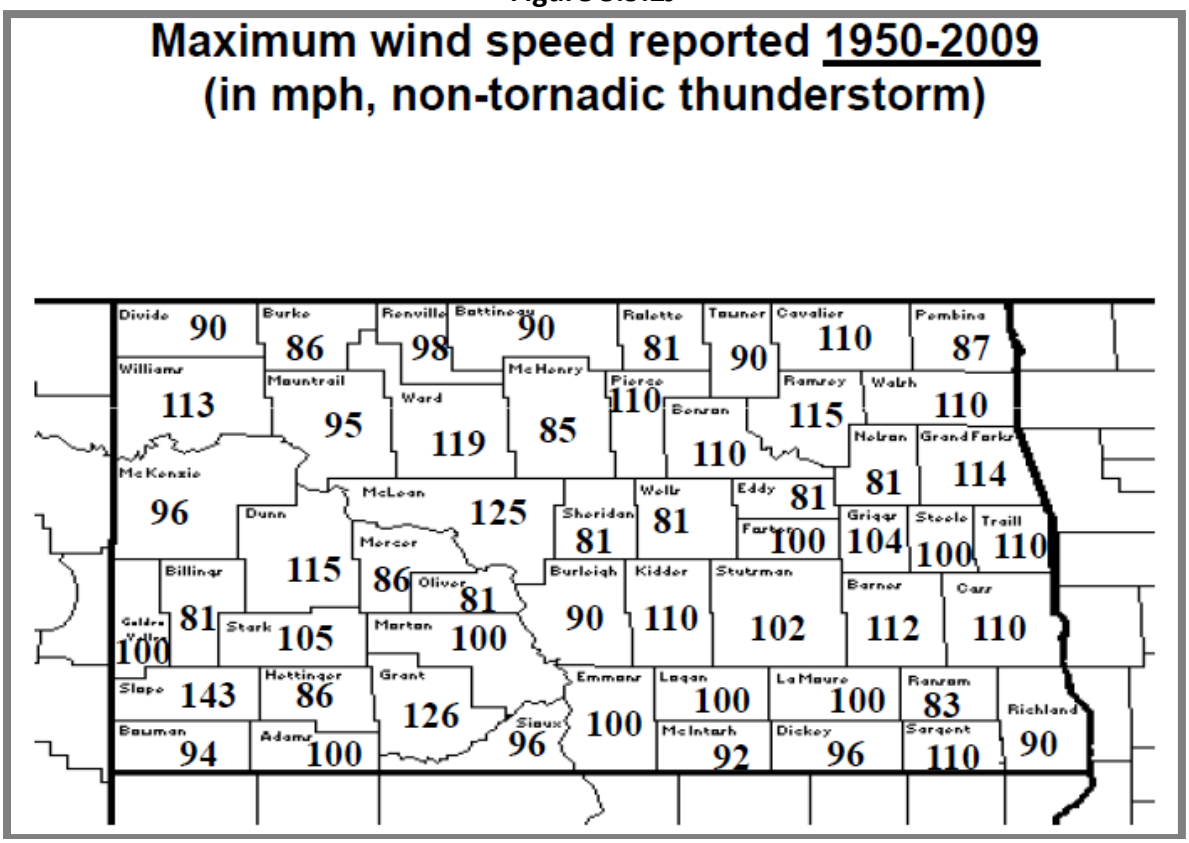
In 1919, a windstorm hit Williams and Divide Counties killing 8 and injuring 40. In 1930, North Dakota's most severe windstorm damaged 1,847 buildings. (State Historical Society of North Dakota, 2007)

In June 2005, severe summer storms significantly hit the Dickinson area in western North Dakota and the Langdon/Walhalla area in eastern North Dakota. The Dickinson area had an estimated 4,000 insurance claims that totaled over $14 million in insurable damage and the Langdon/Walhalla area had about 500 claims with $4 million in damage. Many of the claims in Dickinson were for minor roof damage because of wind and hail, and in the Langdon and Walhalla areas, most of the damages were to grain bins, storage sheds, and other farm property. These estimates do not include crop damages. (North Dakota Insurance Department, 2007)

In July 2006, the small community of Coleharbor in McLean County was devastated by severe thunderstorm winds, a wet microburst with estimated winds at 125 mph. Nearly every building in town was damaged. (National Climatic Data Center, 2010) Insured damages totaled about $1.4 million and about 60 claims were made. (North Dakota Insurance Department, 2007)

On July 15, 2007, Cass and Steele Counties were significantly impacted by downburst winds of 80 mph and some localized areas over 100 mph. Roofs, windows, siding, and crops through the area suffered damages with property losses estimated at $15-$20 million and crop losses of $250 million. (National Climatic Data Center, 2010)

Figure 5.9.2J



Source: National Weather Service, 2010a.

Lightning

In North Dakota, between January 1995 and December 2009, there were 92 damaging lightning events reported, resulting in about $1,793,000 in property damage, 1 death, and 7 injuries. In August 1996, a 12-unit condominium in Dickinson (Stark County) caught fire when lightning struck it. This left 24 people homeless and caused $300,000 in property damage. In July 1997, lightning struck three workers in a sugar beet field near Davenport (Cass County) resulting in one fatality and two injuries. In August 2006, two separate oil wells near Lignite (Burke County) were struck by lightning. Both caught on fire and fire crews were unable to get close to the fire due to the intense heat. Loss in production was estimated at $15,000 per day and property damage was estimated at $250,000. (National Climatic Data Center, 2010)

Table 5.9.2K Summer Storm Events Summary from 1995-2009

Event Type	North Dakota
Reported Tornadoes	542 events Highest Magnitude: F4/EF4 (F5 since 1950) $91,888,000+ property damage $5,860,000+ crop damage 2 fatalities 34 injuries
Reported Severe Hail	4,257 events Highest Magnitude: 5.00” $457,455,000+ property damage $176,085,000+ crop damage 20 injuries
Reported Severe Thunderstorm Winds	1,891 events Highest Magnitude: 143 mph $214,940,000+ property damage $185,448,000+ crop damage 2 fatalities 28 injuries
Reported Damaging Lightning Strikes	92 events $1,793,000+ property damage 1 fatality 7 injuries

Note: Flash flood events related to summer storms are addressed in Section 5.4.
Source: National Climatic Data Center, 2010.

Table 5.9.2L North Dakota Summer Storm Declared Disasters and Emergencies

Declaration	Location	Date	Other Information	Casualties	Damages
DR 79	North Dakota	1957	Tornadoes	13 deaths 103 injuries	$25,000,000 estimated total
DR 220	North Dakota	1966	Severe Storms Also included impacts from flooding.	1 death^ 2 injuries^	$1,356,000^ estimated total
DR 287	North Dakota	1970	Severe Storms Also included impacts from flooding.	9 injuries^	$135,000^ estimated total
DR 335	North Dakota	1972	Severe Storms Also included impacts from flooding.	1 injury^	$350,000^ estimated total
DR 475	North Dakota	1975	Severe Storms Also included impacts from flooding.	1 death^ 9 injuries^	$2,830,000^ estimated total
DR 3065	North Dakota	1978	Severe Storms and Tornadoes	5 deaths 35 injuries	$3,590,000 estimated total
State EO	North Dakota	1980	State Declared Severe Summer Weather Disaster	Unknown	Unknown
State Request	North Dakota	1981	Governor's Request for USDA assistance for heat, hail, wind, heavy rain, and insects.	Unknown	Unknown
State EO	North Dakota	1981	State Tornado Disaster Proclamation	Unknown	Unknown
State Request	North Dakota	1982	Governor's Request for USDA assistance for high wind, hail, and heavy rain.	Unknown	Unknown
State Request	North Dakota	1989	Governor's Request for USDA assistance for severe storms.	Unknown	Unknown
DR 1001	39 counties mostly in Central and Eastern North Dakota	June – July 1993	Severe Storms Public Assistance and Individual Assistance Also included impacts from flooding.	None^	$48,446,044*~ $600,000,000~ estimated total
DR 1032	25 counties mostly in Central North Dakota	March – July 1994	Severe Storms Public Assistance Also included impacts from flooding.	4 injuries^	$4,073,939*~ $9,670,000^ estimated total
DR 1050	32 counties in Central and Eastern North Dakota	March – May 1995	Severe Storms Public Assistance Also included impacts from flooding and ground saturation.	3 deaths~ 1 injury~	$15,637,415*~ $102,000,000~ estimated total
DR 1174	All 53 counties in North Dakota	February 28 – May 24, 1997	Severe Storms Public Assistance and Individual Assistance Also included impacts from flooding.	7 deaths~ 2 injuries~	$557,503,842*~ $3,700,000,000~ estimated total
DR 1279	34 counties and 3 tribes in Central and Eastern North Dakota	March 1 – July 19, 1999	Severe Storms and Tornadoes Public Assistance and Individual Assistance Also included impacts from snow, ice, flooding, ground saturation, landslides, and mudslides.	1 death^ 1 injury^	$124,391,622*~ $117,864,000^ estimated total
DR 1334	26 counties and 3 tribes in Central and Eastern North Dakota	April 5 – August 12, 2000	Severe Storms Public Assistance and Individual Assistance Also included impacts from flooding.	1 death^ 25 injuries^	$91,944,041*~ $21,985,000^ estimated total
State Request	North Dakota	2001	Governor's Request for USDA assistance for adverse summer weather conditions	Unknown	Unknown

Table 5.9.2L North Dakota Summer Storm Declared Disasters and Emergencies (continued)

Declaration	Location	Date	Other Information	Casualties	Damages
DR 1431	5 counties and 1 tribe in Eastern North Dakota	June 8 – August 11, 2002	Severe Storms and Tornadoes Public Assistance Also included impacts from flooding.	14 injuries^	$1,266,549*~ $283,797,000^ estimated total
DR 1483	Barnes County	June 24-25, 2003	Severe Storms and High Winds Public Assistance	None	$924,742* $1,900,000 estimated total
DR 1515	19 counties and 2 tribes in Northern North Dakota	March 26 – June 14, 2004	Severe Storms Public Assistance Also included impacts from flooding and ground saturation.	None	$7,459,705*~
DR 1597	26 counties and 3 tribes mostly in Northern and Eastern North Dakota	June 1 – July 7, 2005	Severe Storms Public Assistance Also included impacts from flooding and ground saturation.	1 death^ 1 injury^	$20,350,276*~ $16,305,000^ estimated total
DR 1645	11 counties and 1 tribe in Eastern North Dakota	March 30 – April 30, 2006	Severe Storms Public Assistance Also included impacts from flooding and ground saturation.	None^	$10,388,198*~
DR 1713	13 counties mostly in Southeastern North Dakota	June 2 – June 18, 2007	Severe Storms Public Assistance Also included impacts from flooding.	Unknown	$4,375,932*~
DR 1725	Cass and Steele Counties	July 15, 2007	Severe Storms and Tornadoes Public Assistance	Unknown	$935,462* $270,000,000 estimated total
DR 1726	Grand Forks County	August 26-27, 2007	Severe Storms and Tornadoes Public Assistance	Unknown	$12,775,075* $50,000,000 estimated total
DR 1829	48 counties and 4 tribes in Central and Eastern North Dakota	March 13 – August 10, 2009	Severe Storms Public Assistance and Individual Assistance Also included impacts from flooding.	Unknown	$184,696,371*~

^ Summer Storm portion
~ includes Flood and Summer Storm
* Federal Share (includes Individual and Family Grant, Disaster Housing, Manufactured Housing, Crisis Counseling Immediate and Regular Programs, Disaster Unemployment Assistance, Hazard Mitigation Grant Program, Public Assistance, FEMA Mission Assignments, and SBA Home, Business, and Economic Injury Loans).
Sources: Federal Emergency Management Agency, 2007; North Dakota Department of Emergency Services, 2007b; National Climatic Data Center, 2010; Interagency Hazard Mitigation Team Reports, varied dates; North Dakota Department of Emergency Services, 2007e; North Dakota Department of Emergency Services, 2010b.

5.9.3 Probability and Magnitude

Figure 5.9.3A is a graphical representation of the range of events that can occur within the summer storm hazard. Generally, the more frequent events have a low impact, and the high impact event occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the summer storm hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.9.3A Hazard Frequency and Impact Ranges

Frequency	Negligible	Limited	Critical	Catastrophic
No regional history				
No local history				EF5 Tornado in Urban Area
100 years				
50 years	Damaging Lightning Strike	Widespread Hail and Wind Damage	Strong Tornado in a Community	
Annually				

Impact

Based on the historical record, the following can be expected on average in North Dakota:

- In an average year, 35-40 tornadoes resulting in about $6.5 million in property and crop damage and 2 injuries. Fatalities are possible, averaging one every other year over the past 60 years.
- In an average year, 280-290 severe hail events resulting in about $42 million in property and crop damage and 1-2 injuries. Fatalities are possible, but have not been noted in the past 15 years.
- In an average year, 120-130 severe thunderstorm wind events resulting in about $27 million in property and crop damage and 1-2 injuries. Fatalities are possible, averaging one every 5-10 years over the past 15 years.
- In an average year, 6-7 damaging lightning events resulting in $120,000 in property damage. Fatalities and injuries are possible, averaging one every two years over the past 15 years.

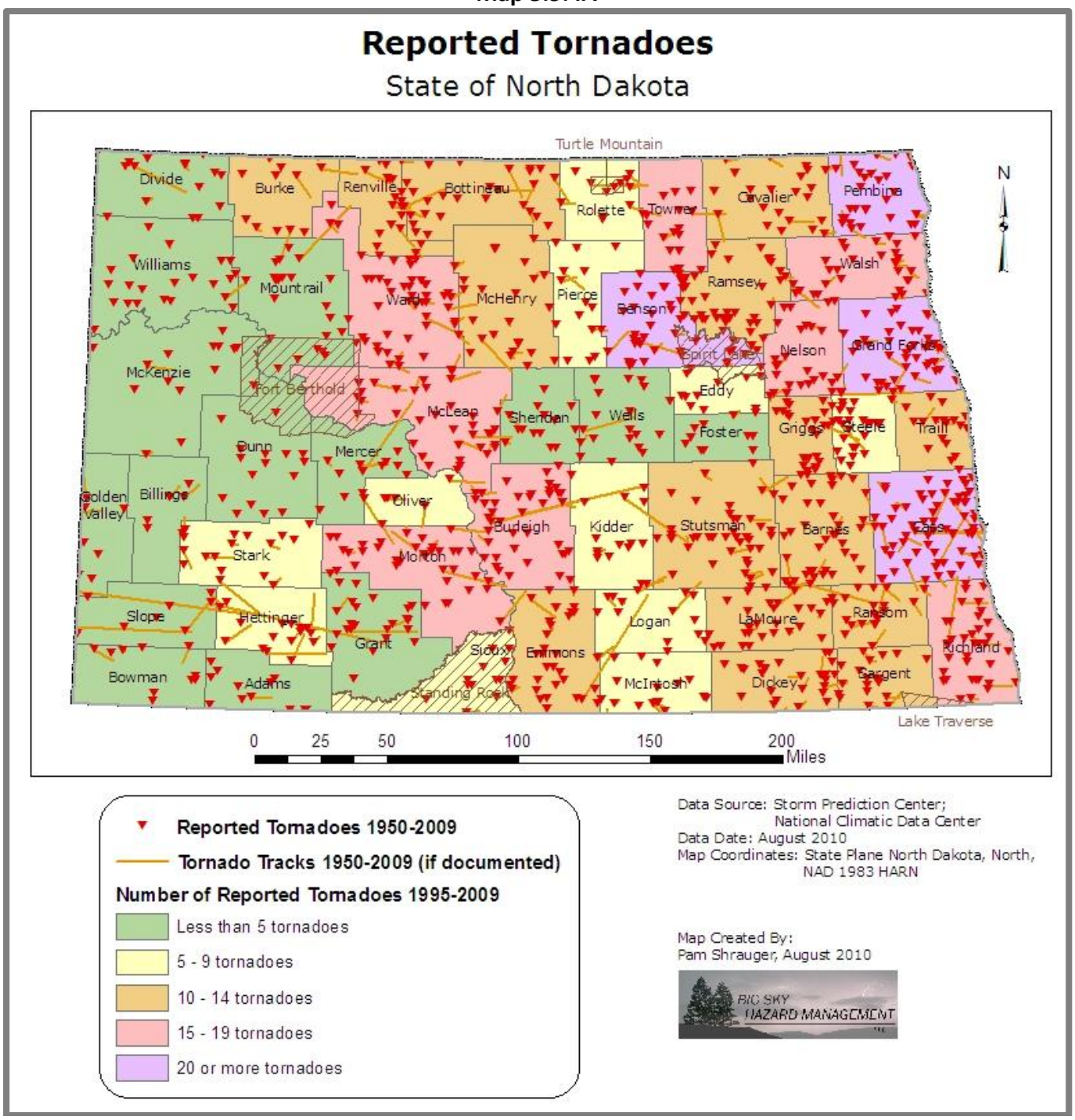
Reported tornado and severe thunderstorm events over the past fifteen years provide an acceptable framework for determining the magnitude of summer storms that can be expected and should be planned for. For tornadoes, even though only a few counties have experienced F5/EF5 tornadoes, all counties could 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) Hail sizes up to 5.00 inches, or even larger, can be expected throughout the state based on historical reports. This size hail and even smaller sizes can damage structures, break windows, dent vehicles, ruin crops, and kill or injure people and livestock. Non-tornadic winds over 100 mph should also be planned for. 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.

5.9.4 Mapping

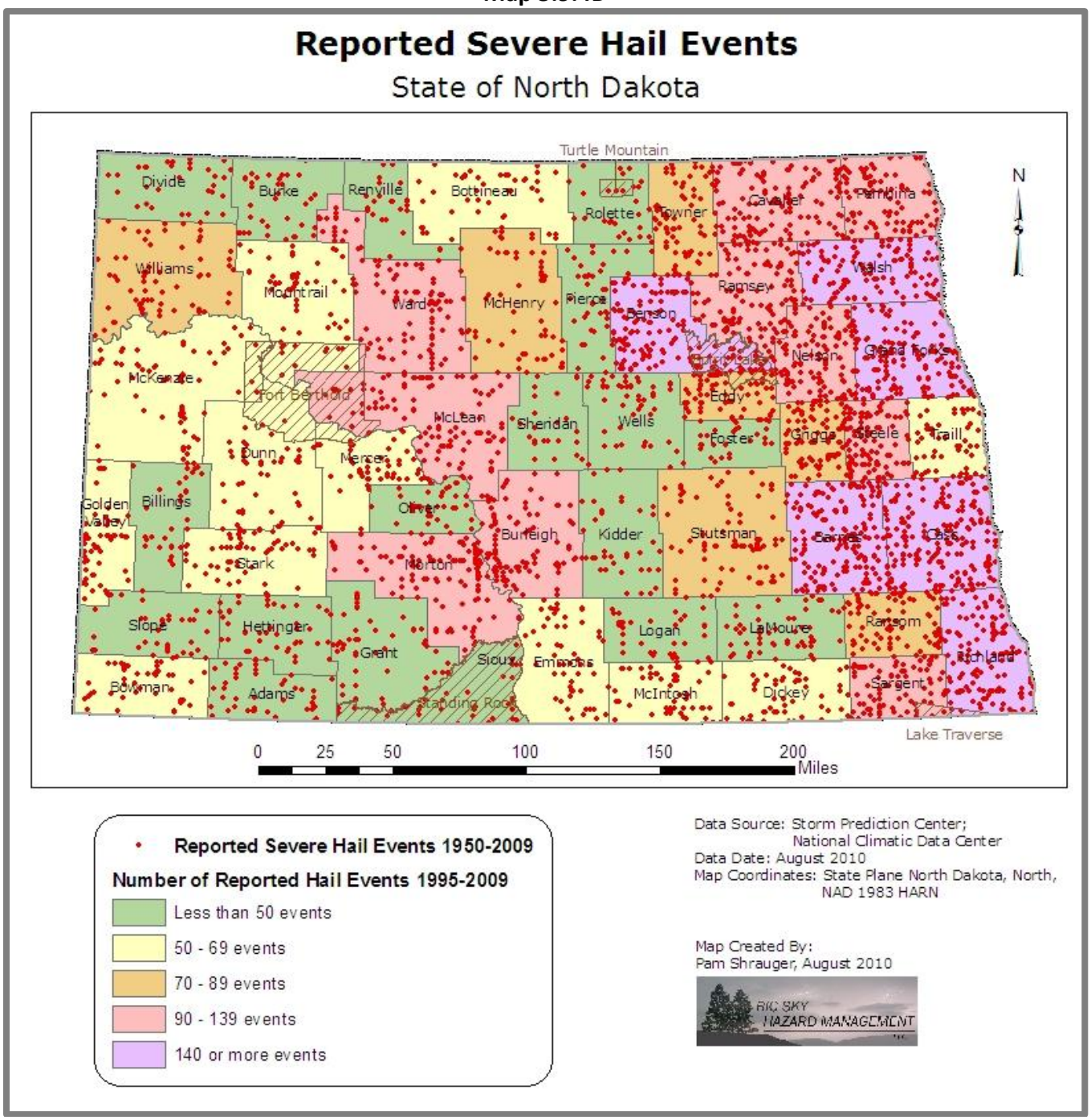
Many summer storm records maintained by the National Climatic Data Center contain location estimates for the reported events. The locations are based on where the reporting party estimates they are in relation to a town center. This data is then converted to an approximate latitude and longitude. These locations are not extremely accurate.

Map 5.9.4A shows the general locations of reported tornadoes across the state from 1950-2009. The map also depicts the number of tornadoes reported over the past 15 years (1995-2009) by county. Generally, this map shows that tornadoes are possible in all parts of the state. For example, Dunn County has not had a tornado reported in the past 15 years, but has had several since 1950. The highest concentrations of tornadoes are in the eastern and central sections of the state. Map 5.9.4B similarly shows the severe hail events. The highest concentrations of severe hail are primarily in the eastern part of the state. Map 5.9.4C shows the severe thunderstorm wind events over the past 15 years and the estimated locations since 1950. Generally, the highest concentration of these types of events is in the eastern and central parts of North Dakota. 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.

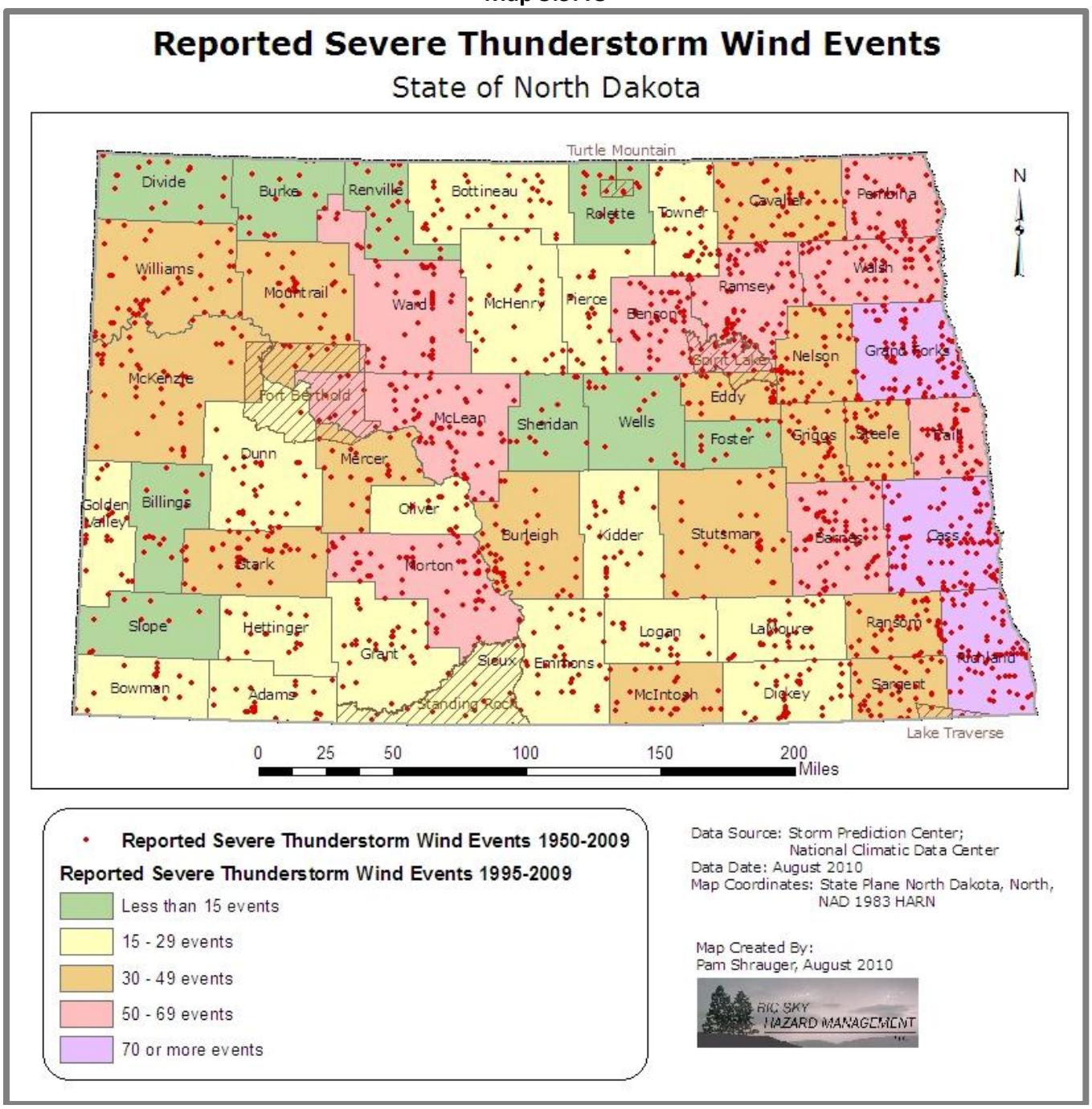
Map 5.9.4A


Reported Tornadoes
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Oliver
Billings
Golden Valley
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0
25
50
100
150
200
Miles
Reported Tornadoes 1950-2009
Tornado Tracks 1950-2009 (if documented)
Number of Reported Tornadoes 1995-2009
Less than 5 tornadoes
5 - 9 tornadoes
10 - 14 tornadoes
15 - 19 tornadoes
20 or more tornadoes
Data Source: Storm Prediction Center;
National Climatic Data Center
Data Date: August 2010
Map Coordinates: State Plane North Dakota, North,
NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY
HAZARD MANAGEMENT

Map 5.9.4B


Reported Severe Hail Events
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Reported Severe Hail Events 1950-2009
Number of Reported Hail Events 1995-2009
Less than 50 events
50 - 69 events
70 - 89 events
90 - 139 events
140 or more events
Data Source: Storm Prediction Center;
National Climatic Data Center
Data Date: August 2010
Map Coordinates: State Plane North Dakota, North,
NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY
HAZARD MANAGEMENT

Map 5.9.4C


Reported Severe Thunderstorm Wind Events
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Nelson
Grand Forks
Spirit Lake
McKenzie
Fort Berthold
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Reported Severe Thunderstorm Wind Events 1950-2009
Reported Severe Thunderstorm Wind Events 1995-2009
Less than 15 events
15 - 29 events
30 - 49 events
50 - 69 events
70 or more events
Data Source: Storm Prediction Center;
National Climatic Data Center
Data Date: August 2010
Map Coordinates: State Plane North Dakota, North,
NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY
HAZARD MANAGEMENT

5.9.5 Vulnerabilities to Jurisdictions

Tables 5.9.5A, 5.9.5B, 5.9.5C, and 5.9.5D show the damage indicators for various types of residential, farm, and business structures.

Table 5.9.5A 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)

Source: Storm Prediction Center, 2007.

Table 5.9.5B Single Wide Manufactured 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)

Source: Storm Prediction Center, 2007.

Table 5.9.5C Small Barns and Farm Outbuildings

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	53-78 mph (62 mph)
Loss of wood or metal roof panels	61-91 mph (74 mph)
Collapse of doors	68-102 mph (83 mph)
Major loss of roof panels	78-110 mph (90 mph)
Uplift or collapse of roof structure	77-114 mph (93 mph)
Collapse of walls	81-119 mph (97 mph)
Overturning or sliding of entire structure	83-118 mph (99 mph)
Total destruction of building	94-131 mph (112 mph)

Source: Storm Prediction Center, 2007.

Table 5.9.5D Small Retail Building

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	54-81 mph (65 mph)
Loss of roof covering (<20%)	65-98 mph (78 mph)
Broken glass in windows and doors	72-103 mph (86 mph)
Uplift of roof decking; significant loss of roof covering (>20%)	81-119 mph (98 mph)
Canopies or covered walkways destroyed	83-114 mph (98 mph)
Uplift or collapse of entire roof structure	101-140 mph (119 mph)
Collapse of exterior walls; closely spaced interior walls remain standing	120-159 mph (138 mph)
Total destruction of entire building	143-193 mph (167 mph)

Source: Storm Prediction Center, 2007.

Since structures are vulnerable to tornadoes and strong winds, those inside them are also at risk. The National Weather Service offices in Bismarck and Grand Forks warn for tornadoes, severe thunderstorms, and high winds events in North Dakota. Meteorologists use a variety of tools such as Doppler radar and weather spotters to predict these hazardous events and issue warnings that are broadcast over NOAA Weather Radio and other media. Therefore, the population may have some lead time to take precautions, if they receive the warning. Generally, these warnings 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. Mobile homes, even if tied down, and automobiles are not safe places. North Dakota has approximately 26,000 mobile homes across the state. Given approximately 2.2 people per housing unit in the state, roughly 57,200 people are at enhanced risk from tornadoes and strong winds. Besides structure failure, wind-driven projectiles and shattered glass can injure or kill occupants.

Large hail is always a threat to the agricultural community. Hail can damage crops and injure or kill livestock. A severe hail event that substantially damages an agricultural area could have significant

economic impacts. Similarly, structures can be damaged by hail, so losses can easily total in the millions of dollars in urban areas. Strong winds and tornadoes could have similar impacts.

Based on the history of summer storms over the past 15 years, the counties have been relatively rated high, moderate-high, moderate, low-moderate, and low as shown in Table 5.9.5E. All counties in North Dakota are certainly at risk from summer storms and a low rating does not mean that the vulnerability is small or non-existent. The history is highly dependent on the population observing and reporting an event, so therefore, the more rural counties may have fewer reports; however, those counties also have less population and property vulnerable to the hazard.

Table 5.9.5E Summer Storm Risk to Jurisdictions

County	Summer Storm Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	Low	B	$44,000,000 estimated tornado losses $43,000,000 estimated hail losses
Barnes	Moderate-High	A	$70,921,572.32 estimated tornado losses $32,713,496.57 estimated hail losses
Benson	High	NP	
Billings	Low	B	
Bottineau	Low-Moderate	A	$81,259,566 estimated tornado losses $28,372,927 estimated hail losses
Bowman	Low-Moderate	A	$35,000,000 estimated tornado losses $12,000,000 estimated hail losses
Burke	Low-Moderate	B	$15,000,000 estimated tornado losses $4,400,000 estimated hail losses
Burleigh	Moderate-High	B	$53,530,492 critical facilities hail losses $138,679,206 residential hail losses $205,495,094 critical facilities tornado losses $832,075,233 residential tornado losses
Cass	High	B	$3,178,314,351 estimated tornado losses $26,135,387,309 estimated hail losses
Cavalier	Moderate	A	$39,000,000 estimated tornado losses $13,000,000 estimated hail losses
Dickey	Low-Moderate	C	
Divide	Low	NP	
Dunn	Low-Moderate	A	
Eddy	Moderate	A	$79,000,000 estimated tornado losses $30,000,000 estimated hail losses
Emmons	Low-Moderate	A	
*Fort Berthold^*	*Moderate*	*NP*	

Table 5.9.5E Summer Storm Risk to Jurisdictions (continued)

County	Summer Storm Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Foster	Low	A	$81,259,566 estimated tornado losses $28,372,927 estimated hail losses
Golden Valley	Low-Moderate	A	
Grand Forks	High	A	$50,000,000 estimated losses
Grant	Low	A	
Griggs	Moderate	A	$22,000,000 estimated tornado losses $4,700,000 estimated hail losses
Hettinger	Low-Moderate	A	
Kidder	Low-Moderate	A	$36,000,000 estimated tornado losses $11,000,000 estimated hail losses
*Lake Traverse^*	*Moderate-High*	*NP*	
LaMoure	Low-Moderate	#5 of 12	
Logan	Low-Moderate	A	$14,2169,283 estimated tornado losses $2,626,974 estimated hail losses
McHenry	Moderate	A	$36,839,898 estimated tornado losses $10,929,376 estimated hail losses
McIntosh	Low-Moderate	B	$33,298,998 estimated tornado losses $12,544,819 estimated hail losses
McKenzie	Low-Moderate	NP	
McLean	Moderate-High	A	
Mercer	Low-Moderate	A	
Morton	Moderate-High	A	
Mountrail	Low-Moderate	B	$18,000,000 estimated tornado losses $5,700,000 estimated hail losses
Nelson	Moderate-High	A	$34,604,999 estimated tornado losses $11,543,038 estimated hail losses
Oliver	Low-Moderate	A	
Pembina	Moderate-High	A	$146,614,008 estimated tornado losses $83,433,626 estimated hail losses
Pierce	Low-Moderate	A	
Ramsey	Moderate-High	A	Millions of dollars in structure losses
Ransom	Moderate	Medium	
Renville	Low-Moderate	A	$72,083,992 estimated tornado losses $51,953,873 estimated hail losses
Richland	High	A	
Rolette	Low	NP	
Sargent	Moderate	A	$39,490,284 estimated tornado losses $12,978,646 estimated hail losses
Sheridan	Low	NP	
Sioux	Low-Moderate	NP	

Table 5.9.5E Summer Storm Risk to Jurisdictions (continued)

County	Summer Storm Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Slope	Low	NP	
Spirit Lake	*High*	*NP*	
*Standing Rock^*	*Low-Moderate*	*NP*	
Stark	Low-Moderate	NP	
Steele	Moderate	NP	
Stutsman	Moderate	A	$307,859,191 estimated tornado losses $98,309,309 estimated hail losses
Towner	Moderate	A	$31,961,278 estimated tornado losses $5,759,480 estimated hail losses
Traill	Moderate	A	$81,259,566 estimated tornado losses $28,372,927 estimated hail losses
*Turtle Mountain^*	*Low*	*NP*	
Walsh	Moderate-High	A	
Ward	Moderate-High	A	$762,653,845 estimated tornado losses $259,603,707 estimated hail losses
Wells	Low	B	
Williams	Low-Moderate	A	$147,818,391 estimated tornado losses $26,585,512 estimated hail losses

NP = no local plan
^ includes only North Dakota parts of the reservation

5.9.6 Vulnerabilities of State-Owned Buildings and Property

The Storm Prediction Center has developed damage indicators to be used with the Enhanced Fujita Scale for different types of buildings. Building types that many state-owned buildings fall under are shown in Tables 5.9.6A and 5.9.6B.

Table 5.9.6A Institutional Buildings

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	59-88 mph (72 mph)
Loss of roof covering (<20%)	72-109 mph (86 mph)
Damage to upper walls and roof, loss of rooftop HVAC equipment	75-111 mph (92 mph)
Broken glass in windows or doors	78-115 mph (95 mph)
Uplift of lightweight roof deck and insulation, significant loss of roofing material (>20%)	95-136 mph (114 mph)
Façade components torn from structure	97-140 mph (118 mph)
Damage to curtain walls or other wall cladding	110-152 mph (131 mph)
Uplift of pre-cast concrete roof slabs	119-163 mph (142 mph)
Uplift of metal deck with concrete fill slab	118-170 mph (146 mph)

Table 5.9.6A Institutional Buildings (continued)

Damage Description	Wind Speed Range (expected in parentheses)
Collapse of some top story exterior walls	127-172 mph (148 mph)
Significant damage to building envelope	178-268 mph (210 mph)

Source: Storm Prediction Center, 2007.

Table 5.9.6B Metal Building Systems

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	54-83 mph (67 mph)
Inward or outward collapsed of overhead doors	75-108 mph (89 mph)
Metal roof or wall panels pulled from the building	78-120 mph (95 mph)
Column anchorage failed	96-135 mph (117 mph)
Buckling of roof purlins	95-138 mph (118 mph)
Failure of X-braces in the lateral load resisting system	118-158 mph (138 mph)
Progressive collapse of rigid frames	120-168 mph (143 mph)
Total destruction of building	132-178 mph (155 mph)

Source: Storm Prediction Center, 2007.

Considering tornadoes and severe thunderstorm winds in North Dakota can exceed 160 mph and even 200 mph, state-owned buildings and property are vulnerable from summer storms. Table 5.9.6C shows the losses to state-owned buildings insured by the North Dakota Fire and Tornado Fund since 1989.

Table 5.9.6C Summer Storm Claims on State-Owned Buildings and Property since 1989

County	Amount Paid for Lightning	Amount Paid for Wind	Amount Paid for Hail	Total Amount Paid
North Dakota	*$158,138*	*$508,497*	*$1,369,238*	*$2,035,873*
Barnes	$5,800	$20,750	$0	$26,550
Bottineau	$1,671	$0	$33,606	$35,277
Burleigh	$138,751	$161,130	$569,002	$868,883
Morton	$0	$4,363	$346,481	$350,844
Ransom	$1,401	$0	$0	$1,401
Rolette	$0	$1,534	$5,482	$7,016
Stark	$0	$187,400	$0	$187,400
Stutsman	$8,663	$2,401	$230,795	$241,859
Walsh	$0	$0	$1,926	$1,926
Ward	$1,852	$130,919	$181,946	$314,717

Source: North Dakota State Fire and Tornado Fund, 2010.

5.9.7 Vulnerabilities of Critical Facilities and Infrastructure

Many of the critical and special needs facilities, although adequate for most events, may not be able to withstand 160-200 mph tornadic or severe thunderstorm winds, as recommended by the Federal Emergency Management Agency. (Federal Emergency Management Agency, 2004) Most structures should be able to provide adequate protection from hail, but the structures could suffer broken windows and dented exteriors. Even if a structure performs well in the high winds, flying debris and falling trees may damage the building. Table 5.9.7A shows the damage indicators for a typical school building. Other critical facilities may fall under the categorizations shown in Section 5.9.6.

Table 5.9.7A 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.

Table 5.9.7B shows the claims paid by the North Dakota State Fire and Tornado Fund for lightning, wind, and hail to local governments and other entities owning critical facilities.

Table 5.9.7B Lightning, Wind, and Hail Claims Paid on Critical Facilities Insured by the State since 1989

County	Local Government	Adjutant General	University System	School Districts	Total
North Dakota	*$9,227,018*	*$478,373*	*$1,691,119*	*$3,495,127*	*$14,997,446*
Adams	$244,388	$0	$83,741	$112,873	$441,002
Barnes	$60,273	$0	$7,540	$66,566	$134,379
Benson	$69,984	$0	$0	$59,584	$129,568
Billings	$219,520	$0	$0	$52,297	$271,817
Bottineau	$43,535	$0	$56,070	$41,097	$140,702
Bowman	$21,252	$0	$0	$11,782	$33,034
Burke	$13,235	$0	$0	$13,835	$27,070
Burleigh	$1,026,008	$424,604	$452,343	$310,738	$2,213,693
Cass	$2,365,372	$0	$258,318	$252,780	$2,876,470

Table 5.9.7B Lightning, Wind, and Hail Claims Paid on Critical Facilities Insured by the State since 1989 (continued)

County	Local Government	Adjutant General	University System	School Districts	Total
Cavalier	$85,580	$0	$147	$36,579	$122,306
Dickey	$65,465	$0	$0	$2,209	$67,674
Divide	$31,036	$0	$0	$5,385	$36,421
Dunn	$40,185	$0	$0	$40,296	$80,481
Eddy	$43,144	$0	$0	$21,188	$64,332
Emmons	$80,678	$0	$0	$81,860	$162,538
Foster	$38,650	$0	$14,617	$47,740	$101,007
Golden Valley	$99,630	$0	$0	$356,075	$455,705
Grand Forks	$982,253	$0	$434,637	$8,081,744	$9,498,634
Grant	$8,720	$0	$0	$37,282	$46,002
Griggs	$214,104	$0	$0	$88,024	$302,128
Hettinger	$2,885	$0	$0	$6,200	$9,085
Kidder	$100,843	$0	$0	$189,628	$290,471
LaMoure	$55,780	$0	$0	$84,088	$139,868
Logan	$42,269	$0	$0	$110,212	$152,481
McHenry	$32,421	$0	$0	$43,625	$76,046
McIntosh	$49,373	$0	$0	$33,680	$83,053
McKenzie	$19,229	$0	$0	$50,624	$69,853
McLean	$224,609	$0	$0	$76,626	$301,235
Mercer	$186,913	$0	$0	$25,879	$212,792
Morton	$633,758	$0	$0	$362,081	$995,839
Mountrail	$164,081	$0	$0	$60,725	$224,806
Nelson	$63,593	$0	$0	$46,280	$109,873
Oliver	$4,389	$0	$0	$26,771	$31,160
Pembina	$77,231	$0	$0	$118,429	$195,660
Pierce	$18,511	$0	$0	$2,650	$21,161
Ramsey	$67,533	$82,478	$9,604	$38,320	$197,935
Ransom	$88,135	$0	$0	$15,023	$103,158
Renville	$27,688	$0	$0	$216,737	$244,425
Richland	$62,220	$0	$0	$46,573	$108,793
Rolette	$17,785	$0	$0	$12,856	$30,641
Sargent	$27,394	$0	$0	$7,870	$35,264
Sheridan	$15,700	$0	$0	$9,584	$25,284
Sioux	$5,925	$0	$0	$50,863	$56,788
Slope	$9,550	$0	$0	$0	$9,550
Stark	$212,438	$0	$345,501	$222,106	$780,045
Steele	$6,674	$0	$0	$9,172	$15,846
Stutsman	$131,830	$0	$0	$39,746	$171,576

Table 5.9.7B Lightning, Wind, and Hail Claims Paid on Critical Facilities Insured by the State since 1989 (continued)

County	Local Government	Adjutant General	University System	School Districts	Total
Towner	$178,952	$0	$0	$18,302	$197,254
Traill	$100,621	$0	$21,759	$32,001	$154,381
Walsh	$119,861	$0	$0	$8,989	$128,850
Ward	$172,904	$0	$91,819	$74,605	$339,328
Wells	$66,699	$0	$0	$67,392	$134,091
Williams	$104,618	$0	$5,625	$61,034	$171,277

Source: North Dakota State Fire and Tornado Fund, 2010.

Above ground infrastructure, namely overhead power lines, communications towers and lines, and structures, are very susceptible to tornadoes, severe thunderstorms, lightning, and strong winds. High winds and falling trees can damage this type of infrastructure and disrupt services. Therefore, even an indirect hit by a tornado or strong winds could disrupt regional electricity and possibly telephone services. Table 5.9.7C shows the Enhanced Fujita Scale Damage Indicators for electric transmission lines.

Table 5.9.7C Electrical Transmission Lines

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	70-98 mph (83 mph)
Broken wood cross member	80-114 mph (99 mph)
Wood poles leaning	85-130 mph (108 mph)
Broken wood poles	98-142 mph (118 mph)
Broken or bent steel or concrete poles	115-149 mph (138 mph)
Collapsed metal truss towers	116-165 mph (141 mph)

Source: Storm Prediction Center, 2007.

Should above ground facilities such as water treatment facilities or a sewer lagoon be damaged, water and sewer services could also be disrupted. Debris may also block roadways making transportation and commerce difficult if not impossible. Table 5.9.7D shows the critical facilities and infrastructure summary for the counties with a high or moderate-high summer storm rating. See Section 4.2 for more details.

Table 5.9.7D Critical Facilities and Infrastructure in High and Moderate-High Summer Storm Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Barnes	CIKR Facilities: Moderate (10-14 facilities) $1.6 million in National Guard Assets Valley City State University Interstate and Railroad Transportation Infrastructure
Benson*	CIKR Facilities: Low (0-4 facilities) Cankdeska Cikana Community College
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck United Tribes Technical College University of Mary Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota

Table 5.9.7D Critical Facilities and Infrastructure in High and Moderate-High Summer Storm Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Grand Forks (continued)	Grand Forks Airport Interstate and Railroad Transportation Infrastructure
McLean*	CIKR Facilities: Moderate (10-14 facilities) Coal Creek Power Plant Garrison Hydroelectric Power Plant
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure
Nelson*	CIKR Facilities: Low-Moderate (5-9 facilities)
Pembina	CIKR Facilities: Moderate (10-14 facilities) Neche Oil Import Site Interstate and Railroad Transportation Infrastructure
Ramsey*	CIKR Facilities: Moderate (10-14 facilities) $62.7 million in National Guard Assets Camp Grafton Lake Region State College Devils Lake Airport
Richland*	CIKR Facilities: Moderate-High (15-24 facilities) $10.8 million in National Guard Assets North Dakota State College of Science Interstate and Railroad Transportation Infrastructure
Walsh	CIKR Facilities: Moderate (10-14 facilities) North Dakota State Developmental Center Interstate and Railroad Transportation Infrastructure
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport

* includes at least part of the reservation

5.9.8 Vulnerabilities to New and Future Development

North Dakota does not have an enforceable statewide building code. The individual jurisdictions have to adopt and enforce the state building code for those regulations to have an impact on development.

Therefore, new and future development in those communities that have not adopted the state building code are more vulnerable to summer storms. Newer structures are generally built to withstand strong winds. Mobile homes, however, continue to be the exception. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties. Bowman, Rolette, and Sioux Counties do not have any jurisdictions that have adopted the state building code. Only a few jurisdictions in Barnes, Benson, Mountrail, Ransom, Sargent, Ward, and Williams Counties have adopted the building codes. New and future development in these jurisdictions are generally at greater risk from summer storms.

5.9.9 Data Limitations and Other Key Documents

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.

Other key documents related to the Summer Storm hazard include:

- North Dakota Emergency Operations Plan, Severe Storms Annex

5.10 Transportation Accident

Including Vehicular, Railway, and Aircraft Accidents

5.10.1 Characteristics

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

Transportation incidents in North Dakota are the same as most states. Passenger and cargo trains, bus and other highway vehicles, and passenger and cargo airplanes pose the highest risks. Since North Dakota has vast areas containing sparse population, even an incident involving a small number of deaths and/or injuries could overwhelm local resources. A large event such as a commercial passenger plane crash could possibly overwhelm state resources.

Federal and state highways, tribal, county, city, and township roadways, active railways, airports, and air traffic routes pass through North Dakota. Map 5.10.4A shows the major road, rail, and airport networks in the state. Two interstates pass through North Dakota, Interstate 94 and Interstate 29. In all, the state has over 105,000 miles of road and 5,026 bridges, including 18 international highway ports of entry along the Canadian border. (North Dakota Department of Transportation, 2007)

Railroads in North Dakota include Amtrak for passenger service and nearly 4,000 miles of railway operated by BNSF Railway, Canadian Pacific Railway, Dakota, Missouri Valley and Western Railroad (DMVW), Dakota Northern Railroad, Northern Plains Railroad, and Red River Valley and Western Railroad for the transportation of goods.

North Dakota has 90 public airports, including eight that provide scheduled commercial passenger service located in Bismarck, Devils Lake, Dickinson, Fargo, Grand Forks, Jamestown, Minot, and Williston. Aviation accidents can occur for a multitude of reasons from mechanical failure to poor weather conditions to intentional causes. The size of accidents also varies widely from single engine incidents to large commercial crashes. The location of the accident, such as a remote area versus a populated location, also plays an important role in the amount of destruction.

Probably the most significant and common hazard associated with transportation accidents is the release of hazardous materials. Many hazardous material releases occur as an element of a transportation accident. Any transportation accident involving the release of hazardous materials significantly increases the complexity and potential damages from such an accident. Transportation accidents can also occur independently due to poor operator judgment or equipment problems.

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

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

5.10.2 History

Whereas most other hazards have a track record in the state, transportation accidents involving mass casualties have had no significant record of occurrence in North Dakota. Listed below are some of the transportation events of greater significance that have occurred in the state.

1906 – Charles Service of Park River became North Dakota's first automobile fatality.

1945 – A train wreck on the outskirts of Michigan, North Dakota killed 34 people.

1968 – Eight teenagers were killed in a traffic accident near Jamestown.

1974 – The first attempted airplane hijack in the state occurred at the Grand Forks Airport.
Source: State Historical Society of North Dakota, 2007

The history of transportation accidents in North Dakota consists primarily of small magnitude incidents, some with fatalities, but most with very little effect on the entire community. Traffic accidents along the roadways occur regularly, usually inconveniencing travelers, requiring local emergency resources, and occasionally causing delays. Table 5.10.2A shows the traffic fatalities and crash data in North Dakota over the past ten years. Table 5.10.2B shows railroad accident statistics and Table 5.10.2C shows the aircraft incident statistics.

Table 5.10.2A North Dakota Traffic Accident Data

Year	Total Number of Crashes	Fatalities	Injuries
1999	14,431	119	4,962
2000	14,527	86	4,619
2001	14,759	105	4,608
2002	16,114	97	4,886
2003	16,552	105	4,817
2004	16,922	100	4,611
2005	15,788	123	4,360
2006	15,094	111	4,141
2007	16,229	111	4,180
2008	16,387	104	4,247

Source: North Dakota Department of Transportation, 2008.

Table 5.10.2B North Dakota Railroad Accident Data

Year	Accidents/ Incidents	Fatalities	Injuries
2000	122	9	82
2001	113	4	76
2002	118	3	1,523*
2003	94	6	62
2004	93	2	71
2005	92	8	55
2006	80	2	51
2007	92	4	56
2008	108	3	73
2009	87	3	59

* includes injuries from the Minot hazardous material release.
Source: Federal Railroad Administration, 2010.

Table 5.10.2C North Dakota Aircraft Incident Data

Year	Accidents/ Incidents	Fatalities
2000	12	1
2001	13	2
2002	7	2
2003	10	0
2004	8	2
2005	12	1
2006	14	2
2007	15	0
2008	7	2
2009	10	2

Source: National Transportation Safety Board, 2010.

Table 5.10.2D North Dakota Transportation Accident Declared Disasters and Emergencies

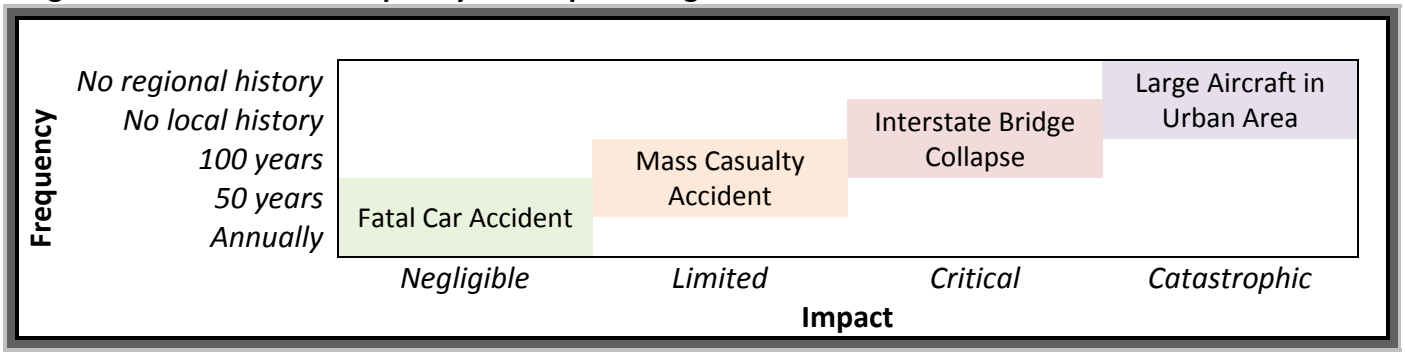
Declaration	Location	Date	Magnitude	Casualties	Damages
None					

5.10.3 Probability and Magnitude

Figure 5.10.3A is a graphical representation of the range of events that can occur within the transportation accident hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the

transportation accident hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.10.3A Hazard Frequency and Impact Ranges



Without detailed history of mass casualty transportation accidents, the probability of such an accident can only be expressed qualitatively. The probability is increased during winter storms, periods of poor visibility from snow, smoke, or dust, during holiday festivities with more instances of drinking and driving, and during times of increased traffic volume. Vehicle accidents with minor damage and injuries occur regularly. On average over the past ten years, North Dakota has about 15,680 accidents annually. Serious, fatal accidents are less frequent but still occur. On average, North Dakota has 106 traffic fatalities and 4,543 injuries annually.

Railroad accidents in North Dakota have historically had very little impact on the communities. The only exception is the January 2002 railroad accident near Minot where those impacted were affected by the hazardous material release rather than the accident itself. Based on records from the past ten years, approximately 100 railroad incidents occur annually resulting in about 4 fatalities.

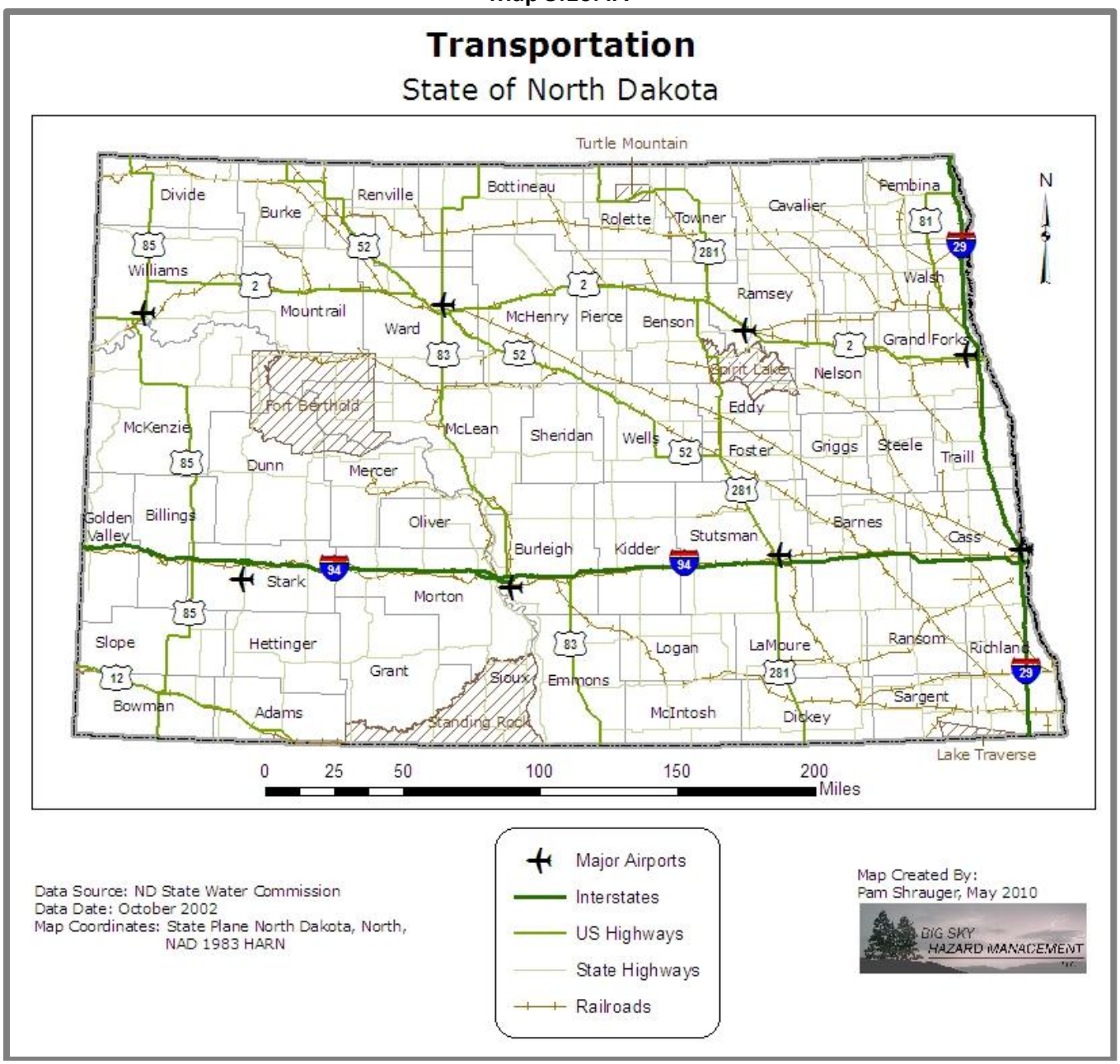
Aircraft accidents are documented carefully. Since 1997, 108 aircraft incidents have occurred averaging 10-11 incidents per year and resulting in about 1-2 fatalities annually in North Dakota. Although an incident involving a commercial passenger flight and mass casualties cannot be ruled out, the probability is considered lower.

Mass casualty incidents that overwhelm the emergency response resources, such as a bus, large multi-vehicle, passenger rail, or plane crash, represent high magnitude events.

5.10.4 Mapping

Map 5.10.4A shows the major road, rail, and airport networks in the state. Theoretically, the more highly used transportation infrastructure that exists in a given area, the more likely a significant transportation accident will occur.

Map 5.10.4A


Transportation
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Grand Forks
Nelson
Spirit Lake
Fort Berthold
Eddy
McKenzie
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Major Airports
Interstates
US Highways
State Highways
Railroads
Data Source: ND State Water Commission
Data Date: October 2002
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, May 2010
BIG SKY HAZARD MANAGEMENT

5.10.5 Vulnerabilities to Jurisdictions

Of all the resources and values, transportation accidents pose the most common risk to the population. Accidents involving aircraft, trains, vans, or busses could have mass casualties. The magnitudes of such population impacts vary from the size of the aircraft or vehicle to the number of vehicles involved. Anywhere from 2-200 people or more could be involved.

Road or railway closures due to a transportation accident could have a temporary effect on the local economy. The local agricultural economy has a strong dependence on the transportation infrastructure. Alternate means of transportation would be needed within a relatively short time frame to maintain the agricultural economy.

Unless a building or site was damaged, historical values would remain intact. Slight ecological values could also be lost should vehicle fluids or hazardous materials seep into a water body or wildlife habitat. Social values may only be temporarily lost due to road closures and inconvenient detours; however, an accident involving a large number of residents and/or children may have lasting emotional effects.

Table 5.10.5A provides the transportation accident risk by jurisdiction. The hazard rating was determined as follows:

- High: Jurisdiction has a major airport, interstate, and railroad infrastructure.
- Moderate-High: Jurisdiction has a major airport or interstate and railroad infrastructure.
- Moderate: Jurisdiction has railroad infrastructure and US highways.
- Low-Moderate: Jurisdiction has railroad infrastructure or US highways.
- Low: Jurisdiction has only state highways.

Table 5.10.5A Transportation Accident Risk to Jurisdictions

County	Transportation Accident Hazard	Hazard Rating in Local/Tribal Plan*	Additional Information from Local/Tribal Plan
Adams	Moderate	C	
Barnes	Moderate-High	D	
Benson	Moderate	NP	
Billings	Moderate-High	C	
Bottineau	Moderate	D	
Bowman	Moderate	C	
Burke	Moderate	B	
Burleigh	High	B	
Cass	High	D	
Cavalier	Low-Moderate	C	
Dickey	Moderate	D	
Divide	Moderate	NP	
Dunn	Low	D	
Eddy	Moderate	C	
Emmons	Moderate	D	

Table 5.10.5A Transportation Accident Risk to Jurisdictions (continued)

County	Transportation Accident Hazard	Hazard Rating in Local/Tribal Plan*	Additional Information from Local/Tribal Plan
*Fort Berthold^*	*Low-Moderate*	*NP*	
Foster	Moderate	D	
Golden Valley	Moderate-High	D	
Grand Forks	High	D	Up to $928,000 structural losses Up to 200 fatalities
Grant	Low	D	
Griggs	Low-Moderate	D	
Hettinger	Low	D	
Kidder	Moderate-High	C	
*Lake Traverse^*	*Low*	*NP*	
LaMoure	Moderate	#7 of 12	
Logan	Low-Moderate	D	
McHenry	Moderate	D	
McIntosh	Low-Moderate	C	
McKenzie	Low-Moderate	NP	
McLean	Moderate	C	
Mercer	Low-Moderate	C	
Morton	Moderate-High	D	
Mountrail	Moderate	D	
Nelson	Moderate	D	
Oliver	Low-Moderate	C	
Pembina	Moderate-High	D	
Pierce	Moderate	D	
Ramsey	Moderate-High	C	
Ransom	Low-Moderate	NI	
Renville	Moderate	D	
Richland	Moderate-High	C	
Rolette	Moderate	NP	
Sargent	Low-Moderate	C	
Sheridan	Low-Moderate	NP	
Sioux	Low	NP	
Slope	Low-Moderate	NP	
Spirit Lake	*Low-Moderate*	*NP*	
*Standing Rock^*	*Low*	*NP*	
Stark	High	NP	
Steele	Low-Moderate	NP	
Stutsman	High	D	
Towner	Moderate	D	
Traill	Moderate-High	D	

Table 5.10.5A Transportation Accident Risk to Jurisdictions (continued)

County	Transportation Accident Hazard	Hazard Rating in Local/Tribal Plan*	Additional Information from Local/Tribal Plan
*Turtle Mountain^*	*Low-Moderate*	*NP*	
Walsh	Moderate-High	B	
Ward	Moderate-High	D	
Wells	Moderate	C	
Williams	Moderate-High	C	

NP = no local plan; NI = not included in the local plan
* Many of the local plans have a mass casualty hazard listed rather than a transportation accident hazard. For analysis purposes, mass casualty is listed under the transportation accident category here.
^ includes only North Dakota parts of the reservation

5.10.6 Vulnerabilities of State-Owned Buildings and Property

Except in the very rare case of an aircraft, train, or vehicle crashing into a structure, state-owned buildings and property should be unaffected by a transportation accident. Should structures be affected, damages could vary in the tens or hundreds of thousands of dollars depending on the structure or structures impacted. A large commercial jet crash could potentially destroy an entire segment of a populated area for a greater loss to buildings and property.

5.10.7 Vulnerabilities of Critical Facilities and Infrastructure

Like state-owned buildings and property, except in the very rare case of an aircraft, train, or vehicle crashing into a critical facility, the facilities should remain unaffected by a transportation accident. An accident involving a first response agency or blocking a primary transportation route could delay emergency services.

In most cases, infrastructure also remains unaffected during transportation accidents. The most likely impact would be the closure of a major roadway due to a vehicular accident, thus resulting in travel inconveniences and long detours. Theoretically, an aircraft or vehicle can take out power lines, telephone lines, or other important pieces of infrastructure, resulting in service disruptions.

5.10.8 Vulnerabilities to New and Future Development

New and future development, particularly the associated increase in traffic, may increase the probability of a major transportation accident. Otherwise, the specific locations of where and how development occurs, except for possibly in the immediate vicinity of the airports or the railroad, should not significantly affect the vulnerabilities from this hazard. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties.

5.10.9 Data Limitations and Other Key Documents

Transportation accidents have had relatively minor impacts on the state in the past, but the level at which such accidents become overwhelming or disastrous varies by jurisdiction. Therefore, understanding the potential damages and impacts that may occur are difficult to quantify. The National Transportation Safety Board keeps very detailed records of damaging aircraft incidents. These records allow for in-depth analysis of individual accidents. The randomness of aircraft accidents, however, limits the usefulness of such information in determining the potential for future losses and areas of greatest hazard. Data outlining the normal flight patterns would help to quantify the potential for a major aircraft accident.

The North Dakota Department of Transportation analyzes the most dangerous traffic locations, however, even detailed data does not rule out a major accident at any given location.

The Federal Railroad Administration records are sufficient for calculating railroad problems over the past 10 years. Where the data is not useful is in determining the probability of a large-scale accident involving hazardous materials. An analysis of the current railroad weaknesses, numbers, and types of materials transported would enhance this profile. Such information would not necessary be placed in a public plan for security reasons.

Other key documents related to the Transportation Accident hazard include:

- North Dakota Emergency Operations Plan, Transportation Annex
- TransAction II, North Dakota's Statewide Strategic Transportation Plan
- North Dakota Highway Safety Plan

5.11 Urban Fire or Structure Collapse

5.11.1 Characteristics

Fire is the result of three components: a heat source, a fuel source, and an oxygen source. When combined, these three sustaining factors will allow a fire to ignite and spread. Within a structure, a small flame can get completely out of control and turn into a major fire within seconds. Thick black smoke can fill a structure within minutes. The heat from a fire can be 100 degrees Fahrenheit at floor level and rise to 600 degrees at eye level. In five minutes, a room can get so hot that everything in it ignites at once; this is called flashover. (US Fire Administration, 2006)

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

North Dakota has approximately 400 fire departments. There are only four fully funded departments. These include Bismarck, Fargo, Grand Forks and Minot. There are nine partially funded departments, which include Bismarck Rural, Devils Lake, Dickinson, Jamestown, Mandan, Minot Rural, Valley City, West Fargo, and Williston. The remaining fire departments are volunteer departments. These firefighters are sometimes only paid for a response call or not at all.

The overall picture of fire safety information reveals that, per capita, the United States has one of the highest fire death rates in the industrialized world. Approximately 3,000-4,000 people die in fires in this country annually, and about 15,000-20,000 are injured. Children under the age of 5 and the population over the age of 54 are at the highest risk of death in fires. On average, fire kills more Americans annually than all natural disasters combined. Approximately 100 firefighters die each year in duty-related incidents. Statistics show approximately 1.5 million fires are reported annually; many others go unreported, causing additional injuries and property loss. About $10-$15 billion in direct property losses occur annually. (US Fire Administration, 2010)

In 2007, North Dakota had a fire death rate of 6.3 people per million, one of the lowest in the country for that year. Other years have been closer to the national average of 13.2 deaths per million. (US Fire Administration, 2010) North Dakota averages just over 2,000 fire incidents per year. Records show that from 1998-2009 the average annual reported loss was $17.6 million. (North Dakota Fire Marshal, 2010) Careless smoking is the leading cause of residential fire deaths. Cooking is the leading cause of home fires and home fire injuries. (National Fire Protection Association, 2010)

Winter weather can have a major effect on the number of fires that occur. Increasing costs of electricity, natural gas, propane, and fuel oil has led many people to look for alternative heating methods for their homes. Consequently, the use of space heaters, fireplaces, wood-burning stoves, and even continued use of coal stoves has created an increased fire hazard. Most people have limited experience with wood burners. Wood burning for heating has a poor safety record. Codes for the

installation of stoves and chimneys may not be followed strictly, leading to an increased fire risk. Other energy sources include portable LP (propane) gas or kerosene heaters with self contained fuel supplies; these are hazardous appliances, even when used according to manufacturer's instructions. Open flames and the leakage of fuel from containers are fire hazards and could cause explosions.

Although structure fires are usually individual disasters and not community-wide ones, the potential exists for widespread urban fires that displace several businesses or families and exceed local and even state resources. The “downtown” urban areas of North Dakota are particularly vulnerable to this hazard. An urban fire that rages uncontrollably despite firefighting efforts and burns a large portion of a downtown area or an important structure could have significant economic impacts. Large fires of this nature have also been known to require significant community resources if lives are lost. North Dakota has the potential for large scale residential fires, commercial fires, and fires in public venues. In industrial areas, there is the potential of chemical plant fires producing hazardous smoke and fumes.

Smoke detectors, automatic fire alarm systems, automatic sprinkler systems, fire doors, and fire extinguishers can all prevent deaths, injuries, and damages from fire. Automatic sprinkler systems are especially important in preventing a small fire from becoming a conflagration.

Structure collapse occurs when the forces of gravity or other external forces overcome the structural integrity of a building. The reasons for structure collapse can vary from poor construction to explosions to extreme winds to heavy snow loads. Structure collapse can trap occupants and damage valuable property. Urban fires and structure collapse can happen independently from other types of incidents.

Alone a fire or collapse can have devastating effects, but they can also be secondary to another hazard. For example, a heavy snow event could lead to structure failure due to overwhelming snow loads. Strong winds and tornadoes can also lift roofs and render structures uninhabitable. Urban fires can be caused by hazardous material releases, lightning, and wildfires. Acts of terrorism and civil unrest may also lead to structure fires or structure collapse. Despite the cause, urban fires and structure collapse can lead to complete building losses in addition to other losses from the causative hazard.

5.11.2 History

Urban fires occur regularly in North Dakota, but some of the more significant events are listed below. Structure collapse occurs with much less frequency.

1882 – Fire destroyed a large portion of Grand Forks.

1884 – Half of the City of Devils Lake was destroyed by fire.

1893 – Fire destroyed almost the entire business section of Fargo, including City Hall and many of the City’s residences, covering 160 acres.

1894 – Fire destroyed four city blocks, including City Hall, in LaMoure.

1898 – Fire almost destroyed the entire Bismarck business section.

1930 – The North Dakota Capitol was destroyed by fire on December 28. The original state constitution was saved by the Secretary of State. Many state records were completely lost. A new Capitol building was constructed by 1934.

1947 – An explosion and fire killed three people and destroyed four city blocks, including nine businesses in Minot on July 21.

1966 – Fire destroyed Fargo Central High School on April 19. Losses were estimated at $1 million.

Figure 5.11.2A Aftermath of the Great Fargo Fire of 1893.
Source: City of Fargo Fire Department, 2007.

1968 – On March 27, seven Jamestown businesses, including the historic Gladstone Hotel were lost to fire.

October 1994 – The highest fatality fire in North Dakota occurred in Devils Lake when nine people died in a house fire.

January 1997 – A portion of the roof of the Winter Show Building in Valley City collapsed postponing events there.

April 1997 – During the 1997 extreme flood event in Grand Forks, a downtown fire, surrounded by floodwaters, burned eleven businesses covering three blocks, including the Grand Forks Herald building and its 120 years of archives.

Sources: State Historical Society of North Dakota, 2007; City of Fargo Fire Department, 2007; The Forum, 1999

Table 5.11.2B shows North Dakota fire statistics since 1987. Note the State Fire Marshal's Office indicates that about 75-85% of the North Dakota population is covered by reporting fire departments.

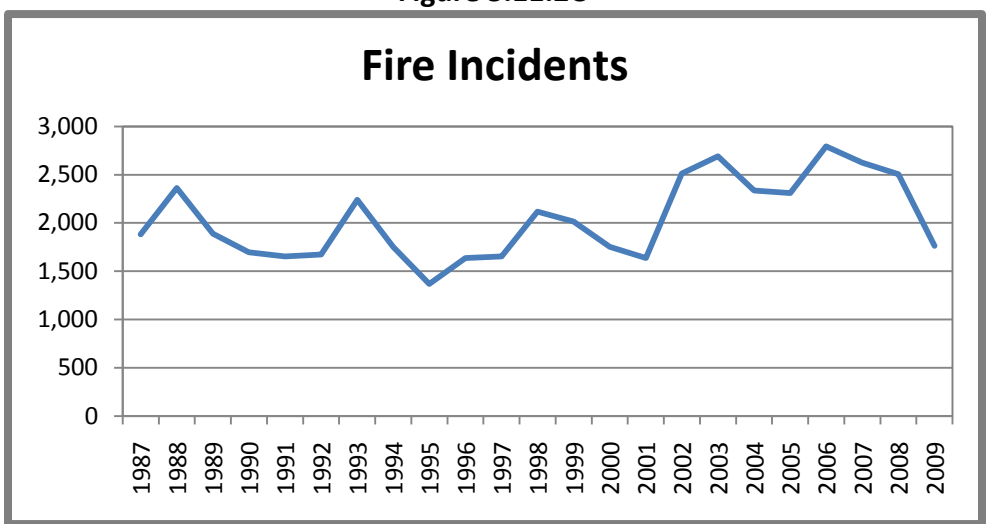
Table 5.11.2B North Dakota Fire Statistics from 1987-2009

Year	Total Number of Fire Incidents	Estimated Losses	Structure Fires	Vehicle Fires	Wildland Fires	Fatalities
1987	1,882 fires	$16,800,000	703	422	472	12
1988	2,363 fires	$13,000,000	764	421	1,003	12
1989	1,889 fires	$12,800,000	719	427	652	10
1990	1,697 fires	$11,300,000	614	385	563	4
1991	1,654 fires	$12,500,000	534	410	479	14
1992	1,674 fires	$9,900,000	531	391	447	11
1993	2,240 fires	$8,000,000	567	355	424	12
1994	1,754 fires	$12,800,000	688	428	518	11
1995	1,367 fires	$15,500,000	610	383	359	16
1996	1,637 fires	$20,000,000	660	441	518	10
1997	1,654 fires	$68,900,000*	693	489	472	5
1998	2,116 fires	$22,000,000	886	585	541	7
1999	2,016 fires	$22,496,819	645	537	508	8
2000	1,754 fires	$17,448,004	572	433	492	9
2001	1,636 fires	$7,935,149	674	448	674	10
2002	2,513 fires	$8,417,885	647	448	1,017	11
2003	2,689 fires	$8,756,663	675	480	1,009	4
2004	2,336 fires	$11,772,206	648	477	706	7
2005	2,310 fires	$22,265,117	643	445	717	11
2006	2,794 fires	$11,533,834	592	429	1,216	8
2007	2,624 fires	$21,096,127	710	443	906	4
2008	2,506 fires	$28,451,096	651	409	976	10
2009	1,762 fires	$21,658,867	581	428	397	7

* includes the devastating flood/fire in Grand Forks

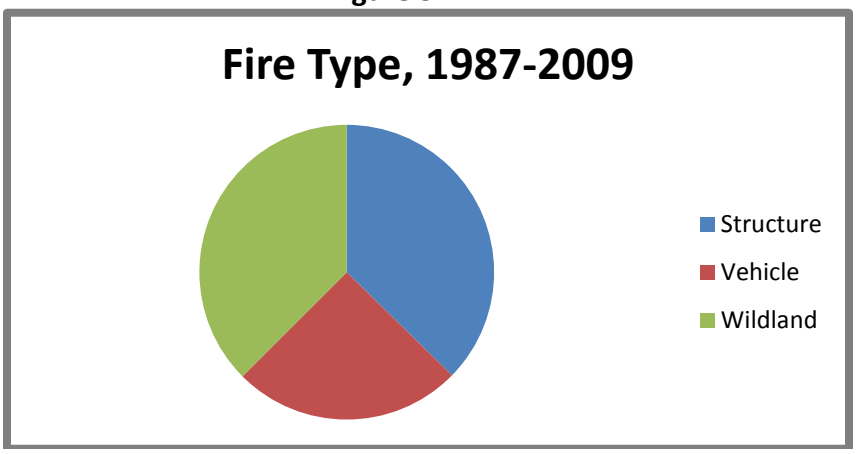
Sources: North Dakota Fire Marshal, 2007, North Dakota Fire Marshal, 2010.

Figure 5.11.2C



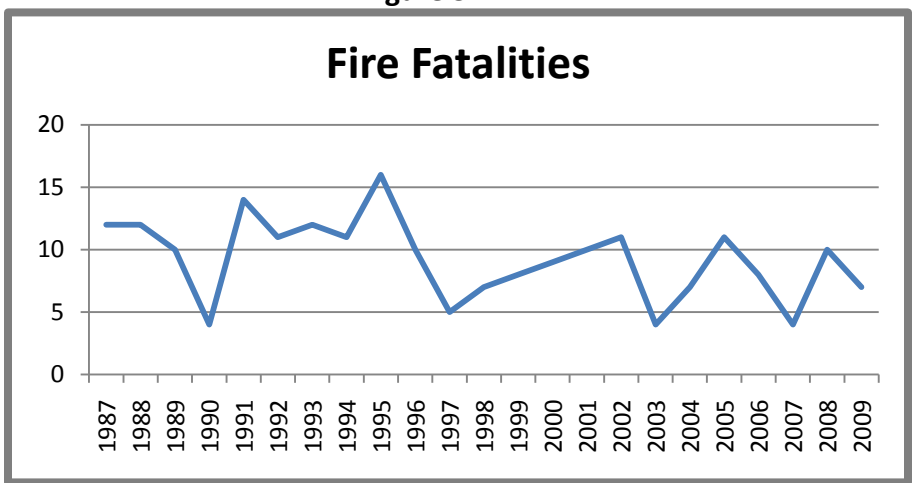
Sources: North Dakota Fire Marshal, 2007, North Dakota Fire Marshal, 2010.

Figure 5.11.2D



Sources: North Dakota Fire Marshal, 2007, North Dakota Fire Marshal, 2010.

Figure 5.11.2E



Sources: North Dakota Fire Marshal, 2007, North Dakota Fire Marshal, 2010.

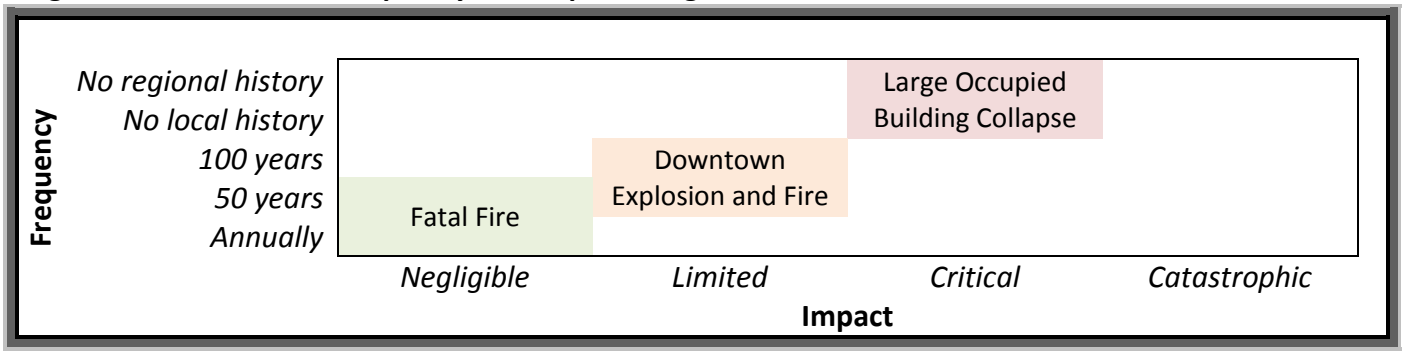
Table 5.11.2F North Dakota Urban Fire or Structure Collapse Declared Disasters and Emergencies

Declaration	Location	Date	Magnitude	Casualties	Damages
None					

5.11.3 Probability and Magnitude

Figure 5.11.3A is a graphical representation of the range of events that can occur within the urban fire and structure collapse hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the urban fire and structure collapse hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.11.3A Hazard Frequency and Impact Ranges



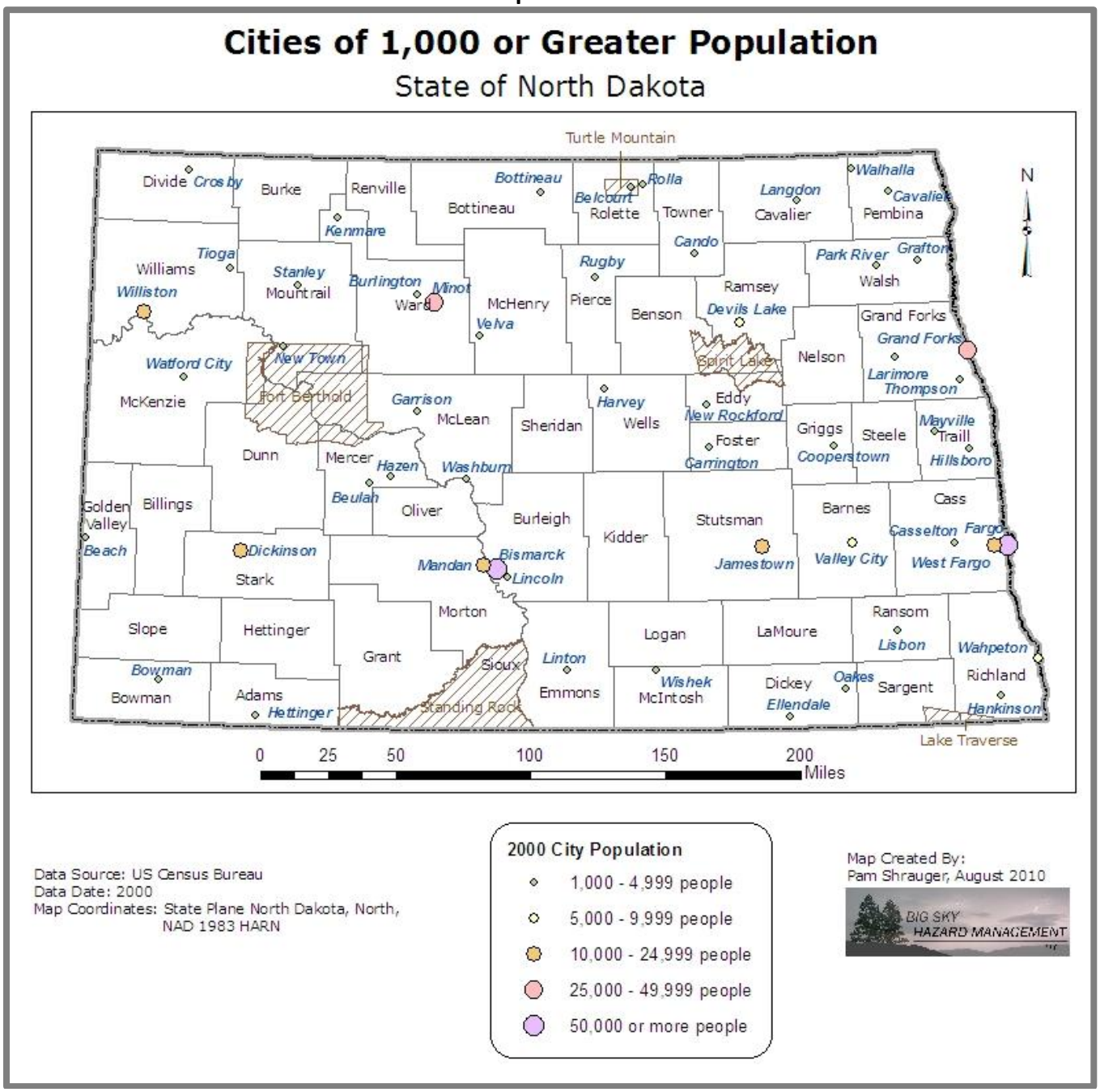
On average, North Dakota experiences 2,038 fire incidents annually, 652 of which are in structures. Losses total $17,623,120 and 9 deaths in an average year. These statistics generally encompass smaller incidents and fires. The probability of a major urban fire is much more difficult to define. With the exception of the major fire during the Grand Forks flood, a significant urban fire has not affected North Dakota communities since the 1960s. Similarly, only minor structure collapse incidents have been recorded. Those structures lacking automatic sprinkler systems are more likely to experience a major urban fire, and those structures with large span roofs or not up to building code standards are more likely to collapse.

A realistic yet devastating urban fire or structure collapse scenario for North Dakota is the complete and rapid destruction of an occupied building. In this scenario, little warning might exist for occupants and many could become trapped.

5.11.4 Mapping

Urban fires can occur anywhere, but are generally most significant in downtown areas. Map 5.11.4A shows the communities with 1,000 or more people based on 2000 census data that presumably have a vulnerable downtown area and public venues.

Map 5.11.4A


Cities of 1,000 or Greater Population
State of North Dakota
Turtle Mountain
Divide
Crosby
Burke
Renville
Bottineau
Bottineau
Belcourt
Rolla
Rolette
Towner
Langdon
Cavalier
Walhalla
Cavalier
Pembina
Kenmare
Tioga
Williams
Williston
Stanley
Mountrail
Burlington
Minot
Ward
McHenry
Velva
Rugby
Pierce
Cando
Benson
Ramsey
Devils Lake
Park River
Grafton
Walsh
Grand Forks
Grand Forks
Larimore
Thompson
Nelson
Spirit Lake
Watford City
New Town
Fort Berthold
McKenzie
Garrison
McLean
Sheridan
Harvey
Wells
Eddy
New Rockford
Foster
Carrington
Griggs
Cooperstown
Steele
Mayville
Traill
Hillsboro
Dunn
Mercer
Hazen
Washburn
Beulah
Golden Valley
Billings
Beach
Oliver
Burleigh
Kidder
Stutsman
Jamestown
Barnes
Valley City
Cass
Casselton
Fargo
West Fargo
Dickinson
Stark
Mandan
Bismarck
Lincoln
Morton
Slope
Hettinger
Grant
Sioux
Standing Rock
Linton
Emmons
Logan
Wishek
McIntosh
LaMoure
Dickey
Ellendale
Oakes
Ransom
Lisbon
Sargent
Richland
Wahpeton
Hankinson
Bowman
Bowman
Adams
Hettinger
Lake Traverse
N
0 25 50 100 150 200 Miles
2000 City Population
1,000 - 4,999 people
5,000 - 9,999 people
10,000 - 24,999 people
25,000 - 49,999 people
50,000 or more people
Data Source: US Census Bureau
Data Date: 2000
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY HAZARD MANAGEMENT

5.11.5 Vulnerabilities to Jurisdictions

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

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

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

Table 5.11.5A shows the urban fire or structure collapse hazard ratings. The county ratings were determined based on the number and size of urban areas within the county. The rating was increased if the county does not have any jurisdictions enforcing building codes. The age of structures in the county and fire department capabilities can also be important factors with respect to fire and collapse vulnerability.

Table 5.11.5A Urban Fire or Structure Collapse Risk to Jurisdictions

County	Urban Fire or Structure Collapse Hazard	Hazard Rating in Local/Tribal Plan*	Additional Information from Local/Tribal Plan
Adams	Low-Moderate	C	
Barnes	Moderate	D	
Benson	Low	NP	
Billings	Low	C	
Bottineau	Low-Moderate	D	
Bowman	Moderate	D	
Burke	Low	C	
Burleigh	High	D	
Cass	High	D	
Cavalier	Low-Moderate	C	
Dickey	Low-Moderate	C	
Divide	Moderate	NP	

Table 5.11.5A Urban Fire or Structure Collapse Risk to Jurisdictions (continued)

County	Urban Fire or Structure Collapse Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Dunn	Low	C	
Eddy	Low-Moderate	C	
Emmons	Low-Moderate	C	
*Fort Berthold^*	*Low-Moderate*	*NP*	
Foster	Low-Moderate	D	
Golden Valley	Low-Moderate	C	
Grand Forks	High	D	
Grant	Low	C	
Griggs	Low-Moderate	C	
Hettinger	Low-Moderate	D	
Kidder	Low-Moderate	C	
*Lake Traverse^*	*Low*	*NP*	
LaMoure	Low	#8 of 12	
Logan	Low	D	
McHenry	Low-Moderate	D	
McIntosh	Moderate	C	
McKenzie	Low-Moderate	NP	
McLean	Low-Moderate	B	
Mercer	Low-Moderate	C	
Morton	Moderate-High	D	
Mountrail	Low-Moderate	C	
Nelson	Low	D	
Oliver	Low	C	
Pembina	Low-Moderate	D	
Pierce	Moderate	C	
Ramsey	Moderate	C	
Ransom	Low-Moderate	Medium	
Renville	Low	D	
Richland	Moderate	C	
Rolette	Moderate	NP	
Sargent	Low	D	
Sheridan	Low	NP	
Sioux	Low-Moderate	NP	
Slope	Low-Moderate	NP	
Spirit Lake	*Low*	*NP*	
*Standing Rock^*	*Low-Moderate*	*NP*	
Stark	Moderate-High	NP	
Steele	Low-Moderate	NP	

Table 5.11.5A Urban Fire or Structure Collapse Risk to Jurisdictions (continued)

County	Urban Fire or Structure Collapse Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Stutsman	Moderate-High	D	
Towner	Moderate	D	
Traill	Low-Moderate	D	
*Turtle Mountain^*	*Moderate*	*NP*	
Walsh	Low-Moderate	B	
Ward	High	C	
Wells	Moderate	D	
Williams	Moderate-High	B	

NP = no local plan
* Many of the local plans include only urban fire.
^ includes only North Dakota parts of the reservation

5.11.6 Vulnerabilities of State-Owned Buildings and Property

Any building is vulnerable to structure fire and collapse, however, sprinkler systems can minimize fire losses. Those state-owned buildings that do not have a sprinkler system are at greater risk for fire losses. Like structure fire, structure collapses will likely result in total or near total structural losses. Using a general assumption, given improvements on construction methodologies over the years, the older the building or property, the more likely it is to succumb to a structural collapse. Flat roofs are also more susceptible to heavy snow loading and collapse. Table 5.11.6A shows the claims paid by the North Dakota State Fire and Tornado Fund to state-owned buildings and property for fire, smoke, and collapse since 1989.

Table 5.11.6A Structure Fire and Collapse Claims Paid on State-Owned Buildings and Property since 1989

County	Amount Paid for Fire	Amount Paid for Explosion	Amount Paid for Smoke	Amount Paid for Collapse	Total Amount Paid
North Dakota	*$230,698*	*$11,609*	*$36,709*	*$2,702,008*	*$2,968,791*
Barnes	$0	$0	$0	$2,685,272	$2,685,272
Bottineau	$0	$0	$0	$3,909	$3,909
Burleigh	$213,624	$0	$36,453	$12,827	$262,904
Stutsman	$15,597	$11,609	$256	$0	$27,462
Walsh	$1,477	$0	$0	$0	$1,477

Source: North Dakota State Fire and Tornado Fund, 2010.

5.11.7 Vulnerabilities of Critical Facilities and Infrastructure

Urban fires or structure collapse in a critical facility could result in temporary delays in emergency and critical services. Depending on the type of infrastructure, a fire or structure failure could result in short-term disruptions while services are rerouted. In the case of a supporting facility, such as the water

treatment plant or a lift station, long-term disruptions could be seen. For example, a fire at an electric substation may leave residents without power for several hours or days or a fire at or collapse of a water treatment plant may leave communities without water for days or weeks. Tables 5.11.7A and 5.11.7B shows the claims paid to local governments and other critical agencies for fire, smoke, and collapse by the North Dakota State Fire and Tornado Fund.

Table 5.11.7A Fire and Smoke Claims Paid on Critical Facilities Insured by the State since 1989

County	Local Govern-ment	Adjutant General	University System	School Districts	Total
North Dakota	*$2,864,496*	*$29,079*	*$2,792,771*	*$4,651,500*	*$10,337,846*
Adams	$0	$0	$3,432	$0	$3,432
Barnes	$554,121	$0	$6,345	$2,273	$562,739
Benson	$16,430	$0	$0	$113,265	$129,695
Billings	$0	$0	$0	$0	$0
Bottineau	$5,600	$0	$0	$210	$5,810
Bowman	$607	$0	$0	$0	$607
Burke	$59,846	$0	$0	$5,352	$65,198
Burleigh	$130,146	$14,666	$176,616	$1,252,164	$1,573,592
Cass	$53,765	$0	$921,004	$18,667	$993,436
Cavalier	$825	$0	$0	$37,902	$38,727
Dickey	$66,362	$0	$0	$4,747	$71,109
Divide	$0	$0	$0	$0	$0
Dunn	$73	$0	$0	$84,706	$84,779
Eddy	$0	$0	$0	$0	$0
Emmons	$28,171	$0	$0	$0	$28,171
Foster	$97,476	$0	$0	$1,676	$99,152
Golden Valley	$0	$0	$0	$0	$0
Grand Forks	$3,432	$0	$200,665	$3,471	$207,568
Grant	$5,948	$0	$0	$37,140	$43,088
Griggs	$6,422	$0	$0	$0	$6,422
Hettinger	$0	$0	$0	$0	$0
Kidder	$93,067	$0	$0	$4,106	$97,173
LaMoure	$1,034	$0	$0	$10,629	$11,663
Logan	$0	$0	$0	$0	$0
McHenry	$830	$0	$0	$17,970	$18,800
McIntosh	$11,157	$0	$0	$35,685	$46,842
McKenzie	$1,054	$0	$0	$2,375	$3,429
McLean	$0	$0	$0	$0	$0
Mercer	$0	$0	$0	$1,890	$1,890
Morton	$290	$0	$0	$7,442	$7,732
Mountrail	$0	$0	$0	$9,166	$9,166

Table 5.11.7A Fire and Smoke Claims Paid on Critical Facilities Insured by the State since 1989 (continued)

County	Local Govern-ment	Adjutant General	University System	School Districts	Total
Nelson	$13,416	$0	$0	$0	$13,416
Oliver	$0	$0	$0	$2,753,809	$2,753,809
Pembina	$1,018,635	$0	$0	$1,552	$1,020,187
Pierce	$0	$0	$0	$0	$0
Ramsey	$0	$14,413	$10,011	$2,145	$26,569
Ransom	$275	$0	$0	$4,269	$4,544
Renville	$10,337	$0	$0	$5,089	$15,426
Richland	$106,296	$0	$129,430	$35,230	$270,956
Rolette	$15,944	$0	$0	$8,873	$24,817
Sargent	$17,199	$0	$0	$0	$17,199
Sheridan	$0	$0	$0	$0	$0
Sioux	$0	$0	$0	$24	$24
Slope	$0	$0	$0	$0	$0
Stark	$128,693	$0	$268,531	$11,078	$408,302
Steele	$0	$0	$0	$0	$0
Stutsman	$135,484	$0	$0	$2,124	$137,608
Towner	$33,797	$0	$0	$6,089	$39,886
Traill	$1,827	$0	$3,725	$13,438	$18,990
Walsh	$76,581	$0	$0	$32,868	$109,449
Ward	$37,586	$0	$1,073,012	$16,993	$1,127,591
Wells	$127,166	$0	$0	$12,818	$139,984
Williams	$4,604	$0	$0	$94,265	$98,869

Source: North Dakota State Fire and Tornado Fund, 2010.

Table 5.11.7B Collapse Claims Paid on Critical Facilities Insured by the State since 1989

County	Local Government	University System	School Districts	Total
North Dakota	*$488,170*	*$1,752*	*$106,513*	*$596,435*
Barnes	$1,150	$0	$50,805	$51,955
Benson	$0	$0	$5,000	$5,000
Bowman	$0	$0	$1,154	$1,154
Burke	$1,670	$0	$0	$1,670
Cass	$298,614	$1,752	$201	$300,567
Dickey	$1,002	$0	$0	$1,002
Divide	$5,764	$0	$0	$5,764
Eddy	$3,236	$0	$0	$3,236
Foster	$735	$0	$0	$735
Grand Forks	$62,143	$0	$1,758	$63,901

Table 5.11.7B Collapse Claims Paid on Critical Facilities Insured by the State since 1989 (continued)

County	Local Government	University System	School Districts	Total
Grant	$3,601	$0	$0	$3,601
Griggs	$0	$0	$5,770	$5,770
LaMoure	$3,142	$0	$0	$3,142
McHenry	$7,289	$0	$1,972	$9,261
McKenzie	$3,771	$0	$0	$3,771
Morton	$3,292	$0	$3,481	$6,773
Nelson	$71,743	$0	$0	$71,743
Oliver	$0	$0	$825	$825
Ramsey	$0	$0	$8,748	$8,748
Ransom	$1,059	$0	$0	$1,059
Sioux	$0	$0	$10,498	$10,498
Stutsman	$2,188	$0	$1,833	$4,021
Towner	$1,000	$0	$0	$1,000
Traill	$0	$0	$6,533	$6,533
Walsh	$9,200	$0	$3,925	$13,125
Wells	$7,571	$0	$4,010	$11,581

Source: North Dakota State Fire and Tornado Fund, 2010.

Table 5.11.7C shows the critical facilities and infrastructure summary for the counties with a high or moderate-high urban fire or structure collapse rating. See Section 4.2 for more information.

Table 5.11.7C Critical Facilities and Infrastructure in High or Moderate-High Urban Fire or Structure Collapse Counties

County	Critical Facilities and Infrastructure Summary Description
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc. St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck United Tribes Technical College University of Mary Missouri River Correctional Center

Table 5.11.7C Critical Facilities and Infrastructure in High or Moderate-High Urban Fire or Structure Collapse Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Burleigh (continued)	North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure
Cass	CIKR Facilities: High (25 or more facilities) $524.7 million in Local Government Facilities $17.2 million in National Guard Assets Innovis Health MeritCare Hospital North Dakota State University Rasmussen College - Fargo Fargo Airport Interstate and Railroad Transportation Infrastructure
Grand Forks	CIKR Facilities: High (25 or more facilities) $432.9 million in Local Government Facilities $17.4 million in National Guard Assets Grand Forks Air Force Base Altru Health System University of North Dakota Grand Forks Airport Interstate and Railroad Transportation Infrastructure
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure
Stark	CIKR Facilities: Moderate-High (15-24 facilities) Dickinson State University Dickinson Airport Interstate and Railroad Transportation Infrastructure
Stutsman	CIKR Facilities: Moderate-High (15-24 facilities) $117.4 million in Local Government Facilities Jamestown College North Dakota State Hospital Jamestown Airport Interstate and Railroad Transportation Infrastructure

Table 5.11.7C Critical Facilities and Infrastructure in High or Moderate-High Urban Fire or Structure Collapse Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport
Williams	CIKR Facilities: Moderate-High (15-24 facilities) $129.3 million in Local Government Facilities Williston State College Williston Airport

* includes at least part of the reservation

5.11.8 Vulnerabilities to New and Future Development

Nationally, fire officials are working toward improved and stricter fire codes in all buildings. Fire codes usually cover the bare minimum of protection when buildings are constructed or remodeled. Future development in communities lacking fire and building codes will be more vulnerable than development that has the appropriate fire suppression systems and building codes for snow loads and structural stability in place. The development of industrial facilities housing hazardous materials could enhance the fire hazard. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties. Bowman, Rolette, and Sioux Counties do not have any jurisdictions that have adopted the state building code. Only a few jurisdictions in Barnes, Benson, Mountrail, Ransom, Sargent, Ward, and Williams Counties have adopted the building codes. New and future development in jurisdictions lacking building codes and not constructed to building code standards are at greater risk from urban fire and structure collapse.

5.11.9 Data Limitations and Other Key Documents

Fire data provides an estimation of future problems, but does not specifically address the potential for a large urban fire or structure collapse. Further evaluation of downtown areas and local building code enforcement would provide additional information in assessing the risk to the communities.

Other key documents related to the Urban Fire or Structure Collapse hazard include:

- North Dakota Emergency Operations Plan, Fire Annex

5.12 Wildland Fire

5.12.1 Characteristics

A wildland fire is an uncontrolled fire in a vegetated area. Wildland fires are a natural part of the ecosystem. They have a purpose in nature and following years of fire suppression, many areas have built up fuels that can lead to larger, more intense fires.

Any flame source can trigger a wildland fire. Once ignited, ambient conditions dictate whether the fire will spread or not. Moist, cool, and calm conditions or a lack of fuels will suppress the fire, whereas, dry, warm, and windy conditions and dry fuels will contribute to fire spread. The terrain, accessibility, and capabilities of the fire agencies are also factors in the fire's growth potential. Problems with wildfire occur when combined with the human environment. People and structures near wildfires can be threatened unless adequately protected through evacuation, mitigation, or suppression.

Wildland fires have always been common and widespread in North Dakota. Travelers, settlers, and explorers, including Lewis and Clark, documented huge fires on the horizon, the constant smell and pall of smoke in the air, and miles of blackened prairie. Studies indicate that wildfires occurred in the same locales every three to four years, with larger conflagrations taking place on a 10 to 30 year sequence. Today's wildfires follow similar cycles, with larger fires frequently coinciding with drought years. (North Dakota Forest Service, 2010a)

The state experiences over 700 wildfires that burn in excess of 37,800 acres annually on average. (North Dakota Forest Service, 2010a) The primary factors influencing these wildland fires include type, amounts, and conditions of fuel supply (vegetation), temperature, wind, precipitation patterns, humidity levels, topography, and the levels of human activity on the land.

Fires in areas of heavy vegetation, if not quickly detected and suppressed, can rapidly flare out of control and cause major damage to habitat, crops, livestock, wildlife, people, and structural property. An example of this was the McKenzie County fire of October 1999 when approximately 70,000 acres burned in just a matter of hours. Wildfire is definitely weather dependent and wind-driven.

North Dakota's general wildfire season runs from April 1st through October 31st. There are three critical periods during wildfire season: early spring prior to green-up, late summer due to higher temperatures, and fall following heavy frosts until snowfall. The first peak occurs during the spring before vegetation turns green. This tends to be a very critical time due to the fuel buildup from the previous growing season, drying winds, decreasing humidity, warmer temperatures, and increased human activity outdoors. The month of April accounts for 20% of the wildfire starts and over a third of the total acreage burned. The second peak in the fire season coincides with the increase in harvesting activities during mid to late summer. Temperatures remain hot, humidity is at its lowest, and precipitation has declined significantly. The third and final peak in fire season occurs between September 1st and October 31st when wildland fuels are fully cured out due to hard frosts, winds are frequent and high, humidity is low, and human activity remains high. Forty percent of the annual fire starts occur in this

third peak, accounting for 50% of the annual burned acreage. This third fire season typically extends until a season-ending snowfall. (North Dakota Forest Service, 2010a)

These seasons are always weather dependent and wind-driven. Wildland fires can occur at any time of the year, although they occur less frequently during the winter months because cold and snow are excellent mitigating factors. The greatest potential for major fire occurrence is in the western half of the state where grasslands are interspersed with woody draws. Annual crops and perennial grasses furnish most of the fuel for North Dakota wildland fires and constitute the largest economic loss. This comprises nearly 90% of available fuels for wildland fires. Fires in these areas are characterized by high rates of spread and moderate intensity.

A statistical breakdown of wildfire causes in North Dakota reveals that humans or human activity cause approximately 90% of the fires. These figures show that 47% of wildland fires in the state result from debris burning, 22% from miscellaneous causes, 12% from farm equipment in fields and pastures, and 7% from numerous other causes, whereas only 12% occurred from lightning. Many human acts of carelessness are demonstrated by loss of fire containment while attempting controlled burns of fields, ditches, and sloughs. Other sources of fire are related to recreational activities such as hunting, camping, off-road vehicle travel, when conditions are right, occasionally along railroad right-of-ways, and through the annual use of fireworks around the 4th of July.

Timber lands in North Dakota only account for about 2% of the available fuel for fires. There are basically six major regions of timber growth within the state: the Turtle Mountains, the Pembina Hills, the area around Devils Lake, and the limited river bottom areas of the Missouri, Red, and Sheyenne Rivers. In contrast to grassland fires, fires in timber areas generally burn hotter but spread slower.

Natural fuels, in contrast with irrigated, developed, or agricultural lands, can burn more readily, particularly on large tracts of natural fuels. Map 4.6B in the Land Use section shows the land cover type across the state. Many of these tracts coincide with government lands. Map 4.6C in the Land Use section shows the state and federal government land ownership in the state. Additionally, many parts of the state have Conservation Reserve Program (CRP) acres. The US Department of Agriculture (USDA) Farm Service Agency's Conservation Reserve Program is a voluntary program available to agricultural producers to safeguard environmentally sensitive lands. Producers enrolled in CRP establish long-term, resource-conserving covers to improve the quality of water, control soil erosion, and enhance wildlife habitat. In return, the Farm Service Agency provides participants with rental payments and cost-share assistance. (Farm Service Agency, 2004) Although the CRP benefits the environment in many respects, CRP lands may increase the fuels available and therefore the wildfire risk to nearby communities. As of July 2010, North Dakota had over 2.7 million acres participating in the CRP. (Farm Service Agency, 2010b)

Wildland fires can have devastating effects, such as the loss of livestock and wildlife, the destruction of habitat, agricultural crops, forage, and watersheds, the loss of personal and real property, valuable timber, and shelter belts, and the degradation of scenic and recreational areas. Secondary damage can occur with soil erosion, silting of streams and reservoirs, contamination of wells, flooding, and damage to utilities.

Limited resources in North Dakota necessitate the cooperation of various agencies to help share the responsibility for wildland fire mitigation and response operations. The North Dakota population is increasingly using more land for recreational activities, thereby creating a need for stronger mitigation activities to ensure minimal property loss and threat to both wildlife and human populations.

As if a raging wildfire isn't bad enough, the charred ground and thick smoke plumes it produces can create other hazards. The heavy smoke may lead to unhealthy air conditions affecting those with respiratory problems and otherwise healthy people. Smoky conditions can also lead to poor visibility and an increased probability of transportation accidents. With vegetation removed and the ground seared from a wildfire, the area also becomes more prone to flash floods and landslides because of the ground's reduced ability to hold water.

5.12.2 History

North Dakota has a long history of wildland fires ranging from small to large. Some have caused damages and others have not. The extent of damages often depends on the fire spread rate and the effectiveness of suppression and mitigation measures. On average, North Dakota has about 700 wildfires that burn a total of about 37,800 acres annually. (North Dakota Forest Service, 2010a)

Table 5.12.2A shows North Dakota fire statistics since 1987 provided by the North Dakota State Fire Marshal. Note the State Fire Marshal's Office indicates that about 75-85% of the North Dakota population is covered by reporting fire departments.

Table 5.12.2A North Dakota Fire Statistics from 1987-2009

Year	Number of Wildland Fire Incidents	Year	Number of Wildland Fire Incidents
1987	472 fires	1999	508 fires
1988	1,003 fires	2000	492 fires
1989	652 fires	2001	674 fires
1990	563 fires	2002	1,017 fires
1991	479 fires	2003	1,009 fires
1992	447 fires	2004	706 fires
1993	424 fires	2005	717 fires
1994	518 fires	2006	1,216 fires
1995	359 fires	2007	906 fires
1996	518 fires	2008	976 fires
1997	472 fires	2009	397 fires
1998	541 fires		

Source: North Dakota Fire Marshal, 2007; North Dakota Fire Marshal, 2010.

Some of the more significant wildland fire events follow:

1988 Fire Season – The 1988 season represented an extreme fire season across the region. North Dakota had at least nine separate fires that were larger than 2,000 acres, including a 10,000 acre fire in Mountrail County.

October 1999 McKenzie County Wildfire – Strong winds pushed two wildfires in McKenzie and Divide Counties, burning about 70,000 acres in a matter of hours. Twelve farms were evacuated and one abandoned farm was destroyed.

August 2000 Blacktail Wildfire – The Blacktail Fire burned nearly 6,000 acres in Billings County in "deep pockets" of cedar. No structures were threatened. Earlier in the season, a large fire burned in McKenzie County. Later in the season, another large fire burned in Golden Valley County.

June-July 2002 Kraft Complex – The Kraft Complex burned approximately 48,000 acres in Sioux and Grant Counties, destroyed 17 residences and 21 outbuildings, burned most of the Town of Shields, and threatened the community of Porcupine. In smaller unrelated fires, two people were killed while fighting fires in Burleigh and Kidder Counties in May 2002. A large fire also burned in Bowman County.

April 2003 McLean Bottoms Wildfire – The 5,000 acre wildfire along the Missouri River in Emmons County injured one firefighter and forced evacuations of some areas.

April 2005 Wilton Wildfire – Three firefighters suffered burn injuries fighting the 1,200 acre fire southwest of Wilton in Burleigh and McLean Counties. One structure was lost.

September 2005 Deep Creek Wildfire – 3,820 acres burned on federal, state, and private lands in Slope County through part of a ponderosa pine forest. Two ranches were evacuated.

September 2005 Clearwater Lake Wildfire – 7,000 acres burned on federal, state, and private lands in Mountrail County east of Stanley destroying four abandoned farmstead structures.

July 2006 Standing Rock Complex – This complex burned nearly 9,500 acres on the Standing Rock Reservation. Two firefighters were injured. At least ten homes and 400 head of livestock were evacuated. Suppression costs were estimated at $430,000.

August 2007 Muskrat Lake Wildfire – 2,800 acres burned on the Fort Berthold Reservation south of New Town. Eight structures were lost with suppression costs estimated at $150,000.

Sources: North Dakota Department of Emergency Services, 2007c; North Dakota Forest Service, 2010b; National Interagency Coordination Center, 2010.

Table 5.12.2B North Dakota Wildland Fire Declared Disasters and Emergencies

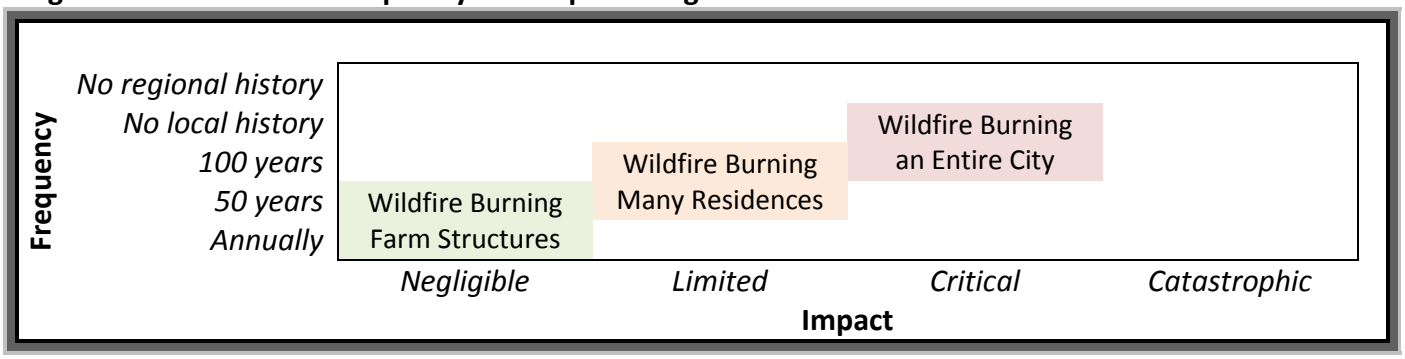
Declaration	Location	Date	Magnitude	Casualties	Damages
State EO	North Dakota	1980	State Declared Fire Disaster	Unknown	Unknown
State EO	North Dakota	1981	State Declared Fire Disaster	Unknown	Unknown
State EO	North Dakota	1988	State Declared Fire Disaster	Unknown	Unknown
State EO	North Dakota	1990	State Declared Fire Disaster	Unknown	Unknown
State EO	North Dakota	1999	State Declared Fire Disaster	Unknown	Unknown
State Request	North Dakota	2000	Governor's Request for USDA assistance for Montana wildfires	Unknown	Unknown
State EO	North Dakota	2000	State Declared Fire Disaster	Unknown	Unknown
State EO	North Dakota	2002	State Declared Fire Disaster	Unknown	Unknown
State EO	North Dakota	2004	State Declared Drought Disaster / Fire Danger Emergency	Unknown	Unknown
State EO	North Dakota	2005	State Declared Fire Disaster	Unknown	Unknown

Source: North Dakota Department of Emergency Services, 2007e.

5.12.3 Probability and Magnitude

Figure 5.12.3A is a graphical representation of the range of events that can occur within the wildland fire hazard. Generally, the more frequent events have a low impact, and the high impact event occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from the wildland fire hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.12.3A Hazard Frequency and Impact Ranges



Wildfires are an annual occurrence in North Dakota. The frequency and size of the wildfires depends on the ambient conditions and other factors. On average, North Dakota has about 700 wildfires that burn a total of about 37,800 acres annually. Nine in ten fires in North Dakota are human caused. (North Dakota Forest Service, 2010a) Studies show that wildfires occur in the same locales every three to four years, with larger conflagrations on a ten to thirty year cycle, frequently coinciding with drought years. (North Dakota Forest Service, 2010c) As history shows, the larger fires can burn tens of thousands of acres, and wildfires in the hundreds of thousands of acres are even possible.

The largest wildfire on record since 1986 in North Dakota is the 1999 McKenzie County Wildfires that burned about 70,000 acres. Wildfires of this magnitude are clearly possible and can be expected in the

future. Of greater significance, however, is a wildfire that spreads into communities destroying structures and infrastructure like the Kraft Complex did in 2002.

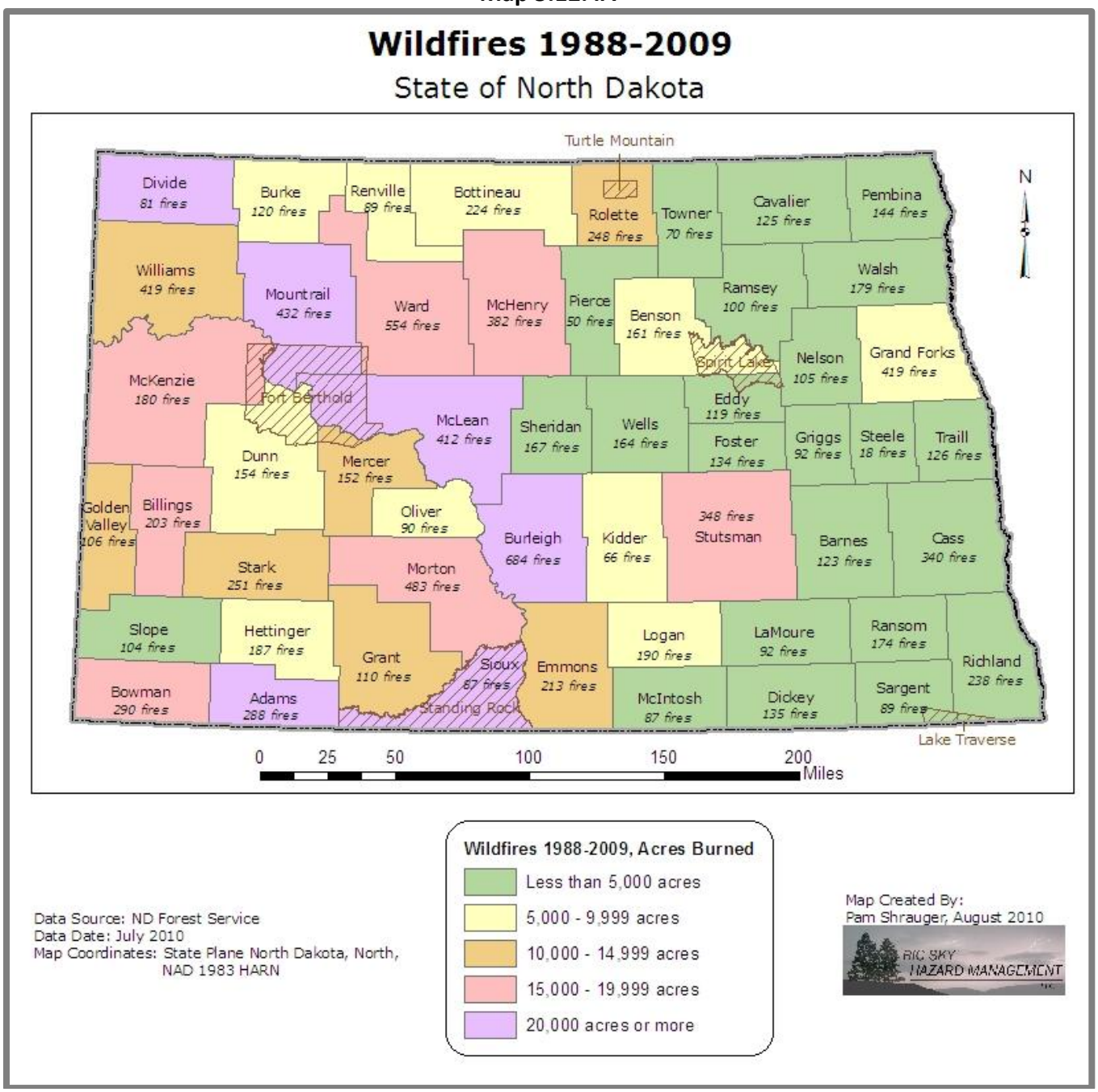
5.12.4 Mapping

Wildfire potential is mapped in a variety of ways. Since many factors play into wildfire risk, components are often mapped individually. Map 5.12.4A shows historical data provided by the North Dakota Forest Service. Note that in the database for the years 1988-2004, the fires are listed by fire department. The county that houses the primary fire station was used, but some inaccuracies may result because of fire districts that overlap county boundaries.

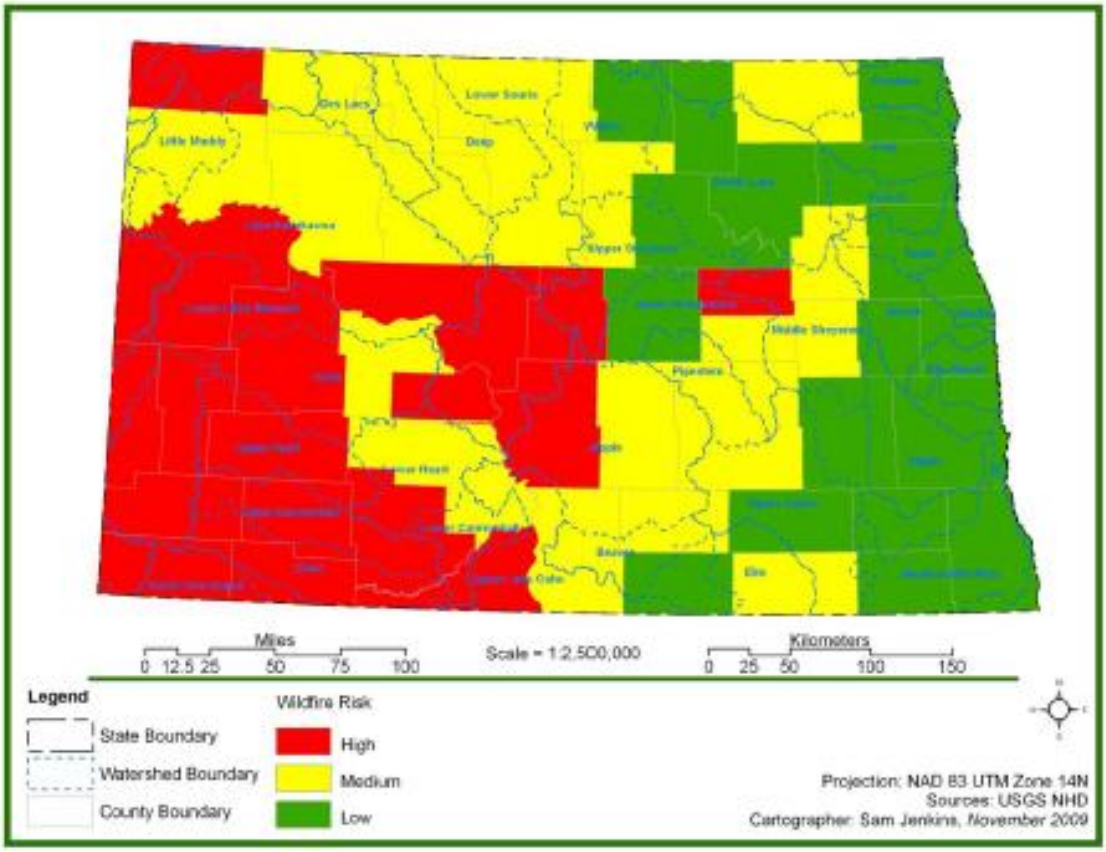
Map 4.6B in the Land Use section shows the general land cover for North Dakota. Land cover demonstrates the type of fuels available for wildfires. In the case of agriculture, the flammability depends on the crop and its condition at that point in the growing season. Grasslands and shrublands are not usually managed significantly and may contain a build-up of flashy fuels year round. Timber areas in the Turtle Mountains, the Pembina Hills, the area around Devils Lake, and the limited river bottom areas of the Missouri, Red, and Sheyenne Rivers can be seen in this map. The widespread prairie grasslands in the western part of the state and scattered in other parts of the state can also be visually depicted.

Map 5.12.4B shows the wildfire risk by county as developed by the North Dakota Forest Service in 2009 based on wildfire occurrence, fire department response capabilities, and weather.

Map 5.12.4A


Wildfires 1988-2009
State of North Dakota
Turtle Mountain
Divide 81 fires
Burke 120 fires
Renville 89 fires
Bottineau 224 fires
Rolette 248 fires
Towner 70 fires
Cavalier 125 fires
Pembina 144 fires
Williams 419 fires
Mountrail 432 fires
Ward 554 fires
McHenry 382 fires
Pierce 50 fires
Benson 161 fires
Ramsey 100 fires
Walsh 179 fires
Spirit Lake
Nelson 105 fires
Grand Forks 419 fires
McKenzie 180 fires
Fort Berthold
McLean 412 fires
Sheridan 167 fires
Wells 164 fires
Eddy 119 fires
Foster 134 fires
Griggs 92 fires
Steele 18 fires
Traill 126 fires
Dunn 154 fires
Mercer 152 fires
Golden Valley 106 fires
Billings 203 fires
Oliver 90 fires
Burleigh 684 fires
Kidder 66 fires
348 fires Stutsman
Barnes 123 fires
Cass 340 fires
Stark 251 fires
Morton 483 fires
Slope 104 fires
Hettinger 187 fires
Grant 110 fires
Sioux 87 fires
Standing Rock
Emmons 213 fires
Logan 190 fires
LaMoure 92 fires
Ransom 174 fires
Richland 238 fires
Bowman 290 fires
Adams 288 fires
McIntosh 87 fires
Dickey 135 fires
Sargent 89 fires
Lake Traverse
N
0 25 50 100 150 200 Miles
Wildfires 1988-2009, Acres Burned
Less than 5,000 acres
5,000 - 9,999 acres
10,000 - 14,999 acres
15,000 - 19,999 acres
20,000 acres or more
Data Source: ND Forest Service
Data Date: July 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY HAZARD MANAGEMENT

Map 5.12.4B
Wildfire Risk by County



Source: North Dakota Forest Service, 2010c.

5.12.5 Vulnerabilities to Jurisdictions

Homes, ranches, farms, and businesses can all be threatened by North Dakota wildland fires, particularly those in rural areas surrounded by dry, natural fuels. Much of western North Dakota has these conditions for a better part of the year, and large wildfires can develop. Estimating damages can be rather difficult because future losses will be highly dependent on future fire characteristics and locations. History has shown that personal property losses can be much greater than just that of residences. Outbuildings, fences, equipment, livestock, pastures, hay bales, and crops are often additional losses. Generally, the land use is not expected to change much in the next ten years, so those areas that have historically been affected by wildland fires will probably continue to be at risk.

Generally, the population at risk can evacuate before a wildfire moves into their area. Occasionally when strong winds are in place, wildfires can move very rapidly and catch people by surprise, or people may just refuse to evacuate; fatalities and injuries are possible. In these types of situations, firefighters can also be at risk from rapidly moving wildfires. Many times, wildfire fatalities of the evacuating population occur when frantic drivers or poor visibilities due to smoke cause a traffic accident. In recent incidents, wildfire deaths have been attributed to landowners trying to protect their own property without adequate firefighting protective equipment.

Wildfires can certainly have an effect on the regional economy. Rapidly moving wildfires can result in livestock, feed, and crop losses. Additionally, ranches may also feel the economic impacts of losing miles of fences and outbuildings. The closures and restrictions in recreation areas could lead to tourism industry losses. Natural resources are often lost during wildfires, but since wildfires are an important part of the ecosystem, such losses are usually only financial. Depending on the location, historic losses could also occur. Impacts to social values could occur for those under evacuation orders and others supporting the firefighting effort. Fire restrictions may prevent campfires, hunting, and other recreational activities people often enjoy.

The wildland fire risk to jurisdictions shown in Table 5.12.5A is based on wildfire occurrence, fire department response capabilities, and weather, as determined by the North Dakota Forest Service in 2009.

Table 5.12.5A Wildland Fire Risk to Jurisdictions

County	Wildland Fire Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	High	B	$8,600,000 estimated losses
Barnes	Low	D	$17,222,644 estimated structure and contents loss
Benson	Low	NP	
Billings	High	B	
Bottineau	Moderate	C	$22,842,716 estimated losses
Bowman	High	C	$9,600,000 estimated losses
Burke	Moderate	C	$3,600,000 estimated losses
Burleigh	High	B	$143,861,236 critical facilities losses $85,703,749 residential losses
Cass	Low	C	$16,182,636,574 estimated losses
Cavalier	Moderate	C	$91,000,000 estimated losses
Dickey	Moderate	C	
Divide	High	NP	
Dunn	High	C	
Eddy	High	C	$156,000,000 estimated losses
Emmons	Moderate	B	
*Fort Berthold^*	*Moderate-High*	*NP*	
Foster	Moderate	C	$22,872,716 estimated losses
Golden Valley	High	C	
Grand Forks	Low	D	Up to $215,000,000 enhanced risk building exposure
Grant	High	C	
Griggs	Moderate	C	$17,000,000 estimated losses
Hettinger	High	D	
Kidder	Moderate	C	$6,300,000 estimated losses

Table 5.12.5A Wildland Fire Risk to Jurisdictions (continued)

County	Wildland Fire Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
*Lake Traverse^*	*Low*	*NP*	
LaMoure	Low	#9 of 12	
Logan	Moderate	D	$1,463,529 estimated losses
McHenry	Moderate	D	$53,659,719 estimated losses
McIntosh	Low	B	$15,132,295 estimated losses
McKenzie	High	NP	
McLean	High	A	
Mercer	Moderate	C	
Morton	Moderate	D	
Mountrail	Moderate	C	$41,000,000 estimated losses
Nelson	Moderate	C	$9,144,594 estimated losses
Oliver	High	B	
Pembina	Low	D	$99,260,441 estimated losses
Pierce	Moderate	C	
Ramsey	Low	B	Hundreds of thousands of dollars in structure losses
Ransom	Low	Medium	
Renville	Moderate	C	$49,860,341 estimated losses
Richland	Low	B	
Rolette	Low	NP	
Sargent	Low	B	$10,221,436 estimated losses
Sheridan	High	NP	
Sioux	High	NP	
Slope	High	NP	
Spirit Lake	*Moderate*	*NP*	
*Standing Rock^*	*High*	*NP*	
Stark	High	NP	
Steele	Low	NP	
Stutsman	Moderate	C	$76,516,123 estimated losses
Towner	Low	D	$85,230,076 estimated losses
Traill	Low	C	$22,872,716 estimated losses
*Turtle Mountain^*	*Low*	*NP*	
Walsh	Low	C	
Ward	Moderate	C	$207,286,493 estimated losses
Wells	Low	C	
Williams	Moderate	A	$2,094,512 estimated losses

NP = no local plan
^ includes only North Dakota parts of the reservation

5.12.6 Vulnerabilities of State-Owned Buildings and Property

Wildland fire can affect any vegetated part of North Dakota but is most prevalent in the abundant fuels of the rural areas. Fortunately, most state-owned buildings and property are in developed communities and are at a low risk for wildland fire losses. Site evaluations would be needed to specifically state which buildings are at highest risk. Mowing, sprinklered lawns, and pavement that surround most state-owned buildings typically provide a buffer from most wildland fires.

5.12.7 Vulnerabilities of Critical Facilities and Infrastructure

Wildfires have the greatest potential to threaten facilities and infrastructure lacking defensible space. Defensible space is a buffer zone between a structure and flammable fuels. Irrigation, mowed areas, tree thinning, roads, and waterways can serve as buffers to wildfires in some cases. The threat to a structure can truly only be assessed on a case-by-case basis. In many cases, critical facilities are located in developed communities, and therefore, are provided some measure of protection from the surrounding development and irrigated agricultural lands.

Often regional electric infrastructure passes through wildland and non-irrigated agricultural areas. In particular, electric substations and transmission lines and telephone lines can be buffered by or overhang natural fuels. A wildfire could disrupt electricity or communications should this infrastructure be damaged. Propane tanks also become hazardous infrastructure when a wildfire encroaches on a structure. Temporary disruptions or low flows on the public water system may occur if large amounts of water are used to fight a fire, particularly during periods of drought or peak usage times.

Table 5.12.7A shows the critical facilities and infrastructure summary for the counties with a high or moderate-high wildland fire rating. See Section 4.2 for more details.

Table 5.12.7A Critical Facilities and Infrastructure in High Wildland Fire Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Adams	CIKR Facilities: Low (0-4 facilities)
Billings	CIKR Facilities: Low-Moderate (5-9 facilities) Interstate and Railroad Transportation Infrastructure
Bowman	CIKR Facilities: Low-Moderate (5-9 facilities)
Burleigh	CIKR Facilities: Moderate-High (15-24 facilities) $290.4 million in Local Government Facilities $64.1 million in National Guard Assets Fraine Barracks State Capital Complex and State Office State Emergency Operations Center/Fusion Center State Bureau of Criminal Investigation Lab Bank of North Dakota State Department of Health Lab and Morgue Medcenter One, Inc.

Table 5.12.7A Critical Facilities and Infrastructure in High Wildland Fire Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Burleigh (continued)	St. Alexius Medical Center Bismarck State College Rasmussen College – Bismarck United Tribes Technical College University of Mary Missouri River Correctional Center North Dakota State Penitentiary Bismarck Airport Interstate and Railroad Transportation Infrastructure
Divide	CIKR Facilities: Low-Moderate (5-9 facilities)
Dunn*	CIKR Facilities: Low (0-4 facilities)
Eddy*	CIKR Facilities: Low (0-4 facilities)
Golden Valley	CIKR Facilities: Low (0-4 facilities) Interstate and Railroad Transportation Infrastructure
Grant	CIKR Facilities: Low-Moderate (5-9 facilities)
Hettinger	CIKR Facilities: Low (0-4 facilities)
McKenzie*	CIKR Facilities: Moderate (10-14 facilities)
McLean*	CIKR Facilities: Moderate (10-14 facilities) Coal Creek Power Plant Garrison Hydroelectric Power Plant
Oliver	CIKR Facilities: Low-Moderate (5-9 facilities) Milton R. Young Power Plant
Sheridan	CIKR Facilities: Low (0-4 facilities)
Sioux*	CIKR Facilities: Low (0-4 facilities) Sitting Bull College
Slope	CIKR Facilities: Low (0-4 facilities)
Stark	CIKR Facilities: Moderate-High (15-24 facilities) Dickinson State University Dickinson Airport Interstate and Railroad Transportation Infrastructure

5.12.8 Vulnerabilities to New and Future Development

Remote, isolated, forested areas are becoming more popular places to live or to have a second home, as national trends show. Growth in these parts of North Dakota is possible. Regulating growth in these areas is a delicate balance between protecting private property rights, promoting economic development, and promoting public safety. Future development could have a negative impact on the wildland fire vulnerabilities, putting more people and property in harm's way. Few North Dakota communities have requirements related to ingress and egress, building sites, densities, water supply, building materials, and fuels maintenance. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom,

Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties. Of these counties, Billings, Bowman, Burleigh, McKenzie, Sioux, and Stark have a high wildland fire hazard designation.

5.12.9 Data Limitations and Other Key Documents

A comprehensive historical wildland fire digital database for the state encompassing all firefighting agencies that includes data on start location, cause, area burned, suppression costs, and damage would prove highly beneficial in better pinpointing the hazard areas.

Other key documents related to the Wildland Fire hazard include:

- North Dakota Emergency Operations Plan, Fire Annex
- North Dakota Forest Service, Building Sustainable Communities Through Forestry
- North Dakota Statewide Assessment of Forest Resources and Forest Resource Strategy
- Fire Management Plans for federal lands

5.13 Winter Storm

Including Blizzards, Heavy Snow, Ice Storms, and Extreme Cold

5.13.1 Characteristics

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

The winter season can begin as early as September and last into May. The bulk of North Dakota's winter weather is from mid-November until early April. On average, there are around ten winter storms (ice storms, heavy snow events, winter storms, and blizzards) each year. Three to four of these storms reach blizzard intensity, thus North Dakota typically leads the nation in blizzard frequency. (National Climatic Data Center, 2010; National Weather Service, 2007e)

Other hazards are prolonged periods of cold often associated with high winds, which produce life-threatening situations. Winter weather too often catches people unprepared. Researchers have said that 70 percent of the fatalities related to ice and snow occur in automobiles and about 25 percent are related to people who have been caught off guard out in the storm. Ice storms with wind, or heavy snow without wind, have been extremely dangerous and costly to 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. Rural residents are especially hard hit if they are not adequately stocked with food and fuel. The livestock industry can be severely impacted. The inability to get feed and water to livestock can become critical quickly. Dehydration is a major cause of livestock casualties. Cattle can't lick enough snow to satisfy their thirst; they die of lack of water before succumbing to cold or suffocation.

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, 2007d) Figure 5.13.1A shows the wind chill chart.

Figure 5.13.1A

NWS Windchill Chart

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
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*

Source: National Weather Service, 2007d.

The lack of adherence to simple but important and necessary precautions or even apathy can result in loss of property, injury, and even death. Wind chill conditions become very relevant when human tissue is exposed to the outside air. This can occur when people become stranded in a blizzard and attempt to walk to safety and become lost. Overexertion due to winter activities can and does cause heart attacks. Lowering of the body core temperature leads to the condition known as "hypothermia." Hypothermia has often been called "the killer of the unprepared." It also claims the lives of many outdoor sports enthusiasts. This condition occurs when the body or "core temperature" is lowered. The blood is cooled, thereby reducing the amount of oxygen which is carried to the brain, thus dulling the senses. The victim becomes fatigued, delirious, and loses dexterity and control of arms and legs. If the body core temperature continues to drop and nears 85°F, the victim eventually slips into unconsciousness. If treatment is not started immediately, the result is arrest of the circulatory and respiratory systems and death.

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

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

5.13.2 History

North Dakota has winter storms several times per year. Records show that only three to four severe, widespread blizzards occur each decade. The winter of 1996 with incredible levels of snow almost statewide and the blizzard and rapid thaw of April 1997 produced conditions of such dramatic proportions that records were not available to compare the magnitude of the total loss which occurred. A summary of some of the more significant winter weather events across the state follow:

1886-1887 Winter – A severe winter in the western part of the Dakota Territory put an end to open range ranching.

January 1888 Blizzard – Also called the "Schoolhouse Blizzard," the blizzard of 1888 swept through the Dakota Territory during the afternoon of January 12. The day started off with relatively warm temperatures and caught many people off guard. Reportedly, the temperature dropped from 32°F to -20°F in five minutes and the wind blew so strong that people were knocked off their feet. Many children, sent home from school, did not make it home. The blizzard was so withering that people lost their sense of direction and wandered about until they died of hypothermia. Thousands of head of livestock and wild animals perished. Many buildings were covered with snow or destroyed, and all transportation stopped. Although the storm lasted less than one day, an estimated 400 people died in the Dakotas.

March 1920 Blizzard – The blizzard, lasting three days with winds to 70 mph, killed 34 people. In front of the Oliver County Courthouse, this storm is remembered by a statue of Hazel Miner, killed on her way home from school near Center.

March 1941 Blizzard – The Red River Valley blizzard killed 39 people in North Dakota.

March 1966 Blizzard – This remarkable blizzard hit the Northern Plains and is noted for its long duration. Bismarck had near zero visibility for 42 consecutive hours with 22.4 inches of snow. The livestock losses were extreme; over 100,000 head of livestock were lost in the Dakotas. One farm in eastern North Dakota lost 7,000 turkeys. An estimated 15 people died in this storm.

Figure 5.13.2A The March 1966 blizzard nearly buried utility poles. This photo was taken by Bill Koch of the North Dakota State Highway Department near Jamestown.
Source: National Oceanic and Atmospheric Administration, 2007.

January 1975 Blizzard – A blizzard with 60-70 mph winds and -20°F temperatures resulted in the deaths of 12 North Dakotans and countless cattle.

February 1984 Blizzard – The sudden onset of the blizzard that struck eastern North Dakota claimed six lives in North Dakota, including four people that died at the Fargo 19th Avenue North underpass of carbon monoxide poisoning.

1996-1997 Winter - The heavy snows of late 1996, accompanied by severe winds in early January 1997, resulted in near statewide disruption of transportation with major road blockage as well as rail and local airport disruptions. The January 9, 1997 blizzard left cumulative snow amounts across the state from 13 to 65 inches. Wind chills of 80 degrees below zero were recorded. Interstates 1-29 and 1-94 were closed for four days. Nine storm-related deaths occurred, several of which were due to cold exposure. Snow and ice blocked vents preventing adequate air circulation resulted in numerous residents being treated for carbon monoxide poisoning in Mandan. A rapid spring thaw created flooding in west central and southwestern North Dakota in mid to late March. Another blizzard moved into western North Dakota on April 4th and 5th, leaving an additional 10 to 24 inches of snow throughout the state. The life threatening conditions caused massive power outages and shut down road systems. Freezing rain, combined with high winds, toppled government and commercial radio and television towers, leaving many without access to emergency information. Reports from ten electric power cooperatives stated that hundreds of transmission towers and about 4,300 power poles toppled. Propane and food shortages were reported by some rural residents. Many farm buildings collapsed under the weight of the snow. Snow blocked roadways compounded many problems. At least 100,000 cattle were lost. Damages were estimated at $317 million with at least 8 deaths and 91 injuries.

April 1999 Ice Storm – The eastern part of North Dakota experienced ice and snow that collected on power lines and resulted in widespread power outages. Thousands were without power and city foresters spent weeks hauling away downed tree branches.

November 2000 Winter Storm and Ice Storm – Early season heavy snowfall in north-central and western North Dakota, up to 18 inches, closed roads and caused numerous accidents, injuring 7 seriously in a bus accident. In the northwest part of the state, at least 500 power poles were damaged at a cost of about $1 million. In Cavalier and Ramsey Counties, ice accumulations caused power outages of up to 12 hours for some.

January 2004 Winter Storm – A persistent winter storm brought snow up to 12 inches to northwest and central North Dakota. The storm began as freezing rain before changing to snow. Winds of 15-25 mph

caused considerable blowing and drifting snow and wind chills to 30 below zero. Travel was significantly impacted.

October 2005 Blizzard – An early season blizzard in western and northern North Dakota dropped up to 22 inches of heavy wet snow, downing power lines and closing many roadways, including 155 miles of Interstate 94. The National Guard was called in to rescue hundreds of stranded motorists. Damages were estimated at $2.2 million.

November 2005 Ice Storm – An accumulation of ice covered trees and power lines in southeastern North Dakota. When the wind picked up, the power lines snapped. Thousands of power poles and a high voltage transmission line snapped and thousands were without power. Airports and interstates in the Fargo area were closed. Power line repairs in the Fargo area exceeded $3,000,000.

April 2006 Blizzard – A late season winter storm with winds gusting in the 35 to 45 mph range created visibilities near zero in some areas. In Williams County alone, 184 power poles were damaged or destroyed and an estimated 1,500 people were without power throughout the region. Vehicle accidents due to poor road conditions and electric system repairs lead to 3 deaths and 4 injuries. About 100 miles of Interstate 94 were closed. The storm caused major disruption to transportation, commerce, and electrical service with property damage estimated at $1,500,000. Deaths of newborn calves and school closures were also reported.

January 2010 Blizzard – Intense storm systems brought blizzard conditions and wind gusts of 45 to 55 mph to North Dakota. Many roadways and schools statewide were closed due to icy conditions, near zero visibilities, and widespread power outages. An estimated $20 million in damages, primarily to electric systems, were reported in western and central North Dakota.

April 2010 Winter Storm – Heavy wet snow and sleet combined with strong winds to cause widespread damages to electric systems and extended power outages lasting from several days to several weeks. Thousands of power poles and hundreds of high voltage transmission towers collapsed. Travel throughout central North Dakota was nearly impossible. Damages were estimated at over $35 million.

Sources: State Historical Society of North Dakota, 2007; South Dakota Office of Emergency Management, 2007; National Climatic Data Center, 2010.

The National Climatic Data Center has 369 winter weather events listed for North Dakota from 1995-2009 totaling over $326 million in damage, 15 deaths, and 129 injuries. An additional 116 extreme cold events were recorded from 1995-2009 resulting in $435,000 in damage, 9 deaths, and 2 injuries. (National Climatic Data Center, 2010) Note that some winter weather events in the database may be listed more than once if they occurred over several regions. The total number of distinct winter storms in North Dakota from 1992-April 2007 is about 155, which equates to about 10 per year. (National Weather Service, 2007e) Losses listed through the federal crop insurance program due to frost, freeze, cold winter, and cold wet weather from 2000-2009 totaled $318,042,177, or about $31.8 million annually. (Risk Management Agency, 2010)

Table 5.13.2B North Dakota Winter Weather Declared Disasters and Emergencies

Declaration	Location	Date	Other Information	Casualties	Damages
DR 3061	North Dakota	1978	For blizzards and snowstorms.	Unknown	Unknown
State EO	North Dakota	1983	For ice storm.	Unknown	Unknown
DR 1157	All counties in North Dakota	January 2-31, 1997	Public Assistance. For blizzards and severe winter storms.	8 deaths 91 injuries	$14,801,246* $317,000,000 estimated total
DR 1279	34 counties and 3 tribes in Central and Eastern North Dakota	March 1 – July 19, 1999	Public Assistance and Individual Assistance. For snow and ice. Also included impacts from severe storms, tornadoes, flooding, ground saturation, landslides, and mudslides	None	$124,391,622*~
DR 1353	Benson, Bowman, Cavalier, Divide, Golden Valley, McKenzie, Ramsey, Towner, and Williams Counties	November 1-20, 2000	Public Assistance. For winter storms.	7 injuries	$1,202,000 estimated total
State EO	North Dakota	2003	State Declared Winter Emergency	Unknown	Unknown
EM 3196	Dunn, McHenry, McKenzie, McLean, Mercer, Ward Counties and Fort Berthold Reservation	January 23-27, 2004	Public Assistance. For snow.	None	Unknown
DR 1616	23 counties and 1 tribe in western and north central North Dakota	October 4-6, 2005	Public Assistance. For severe winter storms and record/near record snow.	None	$2,689,148* $2,200,000 estimated total
DR 1621	Cass, Ransom, Richland, and Sargent Counties	November 27-30, 2005	Public Assistance. For severe winter storms.	None	$2,728,807* $3,000,000 estimated total
DR 1879	25 counties and 1 tribe mostly in western and south central North Dakota	January 20-25, 2010	Public Assistance. For severe winter storms.	None	$17,820,975*^
DR 1901	12 counties and 1 tribe in central North Dakota	April 1-3, 2010	Public Assistance. For severe winter storms.	None	$25,879,643*^

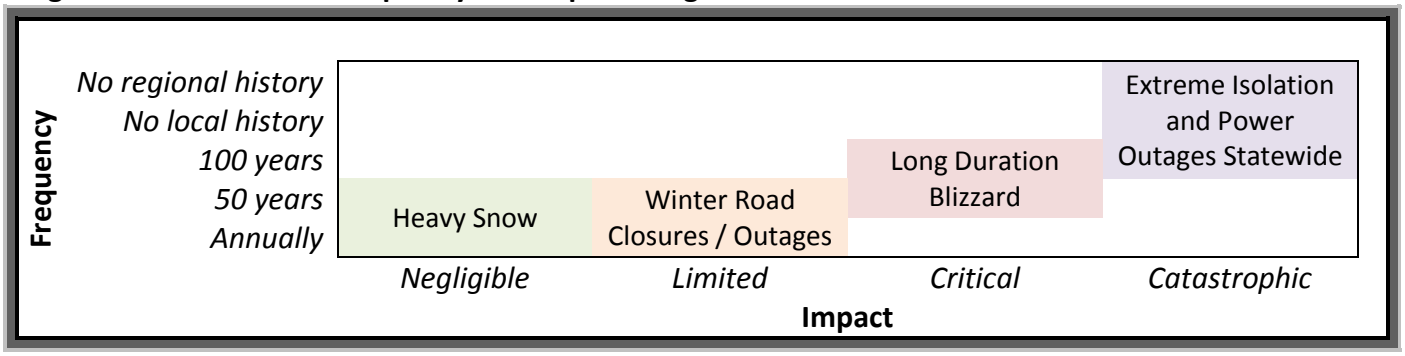
* Federal Share (includes Individual and Family Grant, Disaster Housing, Manufactured Housing, Crisis Counseling Immediate and Regular Programs, Disaster Unemployment Assistance, Hazard Mitigation Grant Program, Public Assistance, FEMA Mission Assignments, and SBA Home, Business, and Economic Injury Loans.
~ primarily includes flood impacts.
^ preliminary numbers, subject to change.
Sources: Federal Emergency Management Agency, 2007; North Dakota Department of Emergency Services, 2007b; National Climatic Data Center, 2010; Interagency Hazard Mitigation Team Reports, varied dates; North Dakota Department of

Emergency Services, 2007e; Federal Emergency Management Agency, 2010b, North Dakota Department of Emergency Services, 2010b; North Dakota Department of Emergency Services, 2010c.

5.13.3 Probability and Magnitude

Figure 5.13.3A is a graphical representation of the range of events that can occur within the winter weather hazard. Generally, the more frequent events have a low impact, and the high impact events occur less frequently. All types of events may not appear in the figure, but the information presented can assist when comparing hazards (high frequency, low impact events versus low frequency, high impact events) or when assessing the range of magnitudes possible from winter weather hazard. Section 3.6 defines the impact categories and provides additional information.

Figure 5.13.3A Hazard Frequency and Impact Ranges



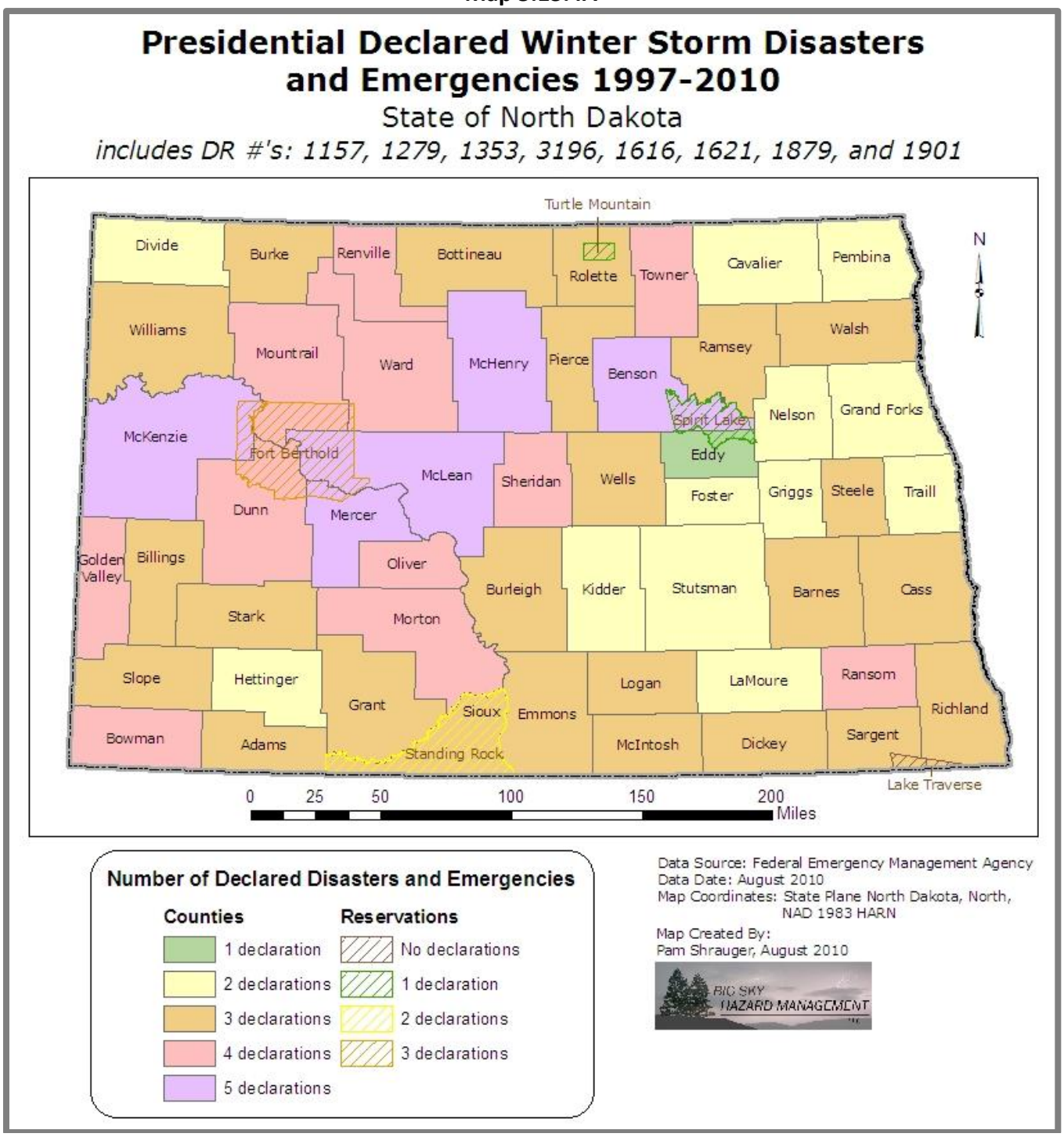
Based on blizzard studies, a typical North Dakota county may experience an average of two blizzards annually, while statewide, about three to four of these extremely dangerous storms occur. (Schwartz, 2000; National Weather Service, 2007e) The National Climatic Data Center data from 1992-April 2007 translates into about 10 winter storm events annually in the state with an annual average of $20-25 million in damages, 1-2 deaths, and 5-10 injuries. Extreme cold events, separate from the winter storms, occur about 2 times per year and result in about 1 death or injury annually. (National Climatic Data Center, 2010; National Weather Service, 2007e)

The severe blizzards and winter storms that result in the loss of life, extended road closures, long-term power outages, communication failures, or significant isolation problems represent high magnitude winter storm events for North Dakota. Blizzard conditions continuing for 2 or more days and blocked roadways or power outages for a week or more both represent extreme winter weather conditions that are possible. These types of events present significant transportation, sheltering, and logistical challenges.

5.13.4 Mapping

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. Map 5.13.4A shows the number of winter storm Presidential disaster and emergency declarations since 1997 by county.

Map 5.13.4A


Presidential Declared Winter Storm Disasters and Emergencies 1997-2010
State of North Dakota
includes DR #'s: 1157, 1279, 1353, 3196, 1616, 1621, 1879, and 1901
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
N
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
0 25 50 100 150 200 Miles
Number of Declared Disasters and Emergencies
Counties
1 declaration
2 declarations
3 declarations
4 declarations
5 declarations
Reservations
No declarations
1 declaration
2 declarations
3 declarations
Data Source: Federal Emergency Management Agency
Data Date: August 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, August 2010
BIG SKY HAZARD MANAGEMENT

5.13.5 Vulnerabilities to Jurisdictions

The population of North Dakota is most threatened by winter storms while driving or when electric service is lost. Transportation accidents are more common during poor road and visibility conditions and may result in injuries or deaths. Property losses are usually covered by insurance. Approximately 29 percent of North Dakota's population relies on electricity for heat. Many of the counties in eastern and northern North Dakota have electricity as their primary heat source (see Table 4.2H and Map 4.2J in the Critical Facilities and Infrastructure Section). In addition, those homes and businesses that use natural gas, propane, and fuel oil still often require electricity to run the blowers and heating systems. Therefore, an extended power outage during winter may make many homes and offices unbearably cold. Additionally, during extended winter-time power outages, people often make the mistake of bringing portable generators inside or not venting them properly, leading to carbon monoxide poisoning. With poor road conditions, sheltering residents may present significant logistical challenges with getting people to heated facilities, feeding, and providing medical care. These situations, accompanied by stranded motorists that need to be rescued, represent significant threats to the population. As history has demonstrated, poorly built structures may also experience structural collapses resulting in property losses.

With respect to the economy, agriculture, transportation, and businesses in general may be affected. Winter is not a peak growing season, so agriculture may not be severely affected unless the storms arrive early or late in the growing season. The primary exceptions for agriculture are extreme cold temperatures during calving operations and keeping animals hydrated during blizzards. Ranchers must take precautions not to lose large numbers of calves and livestock during cold and snowy weather. This could have an impact on agricultural profits. Winter storms may slow transportation resulting in business closures and delivery delays. Schools often close temporarily if conditions warrant.

Perhaps the greatest threat to historical values from winter weather is the potential for pipes to freeze and burst during cold weather. Water can easily damage the interiors of structures and their contents, including items of historic value. When roads are impassable, social events may also be postponed or cancelled.

All jurisdictions in North Dakota are at high risk for winter storm losses. Table 5.13.5A shows the relative risk by county based on the number of past federal disasters and emergency declared. Note that because a county or tribe is listed as "low", this does not mean that that community is not at risk from winter storms. The relative hazard of "low" only indicates that a relatively low number of federal disasters have been declared for that particular area in comparison to the rest of the state. In general, all areas of North Dakota are at similar risk from winter storms.

Table 5.13.5A Winter Storm Risk to Jurisdictions

County	Winter Storm Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Adams	Moderate	A	$42,600,000 estimated losses
Barnes	Moderate	A	$32,713,497 estimated structure and contents loss
Benson	High	NP	
Billings	Moderate	C	
Bottineau	Moderate	A	$28,372,927 estimated losses
Bowman	Moderate-High	A	$12,000,000 estimated losses
Burke	Moderate	A	$4,400,000 estimated losses
Burleigh	Moderate	B	$53,530,492 critical facilities losses $138,679,206 residential losses
Cass	Moderate	B	$26,135,387,309 estimated losses
Cavalier	Low-Moderate	A	$19,000,000 estimated losses
Dickey	Moderate	B	
Divide	Low-Moderate	NP	
Dunn	Moderate-High	A	
Eddy	Low	A	$30,000,000 estimated losses
Emmons	Moderate	A	
*Fort Berthold^*	*Moderate*	*NP*	
Foster	Low-Moderate	A	$28,372,927 estimated losses
Golden Valley	Moderate-High	A	
Grand Forks	Low-Moderate	A	
Grant	Moderate	A	
Griggs	Low-Moderate	A	$4,700,000 estimated losses
Hettinger	Low-Moderate	A	
Kidder	Low-Moderate	A	$8,100,000 estimated losses
*Lake Traverse^*	*Low*	*NP*	
LaMoure	Low-Moderate	#1 of 12	
Logan	Moderate	A	$2,626,974 estimated losses
McHenry	High	A	$10,929,376 estimated losses
McIntosh	Moderate	B	$12,544,819 estimated losses
McKenzie	High	NP	
McLean	High	A	
Mercer	High	A	
Morton	Moderate-High	A	
Mountrail	Moderate-High	A	$5,700,000 estimated losses
Nelson	Low-Moderate	A	$11,543,038 estimated losses
Oliver	Moderate-High	A	
Pembina	Low-Moderate	A	$83,433,626 estimated losses
Pierce	Moderate	A	

Table 5.13.5A Winter Storm Risk to Jurisdictions (continued)

County	Winter Storm Hazard	Hazard Rating in Local/Tribal Plan	Additional Information from Local/Tribal Plan
Ramsey	Moderate	A	
Ransom	Moderate-High	High	
Renville	Moderate-High	A	$51,953,873 estimated losses
Richland	Moderate	A	
Rolette	Moderate	NP	
Sargent	Moderate	A	$12,978,646 estimated losses
Sheridan	Moderate-High	NP	
Sioux	Moderate	NP	
Slope	Moderate	NP	
Spirit Lake	*Low*	*NP*	
*Standing Rock^*	*Low-Moderate*	*NP*	
Stark	Moderate	NP	
Steele	Moderate	NP	
Stutsman	Low-Moderate	A	$98,309,310 estimated losses
Towner	Moderate-High	A	$5,326,880 estimated losses
Traill	Low-Moderate	A	$28,372,927 estimated losses
*Turtle Mountain^*	*Low*	*NP*	
Walsh	Moderate	A	
Ward	Moderate-High	A	$259,603,707 estimated losses
Wells	Moderate	B	
Williams	Moderate	A	$26,585,512 estimated losses

NP = no local plan
^ includes only North Dakota parts of the reservation

5.13.6 Vulnerabilities of State-Owned Buildings and Property

Most structures usually remain unaffected by winter weather with the primary exceptions being heavy snow loads, frozen pipes, or other utility failure. Should the weight of the snow on the roof of a state-owned building exceed its structural capability, the roof could collapse, as was the case in January 1997 when the roof of the Winter Show Building in Valley City collapsed. This type of loss might be generally categorized as a collapse by the North Dakota State Fire and Tornado Fund, along with other buildings that have collapsed for other reasons. Table 5.11.6A in the Urban Fire or Structure Collapse Hazard Profile shows the collapse claims paid for state-owned buildings and property. A total of about $3 million has been paid since 1989. State-owned buildings may become inaccessible during periods of heavy snow and drifting, therefore, functional losses may also occur.

5.13.7 Vulnerabilities of Critical Facilities and Infrastructure

The critical facilities themselves generally are not threatened by winter storms. Heavy snow loads on roofs, particularly large span roofs, can cause the roof to leak or even collapse depending on its

construction. Table 5.11.7B in the Urban Fire or Structure Collapse Hazard Profile shows the collapse claims paid to local governments, adjutant general, universities, and school districts since 1989; a total of nearly $600,000 in claims have been paid. Extremely cold temperatures may cause pipes to freeze and subsequently burst, causing water damage. Probably the greatest issue for critical facilities during significant winter weather is the inaccessibility of such facilities due to poor roadways, utility outages, or dangerous wind chills. First responders such as fire, law enforcement, and ambulance may have a difficult time responding during poor road conditions or may not be able to provide certain services during electric outages. Those facilities with back-up generators are better equipped to handle a winter storm situation should the power go out.

Winter weather does pose a threat to key infrastructure. The most difficult network to maintain is the road infrastructure. During periods of heavy snow, ice, or blizzards, roads can quickly become impassable, stranding motorists and isolating communities. Long term road closures during an extended cold period may diminish and threaten propane, fuel, and food supplies. Above ground power and telephone lines can be taken out by falling tree branches or thick ice accumulations. Following severe ice storms, power may take weeks to be restored. Water infrastructure may also be threatened by winter weather, particularly rapid freeze and thaw periods that cause underground water mains to burst. This could result in temporary disruptions of running water.

Table 5.13.7A shows the critical facilities and infrastructure summary for the counties with a high or moderate-high winter storm rating. See Section 4.2 for more details.

Table 5.13.7A Critical Facilities and Infrastructure in High and Moderate-High Winter Storm Hazard Counties

County	Critical Facilities and Infrastructure Summary Description
Benson*	CIKR Facilities: Low (0-4 facilities) Cankdeska Cikana Community College
Bowman	CIKR Facilities: Low-Moderate (5-9 facilities)
Dunn*	CIKR Facilities: Low (0-4 facilities)
Golden Valley	CIKR Facilities: Low (0-4 facilities) Interstate and Railroad Transportation Infrastructure
McHenry	CIKR Facilities: Low (0-4 facilities)
McKenzie*	CIKR Facilities: Moderate (10-14 facilities)
McLean*	CIKR Facilities: Moderate (10-14 facilities) Coal Creek Power Plant Garrison Hydroelectric Power Plant
Mercer*	CIKR Facilities: Moderate (10-14 facilities) Great Plains Synfuels Plant Antelope Valley Power Plant Coyote Power Plant Garrison Hydroelectric Power Plant Leland Olds Power Plant Stanton Power Plant

Table 5.13.7A Critical Facilities and Infrastructure in High and Moderate-High Winter Storm Hazard Counties (continued)

County	Critical Facilities and Infrastructure Summary Description
Morton	CIKR Facilities: Moderate-High (15-24 facilities) $2.1 million in National Guard Assets R.M. Heskett Power Plant Tesoro West Coast Refinery North Dakota Youth Correctional Center Interstate and Railroad Transportation Infrastructure
Mountrail*	CIKR Facilities: Low-Moderate (5-9 facilities) Fort Berthold Community College
Oliver	CIKR Facilities: Low-Moderate (5-9 facilities) Milton R. Young Power Plant
Ransom	CIKR Facilities: Low-Moderate (5-9 facilities) North Dakota Veterans Home
Renville	CIKR Facilities: Low (0-4 facilities)
Sheridan	CIKR Facilities: Low (0-4 facilities)
Towner	CIKR Facilities: Low (0-4 facilities)
Ward*	CIKR Facilities: Moderate-High (15-24 facilities) $142.5 million in Local Government Facilities $23.1 million in National Guard Assets Minot Air Force Base Trinity Hospital Minot State University Minot Airport

* includes at least part of the reservation

5.13.8 Vulnerabilities to New and Future Development

Future development could be impacted by winter storm hazards in those communities that lack building codes. Homes and businesses lacking the integrity to hold heavy snow loads could be placed in those areas. Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties. Bowman, Rolette, and Sioux Counties do not have any jurisdictions that have adopted the state building code. Only a few jurisdictions in Barnes, Benson, Mountrail, Ransom, Sargent, Ward, and Williams Counties have adopted the building codes. New and future development in those counties that have adopted and enforce the state building code should be better able to withstand extreme winter weather.

5.13.9 Data Limitations and Other Key Documents

Since major winter storms occur frequently in North Dakota, but do not always cause significant damages, the biggest data limitation is understanding the magnitude of an event that begins to

challenge North Dakota communities. Records outlining the winter weather conditions (snow depth, temperature, wind, snowfall rates, water content, and duration) and the problems (number of accidents, condition of roadways, electric damages, and services needed) would increase the understanding of this hazard. Meteorologists can provide more detail on the atmospheric elements of winter storms.

Other key documents related to the Winter Storm hazard include:

- North Dakota Emergency Operations Plan

5.14 Risk Assessment Summary

This risk assessment represents an approximate history and estimated vulnerabilities to the State of North Dakota from the hazards identified. As with any assessment involving natural or human-caused hazards, all potential events may not be represented here, and an actual incident may occur in a vastly different way than described. This assessment, however, will be used, where possible, to minimize damages from these events in the future.

Every type of event is different, ranging from population to property to economic impacts. Incidents also have different probabilities and magnitudes even within hazards. For example, a light snowstorm will be different than a blizzard and a moderate flood will be different from both of those. Some hazards have estimates of dollar losses and population impacts whereas others are more qualitatively assessed based on the information available during the risk assessment process. In an attempt to rate hazards and prioritize mitigation activities, the hazards are summarized based on their historical occurrence, potential losses, and local hazard assessments. For more information on these determinations, see the individual hazard profiles and local mitigation plans.

5.14.1 Presidentially Declared Disaster and Emergency Summary

Table 5.14.1A Presidentially Declared Disasters and Emergencies in North Dakota

Declaration	Date	Hazard(s)	Casualties	Damages
DR 79	1957	Tornadoes	13 deaths 103 injuries	$25,000,000 estimated total
DR 195	1965	Flood	Unknown	Unknown
DR 216	1966	Flood	Unknown	Unknown
DR 220	1966	Flood Severe Storms	1 death^ 2 injuries^	$1,356,000^ estimated total
DR 256	1969	Flood	None	$27,000,000
DR 287	1970	Flood Severe Storms	9 injuries^	$135,000^ estimated total
DR 335	1972	Flood Severe Storms	1 injury^	$350,000^ estimated total
DR 434	1974	Flood	Unknown	Unknown
DR 469	1975	Flood	Unknown	$1,000,000,000
DR 475	1975	Flood Severe Storms	1 death^ 9 injuries^	$2,830,000^ estimated total
EM 3012	1976	Flood	Unknown	Unknown
DR 501	1976	Flood	Unknown	Unknown
EM 3016	1976	Drought	None	Unknown
DR 554	1978	Flood Severe Storms	Unknown	Unknown
EM 3061	1978	Winter Storms	Unknown	Unknown
EM 3065	1978	Severe Storms Tornadoes	5 deaths 35 injuries	$3,590,000 estimated total
DR 581	1979	Flood Severe Storms	Unknown	$64,800,000
DR 658	1982	Flood	Unknown	Unknown

Table 5.14.1A Presidentially Declared Disasters and Emergencies in North Dakota (continued)

Declaration	Date	Hazard(s)	Casualties	Damages
DR 825	March – April 1989	Flood	None	$2,719,000*
DR 1001	June – July 1993	Flood Severe Storms	2 deaths	$48,446,044* $600,000,000 estimated total
DR 1032	March – July 1994	Flood Severe Storms	1 death 4 injuries	$4,073,939* $9,670,000^ estimated total
DR 1050	March – May 1995	Flood Severe Storms	3 deaths 1 injury	$15,637,415* $102,000,000 estimated total
DR 1118	March 12 – June 21, 1996	Flood	2 deaths	$13,348,768*
DR 1157	January 2-31, 1997	Winter Storms	8 deaths 91 injuries	$14,801,246* $317,000,000 estimated total
DR 1174	February 28 – May 24, 1997	Flood Severe Storms	7 deaths 2 injuries	$557,503,842* $3,700,000,000 estimated total
DR 1220	March 2 – July 18, 1998	Flood	None	$18,054,727*
DR 1279	March 1 – July 19, 1999	Flood Severe Storms Tornadoes Snow and Ice	1 death^ 1 injury^	$124,391,622* $117,864,000^ estimated total
DR 1334	April 5 – August 12, 2000	Flood Severe Storms	2 deaths 25 injuries^	$91,944,041* $21,985,000^ estimated total
DR 1353	November 1-20, 2000	Winter Storms	7 injuries	$1,202,000 estimated total
DR 1376	March 1 – July 31, 2001	Flood	3 injuries	$27,858,168*
DR 1431	June 8 – August 11, 2002	Flood Severe Storms Tornadoes	19 injuries	$1,266,549* $283,797,000^ estimated total
DR 1483	June 24-25, 2003	Severe Storms High Winds	None	$924,742* $1,900,000 estimated total
EM 3196	January 23-27, 2004	Winter Storms	None	Unknown
DR 1515	March 26 – June 14, 2004	Flood Severe Storms	None	$7,459,705*
DR 1597	June 1 – July 7, 2005	Flood Severe Storms	1 death^ 1 injury^	$20,350,276* $16,305,000^ estimated total
EM 3247	September 2005	Hurricane Katrina	None	Unknown
DR 1616	October 4-6, 2005	Winter Storms	None	$2,024,210* $2,200,000 estimated total
DR 1621	November 27-30, 2005	Winter Storms	None	$2,728,807* $3,000,000 estimated total
DR 1645	March 30 – April 30, 2006	Flood Severe Storms	2 deaths	$10,388,198*
DR 1713	June 2 – June 18, 2007	Flood Severe Storms	Unknown	$4,375,932*
DR 1725	July 15, 2007	Severe Storms Tornadoes	Unknown	$935,462* $270,000,000 estimated total
DR 1726	August 26-27, 2007	Severe Storms Tornadoes	Unknown	$12,775,075* $50,000,000 estimated total
DR 1829	March 13 – August 10, 2009	Flood Severe Storms	2 deaths 50 injuries	$184,696,371* $623,000,000 estimated total
DR 1879	January 20-25, 2010	Severe Winter Storms	None	$17,820,975*~
EM 3309	February 26 – April 30, 2010	Flood	None	$4,312,500*~

Table 5.14.1A Presidentially Declared Disasters and Emergencies in North Dakota (continued)

Declaration	Date	Hazard(s)	Casualties	Damages
DR 1901	April 1-3, 2010	Severe Winter Storms	None	$25,879,643*~
DR 1907	February 26 - July 15, 2010	Flood	None	$6,221,213*~

^ Summer Storm portion
~ preliminary numbers, subject to change
* Federal Share (includes Individual and Family Grant, Disaster Housing, Manufactured Housing, Crisis Counseling Immediate and Regular Programs, Disaster Unemployment Assistance, Hazard Mitigation Grant Program, Public Assistance, FEMA Mission Assignments, and SBA Home, Business, and Economic Injury Loans).

Table 5.14.1B Presidentially Declared Disasters and Emergencies by County

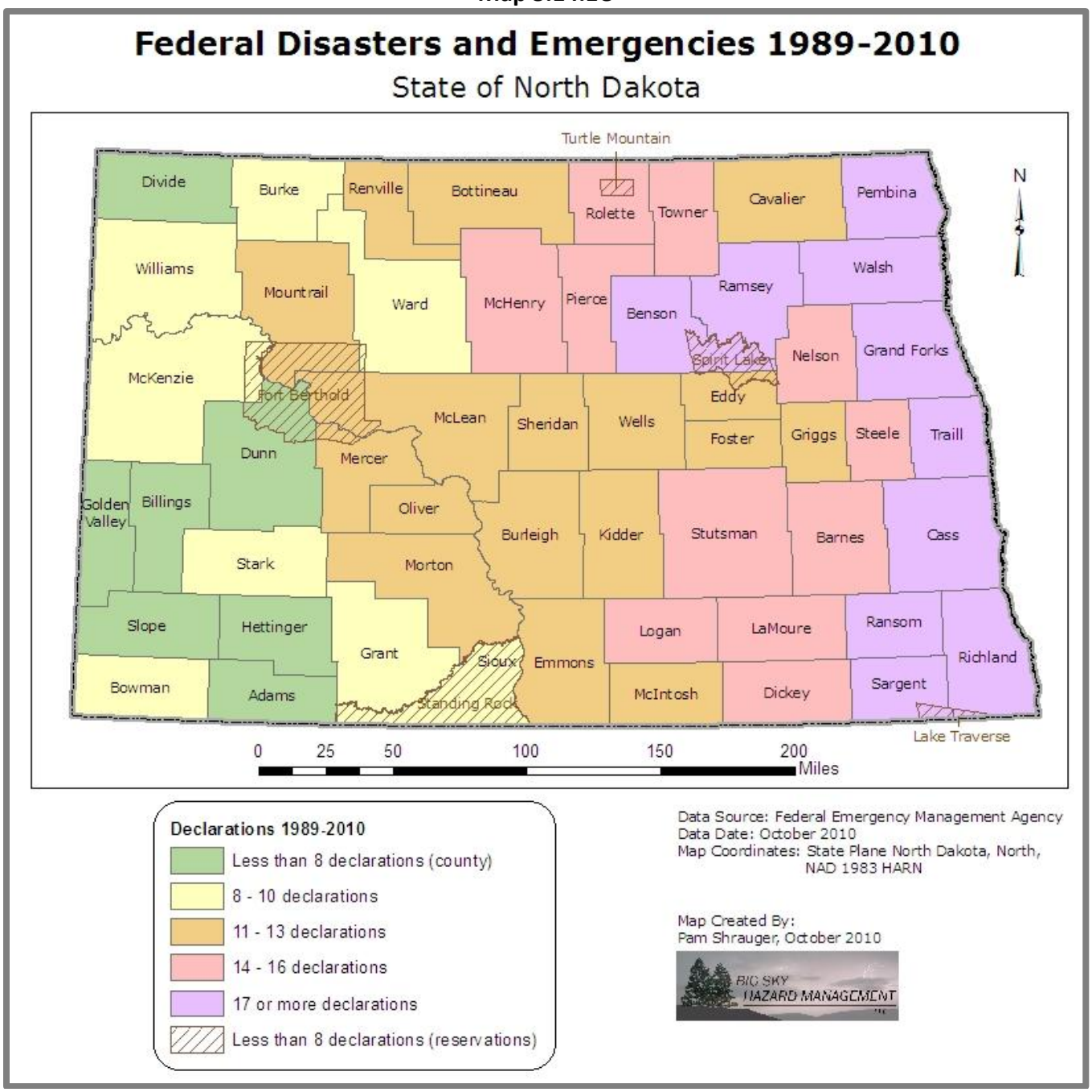
Jurisdiction	Federal Disaster/Emergency Number																												
	DR 825	DR 1001	DR 1032	DR 1050	DR 1118	DR 1157	DR 1174	DR 1220	DR 1279	DR 1334	DR 1353	DR 1376	DR 1431	DR 1483	EM 3196	DR 1515	DR 1597	EM 3247	DR 1616	DR 1621	DR 1645	DR 1713	DR 1725	DR 1726	DR 1829	DR 1879	EM 3309	DR 1901	DR 1907
Adams						X	X					X						X							X	X		X	
Barnes		X	X	X	X	X	X	X	X			X		X				X				X			X	X	X		X
Benson		X	X	X	X	X	X	X	X	X	X	X				X	X	X	X						X		X	X	X
Billings						X	X											X	X						X	X			
Bottineau				X		X	X		X	X		X				X	X	X	X						X				X
Bowman						X	X				X							X	X			X			X	X			
Burke		X				X	X								X	X		X	X						X	X			
Burleigh		X		X	X	X	X		X	X		X						X							X		X	X	
Cass	X	X			X	X	X	X	X	X		X						X		X	X	X	X		X		X		X
Cavalier		X		X	X	X	X				X	X				X	X	X			X	X			X				
Dickey		X		X	X	X	X	X	X			X					X	X				X			X	X	X		X
Divide		X				X	X				X							X											
Dunn						X	X								X			X	X						X	X			
Eddy		X	X	X	X	X	X			X		X				X		X							X				X
Emmons		X		X	X	X	X		X									X							X	X	X		X
*Fort Berthold^*									X	X			X		X		X		X										
Foster			X	X	X	X	X		X	X		X						X							X		X		X
Golden Valley						X	X				X	X						X	X							X			
Grand Forks	X	X			X	X	X		X	X		X	X			X	X	X			X			X	X		X		X
Grant		X			X	X	X					X						X				X			X	X		X	
Griggs		X	X	X	X	X	X		X	X		X				X	X	X							X				
Hettinger		X	X			X	X											X							X	X			
Kidder		X	X	X	X	X	X		X	X		X					X	X							X				X
Lake Traverse^																									X				
LaMoure		X	X	X	X	X	X	X	X			X					X	X				X			X		X		X
Logan		X	X	X	X	X	X		X	X		X						X				X			X	X			X
McHenry				X	X	X	X		X	X		X			X	X	X	X	X			X			X			X	X

Table 5.14.1B Presidentially Declared Disasters and Emergencies by County (continued)

Jurisdiction	Federal Disaster/Emergency Number																												
	DR 825	DR 1001	DR 1032	DR 1050	DR 1118	DR 1157	DR 1174	DR 1220	DR 1279	DR 1334	DR 1353	DR 1376	DR 1431	DR 1483	EM 3196	DR 1515	DR 1597	EM 3247	DR 1616	DR 1621	DR 1645	DR 1713	DR 1725	DR 1726	DR 1829	DR 1879	EM 3309	DR 1901	DR 1907
McIntosh		X	X	X	X	X	X		X									X							X	X			X
McKenzie			X			X	X				X				X			X	X						X	X			
McLean		X		X	X	X	X		X	X		X			X			X	X						X			X	
Mercer		X				X	X								X			X	X						X	X	X	X	X
Morton		X			X	X	X					X						X	X						X	X		X	X
Mountrail						X	X		X			X			X	X	X	X	X						X	X			
Nelson		X	X	X	X	X	X	X	X	X		X				X	X	X							X		X		X
Oliver		X	X		X	X	X			X								X	X						X	X		X	
Pembina	X	X		X	X	X	X	X	X	X		X	X			X	X	X			X				X		X		X
Pierce			X	X	X	X	X	X	X	X		X				X	X	X	X						X				
Ramsey		X	X	X	X	X	X	X	X	X	X	X				X	X	X							X		X		X
Ransom		X		X	X	X	X	X	X	X		X					X	X		X	X	X			X	X	X		X
Renville				X		X	X		X	X						X	X	X	X							X			X
Richland	X	X	X		X	X	X	X	X	X		X					X	X		X	X	X			X		X		X
Rolette		X	X	X		X	X	X	X	X		X					X	X	X		X				X				
Sargent		X	X	X	X	X	X	X	X	X		X					X	X		X	X	X			X				X
Sheridan		X	X	X	X	X	X		X	X		X						X	X						X			X	
Sioux		X		X		X	X										X	X							X	X		X	
Slope						X	X											X	X							X			
Spirit Lake								X	X	X						X									X		X		X
*Standing Rock^*																	X								X	X		X	
Stark		X				X	X										X	X	X						X	X			
Steele		X	X	X	X	X	X		X			X				X	X	X					X		X	X			X
Stutsman		X	X	X	X	X	X	X	X			X	X					X				X			X		X		X
Towner		X	X	X		X	X	X	X		X	X				X	X	X	X		X				X				
Traill	X	X		X	X	X	X		X	X		X	X			X	X	X			X				X		X		X
*Turtle Mountain^*								X	X							X	X				X								
Walsh	X	X	X	X	X	X	X	X	X	X		X	X			X	X	X			X				X	X	X		X
Ward						X	X		X						X	X	X	X	X						X				X
Wells		X	X	X	X	X	X		X	X		X						X							X			X	X
Williams		X	X			X	X		X		X				X			X	X						X				

^ includes only North Dakota parts of the reservation

Map 5.14.1C


Federal Disasters and Emergencies 1989-2010
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Declarations 1989-2010
Less than 8 declarations (county)
8 - 10 declarations
11 - 13 declarations
14 - 16 declarations
17 or more declarations
Less than 8 declarations (reservations)
Data Source: Federal Emergency Management Agency
Data Date: October 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, October 2010
BIG SKY HAZARD MANAGEMENT

5.14.2 Historical and Potential Loss Summary

5.14.2A Jurisdictional Losses (Private Structures, Population, Economy, and Other Values)

Hazard	Estimated Historical	Estimated Potential
Communicable Disease	6,000 people infected and 2,700 deaths with influenza in 1918 617 West Nile Virus human cases in 2003 3,254+ cases of H1N1 influenza in 2009-2010 $15M insured crop losses annually	226,395 pandemic influenza human infections 2 million head of livestock exposure $5B crop exposure Widespread economic impacts
Dam Failure	Minimal	Losses in the hundreds of millions of dollars
Drought	$200M-$1.24B annually (mostly economic losses) $89M insured crop losses annually	Continued historical losses without mitigation
Flood	$387M annually $4.7M in NFIP claims annually 2 deaths annually	Continued historical losses without mitigation $13.6M direct economic losses annually based on HAZUS estimates
Geologic Hazards	12 homes lost and numerous roads damaged	Losses in the millions of dollars
Hazardous Material Release	$2M in damages in 2002 1 death, 333 injuries in 2002	Very high population losses possible Economic and ecologic losses possible
Homeland Security Incident	Minimal, other than economic losses due to national incidents	Very high population and economic losses possible
Shortage or Outage of Critical Materials or Infrastructure	Minor economic losses	High population and economic losses possible
Summer Storm	$75M+ property and crop losses annually 0.3 deaths annually 6 injuries annually	Continued historical losses without mitigation
Transportation Accident	110 deaths annually, none from a large-scale accident	Very high population losses possible
Urban Fire or Structure Collapse	$17.6M property losses annually from minor and moderate incidents, except $68.9M in Grand Forks in 1997 9 deaths annually from minor and moderate incidents	Continued historical losses without mitigation High property, population, and economic losses possible

5.14.2A Jurisdictional Losses (Private Structures, Population, Economy, and Other Values) (continued)

Hazard	Estimated Historical	Estimated Potential
Wildland Fire	37,800 acres burned annually Minor structural loses	Continued historical losses without mitigation High property, population, and economic losses possible
Winter Storm	$22M+ annually 1-2 deaths annually 5-10 injuries annually	Continued historical losses without mitigation

5.14.2B State-Owned Buildings and Property Losses

Hazard	Estimated Historical	Estimated Potential
Communicable Disease	None	Clean-up costs possible
Dam Failure	None	Losses in the millions of dollars
Drought	None	None
Flood	$6,844 annually	Continued historical losses without mitigation
Geologic Hazards	None	Minor losses possible
Hazardous Material Release	None	None
Homeland Security Incident	$3,879 annually from minor incidents, mostly vandalism	Losses in the millions of dollars
Shortage or Outage of Critical Materials or Infrastructure	None	Minor losses possible
Summer Storm	$92,540 annually	Continued historical losses without mitigation
Transportation Accident	None	Losses possible but not likely
Urban Fire or Structure Collapse	$134,945 annually from minor and moderate incidents	Continued historical losses without mitigation
Wildland Fire	None	Isolated losses possible
Winter Storm	$136,000 annually	Continued historical losses without mitigation

5.14.2C Critical Facilities and Infrastructure Losses

Hazard	Estimated Historical	Estimated Potential
Communicable Disease	None	Clean-up costs possible Infrastructure problems possible due to lack of workers
Dam Failure	None	High losses possible
Drought	Several incidents of water and energy related losses	Continued water and energy supply losses possible
Flood	$129,267 annually, plus millions in road infrastructure damages	Continued historical losses without mitigation
Geologic Hazards	Some transportation infrastructure losses	Continued historical losses without mitigation
Hazardous Material Release	None	Contamination losses possible
Homeland Security Incident	$71,343 annually from minor incidents, mostly vandalism	Very high losses possible
Shortage or Outage of Critical Materials or Infrastructure	Electric infrastructure losses related to outages	Infrastructure losses possible related to the outages
Summer Storm	$681,702 annually, plus electric infrastructure damages	Continued historical losses without mitigation
Transportation Accident	None	Losses possible but not likely
Urban Fire or Structure Collapse	$497,013 annually from minor and moderate incidents	Continued historical losses without mitigation
Wildland Fire	None	Isolated structure and infrastructure losses possible
Winter Storm	Millions of electric infrastructure losses alone	Continued historical losses without mitigation

5.14.2D New and Future Development Losses

Hazard	Estimated Potential
Communicable Disease	Low
Dam Failure	High
Drought	Moderate – for general development High – for potable water supplies and large water users
Flood	High – 12 jurisdictions with flood hazards not in the NFIP and enforcement can be difficult in other jurisdictions
Geologic Hazards	Moderate
Hazardous Material Release	Moderate
Homeland Security Incident	Moderate
Shortage or Outage of Critical Materials or Infrastructure	Low
Summer Storm	Moderate – for communities that have adopted building codes High – for communities that have not adopted building codes
Transportation Accident	Low
Urban Fire or Structure Collapse	Moderate – for communities that have adopted building and fire codes High – for communities that have not adopted building and fire codes
Wildland Fire	Moderate
Winter Storm	Moderate – for communities that have adopted building codes High – for communities that have not adopted building codes

Population increases are being seen or are expected in Barnes, Benson, Billings, Bowman, Burleigh, Cass, Grand Forks, McKenzie, Morton, Mountrail, Ransom, Rolette, Sargent, Sioux, Stark, Ward, and Williams Counties.

5.14.3 Hazard Rankings by County/Reservation

Table 5.14.3A Statewide Hazard Rankings by County/Reservation

Jurisdiction	Communicable Disease	Dam Failure	Drought	Flood	Geologic Hazards	Hazardous Material Release	Homeland Security Incident	Shortage or Outage of Critical Materials or Infrastructure	Summer Storm	Transportation Accident	Urban Fire or Structure Collapse	Wildland Fire	Winter Storm	Multi-Hazard Rating
Adams	LM	M	M	L	L	LM	M	L	L	M	LM	H	M	**LM**
Barnes	M	H	LM	H	M	M	M	M	MH	MH	M	L	M	**MH**
Benson*	LM	L	M	H	L	LM	L	LM	H	M	L	L	H	**LM**
Billings	L	L	MH	LM	MH	H	L	L	L	MH	L	H	M	**M**
Bottineau	M	LM	MH	M	L	M	LM	M	LM	M	LM	M	M	**M**
Bowman	M	MH	MH	LM	M	M	LM	LM	LM	M	M	H	MH	**MH**
Burke	L	H	M	LM	LM	M	L	L	LM	M	L	M	M	**LM**
Burleigh	MH	H	L	MH	M	MH	H	H	MH	H	H	H	M	**H**
Cass	H	H	LM	H	L	H	H	H	H	H	H	L	M	**H**
Cavalier	LM	MH	MH	MH	L	L	M	LM	M	LM	LM	M	LM	**M**
Dickey	M	LM	M	M	L	LM	M	LM	LM	M	LM	M	M	**LM**
Divide	L	L	MH	L	M	LM	LM	L	L	M	M	H	LM	**LM**
Dunn*	LM	MH	MH	LM	MH	L	LM	LM	LM	L	L	H	MH	**M**
Eddy*	L	L	M	M	L	LM	L	L	M	M	LM	H	L	**L**
Emmons	M	LM	M	M	M	LM	M	LM	LM	M	LM	M	M	**M**
*Fort Berthold^*	LM	L	M	LM	MH	LM	LM	LM	M	LM	LM	MH	M	**LM**
Foster	LM	L	M	LM	L	LM	M	LM	L	M	LM	M	LM	**L**
Golden Valley	L	H	M	L	M	M	LM	L	LM	MH	LM	H	MH	**M**
Grand Forks	H	MH	LM	H	L	H	H	H	H	H	H	L	LM	**H**
Grant	LM	MH	M	LM	L	L	LM	L	L	L	L	H	M	**L**
Griggs	L	L	M	M	L	L	LM	L	M	LM	LM	M	LM	**L**
Hettinger	L	MH	MH	LM	L	L	LM	L	LM	L	LM	H	LM	**L**
Kidder	LM	L	MH	M	L	M	M	L	LM	MH	LM	M	LM	**LM**
*Lake Traverse^*	LM	L	LM	M	L	L	LM	L	MH	L	L	L	L	**L**
LaMoure	M	M	M	MH	L	M	LM	LM	LM	M	L	L	LM	**LM**
Logan	LM	L	MH	M	L	L	L	L	LM	LM	L	M	M	**L**
McHenry	M	M	MH	MH	M	M	L	LM	M	M	LM	M	H	**MH**
McIntosh	M	L	M	LM	L	L	LM	LM	LM	LM	M	L	M	**L**
McKenzie*	M	M	LM	LM	MH	MH	LM	LM	LM	LM	LM	H	H	**MH**

Table 5.14.3A Statewide Hazard Rankings by County/Reservation (continued)

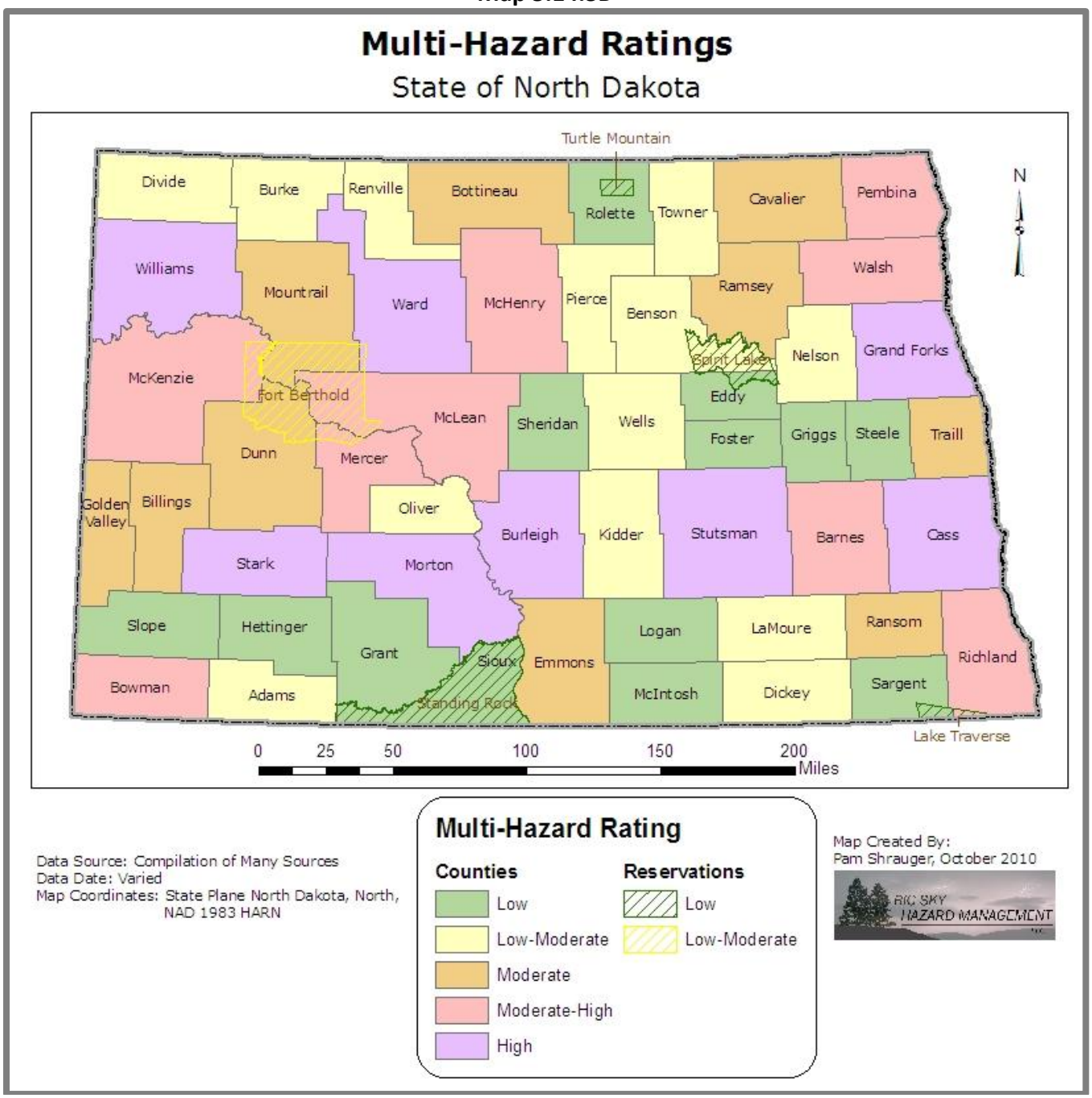
Jurisdiction	Communicable Disease	Dam Failure	Drought	Flood	Geologic Hazards	Hazardous Material Release	Homeland Security Incident	Shortage or Outage of Critical Materials or Infrastructure	Summer Storm	Transportation Accident	Urban Fire or Structure Collapse	Wildland Fire	Winter Storm	Multi-Hazard Rating
McLean*	M	MH	MH	M	M	M	LM	M	MH	M	LM	H	H	**MH**
Mercer*	LM	H	M	M	M	MH	M	M	LM	LM	LM	M	H	**MH**
Morton	H	MH	LM	MH	M	MH	M	H	MH	MH	MH	M	MH	**H**
Mountrail*	LM	H	M	LM	MH	M	LM	LM	LM	M	LM	M	MH	**M**
Nelson*	LM	M	M	MH	L	LM	L	LM	MH	M	L	M	LM	**LM**
Oliver	LM	H	MH	LM	L	L	L	L	LM	LM	L	H	MH	**LM**
Pembina	M	MH	MH	H	L	MH	M	M	MH	MH	LM	L	LM	**MH**
Pierce	LM	L	M	MH	L	LM	M	LM	LM	M	M	M	M	**LM**
Ramsey*	M	L	LM	H	L	M	MH	M	MH	MH	M	L	M	**M**
Ransom	LM	H	LM	H	L	LM	M	LM	M	LM	LM	L	MH	**M**
Renville	L	L	H	M	L	M	L	L	LM	M	L	M	MH	**LM**
Richland*	H	L	M	H	L	MH	M	MH	H	MH	M	L	M	**MH**
Rolette*	M	L	L	M	L	LM	LM	M	L	M	M	L	M	**L**
Sargent*	M	L	M	MH	L	L	LM	LM	M	LM	L	L	M	**L**
Sheridan	L	L	MH	LM	L	L	LM	L	L	LM	L	H	MH	**L**
Sioux*	M	L	LM	LM	M	L	L	LM	LM	L	LM	H	M	**L**
Slope	L	LM	H	L	M	L	L	L	L	LM	LM	H	M	**L**
Spirit Lake	LM	L	M	H	L	L	L	LM	H	LM	L	M	L	**L**
*Standing Rock^*	LM	L	LM	LM	M	L	L	LM	LM	L	LM	H	LM	**L**
Stark	MH	MH	LM	M	M	H	MH	MH	LM	H	MH	H	M	**H**
Steele	L	LM	H	M	L	L	LM	L	M	LM	LM	L	M	**L**
Stutsman	MH	MH	M	H	M	MH	MH	MH	M	H	MH	M	LM	**H**
Towner	L	LM	MH	M	L	LM	LM	L	M	M	M	L	MH	**LM**
Traill	M	M	M	H	L	M	LM	M	M	MH	LM	L	LM	**M**
*Turtle Mountain^*	LM	L	L	M	L	L	LM	LM	L	LM	M	L	L	**L**
Walsh	M	H	M	H	L	M	M	M	MH	MH	LM	L	M	**MH**
Ward*	MH	MH	L	MH	M	MH	H	H	MH	MH	H	M	MH	**H**
Wells	LM	LM	M	MH	L	M	LM	LM	L	M	M	L	M	**LM**
Williams	MH	H	LM	M	H	H	MH	MH	LM	MH	MH	M	M	**H**

L = low; LM = low-moderate; M = moderate; MH = moderate-high; H = high

* includes at least part of the reservation population

^ includes only North Dakota parts of the reservation

Map 5.14.3B


Multi-Hazard Ratings
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Data Source: Compilation of Many Sources
Data Date: Varied
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Multi-Hazard Rating
Counties
Low
Low-Moderate
Moderate
Moderate-High
High
Reservations
Low
Low-Moderate
Map Created By:
Pam Shrauger, October 2010
BIG SKY
HAZARD MANAGEMENT

In addition to the statewide assessment of the counties and reservations using statewide data for each hazard, each of the counties that completed local mitigation plans conducted their own assessments. A similar approach was used for most areas; each hazard was assigned a "risk class". The classes were based on the following criteria shown in Tables 5.14.3C and 5.14.3D.

The primary limitation with this methodology is that each county, each with their own perspectives and individuals conducting the assessments, determines its risk class for each hazard. In addition, this assessment demonstrates the variation of hazards within the county, showing which hazards have the higher disaster potential, rather than as a comparison to other counties. This information is very important for the integration of local perspectives and hazard assessments, but it does not allow for a very consistent statewide picture.

Table 5.14.3C Local Risk Analysis Criteria

FREQUENCY	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year, or at least 1 chance in the next 10 years
Possible	1-10% probability next year, or at least 1 chance in the next 100 years
Unlikely	Less than 1% probability in the next 100 years
SEVERITY	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Table 5.14.3D Local Risk Analysis Classifications

		SEVERITY			
		Negligible	*Limited*	*Critical*	*Catastrophic*
FREQUENCY	*Highly Likely*	**C**	**B**	**A**	**A**
	Likely	**C**	**C**	**B**	**A**
	Possible	**D**	**C**	**B**	**B**
	Unlikely	**D**	**D**	**C**	**C**

Table 5.14.3E Local Hazard Classifications

Jurisdiction	Communicable Disease	Dam Failure~	Drought	Flood	Geologic Hazards#	Hazardous Material Release	Homeland Security Incident^	Shortage or Outage of Critical Materials or Infrastructure	Summer Storm	Transportation Accident*	Urban Fire or Structure Collapse	Wildland Fire	Winter Storm
Adams	NI	D	B	C	NI	C	D/D	C	B	C	C	B	A
Barnes	C	C	B	A	D	B	C	B	A	D	D	D	A
Benson	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Billings	NI	D	C	C	NI	C	D/D	D	B	C	C	B	C
Bottineau	B	D	B	B	NI	B	C	D	A	D	D	C	A
Bowman	NI	B	A	C	NI	B	C/D	B	A	C	D	C	A
Burke	NI	C	B	B	NI	D	C/C	C	B	B	C	C	A
Burleigh	NI	B	A	B	NI	B	B/B	B	B	B	D	B	B
Cass	NI	C	A	B/C	NI	B	B/C/D	C	B	D	D	C	B
Cavalier	NI	D	B	C	NI	B	D/C	D	A	C	C	C	A
Dickey	NI	D	B	C	NI	C	D/C	B	C	D	C	C	B
Divide	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Dunn*	NI	D	B	C	NI	C	D/C	D	A	D	C	C	A
Eddy*	NI	C	B	C	NI	C	D/C	D	A	C	C	C	A
Emmons	A	D	A	B	NI	C	D/C	B	A	D	C	B	A
Fort Berthold	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
Foster	B	D	B	B	NI	B	C	D	A	D	D	C	A
Golden Valley	NI	D	B	D	NP	C	C/D	C	A	D	C	C	A
Grand Forks	B	D	C	A	NI	B	D	B	A	D	D	D	A
Grant	NI	D	B	C	NI	D	C/D	C	A	D	C	C	A
Griggs	NI	D	B	B	NI	C	D/C	D	A	D	C	C	A
Hettinger	A	B	A	A	NI	C	C	B	A	D	D	D	A
Kidder	NI	D	B	C	NI	B	D/B	D	A	C	C	C	A
Lake Traverse	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
LaMoure	#4	#11	#3	#6	NI	#10	#12	#2	#5	#7	#8	#9	#1
Logan	NL	C	B	A	NI	B	C	B	A	D	D	D	A
McHenry	D	C	B	A	NI	B	C	B	A	D	D	D	A
McIntosh	NI	D	B	B	NI	B	C/C	B	B	C	C	B	B
McKenzie	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
McLean	NL	A	B	A	NI	B	B	D	A	C	B	A	A

Table 5.14.3E Local Hazard Classifications (continued)

Jurisdiction	Communicable Disease	Dam Failure~	Drought	Flood	Geologic Hazards#	Hazardous Material Release	Homeland Security Incident^	Shortage or Outage of Critical Materials or Infrastructure	Summer Storm	Transportation Accident*	Urban Fire or Structure Collapse	Wildland Fire	Winter Storm
Mercer	A	D	B	B	NI	B	C/D	D	A	C	C	C	A
Morton	NI	B	B	A	NI	B	C/D	B	A	D	D	D	A
Mountrail	NI	D	A	B	NI	C	C/B	B	B	D	C	C	A
Nelson	NL	D	B	B	NI	B	C	D	A	D	D	C	A
Oliver	NI	D	B	B	NI	B	C/D	D	A	C	C	B	A
Pembina	NL	C	B	A	NI	B	C	B	A	D	D	D	A
Pierce	NI	D	B	B	NI	C	D/C	C	A	D	C	C	A
Ramsey	C	B	C	A	NI	B	D	B	A	C	C	B	A
Ransom	Med	High	High	Med	Med	Med	Med	Low	Med	NI	Med	Med	High
Renville	B	D	B	B	NI	B	C	D	A	D	D	C	A
Richland	NI	C	B	B	NI	B	C/B	B	A	C	C	B	A
Rolette	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Sargent	NI	D	B	C	NI	C	C/D	C	A	C	D	B	A
Sheridan	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Sioux	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Slope	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Spirit Lake	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
Standing Rock	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
Stark	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Steele	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Stutsman	D	D	B	B	NI	B	C	D	A	D	D	C	A
Towner	C	C	B	A	NI	B	C	B	A	D	D	D	A
Traill	B	D	B	B	NI	B	C	D	A	D	D	C	A
Turtle Mountain	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
Walsh	B	C	B	A	NI	B	C	B	A	B	B	C	A
Ward	NI	D	A	B	NI	B	B/C	C	A	D	C	C	A
Wells	NI	C	A	B	NI	C	D/D	D	B	C	D	C	B
Williams	NI	C	B	A	NI	B	D/D	D	A	C	B	A	A

NI = not identified in the local plan; NP = no local plan; NL = included in the local plan, but no classification listed
~ Some local plans include dike and/or embankment failure.
# Some local plans included a landslide or riverbank erosion hazard that was included under geologic hazards.

^ Many of the local plans have both a civil disorder/terrorism hazard and a national security hazard. Both classifications are listed respectively.
* Many of the local plans have a mass casualty hazard listed rather than a transportation accident hazard. For analysis purposes, the mass casualty is listed under the transportation accident category here.

5.14.4 Statewide Hazard Rankings

All hazards identified in this plan have the potential to cause disastrous impacts. For the purposes of focusing the mitigation strategies across the state, the hazards were prioritized and categorized into high, moderate, and low hazards. The local hazard classifications shown in Table 5.14.3E were translated into numbers (A=4, B=3, C=2, and D=1) and averaged across the state. Communicable disease was listed as a moderate hazard and geologic hazards were listed as a low hazard based on evaluations of the probability, potential impacts, and consensus during the planning process due to their exclusion in many local mitigation plans.

High Hazards:
- Winter Storm
- Summer Storm
- Drought
- Flood

Moderate Hazards:
- Communicable Disease
- Hazardous Material Release
- Wildland Fire
- Shortage or Outage of Critical Materials or Infrastructure

Low Hazards:
- Homeland Security Incident
- Geologic Hazards
- Urban Fire or Structure Collapse
- Dam Failure
- Transportation Accident

6. MITIGATION STRATEGY

6.1 Mitigation Goals, Objectives, and Initiatives

Hazard mitigation, as defined by the Disaster Mitigation Act of 2000, is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Studies on hazard mitigation show that for each dollar spent on mitigation, society saves an average of four dollars in avoided future losses. (Multihazard Mitigation Council, 2005) Mitigation can take many different forms from construction projects to public education.

The development of a mitigation strategy allows the State of North Dakota to create a vision for preventing future disasters, establish a common set of mitigation goals across state, tribal, and local agencies, prioritize actions, and evaluate the success of such actions. The North Dakota Mitigation Strategy is based on the results of the statewide risk assessment, local risk assessments and mitigation strategies, and additional recommendations by mitigation stakeholders. The goals are broad, visionary, forward-looking statements that outline in general terms what the state would like to accomplish. Goals are usually not measurable or fully attainable but rather ideals to which the state and jurisdictions should strive for as they develop and implement mitigation projects.

The following goals outline the overall hazard mitigation strategy for the State of North Dakota. The goals were revised in 2007 to reflect a greater emphasis and focus on mitigation as opposed to preparedness, response, or recovery. Preparedness, response, and recovery are vital elements of emergency management, and the goals and objectives related to them should not be minimized by their exclusion from this mitigation strategy. Changes made in 2010 include:

- Modifications to the initiative descriptions to highlight additional hazards or include related activities.
- Addition of an objective and initiative specific to the National Flood Insurance Program.
- Modification of an objective and addition of an initiative specific to impact resistant building materials.

Goal 1: ***Encourage sound state and local planning related to hazard understanding and mitigation.***
Planning is an ongoing activity at the state level and has a prominent place in the overall mitigation strategy. Through planning, we learn our capabilities and our strengths as well as areas that need to be addressed in different ways. Planning is not an activity that occurs every three years or only after a disaster; it's an integral part of the overall system. As new technology and methods are developed and new ideas are presented, plans are adapted in order to keep pace with an ever-changing world. This goal supports mitigation for each of the hazards.

Objective 1.1: Increase and improve mitigation planning efforts at the state, tribal, and local levels through technical assistance, plan development, and plan updates.

Mitigation Planning
Mitigation plans can be developed at all levels of government, private companies, and non-profit organizations. All tribal and local jurisdictions are encouraged to develop and adopt a mitigation plan that meets the requirements of the Disaster Mitigation Act of 2000 and meets the needs of the jurisdictions. In some cases, grant funding is contingent on a mitigation plan approved by the Federal Emergency Management Agency. North Dakota Department of Emergency Services provides technical and financial assistance to those jurisdictions developing or updating their mitigation plans. Improvements can additionally be made to existing plans. Similarly, Community Wildfire Protection Plans that specifically address mitigation for wildland fires may be required for jurisdictions to receive wildfire mitigation funding. The North Dakota Forest Service can provide technical assistance regarding Community Wildfire Protection Plans. An important part of the mitigation plans is to document best practices, successes, and losses avoided studies that can be shared with other communities.

Basin-Wide Water Management Planning
Comprehensive basin-wide planning in the five major basins in North Dakota – the Missouri River Basin, the James River Basin, the Souris River Basin, the Red River Basin, and the Devils Lake Basin – allows for a consistent and collaborative approach to flood and drought mitigation plans and projects. Looking at the issues that face the basins from a regional and watershed perspective rather than through single jurisdictions typically results in a more favorable and thorough plan of action.

Objective 1.2: Improve hazard understanding and risk assessments through individual hazard studies and analyses using digital data.

Data Digitization
Digital data is especially important for Geographic Information System (GIS) analyses. Current technology allows for the comparison of assets with hazard areas and a variety of other analyses. HAZUS-MH is one example of a loss estimation model that can quantify potential losses from a variety of hazards when provided with the appropriate digital data. Digitization of data such as state-owned buildings, critical facilities and infrastructure, dam inundation areas, and floodplains would allow for a better understanding of hazard vulnerabilities and improve mitigation planning in North Dakota.

Impacts Database
An all-hazard database that outlines the impacts of disasters such as physical and economic losses for the State of North Dakota would significantly increase the understanding of the hazards that threaten the state. A large number of agencies, such as the Federal Emergency Management Agency, the US Department of Agriculture, the US Department of Health and Human Services, firefighting agencies, the insurance industry, and each of their state counterparts, play important roles in disaster response and recovery. Unfortunately, because so many agencies are involved, capturing information regarding disaster losses and impacts is very challenging. A centralized, accessible source of disaster impact information that provides loss estimates for historical disasters of all types would allow for a more comprehensive risk assessment. For example, since winter weather is a regular occurrence in North Dakota, understanding the level at which such weather events create significant impacts is still relatively unknown. A database that outlines the winter weather conditions (snow depth, temperature, wind, snowfall rates, water content, and duration) and the problems (number of accidents, condition of roadways, electric damages, and services needed) would allow officials and meteorologists to better understand those conditions that severely threaten life and property. These types of databases would generally require a high level of coordination and information sharing from a wide variety of sources.

Hazardous Materials Studies
Hazardous materials are transported throughout the state in vehicles, trains, and planes. Generally, the types and quantities of hazardous materials at fixed facilities are known through reporting requirements. Much less is known about mobile hazardous materials. A study that estimates the types, quantities, and possible worst case scenarios of hazardous materials transported on the roadways, railways, and airports using field, company, and/or agency data would allow for a more accurate portrayal of the hazard. Additionally, a working group consisting of the oil industry and local and state officials could identify the long-term hazards caused by the oil boom in the state, such as the degradation of road networks and related safety issues, increased health hazards, and quality of life threats and identify additional strategies for mitigating the threats.

Utility and Critical Material Studies
Individual studies of the utilities and critical materials such as fuel, food, water, and agricultural supplies would promote a better understanding of the circumstances that may cause shortages or outages. Such studies could then be used to mitigate and prepare for future outages and shortages.

Transportation Database
A GIS database that outlines the location, number, and severity of accidents on North Dakota roadways, railways, and airports would allow for focused mitigation to reduce future losses. Similarly, compiling data on roadway, railway, air traffic, and airport use would pinpoint the areas that could most benefit from improvements.

Wildland Fire Database
Since many agencies are involved in wildland firefighting efforts across the state, a centralized, accessible, digital database that contains information such as start location, cause, area burned, suppression costs, and damage would allow for a more comprehensive analysis of the history and risk of wildfires in North Dakota.

Floodplain Map Modernization

Flood insurance rate maps (FIRMs) produced through the National Flood Insurance Program (NFIP) are widely used for insurance and risk assessment purposes. Many maps throughout the state are becoming dated as new technology has improved mapping methodologies. Updating and digitizing the maps allows for a more accurate understanding of the flood hazard and improves the basis for the NFIP.

Goal 2: *Enhance the public's awareness of hazards*.
Awareness activities educate the general public to the hazards they may encounter in the state. Since an informed public can better prepare themselves for any disaster situation, awareness activities continue to be a vital part of the overall mitigation strategy in North Dakota. This goal supports one or more awareness activities for each hazard. Special emphasis for public awareness activities is on special needs and vulnerable populations.

Objective 2.1: Provide the public with information that allows individuals to make sound personal and financial decisions before a disaster threatens.

Public Education
The individual is a powerful element of disaster mitigation. The more people that understand the hazards that threaten them and what can be done to mitigate the effects, the more likely such measures will be undertaken and future losses averted. For example, the public can be educated to recognize unusual behavior and seek help for those that may be preparing for a violent act or terrorist attack. As technology improves and new studies are conducted, the new hazard information and best practices need to be distributed to local leaders and the public. One example is a publication that demonstrates the losses avoided or that could be avoided through various land use regulations for distribution to local officials. Public education can be used as a mitigation measure for essentially any hazard, even those that are difficult to otherwise mitigate.

Situational Awareness
Increasing the understanding of and communicating hazard forecasts and outlooks can assist individuals and agencies in making sound decisions regarding the protection of lives and property. For example, farmers and ranchers can choose alternative crop or land practices if severe drought conditions are expected. The anticipation of flood conditions may allow for wiser water management decisions. The public may also make smarter pre-emptive choices that reduce the potential loss of life knowing that severe winter weather or thunderstorms are expected. Programs such as the National Weather Service's StormReady program enhance a community's situational awareness capabilities. Other systems may improve monitoring of potentially hazardous conditions such as river gauges, weather stations, and earthquake and dam monitoring systems. The concept of situational awareness as a mitigation activity extends into the homeland security realm as alert and responsible individuals and law enforcement can thwart terrorist acts or other acts of violence through situational awareness and information sharing.

Insurance Education
Informing the public of their insurance options and the associated hazards may increase their financial protection from disaster. For example, many standard homeowners' insurance policies do not cover flood losses. Earthquake and terrorism are not generally covered in many insurance policies either. Educating those in flood hazard areas regarding their financial vulnerabilities may increase their participation in the National Flood Insurance Program. Similarly, educating agricultural producers regarding crop insurance may decrease their financial losses from drought, hail, and other severe weather events.

Goal 3: ***Reduce the impact future development has on potential losses and vulnerabilities.***
Hazard mitigation becomes much more cost effective when handled before structures and infrastructure are placed in hazardous areas. Restricting development in known hazard areas or enforcing measures that mitigate the potential impacts in such areas lessens the likelihood that future disasters will affect the development. Future development is a concern in parts of North Dakota and mechanisms for reducing risk are best developed and considered before development pressures become significant.

Objective 3.1: Use land management tools to mitigate disasters before construction occurs.

Building Codes
North Dakota has a state building code. The North Dakota State Building Code consists of the 2009 International Building Code, International Residential Code, International Mechanical Code, and International Fuel Gas Code, with some state amendments. The adoption and enforcement of the State Building Code is the responsibility of the individual jurisdictions within the state. Through the State Building Code Advisory Committee, the State Building Code can be modified and strengthened. Local jurisdictions can also make their own improvements to suit their needs. Those jurisdictions that have not adopted the State Building Code can do so and improve their future development's disaster resistance. An emphasis on enforcement is encouraged for those communities that have adopted the codes. Additional improvements to the State Life Safety and Fire Codes could further reduce losses.

Zoning and Ordinances
Local governments in North Dakota are given zoning authority through zoning and planning boards and commissions. Master plans and/or comprehensive plans may be required as part of the zoning authority. Zoning and ordinances can be used to regulate development in hazardous areas. A common example of a local ordinance is the floodplain ordinance. Those communities lacking floodplain ordinances are encouraged to adopt them and join the National Flood Insurance Program. With the appropriate data, zoning in dam inundation areas could also be used. Another example encouraged by the pipeline industry is zoning critical and special needs facilities away from high pressure pipeline areas. Zoning and ordinances are tools that local jurisdictions can use to improve the disaster resistance of their future development.

Restrictive Covenants
Restrictive covenants, also known as deed restrictions, can be placed upon real estate, with some restrictions. These covenants provide regulations to the property owners and are usually governed by a homeowners' association. Covenants are typically put in place by developers or associations as opposed to government agencies. Restrictive covenants can be a way for developments to continue disaster resistance beyond the initial development phase and beyond government regulations.

Goal 4: ***Reduce impacts of flooding to people and property in North Dakota.***
Responsible floodplain management is crucial to preventing loss of life and damage to property from floods. Careful floodplain management, including the acquisition of structures currently in the floodplain, particularly repetitive loss properties, is an ongoing state priority. Other actions taken can protect infrastructure and minimize losses from floodwaters. This goal supports the broad range of the flood mitigation measures outlined in this strategy.

Objective 4.1: Prevent floodwaters from entering developed areas.

Bank Stabilization
The stabilization of riparian areas, wetlands, and roadways can reduce flood losses through the retention of water and soil in floodplains and other natural wetlands and by slowing flow velocities. Bank stabilization projects can take many forms and careful planning regarding the best solution for a given location is an important step.

Flood Control
Flood control projects are generally used to physically prevent flood waters from entering an area. Examples include levees, flood walls, channel diversions, dams, channelization, flood gates, retention basins, control structures such as the Devils Lake outlet, and the Waffle® concept of temporary runoff storage. Flood control projects can protect specific facilities such as water treatment plants or entire communities. Flood control projects must be approached with caution, however, because they can sometimes create additional hazards such as dam or levee failure, increased flooding in upstream or downstream areas, or water quality problems. Such projects also require regular maintenance to ensure the functionality and safety of the system.

Objective 4.2: Reduce property and infrastructure losses to developed areas during periods of flood.

Property Acquisition, Relocation, and Elevation
Removing properties from flood hazard areas by purchasing property or easements, relocating structures, or elevating structures or infrastructure reduces potential losses from future flood events. These types of measures are generally permanent in reducing flood losses. A particular emphasis and priority is on severe repetitive loss and repetitive loss structures through the National Flood Insurance Program.

Storm Water Management and Roadway Protection
Effective storm water systems can prevent flood damages in developed areas. Development such as buildings and pavement reduce the absorption of water into the ground and can create runoff problems. Storm water management systems and their improvements can reduce problems in flood prone areas. Similarly, roadways often cross paths with waterways, and the water can be directed through bridges or culverts. Improvements to the bridge and culvert systems can mitigate future losses to road infrastructure. Culverts, drainage systems, storm sewers, bridge and road improvements, and ditches are examples of storm water management and roadway protection tools. Caution must be taken with these types of projects to ensure the hazard is not substantially increased as a result downstream.

Floodproofing
Floodproofing structures does not eliminate the flood hazard, but reduces the losses that may occur during a flood. All types of structures including critical facilities, utility infrastructure, government buildings, and residential structures can be floodproofed. Examples of floodproofing include anchoring buildings and tanks, reinforcement of walls with water resistant materials, installing watertight doors and windows, sealing basements and walls to prevent seepage, installing permanent pumps, installing backflow prevention valves on utilities, elevating utility systems and other equipment, and taking measures to protect water and sewer systems from floodwaters. Creative floodproofing measures can be used to protect ecologic and other values. For example, fisheries could be protected through measures that prevent the crossover of species during floods.

Objective 4.3: Prevent flood losses due to dam failures.

Dam Safety
Continued improvements to the comprehensive dam safety program for the inspection, maintenance, and repairs of dams in North Dakota would reduce the risk of dam failure. Federal, state, local, and private dams in North Dakota need a program that allows for consistency and enforcement of dam regulations. A comprehensive program could be achieved through legislation and the associated funding to improve the existing state program. Emergency action plans for all high hazard dams should be required and enforced through the program.

Objective 4.4: Improve financial protection from flood while minimizing the risk to future development.

National Flood Insurance Program
The National Flood Insurance Program (NFIP) is a mechanism to reduce the vulnerabilities to flood through local regulation and the opportunity and/or requirement for individuals to purchase flood insurance. The NFIP is firmly in place in many North Dakota jurisdictions and the purpose of this strategy is to encourage additional communities to join the program, identify and map additional communities at risk, update old mapping, promote participation in the Community Rating System (an incentive program that can reduce insurance rates), and support the state's additional requirement for construction of one foot above the base flood elevation. Communities are encouraged to adopt standards higher than the state and federal National Flood Insurance Program minimums.

Goal 5: ***Mitigate the effects severe summer and winter weather have on people and property.***
Weather impacts in North Dakota can have devastating consequences. In most cases, weather events such as tornadoes, severe hail, strong winds, blizzards, extreme wind chills, and winter storms cannot be prevented, however, property can be better protected through a variety of activities. This goal strives to mitigate the impacts such events have on the communities and the state.

Objective 5.1: Improve severe weather warnings and public notifications to increase personal protective actions during severe summer and winter weather.

Warning Systems
Systems that alert the public of immediate weather threats can allow the population, including those in critical and special needs facilities, to take protective actions that may prevent the loss of life and injuries. Examples of warning systems include warning sirens in populated areas, television and radio emergency alert systems, automated community notification systems, and NOAA Weather Radios. Specially built NOAA Weather Radios have the capability to alert individuals, businesses, agencies, and organizations of immediate storm threats. Warning systems can also generally be used for other hazards besides severe summer and winter weather.

Weather Spotter Training
Volunteers trained by the National Weather Service have the ability to report real-time, ground truth information to the National Weather Service. These reports help forecasters with decisions related to weather warnings and alerting the population of the life-threatening hazards. Such reports are especially critical in areas with poor radar coverage.

Objective 5.2: Provide safe places for the public to take protective actions during extreme weather events.

Tornado Safe Rooms and Shelters
Rooms designed specifically to withstand tornadoes and strong winds provide emergency protection to the population during such events. Buildings with large span roofs, community gathering places, park facilities (specifically North Dakota Parks and Recreation Comfort Stations), institutional buildings, commercial buildings, mobile home parks, and individual homes could all be well served by tornado safe rooms and shelters.

Window Safety Film
Safety films can be placed on glass windows and doors that strengthen and prevent the shattering of glass during high wind and impact events. Facilities such as schools, assisted living facilities, businesses, and community centers could benefit through injury prevention during events that break windows such as strong winds, hail, and explosions. The film may also have the added benefit of protecting from vandalism and other intentional acts.

Objective 5.3: Protect critical facilities and infrastructure from strong wind, heavy snow, and hail events.

Electric Infrastructure Protection
Electric infrastructure can be protected to reduce future service failures. Upgrading and maintaining electric distribution and transmission systems for snow and wind resistance is one example of protecting the infrastructure from future hazards. Burying lines in particularly hazardous areas is another example. Documenting losses avoided and best practices, through publications and articles from the rural electric cooperatives and other entities, could further promote improvement and mitigation to electric systems.

Snow Fences
Tree or vegetation shelter belts can provide wind breaks along highways and other infrastructure prone to blowing snow and other winter weather problems. Targeting key areas may allow transportation to continue safely during winter weather and strong winds. Traditional snow fences are another option.

Impact Resistant Building Materials
The selection of building materials when constructing or renovating a structure can be the determining factor on whether the structure is damaged in an event. For example, vinyl siding and certain types of steel are more prone to dents and damage from hail than other building materials such as brick, concrete, or composite siding. Damage from other hazards, such as flying debris in strong winds or explosions, may also be minimized.

Goal 6: ***Reduce impacts of drought and wildland fires on North Dakota communities.***
With drought regularly affecting the state, several communities have sustained prolonged shortages of water due to silt, sand buildup, and water intake pipes no longer reaching water sources. A crucial part of the mitigation plan for North Dakota is to mitigate instances where emergency water supplies for communities are needed. Areas of the state that have suffered from floods are also being urged to identify long-term water needs and plan for emergency drought situations. This goal supports the drought mitigation measures outlined in this strategy. Most wildfire seasons lead to the evacuation or threatening of structures because of wildland fires. Actions taken to protect homes from wildfires reduce the burden on firefighters and improve the structures' survivability from an approaching fire.

Objective 6.1: Support practices that reduce drought losses and impacts.

Drought Water Management
During periods of drought, water conservation measures can be effectively employed by farmers and ranchers to reduce the amount of water required. The choice of irrigation system, its maintenance, and water storage options are individual choices that can be promoted among water users to reduce the water demand during drought periods. The effective management of water rights can also reduce the number of conflicts during droughts.

Drought Land and Crop Practices
The choice of drought-resistant crops, crop rotation, and soil conserving tillage practices can reduce the losses suffered by farmers and ranchers during periods of drought. Establishing conservation buffers around water sources can also reduce the amount of evaporation and runoff. Recognizing and managing livestock's forage and water needs during periods of drought can mitigate the need for emergency supplies. Educating the farmers and ranchers in effective land and livestock practices will increase their ability to sustain during periods of drought.

Weather Modification
Years of application and research by the North Dakota Atmospheric Resources Board has found that cloud seeding operations reduce hail impacts and increase rainfall. Continued research and application of weather modification techniques may lead to the reduction of future losses from hail, drought, and other weather-related hazards.

Water Supply Intakes
When water levels are low during periods of drought, water supply intakes for municipal water systems and power generation can become damaged or unusable. Moving or modifying the water supply intakes can reduce the impacts of low water levels and allow operations to continue.

Objective 6.2: Reduce the vulnerability of homes and businesses from approaching wildland fires.

Firewise Programs
Community and individual Firewise-type programs encourage wildfire protection measures around homes and businesses such as reducing fuels, using fire resistant plants and mulch, regular mowing around structures, and building with fire resistant materials. These concepts when applied can protect

structures from approaching wildland fires. Firewise principles can also be applied along roads and utility infrastructure.

Firebreaks
Firebreaks consisting of bare ground, non-combustible materials such as stone, or fire resistant vegetation may prevent the spread of wildfires into communities and inhabited areas. Firebreaks between fire prone landscapes such as grasslands, CRP acres, and forests and homes, businesses, farms, and communities may prevent wildfire losses and help contain the fire.

Emergency Haying and Grazing
During severe droughts and periods of extreme wildfire danger, land participating in the Community Reserve Program (CRP) may be authorized to hay and/or graze those CRP lands that must otherwise be left in their natural state. During these periods, haying and grazing of the lands may prevent the spread of wildfire. Caution must be emphasized with this mitigation measure, however, since equipment used in haying and grazing operations can ignite fires and create a larger hazard.

Goal 7: ***Reduce population and property losses from human-caused hazards.***
Hazard mitigation has traditionally focused on natural hazards. Concerns over human-caused hazards are continuously increasing. Certain aspects of human-caused hazards are regulated through industry standards and legislation. Activities that reduce the long-term disaster risk from the human-caused hazards are supported by this goal and are considered in this multi-hazard mitigation plan.

Objective 7.1: Prevent intentional and accidental acts through observations, regulations, and enforcement.

Transportation Inspection Programs
The creation, support, management, and improvement of inspection programs on vehicles, trucks, trains, and planes may mitigate hazardous material releases and intentional attacks.

Household Hazardous Waste Regulations
The development of a statewide hazardous waste collection program and disposal regulations may reduce the amount of hazardous chemicals that can contaminate drinking water supplies. Similarly, stricter regulations on storage tanks containing hazardous materials may reduce the chances of a spill.

Facility Hardening and Security
Hardening critical facilities and infrastructure may reduce the risk of an intentional attack or vandalism. Examples include putting up security fences, concrete barriers, security cameras, key card controlled access to facilities, and security forces. Private facilities such as industrial plants, power plants, and oil fields that have the potential to release hazardous materials or are critical to energy production are especially important to protect. Measures taken to improve security at research facilities and within the agriculture and food industries could prevent large-scale communicable disease outbreaks.

Objective 7.2: Reduce the impact of all hazards, including human-caused, by lessening the probability of disasters or by keeping a small disaster from becoming larger.

Back-up Power
Failures in electric service can happen because of almost any hazard or can become its own hazard. Back-up generators or alternative solutions such as solar panels can maintain emergency power until the service is restored. Critical facilities, special needs facilities, utility infrastructure, and emergency shelters could all benefit from back-up power should electricity fail, particularly during a disaster or severe weather conditions.

Transportation Engineering and Systems
Improvements made to transportation infrastructure through engineering and the subsequent road, railway, and barrier designs could reduce transportation accidents and prevent mass casualty and hazardous material release incidents. Managed transportation through the implementation of hazardous truck routes and bypasses may prevent hazardous material releases, particularly in populated areas. Regulations related to railway speeds could reduce the probability of accidents in urban areas and provide consistency across the state. Additional considerations could be given to those

communities experiencing growth or development in industries requiring heavy use of the transportation systems.

Smoke Detectors and Sprinkler Systems
The loss of life and property from urban fire can be mitigated through the installation of smoke detectors and/or sprinkler systems. The requirements of such are determined by the State Fire Marshal's office. Essentially any structure can benefit from the installation of such systems.

Many initiatives can reduce losses for more than one hazard. Table 6.1A shows the types of hazards each initiative may mitigate.

Table 6.1A Hazards Mitigated by Each Proposed Initiative

	Communicable Disease	Dam Failure	Drought	Flood	Geologic Hazards	Hazardous Material Release	Homeland Security Incident	Shortage or Outage of Critical Materials or Infrastructure	Summer Storm	Transportation Accident	Urban Fire or Structure Collapse	Wildland Fire	Winter Storm
Mitigation Planning	X	X	X	X	X	X	X	X	X	X	X	X	X
Basin-Wide Water Management Planning		X	X	X				X					
Data Digitization	X	X	X	X	X	X	X	X	X	X	X	X	X
Impacts Database	X	X	X	X	X	X	X	X	X	X	X	X	X
Hazardous Materials Studies						X	X						
Utility and Critical Material Studies	X		X	X			X	X	X				X
Transportation Database						X				X			X
Wildland Fire Database												X	
Floodplain Map Modernization				X									
Public Education	X	X	X	X	X	X	X	X	X	X	X	X	X
Situational Awareness	X	X	X	X	X	X	X	X	X	X	X	X	X
Insurance Education		X	X	X	X		X		X	X	X	X	X
Building Codes				X	X		X		X		X	X	X
Zoning and Ordinances		X	X	X	X	X						X	
Restrictive Covenants		X	X	X	X	X			X		X	X	X
Bank Stabilization		X		X	X								
Flood Control		X		X									
Property Acquisition, Relocation, and Elevation		X		X									
Storm Water Management and Roadway Protection		X		X	X								
Floodproofing		X		X									
Dam Safety		X											
National Flood Insurance Program		X		X									
Warning Systems		X		X	X	X	X	X	X			X	X
Weather Spotter Training		X		X					X				X
Tornado Safe Rooms and Shelters									X				
Window Safety Film							X		X				
Electric Infrastructure Protection		X		X			X	X	X			X	X

Table 6.1A Hazards Mitigated by Each Proposed Initiative (continued)

	Communicable Disease	Dam Failure	Drought	Flood	Geologic Hazards	Hazardous Material Release	Homeland Security Incident	Shortage or Outage of Critical Materials or Infrastructure	Summer Storm	Transportation Accident	Urban Fire or Structure Collapse	Wildland Fire	Winter Storm
Snow Fences						X				X			X
Impact Resistant Building Materials							X		X				
Drought Water Management			X					X					
Drought Land and Crop Practices			X										
Weather Modification			X						X			X	
Water Supply Intakes			X					X					
Firewise Programs												X	
Firebreaks												X	
Emergency Haying and Grazing			X									X	
Transportation Inspection Programs						X	X			X			
Household Hazardous Waste Regulations						X							
Facility Hardening and Security	X	X				X	X	X					
Back-up Power	X						X	X	X				X
Transportation Engineering and Systems					X	X				X			
Smoke Detectors and Sprinkler Systems							X				X	X	

6.2 Statewide Mitigation Initiatives

Statewide mitigation initiatives are those activities that can be implemented at the state government level. Many mitigation projects across the state are initiated and implemented at the local or tribal level. Often state government provides technical assistance and supports the mitigation activities. Clearly, state government cannot dictate the actions local and tribal governments take or do not take. Therefore, this section focuses on those activities which the state can undertake and implement.

Each of the proposed initiatives has value, however, time and financial constraints do not permit all of the proposed initiatives to be implemented immediately. By prioritizing the initiatives, the most critical, cost effective projects can be achieved in the short term. The prioritization of the projects serves as a guide for choosing and funding projects, however, depending on the funding sources and personnel resources, some actions may be best achieved outside the priorities established here.

To ensure that statewide goals, benefit/cost, and other factors are taken into account when prioritizing initiatives, a prioritization model that uses the following factors has been developed: cost, project management, feasibility, population benefit, property benefit, effectiveness, and hazard rating. *Cost* considers the annual direct expenses associated with the initiative. *Project management* evaluates the amount of time needed by state and local government employees to complete or coordinate the project. *Feasibility* assesses the political, social, and/or environmental ramifications of the project and the likelihood such a project would proceed through permitting, public review, and/or legislative processes. The feasibility factor is essentially a summarization of FEMA's Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) evaluation criteria as shown in Table 6.2A. *Population benefit* considers the possible prevention of deaths and injuries through the initiative's implementation. *Property benefit* estimates the reduction of property losses, including structures, infrastructure, and values, from the hazard being mitigated. *Effectiveness* evaluates the successfulness of similar projects in North Dakota or the initiative's potential and amount of maintenance required to keep the mitigation measure effective and useful. The *hazard rating* is based on the results of the risk assessment and is a measure of the history, probability, severity, and vulnerabilities of the hazard.

Table 6.2A FEMA's 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

Table 6.2A FEMA's STAPLEE Criteria (continued)

Criteria	Considerations
Political	Political Support Local Champion or Proponent Public Support
Legal	State Authority 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: Federal Emergency Management Agency, 2003.

Each of the factors was ranked qualitatively for each of the projects. The methods used to assign a category and the associated score can be generally defined as shown in Table 6.2B. The highest possible score is 22. Some factors have a greater range than others, thus indicating a higher weighting. These weightings allow for appropriate prioritization of the project. More specifically, 8 of 22 points account for benefits (population benefit and property benefit), 6 of 22 points account for direct and indirect costs (cost and project management), 4 of 22 points account for the hazard rating (incorporates hazard probability and impacts; see Risk Assessment Summary Section 5.14.4), and 4 of 22 points account for feasibility and effectiveness.

Planning and related projects generally do not result in direct population or property benefits, but they can contribute to increased hazard understanding and project implementation, so their value is seen in other ways. The prioritization of initiatives reflects this.

Table 6.2B Prioritization Criteria

Factor	Threshold	Rating	Score
Cost Range: 0-4	Little to no direct expenses	Low (L)	4
	Less than $100,000	Low-Moderate (LM)	3
	$100,000-$499,999	Moderate (M)	2
	$500,000-$999,999	Moderate-High (MH)	1
	$1,000,000 or greater	High (H)	0
Project Management Range: 0-2	Less than 40 hours of staff time	Low (L)	2
	40-80 hours of staff time	Moderate (M)	1
	Greater than 80 hours of staff time	High (H)	0
Feasibility Range: 0-2	Positive support for the project	High (H)	2
	Neutral support for the project	Moderate (M)	1
	Negative support for the project	Low (L)	0
Population Benefit Range: 0-4	Potential to reduce more than 20 casualties	High (H)	4
	Potential to reduce 10-20 casualties	Moderate-High (MH)	3
	Potential to reduce 5-10 casualties	Moderate (M)	2
	Potential to reduce 1-5 casualties	Low-Moderate (LM)	1
	No potential to reduce casualties	Low (L)	0
Property Benefit Range: 0-4	Potential to reduce losses to 100 or more buildings or severe damages to infrastructure or values	High (H)	4
	Potential to reduce losses to 25-99 buildings or substantial damages to infrastructure or values	Moderate-High (MH)	3
	Potential to reduce losses to 10-24 buildings or moderate damages to infrastructure or values	Moderate (M)	2
	Potential to reduce losses to 1-9 buildings or slight damages to infrastructure or values	Low-Moderate (LM)	1
	No potential to reduce property losses	Low (L)	0
Effectiveness Range: 0-2	Proven to be very effective	High (H)	2
	Expected to be moderately effective	Moderate (M)	1
	Effectiveness unknown or high maintenance	Low (L)	0
Hazard Rating Range: 0-4	see Risk Assessment Summary Section 4.5.4	High (H)	4
	see Risk Assessment Summary Section 4.5.4	Moderate (M)	2
	see Risk Assessment Summary Section 4.5.4	Low (L)	0

Table 6.2C shows the evaluation of each statewide initiative and their associated scores. Those initiatives not listed in Table 6.2C are typically best accomplished at the local or tribal level. The primary exceptions are those specific activities conducted on state buildings or infrastructure. Table 6.2D shows the implementation scheme for statewide mitigation initiatives. Please note that all initiatives listed in this strategy are considered worthwhile, otherwise they would be not listed. Therefore, even though a project may be listed as a low priority, the project is still an important piece of the mitigation strategy in the state.

Table 6.2C Statewide Mitigation Initiative Priorities

	Cost	Project Management	Feasibility	Population Benefit	Property Benefit	Effectiveness	Hazard Rating	Total Score	Priority
Planning-Related Initiatives									
Mitigation Planning	M	H	H	L	L	H	H	10	High
Basin-Wide Water Management Planning	M	H	M	L	L	H	H	9	Moderate
Data Digitization	M	M	H	L	L	H	H	11	High
Impacts Database	LM	M	H	L	L	H	H	12	High
Hazardous Materials Studies	M	M	M	L	L	M	M	7	Low
Utility and Critical Material Studies	M	M	M	L	L	M	H	9	Moderate
Transportation Database	M	M	M	L	L	M	L	5	Low
Wildland Fire Database	LM	M	M	L	L	H	M	9	Moderate
Floodplain Map Modernization	H	H	H	L	L	H	H	8	Moderate
Statewide Non-Planning Initiatives									
Public Education	LM	H	H	H	M	M	H	16	High
Insurance Education	LM	H	H	L	H	M	H	14	High
Building Codes	L	H	M	H	H	H	H	19	High
Dam Safety	L	H	M	MH	LM	M	L	10	Low
National Flood Insurance Program	L	H	M	M	MH	M	H	15	High
Weather Modification	MH	H	M	M	H	M	H	13	Moderate
Transportation Inspection Programs	MH	H	M	H	LM	M	M	10	Low
Household Hazardous Waste Regulations	LM	H	M	H	LM	M	M	12	Moderate
Transportation Engineering and Systems	MH	H	M	H	LM	M	M	10	Low

The proposed and prioritized initiatives are shown in Table 6.2D with the associated goal timeframes for initiation. The timeframes are defined as follows and are generally based on the nature of the initiative and its priority:

- Near Term: Initiated within 0-3 years
- Mid Term: Initiated within 3-6 years
- Long Term: Initiated within 7-10 years
- Ongoing: Already initiated and continuing

Some initiatives may be best achieved outside of the goal timeframes depending on the funding and staff resources available. Others may not be feasible in the goal timeframe due to financial, staff, or political limitations. This prioritized list, however, allows the state to focus on the types of projects with the greatest benefits.

Table 6.2D Statewide Mitigation Initiatives Implementation Scheme

Initiative	Objective	Lead State Agencies	Potential Funding	Timeframe
High Priorities				
Mitigation Planning	1.1	DES Forest Service	FEMA PDM FEMA HMGP USFS BLM	Ongoing: Already initiated and continuing
Data Digitization	1.2	DES SWC DOT Fire Marshal Forest Service Dept. of Health Dept. of Agriculture	Existing Budgets/ Programs	Ongoing: Already initiated and continuing
Impacts Database	1.2	DES SWC DOT Fire Marshal Dept. of Health Dept. of Agriculture	Existing Budgets/ Programs	Near Term: Initiated within 0-3 years
Public Education	2.1	DES SWC DOT Fire Marshal Forest Service Dept. of Health Dept. of Agriculture	Existing Budgets/ Programs	Ongoing: Already initiated and continuing

Table 6.2D Statewide Mitigation Initiatives Implementation Scheme (continued)

Initiative	Objective	Lead State Agencies	Potential Funding	Timeframe
High Priorities (continued)				
Insurance Education	2.1	SWC DES Insurance Dept. Dept. of Agriculture	Existing Budgets/ Programs	Ongoing: Already initiated and continuing
Building Codes	3.1	DCS DES	Existing Budgets/ Programs	Ongoing: Already initiated and continuing
National Flood Insurance Program	4.4	SWC DES	Existing Budgets/ Programs	Ongoing: Already initiated and continuing
Moderate Priorities				
Basin-Wide Water Management Planning	1.1	SWC DES	Existing Budgets/ Programs FEMA PDM FEMA HMGP	Ongoing: Already initiated and continuing
Utility and Critical Material Studies	1.2	DES	Existing Budgets/ Programs	Mid Term: Initiated within 3-6 years
Wildland Fire Database	1.2	Forest Service Fire Marshal DES	Existing Budgets/ Programs	Ongoing: Already initiated and continuing
Floodplain Map Modernization	1.2	SWC	FEMA Map Modernization Funds	Ongoing: Already initiated and continuing
Weather Modification	6.1	SWC	Existing Budgets/ Programs	Ongoing: Already initiated and continuing
Household Hazardous Waste Regulations	7.1	Dept. of Health	Existing Budgets/ Programs	Mid Term: Initiated within 3-6 years
Low Priorities				
Hazardous Materials Studies	1.2	DOT DES	HMEP	Long Term: Initiated within 7-10 years
Transportation Database	1.2	Highway Patrol DOT Aeronautics Commission	Existing Budgets/ Programs	Long Term: Initiated within 7-10 years

Table 6.2D Statewide Mitigation Initiatives Implementation Scheme (continued)

Initiative	Objective	Lead State Agencies	Potential Funding	Timeframe
Low Priorities (continued)				
Dam Safety	4.3	SWC	Existing Budgets/ Programs	Ongoing: Already initiated and continuing
Transportation Inspection Programs	7.1	DOT	Existing Budgets/ Programs	Long Term: Initiated within 7-10 years
Transportation Engineering and Systems	7.2	DOT	Existing Budgets/ Programs	Ongoing: Already initiated and continuing

6.3 Local Mitigation Initiatives

North Dakota is diverse in its population and characteristics. Parts of the state can be considered urban, other areas are rural, and many locations are somewhere in between. The needs and capabilities vary widely from one community to the next. Some communities are more concerned with flood whereas others are more concerned with wildland fire. Hazard mitigation is truly a local phenomenon. Federal and state government can provide support, funding, and technical assistance and integrate aspects of mitigation into state laws and programs, but the majority of successful mitigation activities are developed and implemented at the local level. Many activities that can be achieved at the state level can also be conducted at the local level given the appropriate resources. Examples of local mitigation initiatives, as listed in Section 6.1, include, but are not limited to:

- *Mitigation Planning*
- *Basin-Wide Water Management Planning*
- *Data Digitization*
- *Impacts Database*
- *Hazardous Materials Studies*
- *Transportation Database*
- *Wildland Fire Database*
- *Public Education*
- *Situational Awareness*
- *Insurance Education*
- *Building Codes*
- *Zoning and Ordinances*
- *Restrictive Covenants*
- *Bank Stabilization*
- *Flood Control*
- *Property Acquisition, Relocation, and Elevation*
- *Storm Water Management and Roadway Protection*
- *Floodproofing*
- *National Flood Insurance Program*
- *Warning Systems*
- *Weather Spotter Training*
- *Tornado Safe Rooms and Shelters*
- *Window Safety Film*
- *Electric Infrastructure Protection*
- *Snow Fences*
- *Impact Resistant Building Materials*
- *Drought Water Management*
- *Drought Land and Crop Practices*
- *Water Supply Intakes*
- *Firewise Programs*
- *Firebreaks*
- *Emergency Haying and Grazing*
- *Household Hazardous Waste Regulations*
- *Facility Hardening and Security*
- *Back-up Power*
- *Smoke Detectors and Sprinkler Systems*

Tables 6.3A and 6.3B show the mitigation initiatives listed in the local mitigation plans.

Table 6.3A Mitigation Initiatives Listed in the Local Plans – Part 1

County	Mitigation Planning	Basin-Wide Water Management Planning	Data Digitization	Impacts Database	Hazardous Materials Studies	Transportation Database	Wildland Fire Database	Public Education	Situational Awareness	Insurance Education	Building Codes	Zoning and Ordinances	Restrictive Covenants	Bank Stabilization	Flood Control	Property Acquisition, Relocation, and Elevation	Storm Water Management and Roadway Protection
Adams											x	x					x
Barnes								x	x		x			x	x	x	x
Benson																	
Billings			x					x	x		x						x
Bottineau								x	x	x				x	x		x
Bowman					x			x	x	x	x	x					
Burke											x	x					x
Burleigh	x		x					x	x								x
Cass			x					x	x					x	x	x	x
Cavalier											x	x		x			x
Dickey								x		x				x	x		x
Divide																	
Dunn								x		x	x						x
Eddy											x	x					x
Emmons	x							x	x	x		x			x	x	x
Fort Berthold																	
Foster			x								x	x			x		x
Golden Valley			x					x	x							x	x
Grand Forks	x	x	x		x			x	x	x	x	x		x	x	x	x
Grant																	
Griggs											x	x					x
Hettinger	x							x	x	x					x	x	x
Kidder								x	x		x	x					x
Lake Traverse																	

Table 6.3A Mitigation Initiatives Listed in the Local Plans – Part 1 (continued)

County	Mitigation Planning	Basin-Wide Water Management Planning	Data Digitization	Impacts Database	Hazardous Materials Studies	Transportation Database	Wildland Fire Database	Public Education	Situational Awareness	Insurance Education	Building Codes	Zoning and Ordinances	Restrictive Covenants	Bank Stabilization	Flood Control	Property Acquisition, Relocation, and Elevation	Storm Water Management and Roadway Protection
LaMoure	x		x					x	x	x	x				x	x	x
Logan								x		x		x		x	x		x
McHenry								x	x	x					x		x
McIntosh								x	x	x							x
McKenzie																	
McLean	x		x					x	x	x						x	x
Mercer								x	x			x			x	x	x
Morton	x							x									
Mountrail								x			x	x					x
Nelson		x						x	x	x				x	x		x
Oliver								x	x								x
Pembina	x									x					x	x	x
Pierce			x					x	x	x	x	x				x	x
Ramsey	x				x			x	x	x	x	x		x	x	x	x
Ransom	x							x	x	x	x	x			x	x	x
Renville			x					x	x	x							x
Richland								x	x			x					x
Rolette																	
Sargent			x					x	x			x				x	x
Sheridan																	
Sioux																	
Slope																	
Spirit Lake																	
Standing Rock																	

Table 6.3A Mitigation Initiatives Listed in the Local Plans – Part 1 (continued)

County	Mitigation Planning	Basin-Wide Water Management Planning	Data Digitization	Impacts Database	Hazardous Materials Studies	Transportation Database	Wildland Fire Database	Public Education	Situational Awareness	Insurance Education	Building Codes	Zoning and Ordinances	Restrictive Covenants	Bank Stabilization	Flood Control	Property Acquisition, Relocation, and Elevation	Storm Water Management and Roadway Protection
Stark																	
Steele																	
Stutsman		x	x					x	x	x				x	x	x	x
Towner								x	x	x					x		x
Traill								x		x							x
Turtle Mountain																	
Walsh			x					x	x			x		x		x	x
Ward								x	x			x			x		x
Wells								x	x								x
Williams			x					x	x								x

Table 6.3B Mitigation Initiatives Listed in the Local Plans – Part 2

County	Floodproofing	National Flood Insurance Program	Warning Systems	Weather Spotter Training	Tornado Safe Rooms and Shelters	Window Safety Film	Electric Infrastructure Protection	Snow Fences	Drought Water Management	Drought Land and Crop Practices	Water Supply Intakes	Firewise Programs	Firebreaks	Emergency Haying and Grazing	Household Hazardous Waste Regulations	Facility Hardening and Security	Back-up Power	Smoke Detectors and Sprinkler Systems
Adams			x					x								x		
Barnes	x	x	x									x				x	x	
Benson																		
Billings																x	x	
Bottineau			x	x					x			x	x			x	x	
Bowman	x		x						x							x	x	
Burke			x														x	
Burleigh		x	x									x	x				x	
Cass	x		x													x	x	
Cavalier			x					x										
Dickey			x															
Divide																		
Dunn				x	x			x	x	x								
Eddy																x	x	
Emmons	x		x	x					x									
Fort Berthold																		
Foster		x	x					x				x				x	x	
Golden Valley			x					x	x					x			x	
Grand Forks	x	x	x	x	x		x	x	x			x	x			x	x	x
Grant																		
Griggs			x					x									x	
Hettinger				x	x			x		x	x			x		x	x	
Kidder				x				x										
Lake Traverse																		

Table 6.3B Mitigation Initiatives Listed in the Local Plans – Part 2 (continued)

County	Floodproofing	National Flood Insurance Program	Warning Systems	Weather Spotter Training	Tornado Safe Rooms and Shelters	Window Safety Film	Electric Infrastructure Protection	Snow Fences	Drought Water Management	Drought Land and Crop Practices	Water Supply Intakes	Firewise Programs	Firebreaks	Emergency Haying and Grazing	Household Hazardous Waste Regulations	Facility Hardening and Security	Back-up Power	Smoke Detectors and Sprinkler Systems
LaMoure			x	x				x	x	x						x	x	
Logan		x	x								x							
McHenry			x					x	x		x	x				x	x	
McIntosh			x					x	x							x	x	
McKenzie																		
McLean			x	x				x		x		x		x			x	
Mercer		x	x									x				x	x	
Morton				x				x									x	
Mountrail			x										x	x		x	x	
Nelson	x		x		x		x										x	
Oliver			x	x				x									x	
Pembina	x				x			x									x	
Pierce			x					x	x								x	
Ramsey	x		x		x		x	x	x	x		x	x			x	x	x
Ransom		x	x	x	x		x		x							x	x	
Renville	x		x					x	x							x	x	
Richland			x	x				x	x	x								
Rolette																		
Sargent			x	x														
Sheridan																		
Sioux																		
Slope																		
Spirit Lake																		
Standing Rock																		

Table 6.3B Mitigation Initiatives Listed in the Local Plans – Part 2 (continued)

County	Floodproofing	National Flood Insurance Program	Warning Systems	Weather Spotter Training	Tornado Safe Rooms and Shelters	Window Safety Film	Electric Infrastructure Protection	Snow Fences	Drought Water Management	Drought Land and Crop Practices	Water Supply Intakes	Firewise Programs	Firebreaks	Emergency Haying and Grazing	Household Hazardous Waste Regulations	Facility Hardening and Security	Back-up Power	Smoke Detectors and Sprinkler Systems
Stark																		
Steele																		
Stutsman			x	x				x	x	x						x	x	
Towner			x													x	x	
Traill			x			x	x									x	x	
Turtle Mountain																		
Walsh		x	x		x			x				x				x	x	
Ward		x	x	x														x
Wells											x						x	
Williams			x	x								x					x	

Additional strategies are listed in local mitigation plans and are primarily focused on response and preparedness activities, and thus, are not listed in this plan. However, additional strategies that could be considered mitigation include:

- Truck/Hazardous Materials Routes (Barnes County, LaMoure County, McIntosh County)
- Sanitation/Disease Prevention Activities (Barnes County)
- Fire Hazard Building Demolitions (Bottineau County, Ramsey County)
- Highway Closure Gates (McLean County)
- Emergency Energy Conservation (McIntosh County, McLean County)
- Lake Stabilization / Outlet Projects (Ramsey County)

7. MITIGATION IMPLEMENTATION SYSTEM

Mitigation is implemented through all levels of government and includes many activities conducted in the private and non-profit sectors and by individuals. Mitigation in North Dakota, like many other states, does not "fit in a little box." Mitigation goals and objectives are far reaching and some organizations conduct mitigation activities on the periphery while others make it a primary mission within their organization. This North Dakota Mitigation Implementation System section hopes to capture the mitigation programs and systems used to implement mitigation initiatives in the state. Many agencies and organizations play a central role in implementing mitigation in North Dakota and will be highlighted here. Other groups may play a smaller but important role in mitigation and could be inadvertently missed by this overview.

7.1 State Capability Assessment

Within state government, several agencies and programs are central to mitigation initiatives and programs. In a traditional sense, North Dakota Department of Emergency Services is the lead state agency; however, others such as the North Dakota State Water Commission, North Dakota Division of Community Services, North Dakota Forest Service, and several others implement important mitigation programs. Given the importance of multi-agency involvement, interagency teams are often used to establish priorities and assist communities.

Department of Emergency Services (DES)
North Dakota Department of Emergency Services is the state office housing the State Hazard Mitigation Officer (SHMO) and mitigation specialists. Depending on the funding available in a given year, DES typically has two full-time mitigation specialists and the SHMO.

State Hazard Mitigation Team (SHMT)
The North Dakota State Hazard Mitigation Team is a group of state agencies that are convened as needed and coordinated with regularly by North Dakota DES to provide mitigation support to local and tribal jurisdictions and to review and rank mitigation grant applications. Specifically, the SHMT regularly reviews and prioritizes Hazard Mitigation Grant Program and Pre-Disaster Mitigation grant applications. North Dakota has a dedicated SHMT that strongly promotes a policy of progressive mitigation tactics throughout the state. Members of the SHMT also provide technical assistance to the State Hazard Mitigation Officer (SHMO) on engineering, environmental reviews, archaeological surveys, historic preservation, and other relevant issues. The SHMT receives formal training and maintains informal dialogue several times per year concerning topics involving floodplain management, disaster programs, state construction code changes, and new legislative changes. The team composition varies as needed, depending on the hazard, task, or issue at hand. Members of the SHMT regularly include representatives from the following agencies:

- Department of Emergency Services
- Bureau of Criminal Investigation
- Department of Agriculture
- Department of Health

- Department of Transportation
- Division of Community Services
- Forest Service
- Game and Fish Department
- Governor's Office
- Indian Affairs Commission
- National Guard
- Parks and Recreation Department
- Risk Management Division
- State Fire Marshal
- State Historical Society
- State Water Commission

Agencies are added or removed, as needed, depending on the type of disaster, project reviews, or technical assistance.

Interagency Hazard Mitigation Team (IHMT)

The Interagency Hazard Mitigation Team, consisting of both federal and state agencies, usually convenes following a Presidentially declared disaster to recommend mitigation strategies, conduct applicant briefings, and leverage project funding. Representatives from the following agencies are typically on the IHMT, depending on the type, extent, and nature of the disaster:

- SHMT Members (listed above)
- Federal Emergency Management Agency
- Congressional Offices
- Environmental Protection Agency
- Federal Highway Administration
- Housing and Urban Development
- National Weather Service
- Natural Resources Conservation Service
- Small Business Administration
- US Army Corps of Engineers
- US Department of Agriculture, Rural Development
- US Economic Development Administration
- US Fish and Wildlife Service
- US Geological Survey

Agencies are added or removed, as needed, depending on the type of disaster.

7.1.1 Mitigation Programs

Several mitigation programs are active in North Dakota. This section provides a brief overview of each. During each plan update, the programs are evaluated by the appropriate agency regarding their strengths, weaknesses, changes, and potential improvements.

All-Hazard Programs

Pre-Disaster Mitigation (PDM) Program

The PDM program provides nationally competitive federal funding through the Federal Emergency Management Agency to states, tribal nations, communities, and universities for natural hazards mitigation planning, mapping, and projects. The intent of this program is to provide a consistent source of funding to state, tribal, and local governments for pre-disaster mitigation planning and projects primarily addressing natural hazards. Funding for these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM provides 75% funding of project costs, except small and impoverished communities can get up to 90%. North Dakota Department of Emergency Services provides technical assistance and administers this grant program for the state. The state has an administrative plan for the PDM program. Additional program information can be found at: http://www.fema.gov/government/grant/pdm/index.shtm or http://www.nd.gov/des/disaster/hazard-mitigation/.

Strengths:

- Requires a comprehensive multi-hazard mitigation plan to guide future projects.
- Encourages county-level mitigation planning and public participation.
- Provides mitigation opportunities even if federal post-disaster funding is not available.
- Nationally competitive process strives for consistency across the country.
- Most counties in the state are participating in this program at some level.
- Provides a source of funding for preparing or updating mitigation plans.

Weaknesses:

- The grant application process is lengthy and discourages some communities from applying.
- The time frame between the grant application submission and award occasionally delays implementation of timely projects.
- The program is limited to only certain types of mitigation, leaving funding gaps for related activities such as warning systems and generators.
- Rural areas may not have adequate resources to pull together an application and/or implement a project.

Changes from 2005-2007:

- The program in North Dakota shifted from mostly planning to projects.

Changes since 2007:

- An outreach program and talking points were developed and implemented to promote program opportunities.
- Training opportunities were provided for Benefit Cost Analysis, Local Multi-Hazard Mitigation Planning, and Mitigation Application Development. HAZUS training is also planned.

Ideas for Improvement:

- Develop comprehensive outreach materials for statewide dissemination.
- Develop a guide of best practices and successes.
- Provide additional training for application development and project management.

Hazard Mitigation Grant Program (HMGP)

HMGP provides federal funding for projects that will significantly reduce or permanently eliminate future risk to lives and property from severe natural hazards. HMGP provides up to 75% of funds necessary for a hazard mitigation project through the Federal Emergency Management Agency (FEMA). Mitigation funds that are available as a result of a Presidentially declared disaster are based on a percentage of the overall Public Assistance, Individual Assistance, Small Business Administration Loans, and Federal Mission Assignment funds spent. Mitigation funds can be used anywhere in the state and on any hazard. The SHMT scores and rates hazard mitigation project applications for funding. The HMGP project priorities are set by the Governor. The state has an administrative plan for the HMGP program. The plan defines the roles and responsibilities, procedures, and processes for the program. The North Dakota State Legislature provides up to a 10% match for the Hazard Mitigation Grant Program (HMGP). North Dakota Department of Emergency Services provides technical assistance and administers this grant program for the state. Details on the HMGP grant management can be found in Section 7.5, Project Management. North Dakota has had HMGP funding available 20 times from 1997-2010 which has provided continuity to the program. Table 7.1.1A shows the funding available by disaster through the HMGP. Additional program information can be found at:
http://www.fema.gov/government/grant/hmgp/ or
http://www.nd.gov/des/disaster/hazard-mitigation/.

Table 7.1.1A HMGP Funding in North Dakota as of September 2010

DR Number	Disaster Year	Federal Share
1174	1997	$48,497,752
1220	1998	$2,157,723
1279	1999	$12,937,456
1334	2000	$9,464,131
1376	2001	$3,245,770
1431	2002	$157,311
1483	2003	$78,581
1515	2004	$740,000
1597	2005	$1,600,000
1616	2005	$160,697

Table 7.1.1A HMGP Funding in North Dakota as of September 2010 (continued)

DR Number	Disaster Year	Federal Share
1621	2005	$153,321
1645	2006	$683,621
1713	2007	$501,250
1725	2007	$23,572
1726	2007	$1,777,847
1829	2009	$21,200,000
1879*	2010	$2,324,475
1901*	2010	$3,375,606
1907*	2010	$811,463
TOTAL		$109,890,576

*Numbers for 2010 disasters have not been finalized.
Sources: North Dakota Department of Emergency Services, 2007f, North Dakota Department of Emergency Services, 2010b.

Strengths:

- Many large disasters in the past 14 years have allowed for regular and significant funding from this program.
- As a well established program, policies and procedures have been refined to meet state, tribal, and local needs.
- Funding opportunities are not exclusively limited to disaster areas; all entities statewide can apply.
- The state legislature provides a 10% match on all HMGP projects.

Weaknesses:

- The continuity of this program depends on future disasters.

Changes from 2005-2007:

- No significant changes. The state continued to use priorities established in 1997 that are still valid.

Changes since 2007:

- An outreach program and talking points were developed and implemented to promote program opportunities.
- Training opportunities were provided for Benefit Cost Analysis, Local Multi-Hazard Mitigation Planning, and Mitigation Application Development. HAZUS training is also planned.

Ideas for Improvement:

- Develop comprehensive outreach materials for statewide dissemination.
- Develop a guide of best practices and successes.
- Provide additional training for application development and project management.

Public Assistance (PA) Program

The PA program provides federal funding through the Federal Emergency Management Agency for repairs to public infrastructure damaged as a direct result of a major disaster declaration. In many cases, the PA program will fund limited cost-effective mitigation that has a positive benefit-cost ratio. Infrastructure mitigation must be initiated when federal, state, and local PA inspection teams are determining the damages and writing the project worksheet. A few public assistance projects in North Dakota have incorporated mitigation into the restoration and repairs. The PA program is only available if a Presidential disaster declaration is issued. Typically, the federal share on PA projects is 75%. The North Dakota State Legislature provides up to a 10% match for the PA Program. North Dakota Department of Emergency Services provides technical assistance and administers this grant program for the state. Additional program information can be found at:
http://www.fema.gov/government/grant/pa/index.shtm.

Strengths:

- Funds mitigation work during public infrastructure repairs, thus reducing future losses.
- The public, including local officials, may be more open to mitigation immediately following a major disaster, during the recovery period.

Weaknesses:

- Recovery, not mitigation, is typically the primary objective of communities immediately following a disaster; mitigation opportunities may be missed due to the focus on recovery.
- Identifying mitigation costs versus repair costs can be difficult to document and time consuming for a damaged facility.

Changes from 2005-2007:

- None

Changes since 2007:

- None

Ideas for Improvement:

- Develop a guide of best practices and successes.
- Provide additional training for application development and project management.

Community Development Block Grant (CDBG)

CDBG funds are used to improve communities, particularly low to moderate income communities. Many projects such as property acquisitions and infrastructure improvements can also qualify as hazard mitigation. CDBG funds are unique in that they can be used as grant match in some cases. Historically, CDBG funds in North Dakota have been used for acquisitions following flood events. Grand Forks and Fargo both had substantial acquisition programs using CDBG funds. The North Dakota Division of Community Services administers the CDBG program. Additional program information can be found at:

http://www.hud.gov/offices/cpd/communitydevelopment/programs/ and http://www.communityservices.nd.gov/community/block-grant/.

Strengths:
- Many mitigation activities, such as acquisitions, qualify for CDBG funding.
- CDBG funds may be used as match on other grants.

Weaknesses:
- CDBG funding is used for other priorities besides hazard mitigation.
- Funding is generally limited to low or moderate income communities.

Changes from 2005-2007:
- None

Changes since 2007:
- None

Ideas for Improvement:
- None

Building Code Program

North Dakota has a voluntary building code program in the state. The North Dakota State Building Code consists of the 2009 International Building Code, International Residential Code, International Mechanical Code, and International Fuel Gas Code, with some state amendments. Communities can join by adopting and enforcing the state building code. As of 2010, 114 communities in North Dakota participated in the program. Map 7.1.1B shows these communities. A significant limitation of this program is that communities may adopt the state building code but not enforce it. Therefore, simply adopting the code does not guarantee that new development and remodels meet current codes. The Manufactured Home Installation Program within DCS requires that all new manufactured/mobile homes installed anywhere in the state be inspected to ensure the unit is properly installed. Maintenance of the code and technical assistance is provided by the North Dakota Division of Community Services (DCS). Additional program information can be found at:
http://www.communityservices.nd.gov/government/state-building-code/.

The Manufactured Home Installation Program within DCS requires that all new manufactured/mobile homes installed anywhere in the state be inspected to ensure the unit is properly installed.

Strengths:
- Enables communities to adopt and enforce building code standards.
- Provides technical assistance to communities that do adopt building codes.
- Requires at least minimal inspection of all new manufactured/mobile homes.

Weaknesses:

- Requires local adoption and enforcement which can be a drain on resources or cost-prohibitive in some areas.
- Enforcement may not be consistent across the state.

Changes from 2005-2007:

- The Manufactured Home Installation Program was created per changes in state law.

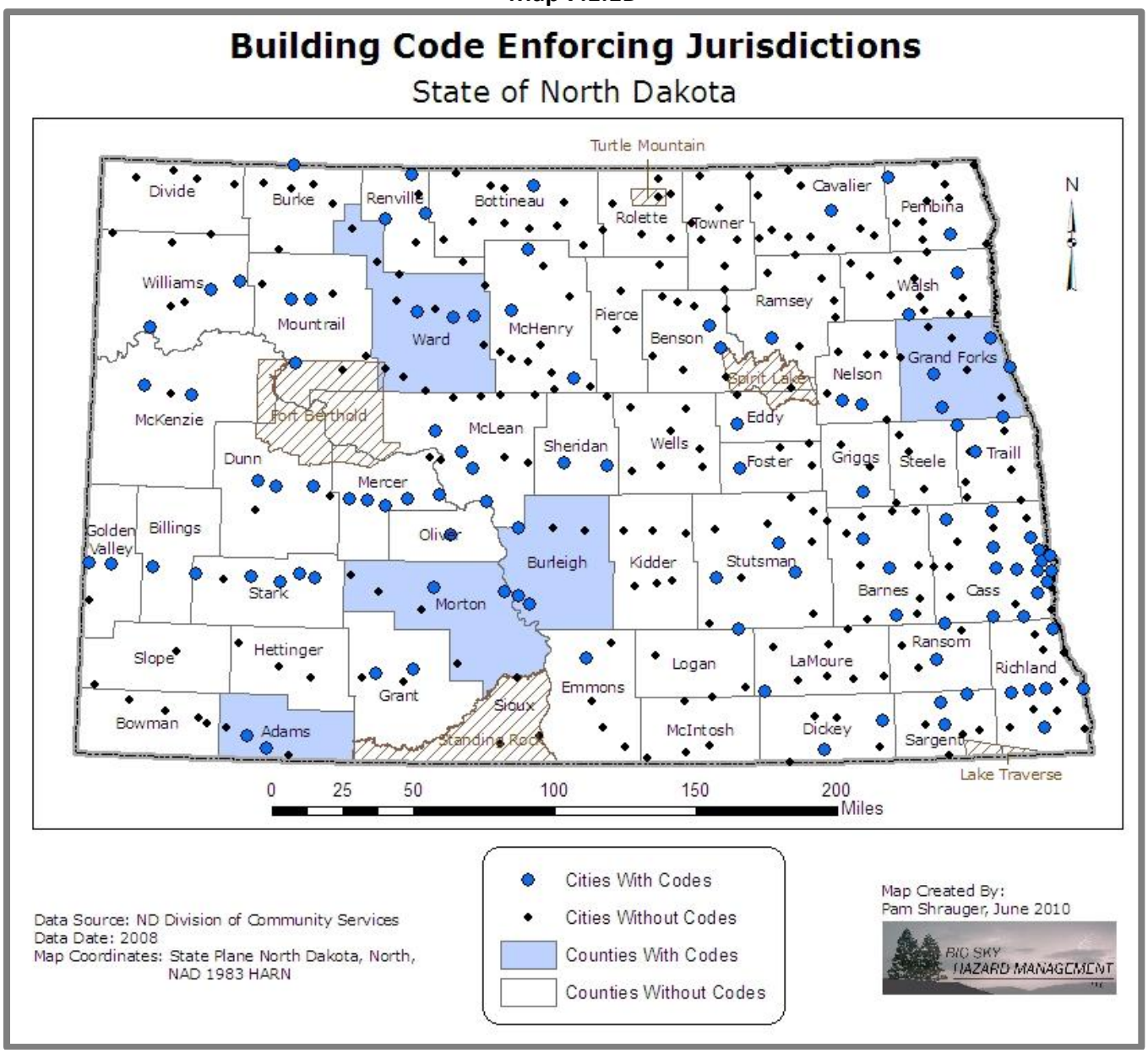
Changes since 2007:

- Adoption of the newer 2009 versions of several codes.

Ideas for Improvement:

- Develop comprehensive outreach materials for statewide dissemination.

Map 7.1.1B


Building Code Enforcing Jurisdictions
State of North Dakota
Turtle Mountain
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Grand Forks
Nelson
Spirit Lake
Fort Berthold
McKenzie
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Stark
Morton
Slope
Hettinger
Grant
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Sioux
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Cities With Codes
Cities Without Codes
Counties With Codes
Counties Without Codes
Data Source: ND Division of Community Services
Data Date: 2008
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

Flood-Specific Programs

Silver Jackets Program

The North Dakota Silver Jackets Program is primarily focused on the communication and collaboration of agencies for the coordination, enhancement, and streamlining of flood-related solutions. The concept is just being organized in North Dakota and is a result of the 2009 floods. Members of the Silver Jacket Flood Risk Management Team in North Dakota include the Federal Emergency Management Agency, North Dakota Department of Emergency Services, North Dakota State Water Commission, and US Army Corps of Engineers. The charter goals of the team focus on improving flood mitigation at all levels of government. The North Dakota Silver Jackets Program is managed by the State Water Commission. Additional program information can be found at: http http://swc.state.nd.us/4dlink9/4dcgi/GetContentPDF/PB-1744/Silver%20Jackets.pdf.

Strengths:

- Provides a mechanism for improvements to the flood mitigation system.
- Fosters collaboration and communication across agencies.
- Provides an avenue for local and tribal agencies to receive guidance and information regarding flood-related problems.

Weaknesses:

- Does not have a definitive source of funding.
- As a new program, the concept has not been integrated into mitigation programs in North Dakota to date.

Changes since 2007:

- Program was initiated in 2009.

Ideas for Improvement:

- Hire a full-time program coordinator.

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. 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. As of 2010, 322 communities participate in the NFIP. Twelve communities have identified flood hazards but do not participate in the program. These communities are shown in Map 7.1.1C.

The trend in flood insurance losses/claims in North Dakota is generally declining. Historically, after North Dakota's most significant flood events in 1979, 1997, and 2009, flood insurance claims spiked upward. About $156 million dollars in flood insurance claims has been paid within North Dakota over the period of 1978-2010. About 50 percent of this figure is due to the 1997 spring flood. Most of the state's flood insurance losses have occurred in the six Red River Valley counties and in two counties bordering Devils Lake.

A predictable trend occurs in flood insurance policy purchases in North Dakota. The number of flood insurance policies in effect jumps significantly in years of heavy winter snowfall, which subsequently bring forecasts of severe spring flooding. The floods of 1979, 1997, and 2009 are examples due to the long lead time characteristics of eastern North Dakota's spring snow melt. With ample time and notification, residents do purchase flood insurance as policy numbers and claims demonstrate. Unexpected rainfall flood events occurring in years 1975, 1993, and 2004 show no such increase in flood insurance policy numbers. Policy numbers for the state were trending downward despite the 14 years of flood disasters declared within the state from 1993 through 2007, but have increased substantially since the floods of 2009.

An important strength of the NFIP in North Dakota is the statewide policy of an additional one foot above the base flood elevation as the standard in flood ordinances. This improvement provides additional protection for structures during floods greater than the 100 year flood and is an important and effective flood mitigation strategy across the state for future development.

The primary weakness of the program is sustaining a functional floodplain management understanding in all NFIP participating communities. Many small communities have part-time staff that are often unfamiliar with the concept of floodplain management in their mix of job duties. Many of these communities experience occasional development or redevelopment pressure, and the potential for a significant floodplain management mistake exists anywhere flood hazards are identified. A structure built below the base flood elevation is a sizeable liability if a community is at fault within its floodplain management responsibilities. (North Dakota State Water Commission, 2007d)

The North Dakota State Water Commission is responsible for managing the National Flood Insurance Program in the state. Additional program information can be found at:
http://www.swc.state.nd.us/4dlink9/4dcgi/GetCategoryRecord/Floodplain%20Management

Strengths:

- Individuals can purchase insurance for flood.
- Much of North Dakota participates in the program.
- State law exceeds NFIP minimums addressing elevating on fill or dry floodproofing above the base flood elevation. Compliance means eligibility for a letter of map revision.
- Model ordinances used in North Dakota exceed minimum NFIP requirements.
- The companion Map Modernization Program works to improve community flood maps which help strengthen communities' abilities to practice floodplain management.

Weaknesses:

- Requires local adoption and enforcement of floodplain ordinances.
- Mapping is often outdated and can lead to inequalities in mapped areas versus unmapped areas.
- In most areas, permits are issued only very rarely, so continuing education and active participation are challenges.
- Indications are that some homeowners may only purchase policies during winters with high snowpack and then cancel their policies.
- One third of all communities in the NFIP have no flood hazard map.
- State zoning law for cities, counties and townships can confuse the practice of floodplain management in rural areas and where urbanization may be occurring.
- Floodplain management is often just one responsibility among numerous other job duties for community floodplain administrators.
- Community floodplain administrator turnover causes floodplain management inconsistencies, often there is no transition of information.

Changes from 2005-2007:

- Policy numbers dropped during the period, possibly due to a lack of recent flood events.
- One community joined the NFIP in 2005.
- No communities dropped out of the NFIP.
- Model state floodplain ordinances were updated. These model ordinances which NFIP communities use to update their local floodplain management ordinances now contain state elevation and floodproofing standards. These exceed national NFIP minimum standards. State standards specifically require new residences to elevate on fill one foot above base flood elevation or for non-residential buildings to dry floodproof two feet above base flood elevation.
- The North Dakota State Water Commission is considering increasing the amount of money available per biennium for rural flood protection, as well as increasing its cost share percentage for rural flood protection. These increases will primarily benefit the Red River Valley area of the state.

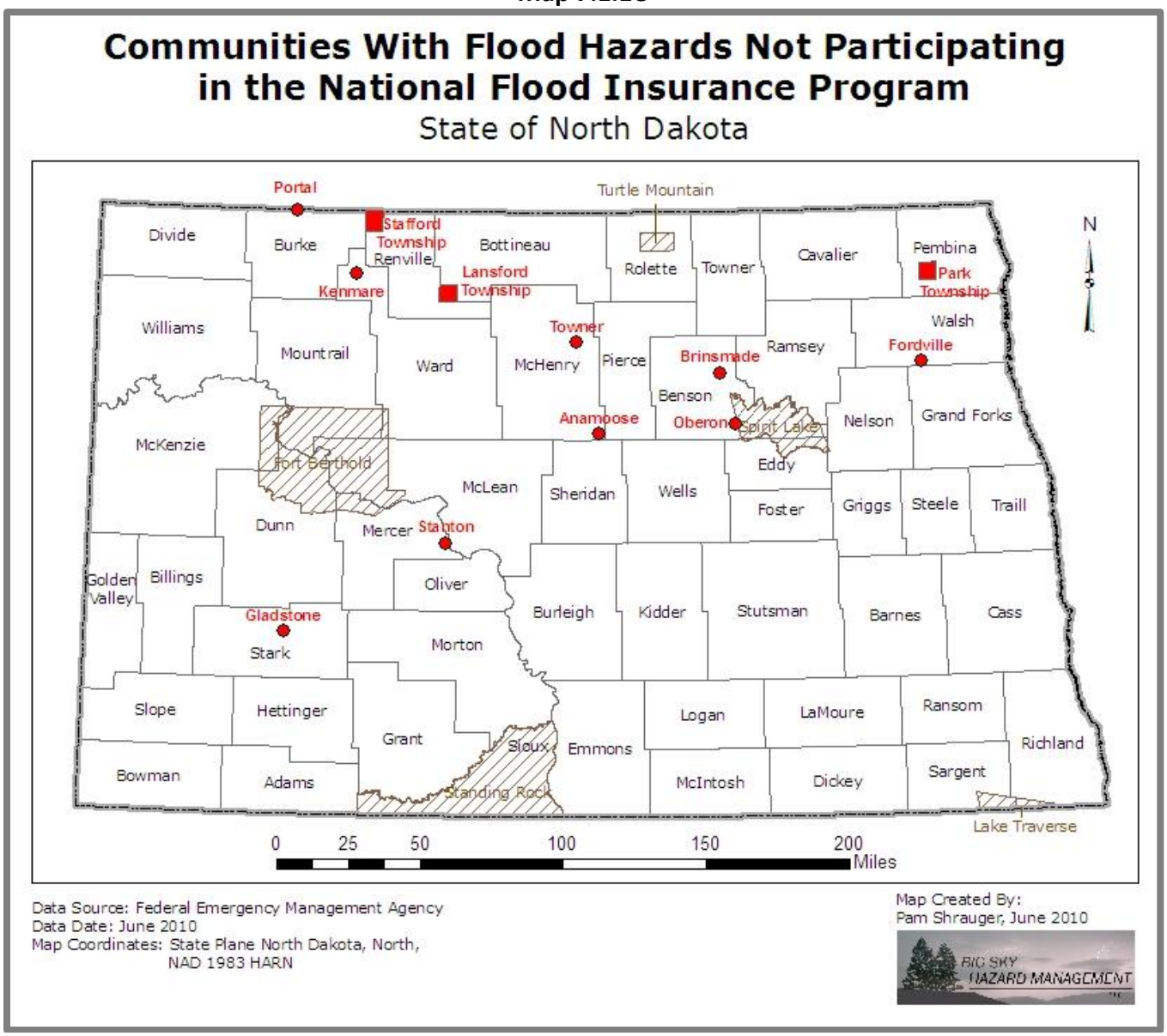
Changes since 2007:

- None

Ideas for Improvement:

- Develop a guide of best practices and successes.
- Develop a better partnership with FEMA to identify and map communities at risk and promote NFIP participation and implementation.

Map 7.1.1C


Communities With Flood Hazards Not Participating in the National Flood Insurance Program
State of North Dakota
Portal
Turtle Mountain
Divide
Burke
Stafford Township
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Park Township
Kenmare
Lansford Township
Williams
Mountrail
Ward
Towner
McHenry
Pierce
Brinsmade
Ramsey
Walsh
Fordville
Benson
Anamoose
Oberon
Spirit Lake
Nelson
Grand Forks
McKenzie
Fort Berthold
Eddy
McLean
Sheridan
Wells
Foster
Griggs
Steele
Traill
Dunn
Mercer
Stanton
Golden Valley
Billings
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Gladstone
Stark
Morton
Slope
Hettinger
Grant
Sioux
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Standing Rock
McIntosh
Dickey
Sargent
Lake Traverse
N
0 25 50 100 150 200 Miles
Data Source: Federal Emergency Management Agency
Data Date: June 2010
Map Coordinates: State Plane North Dakota, North, NAD 1983 HARN
Map Created By:
Pam Shrauger, June 2010
BIG SKY HAZARD MANAGEMENT

Community Assistance Program (CAP)

The North Dakota State Water Commission conducts outreach and provides technical assistance to local and tribal governments through the NFIP Community Assistance Program – State Support Services Element (CAP-SSSE); two full-time employees provide this support. The policy of the state through the CAP program is to provide state coordination and assistance to communities in floodplain management activities, to encourage communities to adopt, administer, and enforce sound floodplain management ordinances, to provide the state engineer with authority necessary to carry out and enforce a floodplain management program, and to coordinate federal, state, and local floodplain management activities in the state. State elements of this program include community assistance visits, community assistance contacts, workshops, training, technical assistance, mapping assistance, and disaster assistance. The State Water Commission maintains a five-year plan for CAP activities. Additional program information can be found at: http://www.fema.gov/plan/prevent/floodplain/fema_cap-ssse.shtm.

Strengths:

- Allows the state to provide technical assistance to local communities with flood problems.
- The state has experienced staff in the flood management section.
- Limited areas of the state are experiencing floodplain development pressure which allows a concentrated targeting of assistance.
- North Dakota State Water Commission staff have developed familiarity with communities enrolled in the NFIP.

Weaknesses:

- Sustaining a floodplain management understanding in all NFIP participating communities.
- Community floodplain administrator turnover causes lack of continuity.

Changes since 2007:

- None

Ideas for Improvement:

- Develop a better partnership with FEMA to identify and map communities at risk and promote NFIP participation and implementation.

Map Modernization Program / Risk Mapping, Assessment, and Planning (RiskMAP)

The Map Modernization Program of the National Flood Insurance Program provides funding for the purpose of updating and modernizing Flood Insurance Rate Maps. Mapping of North Dakota flood hazards is now being done on a countywide basis with 17 counties having complete Digital Flood Insurance Rate Maps (DFIRMs). The RiskMAP program's purpose is "to deliver quality data that increases public awareness and leads to mitigation actions that reduce risk to life and property."

The North Dakota State Water Commission is a Cooperating Technical Partner (CTP) with the Federal Emergency Management Agency (FEMA); one full-time employee is dedicated to this program. Unfortunately, sufficient funding is not available to map all risk areas of North Dakota. Funding for this

program since 2003 includes $596,000 in FY 2004, $1,550,000 in FY 2005, $1,420,000 in FY 2006, $1,148,000 in FY 2007, $922,000 in FY 2008, and $1,226,000 in FY 2009. Additional program information can be found at: http://www.fema.gov/plan/prevent/fhm/mm_main.shtm.

Strengths:
- Provides a direct solution for areas with problematic flood mapping.
- Updates paper mapping to more modern digital formats.

Weaknesses:
- One third of all communities in the NFIP do not have a flood map.
- More mapping updates are needed than funding allows.
- Floodplain mapping processes and updates are time consuming and expensive.

Changes from 2005-2007:
- Continued funding has increased the number of counties with digital maps.

Changes since 2007:
- DFIRMs are being integrated into the RiskMAP program.

Ideas for Improvement:
- Develop a better partnership with FEMA to identify and map communities at risk and promote NFIP participation and implementation.

Community Rating System (CRS)

The Community Rating System is a voluntary incentive program within the National Flood Insurance Program (NFIP). Through participation in this program, communities can receive discounts on flood insurance premiums by conducting flood mitigation activities that reduce their long term risk and exceed NFIP minimum requirements. Technical assistance for this program is provided by the North Dakota State Water Commission. As of 2010, two North Dakota communities are part of the program: the City of Fargo (Class 7) and the City of Grand Forks (Class 5). Additional program information can be found at: http://www.fema.gov/business/nfip/crs.shtm.

Strengths:
- Provides discounts on flood insurance for those communities that participate.

Weaknesses:
- As a voluntary program that requires efforts at the local level, limited local resources may discourage a community from participating.
- Communities with few flood insurance policies may have little incentive to participate.

Changes from 2005-2007:
- None

Changes since 2007:

- None

Ideas for Improvement:

- Encourage more communities with significant flood insurance policy numbers to participate in the CRS program.

Flood Mitigation Assistance (FMA) Program

The FMA program funds mitigation activities to structures insured by the National Flood Insurance Program (NFIP) in an effort to reduce or eliminate future claims. Priority is been given to those projects that reduce losses to repetitive loss properties. The FMA program funds 75% of project costs, except will fund up to 90% of project costs for severe repetitive loss properties. The North Dakota State Legislature provides up to a 12.5% match for the FMA Program. The North Dakota Department of Emergency Services provides technical assistance and administers this grant program for the state. Since 1997, thirteen flood mitigation plans have been completed and 56 homes have been acquired with a total federal, state, and local cost of about $12,832,157. Additional program information can be found at: http://www.fema.gov/government/grant/fma/index.shtm or http://www.nd.gov/des/disaster/hazard-mitigation/.

Strengths:

- Targets properties suffering regular and repetitive losses through the NFIP, thus, focusing on those properties that cause the most losses.
- The program is available for all NFIP insured properties that may have experienced loss due to flooding.
- State provides up to 12.5% of the match.

Weaknesses:

- Since many homeowners are not interested in acquisition opportunities, often the funds go unused.

Changes from 2005-2007:

- Greater program emphasis on repetitive loss properties.

Changes since 2007:

- Administration of the grant changed from the State Water Commission to the Department of Emergency Services.
- An outreach program and talking points were developed and implemented to promote program opportunities.
- Training opportunities were provided for Benefit Cost Analysis, Local Multi-Hazard Mitigation Planning, and Mitigation Application Development. HAZUS training is also planned.

Ideas for Improvement:

- Develop comprehensive outreach materials for statewide dissemination.

- Develop a guide of best practices and successes.
- Provide additional training for application development and project management.

Repetitive Flood Claims (RFC) Program

The RFC program of the National Flood Insurance Program provides grants to reduce flood damages to properties that have had one or more claims under the NFIP. North Dakota Department of Emergency Services provides technical assistance and administers this grant program for the state. Additional program information can be found at: http://www.fema.gov/government/grant/rfc/index.shtm or http://www.nd.gov/des/disaster/hazard-mitigation/.

Strengths:
- Provides an emphasis on properties that have repetitive claims due to flood.

Weaknesses:
- Projects are limited to properties with repetitive claims.
- Property owners may not be interested in participating.

Changes from 2005-2007:
- None: New program

Changes since 2007:
- Administration of the grant changed from the State Water Commission to the Department of Emergency Services.
- An outreach program and talking points were developed and implemented to promote program opportunities.
- Training opportunities were provided for Benefit Cost Analysis, Local Multi-Hazard Mitigation Planning, and Mitigation Application Development. HAZUS training is also planned.

Ideas for Improvement:
- Develop comprehensive outreach materials for statewide dissemination.
- Develop a guide of best practices and successes.
- Provide additional training for application development and project management.

Severe Repetitive Loss (SRL) Program

The SRL program of the National Flood Insurance Program provides funding for the reduction or elimination of repetitive flood claims on insured property. To qualify, the property must meet the definition of a severe repetitive loss property. North Dakota Department of Emergency Services provides technical assistance and administers this grant program for the state. Additional program information can be found at: http://www.fema.gov/government/grant/srl/index.shtm or http://www.nd.gov/des/disaster/hazard-mitigation/.

Strengths:
- Provides an emphasis on properties that have frequent and repetitive claims due to flood.

Weaknesses:
- Projects are limited to properties with severe repetitive claims; North Dakota only has one such property.
- The property owner has not been interested in participating.

Changes from 2005-2007:
- None: New program

Changes since 2007:
- Administration of the grant changed from the State Water Commission to the Department of Emergency Services.
- An outreach program and talking points were developed and implemented to promote program opportunities.
- Training opportunities were provided for Benefit Cost Analysis, Local Multi-Hazard Mitigation Planning, and Mitigation Application Development. HAZUS training is also planned.

Ideas for Improvement:
- Develop comprehensive outreach materials for statewide dissemination.
- Provide additional training for application development and project management.

Other Hazard-Specific Programs

Transportation Improvements

The North Dakota Department of Transportation (DOT) regularly conducts mitigation through road improvements. DOT prepares risk assessments and designs facilities in anticipation of high water flows and other potential hazards. Minimum design standards are used to determine structure sizes for different road classifications. DOT also encourages local officials to adopt design standards. The structures are evaluated for various flood frequencies in relation to overtopping. This information is then used to assess the risks associated with the various structure sizes. DOT also works through transportation improvements to reduce traffic accidents and mitigate losses and casualties due to hazardous material releases and other transportation incidents.

Strengths:
- Encourages mitigation when transportation improvements are made.
- Minimum design standards are used for roadways.
- State design standards may be used as models for local transportation officials.
- Hazard mitigation is being considered at the strategic level as well as the individual project level.
- Bridge inspection program identifies bridge issues before they are a problem.

Weaknesses:
- Hazard mitigation is not the primary focus, so it may at times be overlooked.

Changes from 2005-2007:
- None

Changes since 2007:
- DOT's Traveler Information System has improved so that work zones, incidents, road conditions, and weather radar can be seen on one map.
- Program priorities have shifted to focus on transportation infrastructure in areas experiencing rapid energy development.

Ideas for Improvement:
- None

National Fire Plan/Firewise North Dakota/State Fire Assistance (SFA) Program

The Firewise North Dakota/SFA program promotes wildfire awareness, prevention, and mitigation, particularly in fire prone areas. Activities typically involve equipment purchases, outreach, hazardous fuels reductions, planning, and defensible space projects. This program is managed by the North Dakota Forest Service. Additional program information can be found at: http://www.ndsu.edu/ndfs/fire_management/fire_management_program/.

Fuels treatments in the wildland urban interface by federal agencies in North Dakota occurred on 3,584 acres in FY 2009, 3,631 acres in FY 2008, 3,673 acres in FY 2007, 4,883 acres in FY 2006, 3,782 acres in FY 2005, 2,368 acres in FY 2004, and 978 acres in FY 2003. (Healthy Forests and Rangelands, 2010)

Strengths:
- Funding priorities emphasize mitigation, particularly fuels reductions, in wildland urban interfaces.
- A wide variety of mitigation activities are eligible through this program.
- Nationally competitive grants provide consistency across the nation.

Weaknesses:
- The focus can easily shift to preparedness activities rather than mitigation. (Note: This can be seen as a strength from the preparedness perspective.)
- Funding can vary greatly from year to year.
- The relatively low number of timbered acres versus dry grassland acres in North Dakota can reduce the number of projects that fit within the usual timber-focused programs.

Changes from 2005-2007:
- Annual fuel treatments increased.

Changes since 2007:

- None

Ideas for Improvement:

- Develop a guide of best practices and successes.

Living Snow Fence Program

Following the 1996-1997 winter season, the Living Snow Fence program was initiated in North Dakota to plant living snow fences to prevent the blowing and drifting of snow along roadways. The program was initially funded through the Hazard Mitigation Grant Program. The program is now funded 80% with federal Transportation Enhancement funds and 20% with state DOT funds. Since 1997, 594 living snow projects have been completed protecting 270 miles of roads. The Living Snow Fence program is managed by the Natural Resource Conservation Service, North Dakota Forest Service, and North Dakota Department of Transportation.

Strengths:

- Provides a specific emphasis on living snow fence projects related to the winter storm hazard.
- No local match requirements due to match requirement being met with state DOT funds.
- High participation rates.
- Is a great example of interagency participation to achieve a specific mitigation goal.

Weaknesses:

- Funding for this program is dependent on grants.
- Many more “snow drifting” problems exist across the state than funding can mitigate.

Changes from 2005-2007:

- None

Changes since 2007:

- Federal funding for the program has shifted from Hazard Mitigation Grant Program funds (75%) to Federal Highway Administration Transportation Enhancement funds (80%). This new funding source also allows for the preliminary assessment, actual plantings, and maintenance.

Ideas for Improvement:

- None

Dam Safety Program

The primary function of the Dam Safety program is to inspect dams, provide reports on the conditions of those dams, and make recommendations to dam owners on necessary maintenance and repairs. The Dam Safety program also maintains an electronic database of dams in North Dakota. As of 2010, full periodic inspections of 107 high and medium hazard dams are conducted by program staff on a rotational basis. All non-federally owned high hazard dams are inspected at least once every four years.

All non-federally owned medium hazard dams greater than ten feet high are inspected at least once every ten years. In addition, 142 dams are given an annual partial inspection to check on their status after the spring runoff; these annual spring inspections are for non-federally owned high and medium hazard dams and selected low hazard dams. The Dam Safety program is managed by the North Dakota State Water Commission. The program is primarily state funded, however, some federal funding is provided by FEMA through National Dam Safety Program grants. Federal funding provides enough resources to fund one part-time position, provide training opportunities for dam safety employees, purchase equipment necessary for inspections, and provide some limited assistance to dam owners to develop Emergency Action Plans. The North Dakota Dam Safety program is staffed by two full time employees and one part time employee. Permitting of the construction of dams is handled through the North Dakota State Water Commission's Regulatory Section and is not included in this discussion of the Dam Safety program. Additional program information can be found at:
http://www.swc.state.nd.us/4dlink9/4dcgi/GetSubCategoryRecord/Special%20Projects/Dam%20Safety#

Strengths:
- Allows for regular inspection of selected dams.
- Provides for a comprehensive dam identification and inventory process.
- Funding is available to dam owners to assist with the development of Emergency Action Plans.

Weaknesses:
- Lack of resources to ensure that problems identified by inspections are corrected.
- Lack of resources to enforce Emergency Action Plan requirements.
- Funding through federal grants is uncertain from year to year.

Changes from 2005-2007:
- None

Changes since 2007:
- Overhauled the inspection schedule and report format.
- Began providing cost share to dam owners for the development of Emergency Action Plans using both federal and state funding.
- Significant progress was made on the number of dams in the state with current Emergency Action Plans in place.

Ideas for Improvement:
- Update the North Dakota Dam Design Handbook.

Hazardous Materials Emergency Preparedness Program

Despite the word "preparedness" in the program name, the Hazardous Materials Emergency Preparedness (HMEP) program through the US Department of Transportation provides grants for planning and training. Within the planning program, risk assessments and hazard studies are eligible. North Dakota Department of Emergency Services provides technical assistance and administers this grant program for the state. North Dakota has received about $60,569 annually in HMEP planning funds

since 2001. Additional program information can be found at:
http://www.phmsa.dot.gov/hazmat/grants.

Strengths:
- Promotes hazardous material risk assessments and studies.

Weaknesses:
- The focus is more on preparedness rather than mitigation.

Changes from 2005-2007:
- None

Changes since 2007:
- None

Ideas for Improvement:
- None

Cloud Modification Program

The North Dakota Cloud Modification Project (CMP) is an operational program that seeds clouds for hail reduction and rain enhancement in all or parts of six counties in western North Dakota. Counties currently participating in program include Bowman, McKenzie, Mountrail, Ward, Williams, and part of Slope. Studies have shown a 45% reduction in hail crop losses through this program.

Strengths:
- Has a proven history of reducing hail losses.
- Exhibits an excellent benefit to cost ratio of 16-26:1 for agricultural production, and 48-72:1 for gross economic impact.

Weaknesses:
- The overall program is somewhat expensive.
- Only six counties in the state participate.

Changes from 2005-2007:
- None

Changes since 2007:
- Replaced piston-engine plane with a turbo-prop aircraft, possessing improved performance and payload capacity, for top-seeding purposes for the 2010 project.

Ideas for Improvement:
- An ongoing research program is focusing on alternative seeding methods to improve efficacy.

7.1.2 Mitigation Legislation, Regulations, and Policies

State laws, regulations, and policies are important to disaster mitigation, particularly as it relates to new development. An evaluation of the North Dakota Century Code (NDCC) and other documents with respect to hazard mitigation was originally conducted in 2005. The evaluation was updated in 2007 and 2010 with a complete review of North Dakota laws. Most of the laws and regulation did not change from 2005-2010, but a number of existing laws and regulations were identified as relevant to mitigation efforts and added to the list in 2007 and 2010; others were re-evaluated and removed because of their extraneous nature with little relationship to hazard mitigation. A summary of the relevant sections follows. Changes and additions since 2005 are noted.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Emergency Management		
Disaster Act of 1985 Emergency Services *NDCC 37-17.1*	Establishes the Department of Emergency Services and its authorities and responsibilities, including mitigation. *Updated in 2009 to create the state disaster relief fund, allow for regional coordination of emergency management activities, and increase burn ban penalties.* *Updated in 2007 with homeland security and National Incident Management System language.* *Updated in 2005 to change the Division of Emergency Management to the Department of Emergency Services, to allow for burn ban violation penalties, and to add intrastate mutual aid provisions.*	- Has a stated purpose to "reduce vulnerability of people and communities of this state to damage, injury, and loss of life and property resulting from natural or manmade disasters or emergencies, threats to homeland security, or hostile military or paramilitary action." - NDCC 37-17.1-11 specifically covers disaster or emergency mitigation.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Land Use and Future Development		
State Building Code *NDCC 54-21.3*	Establishes a state building code and an advisory committee. Establishes the North Dakota Manufactured Home Installation Program that inspects manufactured homes to ensure they are installed property. *Updated in 2009 to prohibit the requirement for fire sprinklers in single family dwellings or residential buildings with less than three units in state or local building codes.* *Updated in 2005 to add the Manufactured Home Installation Program.*	- The building code relies on individual jurisdictions to adopt and enforce the code. - Requires all modular and prebuilt residential structures to meet the code and local amendments and be inspected by a third party.
Capitol Grounds Planning Commission *NDCC 48-10*	Establishes a planning commission and capitol building fund for the capitol grounds.	- The commission advises the director of the office of management and budget and the legislative council on matters relating to the physical and aesthetic features of the interior of all buildings on the capitol grounds. - Does not provide any reference to disaster resistance of the grounds.
Municipal Master Plans and Planning Commissions *NDCC 40-48*	Authorizes master plans and subdivision regulations by the municipalities. *Updated in 2009 to address joint jurisdiction zoning and subdivision authority.* *Updated in 2007 to address unincorporated areas outside municipal boundaries and approval procedures.*	- "In the preparation of the master plan, the planning commission shall make careful and comprehensive surveys and studies of present conditions and future growth…" - Does not require that subdivision regulations provide for public safety.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Regional Planning and Zoning Commissions *NDCC 11-35*	Authorizes the formation of Regional Planning and Zoning Commissions.	- Requires coordination between multiple jurisdictions.
Regional Planning Councils *NDCC 54-40.1*	Authorizes regional planning councils.	- Requires coordination between multiple jurisdictions.
County Zoning *NDCC 11-33*	Authorizes county governments to regulate and restrict the location of structures in the county. *Updated in 2007 regarding approval procedures and farming and ranching regulations.* *Updated in 2005 to address institutional controls for environmental concerns.*	- Townships and cities may have their own zoning regulations or relinquish powers to the county. - The adoption and enforcement of zoning is the responsibility of the county.
City Zoning *NDCC 40-47*	Authorizes city governments to regulate and restrict the location of structures in the city and in some cases immediately surrounding. *Updated in 2009 to address joint jurisdiction zoning and subdivision authority.* *Updated in 2007 to address unincorporated areas outside city boundaries and approval procedures.* *Updated in 2005 to address institutional controls for environmental concerns.*	- The adoption and enforcement of zoning is the responsibility of the city.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Powers of Township and Electors of the Township *NDCC 58-03*	Outlines the powers of townships and authorizes zoning regulations. *Updated in 2007 regarding approval procedures, farming and ranching regulations, and violation penalties.* *Updated in 2005 to address institutional controls for environmental concerns.*	- The adoption and enforcement of zoning is the responsibility of the township.
Subdivision Regulation *NDCC 11-33.2*	Authorizes county governments to regulate and restrict the subdivision of land. *Updated in 2007 regarding approval procedures and farming and ranching regulations.* *Updated in 2005 to address institutional controls for environmental concerns.*	- Lists provisions that may be included in the subdivision regulations. - Establishes parameters through which the regulations can be managed and enforced. - Contains requirements with respect to the floodplain.
Airport Zoning *NDCC 2-04*	Authorizes and provides procedures to establish airport zoning.	- Allows any political subdivision of the state to establish airport zoning.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Water Management – Flood and Drought		
Water Commission *NDCC 61-02*	Establishes the State Water Commission, including its authorities and duties. Law also includes provisions for the state water development program, flood control, the Devils Lake outlet, water rights, and the emergency municipal, tribal, and rural water system drinking water grant program. *Updated in 2007 to add the emergency municipal, tribal, and rural water system drinking water grant program and to update the Red River valley water supply project regulations.* *Updated in 2005 to address operation of the Devils Lake outlet.*	- Provides a wide range of responsibilities for the State Water Commission, including flood and drought mitigation.
Flood Control or Reduction Projects *NDCC 61-02.1*	Declares flood control and reduction projects to be "necessary for the protection of health, property, and enterprises" and includes the Devils Lake outlet, southwest pipeline, and Grand Forks flood control projects. *Updated in 2009 to require the Commission to develop policies, including cost-sharing guidelines, for flood control water retention projects.*	- Underscores the importance of flood control and reduction projects. - The State Water Commission may issue bonds for flood control and reduction projects that meet specific criteria.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
State Engineer *NDCC 61-03*	Authorizes the state engineer to require operating plans from reservoir operators, inspect structures, and order the modification or removal of unsafe or unauthorized works (dams, dikes, wells, or other devices for water conservation, flood control, regulation, storage, diversion, or carriage of water). *Updated in 2007 to clarify responsibilities for submerged property.*	- Allows for dam safety activities. - Provides the authority to enforce dam safety regulations.
Weather Modification *NDCC 61-04.1*	Establishes an atmospheric resource board as a division of the State Water Commission. States that "…weather modification affects the public health, safety, and welfare, and that, properly conducted, weather modification operations can improve water quality and quantity, reduce losses from weather hazards, and provide economic benefits for the people of the state."	- Allows counties to establish ten-year weather modification authorities, if a petition from the citizens allows.
Irrigation Districts *NDCC 61-05 through 61-11*	Establishes irrigation districts, including the powers and duties.	- Provides for controlled and locally managed irrigation.
Flood Irrigation Projects *NDCC 61-12*	Regulates flood irrigation projects such as dam construction.	- Provides for fees to maintain dams and damage payments to affected landowners.
General Rules Governing Irrigation *NDCC 61-14*	Establishes general rules governing irrigation.	- Addresses irrigation through amounts of water, measuring devices, and rights to use of water. - Limits amounts of water to that which can be "beneficially used". - Does not clarify length of time the water can be "beneficially used".

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Water Conservation *NDCC 61-15*	Regulates water conservation, including allowing municipal corporations to dam the Red River.	- Requires municipalities to obtain the consent of US or Minnesota governments prior to damming the Red River, if required by treaty. - Section is very brief and may not be adequate to address full range of water issues arising from drought.
Floodplain Management *NDCC 61-16.2*	Regulates floodplain management and places the state management responsibility on the state engineer. One of the purposes of the law is "to guide development of the floodplains of this state in accordance with the enumerated legislative findings, to reduce flood damages through sound floodplain management, stressing nonstructural measures such as floodplain zoning and floodproofing, acquisition and relocation, and flood warning practices; and to ensure as far as practicable that the channels and those portions of the floodplains of watercourses which are the floodways are not inhabited and are kept free and clear of interference or obstructions which may cause any undue restriction of the capacity of the floodways."	- Encourages flood mitigation and lists possible measures. - Thoroughly describes duties of state engineer in floodplain management, delineates permissible floodway uses, and provides for enforcement. - Clearly states that communities that choose not to participate in the NFIP are ineligible for state flood disaster assistance.
Drainage Projects *NDCC 61-21*	Regulates drainage projects. *Updated in 2007 to address assessment drain culverts and ditch clearing.*	- Thoroughly describes the construction, maintenance, repair, improvement, and extension of watercourses, ditches, and drains.
Waterbank Program *NDCC 61-31*	Authorizes the commissioner of agriculture to enter into agreements with landowners for the conservation of wetlands, including regulation of haying and grazing of grasslands in a drought.	- Adequately addresses this issue by permitting the commissioner of agriculture to regulate haying and grazing of wetlands during times of drought and to prevent the destruction of wetlands.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Wetlands *NDCC 61-32*	Regulates wetlands.	- Addresses the permitting process for draining wetlands. - Only applies to a watershed area comprised of 80 acres or more.
Devils Lake Outlet Committee *NDCC 61-36*	Establishes a Devils Lake outlet management advisory committee and requires it to develop an annual operating plan for the Devils Lake outlet. *Updated in 2005 to add a member of the upper Sheyenne River joint water resource board.*	- Requires the Devils Lake outlet advisory committee to recommend a plan of operation within two weeks following the first numerical NWS spring flood outlook.
Fire Prevention		
Fire Marshal Department *NDCC 18-01* 18-01	Outlines the duties of the state fire marshal and deputy state fire marshals.	- NDCC 18-01-04 authorizes the fire marshal to establish a State Fire Code.
Fire Prevention Code for School Buildings *NDCC 18-12*	Establishes a fire code for the construction of, addition to, and remodel of public and private elementary and secondary schools and all instructional areas of all institutions of higher education.	- Requires fire alarm systems and that schools also meet the state building code. - Many schools in North Dakota are older buildings, especially in rural communities, and are exempt unless remodeling occurs.
Wildland Fire Mitigation		
Firebreaks in Counties *NDCC 18-07*	Establishes a mechanism for communities to petition and counties to pay for firebreaks.	- Allows citizens to initiate process for creating firebreaks. - A legal firebreak is 200 feet wide through plowing and controlled burning.
Hazardous Material Release Prevention		
Liquefied Petroleum Gas Regulation *NDCC 18-09*	Regulates the use of liquefied petroleum (LP) gas.	- Allows the state fire marshal to make rules regulating equipment using liquefied petroleum gas. - Prohibits state agencies from banning the installation of a furnace or other appliance that uses LP gas, so long as it is located in the structure's basement.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Anhydrous Ammonia Facilities *NDCC 19-20.2*	Regulates anhydrous ammonia facilities.	- Follows the 1989 American national standard safety requirements for the storage and handling of anhydrous ammonia, with some exceptions. - Establishes licensing for all facilities and siting requirements for new facilities. - Enforcement is provided by the agriculture commissioner.
Hazardous Substances Labeling Act *NDCC 19-21*	Regulates the labeling of hazardous substances.	- Provides authorities regarding the sale, delivery, and labeling of hazardous materials. - Authorizes the examination and inspection of hazardous substances by health officials.
Hazardous Waste Management *NDCC 23-20.3*	Establish a program to regulate hazardous waste from the time of generation through transportation, storage, treatment, and disposal. *Updated in 2007 to address the requirements of the federal Resource Conservation and Recovery Act and the federal Energy Policy Act of 2005.* *Updated in 2005 to address institutional controls of contaminated properties.*	- Regulates municipal and commercial facilities. - Provides regulations for underground storage tanks.
Air Pollution Control *NDCC 23-25*	Establishes air quality standards	- Protects air quality through standards and permit system for controlled releases.
Solid Waste Management and Land Protection *NDCC 23-29*	Regulates solid waste, including hazardous and infectious materials.	- Requires proper treatment of infectious waste before disposal in landfill. - Prohibits disposal of lead-acid batteries, used motor oil, and major appliances in landfills.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Ground Water Protection *NDCC 23-33*	Establishes means for ground water protection, including chemical registration, sales data, and ground water standards.	- Protects ground water through a degradation prevention program, education programs, monitoring, standards, and notification requirements.
Control, Prevention, and Abatement of Pollution of Surface Waters *NDCC 61-28*	Regulates the control and abatement of pollution of surface waters and establishes the state water pollution prevention agency board.	- Describes the composition of the state water pollution control board and the powers and duties of the state board of health regarding water pollution. - Prohibits the pollution of any waters of the state.
Safe Water Drinking Act *NDCC 61-28.1*	Authorizes the state department of health to establish a safe drinking water program.	- Thoroughly establishes regulations for safe drinking water and authorizes the state department of health to establish a plan for the provision of safe drinking water under emergency circumstances.
Communicable Disease Control		
Reportable Diseases *NDCC 23-07*	Requires the state department of health to designate reportable diseases and authorizes power for quarantines, temporary hospitals, and destruction of contaminated clothing. *Updated in 2007 regarding immunization requirements.*	- Addresses disease surveillance and includes provisions for emergency reporting of imminent or emerging conditions, including actual or threatened terrorism.
Communicable Disease Confinement Procedure *NDCC 23-07.6*	Provides authority to order a quarantine or isolation.	- Authority for confinement is listed as, "…state health officer or any local health officer may order any person or group into confinement by a written directive if there are reasonable grounds to believe that the person or group is infected with any communicable disease".
Vector Control Districts *NDCC 23-24*	Establishes vector control districts.	- Authorizes the board of district commissioners to declare that a public health hazard exists and take necessary steps to eradicate public health vectors.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title ***Reference***	**Summary**	**Strengths/Limitations**
Contagious and Infectious Diseases Generally *NDCC 36-14*	Generally establishes procedures for importing, inspecting, containing, and disposing of livestock with contagious and infectious diseases.	- Gives the state veterinarian the authority to inspect and order the destruction of infected livestock to prevent the disease spread.
Weapons Control and Population Protection		
Machine Guns, Automatic Rifles, Silencers, Bombs *NDCC 62.1-05*	Prohibits the purchase, sale, and possession of machine guns, fully automatic rifles, silencers, and bombs loaded with explosives or poisonous or dangerous gases.	- People that violate this regulation are guilt of a Class C felony. - Does allow law enforcement, the military, and others with special permits to carry the prohibited weapons.
Temporary Roadblocks *NDCC 24-15*	Establishes the authority to establish temporary roadblocks.	- Provides authority to duly authorized law enforcement officers for the purpose of apprehending wanted persons.
Infrastructure Protection		
State Highway System* *NDCC 24-01*	Provides for the management, operations, and maintenance of highway transportation. *Updated in 2009 to require metropolitan planning organizations to develop transportation plans and programs.*	- Emphasizes the coordination of state, county, city, and township highway systems. - Requires metropolitan transportation plans or master street plans for municipalities over 5,000 people.
Construction and Maintenance of State Highway System *NDCC 24-03*	Regulates the construction and maintenance of the state highway system.	- Authorizes the state department of transportation to construct and maintain the state highway system and to close state highways.
Bridges *NDCC 24-08*	Regulates the building and maintenance of bridges.	- Mandates the regular inspection and closure of unsafe bridges.
Railroad Crossings *NDCC 24-09*	Regulates railroad crossing systems and signage.	- Allows jurisdictions to create stricter regulations. - Warning systems must be approved by the state department of transportation.

Table 7.1.2A North Dakota Laws and Regulations Related to Hazard Mitigation (continued)

Law Title *Reference*	**Summary**	**Strengths/Limitations**
Railroad Bridges, Crossings, Intersections, and Fences *NDCC 49-11*	Regulates the construction and maintenance of railroad bridges, crossings, intersections, and fences.	- Requires railroad corporations to keep bridges and abutments in good repair. - Limits blocking or obstructing crossings by a train.
Insurance		
State Fire and Tornado Fund *NDCC 26.1-22*	Establishes the authority and operation of the state fire and tornado fund. *Updated in 2007 to allow for blanket coverage of personal property.*	- Addresses how the state fire and tornado fund is to be managed and how claims are to be paid.

* Added to the table list in 2010.

Table 7.1.2B Important North Dakota Mitigation Policies

Policy	**Agency**
NFIP standards are one foot above the base flood elevation.	North Dakota State Water Commission
Property acquisition is the top priority for flood mitigation.	North Dakota Department of Emergency Services
The state provides funding for 10% of the project as local cost share for mitigation grant programs. In special circumstances, such as the 2009 floods, the state has only required 3% in local cost share for Public Assistance.	North Dakota Department of Emergency Services

Table 7.1.2C lists the ideas for legislative and policy changes. Areas considered included laws, regulations, and policies that hinder mitigation efforts and opportunities for the integration of mitigation into new areas.

Table 7.1.2C North Dakota Recommended Legislative and Policy Changes

Section	**Recommended Changes**
Title 11 – Counties and/or Title 58 – Townships	Improve state zoning laws to make floodplain management more efficient in rural areas. For example, townships have zoning authority but not typically the resources to enforce floodplain ordinances or conduct flood fighting operations. The flood fighting responsibilities and costs can then fall on the county jurisdictions that did not approve the developments being protected.

Table 7.1.2C North Dakota Recommended Legislative and Policy Changes (continued)

Section	Recommended Changes
Title 37-17.1 – Emergency Services	Establishment of a state-funded all-hazard mitigation grant program.
Title 37-17.1 – Emergency Services	Local jurisdiction access to the Bank of North Dakota for emergency purposes (including mitigation cost-share).
Title 61 – Waters	Establishment of a comprehensive dam safety program and requirements.
DES policy	Encourage regionalized planning for mitigation.
DES policy	Develop improved performance objectives and mitigation projects through the Public Assistance (PA) program.

7.1.3 Integration into Other State Plans and Programs

Just as data from other state plans and programs was integrated into this mitigation plan, information from this plan can be integrated into other plans and programs. Mitigation planning and activities have been a part of North Dakota state government for many years; therefore, many other plans, programs, and legislation already have mitigation concepts integrated into them. This mitigation plan will only strengthen and improve that integration. Information from this plan can be and has been integrated into agency strategic plans, emergency operations plans, local mitigation plans, and many other types of planning efforts.

Integration is a process. Ultimately, for mitigation to be successful and further integrated into state government, the "usual way of doing things" and mindsets have to change. Changing attitudes towards hazard mitigation and taking action before disaster strikes can be difficult at times, but a very wide variety of stakeholders from across the state participated in the 2007 and 2010 plan updates and previous versions.

Specifically, twenty-eight different local, tribal, state, and federal agencies, non-profit organizations, associations, and businesses participated in the 2010 workshops and forty participated in the 2007 workshops, with many others participating through alternative means. Compared to the much lower participation and involvement rate in 2005, this clearly demonstrates the progress being made towards integrating the state mitigation plan into other new and ongoing efforts. In 2007 and 2010, letters were mailed to each of the department/agency heads in the state explaining the mitigation plan and encouraging each agency to review and integrate the information presented.

Continuously educating and raising the awareness of hazard mitigation with state officials is how this plan will be further integrated with other state plans and programs. The State Hazard Mitigation Team plays a critical role in this process and will continue to integrate hazard and mitigation information into their own agency plans and programs and those of their partner agencies. Many of the mitigation initiatives listed in this plan, such as building code improvements, the living snow fence program, and floodplain map modernization, are already being implemented by agencies besides DES and demonstrate the integration of mitigation concepts into other state missions and programs.

7.1.4 Current and Emerging State Capabilities

The State of North Dakota mitigation programs are capable of implementing a wide variety of mitigation activities, however, improvements can always be made to enhance the strengths of the programs and address the weaknesses. The state strengths, weaknesses, emerging capabilities, and needs are highlighted as follows:

State Capabilities' Strengths

- Strong relationships with other organizations and integrated processes due to a high number of recent disasters.
- Breadth of hazard mitigation experience, institutional knowledge, and ongoing training and awareness at the state level.
- Strong interagency coordination, such as the Hazardous Materials Conference that brings together stakeholders from the public, private, and non-profit sectors to address specific hazards.
- All of the FEMA's Hazard Mitigation Assistance (HMA) programs are managed by one agency.
- Continued outreach and education on the mitigation programs.
- The state managed Public Assistance (PA) program allows for closer linkages to local damages and potential mitigation projects in the Unified Hazard Mitigation Grant Programs.
- The Department of Emergency Services has developed and continues to develop a Geographic Information System (GIS) program that can be used for mitigation planning and project development.
- Focused teams, such as the Devils Lake Basin Technical Review Team, that provide technical assistance on specific problems.
- Proactive regional councils and associated outreach to local jurisdictions.
- Most effective mitigation program in North Dakota is the HMGP, as it is the program best understood and used the most by local jurisdictions; the PDM and FMA programs are becoming more effective but are limited due to the national competitiveness and NFIP requirements, respectively.

State Capabilities' Weaknesses

- The time-consuming nature of recent disasters has made it difficult for state agencies to devote as much time to mitigation.
- The three-year state mitigation planning cycle has left less time for implementation and makes it difficult to synchronize with local plans on a five-year planning cycle.
- Dependency on the HMGP, which can become problematic during periods without disasters.
- Complexities with the major flood areas (Red River and Devils Lake Basins) and the associated complexities with the possible solutions, including possible impacts downstream, can make mitigation strategies difficult to pursue, fund, and implement.
- Only 4 out of 53 counties have local land use planners.
- The state has very little control or influence over development in hazard prone areas.
- Relationships with local emergency managers can be inconsistent due to high turnover rates.

- Difficulties with promoting and using the National Flood Insurance Program (NFIP) due to its solvency problems.

Emerging State Capabilities

- Addition of a Mitigation Planner position within the Department of Emergency Services.
- Further development of DES Regional Emergency Management Coordinator positions that can help specific regions of the state focus on and engage in mitigation.
- Growing and improving relationships with the regional councils and the associated regional mitigation plan possibilities.
- Improved relationships with the tribal nations.
- Use of the Statewide Seamless Map for mitigation project engineering and design and hazardous structure identification.
- Use of teams, such as the Devils Lake Technical Review Team, for basin-wide strategic planning.
- Coordination efforts, such as the Silver Jackets Program, to coordinate state and federal agencies on specific issues.

Additional Needs

- Qualifying standards for mitigation planners.
- A mitigation curriculum through the North Dakota League of Cities for local officials.

7.2 Mitigation Funding Sources

Funding for mitigation projects exist from a multitude of sources. Some sources may be specifically designed for disaster mitigation activities, while others may have another overarching purpose that certain mitigation activities may qualify for. Most mitigation funding sources are recurring through legislation or government support. Some, however, may be from an isolated instance of financial support. Whenever possible, creative financing is encouraged. Often, additional funding sources are found through working with other agencies and businesses to identify common or complementary goals and objectives. Table 7.2A shows the current mitigation funding sources that are used in North Dakota. Table 7.2B shows other, less traditional funding sources that may be used to fund future mitigation activities.

Table 7.2A Current Mitigation Funding Sources

Name	Description	Managing Agencies	Typical Funding
Community Assistance Program (CAP)	Provides funding to states to assist communities in complying with NFIP requirements.	FEMA ND SWC	About $100,000 annually
Dam Safety Program	Provides funding to the state to promote dam safety through emergency action plans and exercises.	FEMA ND SWC	$59,106 FEMA funding annually on average over the past 5 years
Flood Mitigation Assistance Program (FMA)	Provides pre-disaster funding for repetitive flood loss property reduction.	FEMA ND DES	$9,000,000 in 2009 for home acquisitions
Hazard Mitigation Grant Program (HMGP)	Provides post-disaster mitigation funding.	FEMA ND DES	19 disasters from 1997-2010 Average of $7,849,327* annually Average of $5,783,715* per disaster
Living Snow Fence Program	Provides funding to plant living snow fences along roadways.	FHWA ND DOT	$3,700,000 since 2000
Map Modernization Program / RiskMAP	Provides funding to establish or update floodplain mapping.	FEMA ND SWC	$1,253,200 annually on average over the past 5 years
National Fire Plan / Wildfire Mitigation	Provides pre-disaster funding for primarily wildland fire mitigation, but also wildfire planning. Most of the funding in North Dakota has been used for equipment.	USFS NDFS	$188,000 annually on average over the past 6 years

Table 7.2A Current Mitigation Funding Sources (continued)

Name	Description	Managing Agencies	Typical Funding
Pre-Disaster Mitigation Program	Provides grants through a competitive process for specific mitigation projects, including planning.	FEMA ND DES	$435,109* in FY 2009 $539,378* in FY 2008 $373,094* in FY 2007 $8,576* in FY 2006 $2,763,075* in FY 2005
State Water Commission Cost-Share Program	Provides cost-share assistance for flood control, water supply, recreation, snagging and clearing, studies, irrigation, bank stabilization, and technical assistance projects.	ND SWC	About $20,000,000 annually, but varies

* federal share
Sources: North Dakota Department of Emergency Services, 2007f; North Dakota Forest Service, 2007; North Dakota Department of Emergency Services, 2010b; North Dakota State Water Commission, 2010d.

Table 7.2B Potential Mitigation Funding Sources

Name	Description	Managing Agencies
AmeriCorps	Provides funding for volunteers to serve communities, including disaster prevention.	▪ Corporation for National & Community Service
Assistance to Firefighters Grants	Provides funding for fire prevention and safety activities and firefighting equipment.	▪ Department of Homeland Security
Clean Water Act Section 319 Grants	Provides grants for a wide variety of activities related to non-point source pollution runoff mitigation.	▪ US Environmental Protection Agency
Community Development Block Grant (CDBG)	Provides funding for sustainable community development, including disaster mitigation projects.	▪ US Housing and Urban Development
Economic Development Administration (EDA) Grants and Investments	Invests and provides grants for community construction projects, including mitigation activities.	▪ US Economic Development Administration
Emergency Management Performance Grants (EMPG)	Enhances and sustains all-hazard emergency management capabilities, including mitigation.	▪ North Dakota Department of Emergency Services ▪ Federal Emergency Management Agency

Table 7.2B Potential Mitigation Funding Sources (continued)

Name	Description	Managing Agencies
Emergency Watershed Protection	Provides funding and technical assistance for emergency measures such as floodplain easements in impaired watersheds.	▪ US Natural Resources Conservation Service
Environmental Quality Incentives Program	Provides funding and technical assistance to farmers and ranchers to promote agricultural production and environmental quality as compatible goals.	▪ US Natural Resources Conservation Service
Hazardous Fuels Mitigation Program	Provides funding for the reduction of hazardous wildfire fuels.	▪ US Bureau of Land Management
Homeland Security Grants	Through multiple grants, provides funding for homeland security activities. Some projects can be considered mitigation.	▪ North Dakota Department of Emergency Services ▪ US Department of Justice ▪ US Department of Homeland Security
Housing and Urban Development (HUD) Grants	Provides a number of grants related to safe housing initiatives.	▪ US Housing and Urban Development
Individual Assistance (IA)	Following a disaster, funds can mitigate hazards when repairing individual and family homes.	▪ North Dakota Department of Emergency Services ▪ FEMA – Region VIII
Law Enforcement Support Office 1033 Program	Provides surplus military property to local law enforcement agencies	▪ North Dakota National Guard
National Wildlife Wetland Refuge System	Provides funding for the acquisition of lands into the federal wildlife refuge system.	▪ US Fish, Wildlife, & Parks
North American Wetland Conservation Fund	Provides funding for wetland conservation projects.	▪ US Fish, Wildlife, & Parks
NRCS Conservation Programs	Provides funding through a number of programs for the conservation of natural resources.	▪ US Natural Resources Conservation Service
Partners for Fish and Wildlife	Provides financial and technical assistance to landowners for wetland restoration projects in “Focus Areas” of the state.	▪ US Fish, Wildlife & Parks

Table 7.2B Potential Mitigation Funding Sources (continued)

Name	Description	Managing Agencies
Public Assistance (PA)	Following a disaster, funds can be used to mitigate hazards when repairing damages to public structures or infrastructure.	▪ North Dakota Department of Emergency Services ▪ FEMA – Region VIII
Rural Development Grants	Provides grants and loans for infrastructure and public safety development and enhancement in rural areas.	▪ US Department of Agriculture, Rural Development
Rural Fire Assistance Grant (RFA)	Funds fire mitigation activities in rural communities.	▪ National Interagency Fire Center
SBA Pre-Disaster Mitigation Loan Program	Provides low-interest loans to small businesses for mitigation projects.	▪ US Small Business Administration (SBA)
Small Flood Control Projects	Authority of USACE to construct small flood control projects.	▪ US Army Corps of Engineers (USACE)
Streambank & Shoreline Protection	Authority of USACE to construct streambank stabilization projects.	▪ US Army Corps of Engineers (USACE)
Wetland Program Development Grants (WPDGs)	Provides funding for studies related to water pollution prevention.	▪ US Environmental Protection Agency

This list of potential funding sources is certainly not all inclusive. Opportunities for mitigation funding from other sources may exist. State agencies continue to identify and work with foundations and non-government entities to secure outside funding for mitigation purposes.

Many of the federal grants have a cost sharing requirement. In some cases, the state provides a portion of this funding, however, the local governing bodies or subgrantees must also cover a percentage of the project. Often, this local match is covered by in-kind services, but in the case of some of the larger projects, local sales taxes or mil levies have been used. Entities, such as the rural electric cooperatives, often provide cash match or in-kind services for their projects.

Funding Sources' Strengths

- The state provides cash match in many cases.
- Unlike the rest of the country, the State of North Dakota is experiencing prosperous economic activity, including a state surplus and progressive economic stability and opportunities.
- The state has the ability to leverage funding from the state emergency fund for mitigation.

Funding Sources' Weaknesses

- The local match requirement can be a large deterrent in some communities.
- Some communities do not have a clear understanding of what is eligible as match.
- Inability of all jurisdictions to generate income for mitigation purposes.
- Most of the current funding sources require studies and design prior to the grant application; these studies and designs can be costly for local jurisdictions for projects that are not guaranteed funding.

7.3 Local and Tribal Capability Assessment

Most mitigation takes place at the local and tribal levels. The jurisdictions typically understand the local problems best, develop creative solutions for mitigating their problems, apply for grant funding, come up with a portion or all of the grant match, and implement the projects. Since much of North Dakota is rural with limited local and tribal government resources, accomplishing mitigation can be difficult. In many cases, the local emergency manager or elected or appointed officials coordinate the mitigation efforts with input from other local government employees. In many cases, these positions are part-time. Even in communities with full-time emergency managers, their job responsibilities extend far beyond mitigation and include many other aspects of emergency management. Without the support of their local officials, mitigation can become a low priority.

Local and tribal governments have shown their commitment to mitigation through past mitigation successes, the development of their local mitigation plans, and participation in the development of this state mitigation plan. Following a disaster, local jurisdictions regularly assist the Interagency Hazard Mitigation Team and State Hazard Mitigation Team.

Zoning, comprehensive planning, and other land management policies are all local decisions, and the state does not have control over these policies. In jurisdictions such as townships with very few government resources, adopting and enforcing these policies, such as floodplain management, can be particularly problematic. Understanding these limitations, the state places a priority on public education and awareness to assist local governments in making informed and responsible decisions.

This state hazard mitigation plan does not dictate which jurisdictions must conduct each mitigation measure. Although there are statewide goals, local jurisdictions must agree to support the initiatives that are most appropriate for their area, and with limited resources, this can be difficult.

The local mitigation expectations and responsibilities are:

- Develop, update, and implement their local mitigation plans, supplements, and updates.
- Provide input to the state multi-hazard mitigation plan and programs.
- Adopt appropriate hazard mitigation measures including land use and construction standards.
- Apply for mitigation grant funding and conduct specific mitigation activities identified in their local mitigation plans.

Ideally, all communities would participate in some form of hazard mitigation; however, due to differences in local capabilities and priorities, the degree of participation varies greatly from community to community.

7.3.1 Current and Emerging Local and Tribal Capabilities

The capabilities of local and tribal governments in the State of North Dakota vary widely from the large cities that have hundreds of employees to townships with volunteer boards. The size of a jurisdiction, however, is not typically a good indicator of its mitigation effectiveness. Every jurisdiction is unique in

its capabilities and needs, but the common strengths, weaknesses, emerging capabilities, and needs in many jurisdictions follow.

Local and Tribal Capabilities' Strengths

- High level of local institutional knowledge in many jurisdictions.
- Due to a high number of recent disasters, many local officials, emergency managers, and the public are aware of the need for mitigation and possible solutions for their jurisdictions.
- Creative funding solutions such as local sales taxes or mil levies.
- Local and tribal governments have the authority to perform most mitigation activities.
- Generally, local officials and the public care deeply about their communities and can provide lots of support for mitigation activities.

Local and Tribal Capabilities' Weaknesses

- The time-consuming nature of recent disasters has overwhelmed jurisdictions both financially and with personnel time. Emergency managers do not have as much time to devote to mitigation.
- Many local and tribal emergency managers are part-time with many other areas of responsibility and priorities that may take precedence.
- Many small jurisdictions exist, such as townships and cities with less than 100 people, that don't have the staff capabilities to undertake mitigation in their jurisdictions.
- Jurisdictions have many other competing priorities for their time and financial resources.
- Complexities and regional nature of the major flood areas (Red River and Devils Lake Basins) require a large time commitment and coordination with many other jurisdictions to find effective solutions; simple, local solutions are generally not effective for the larger problems.
- Only 4 out of 53 counties have local land use planners.
- High turnover rates for local officials and emergency managers can slow mitigation progress.
- During periods of low disaster activity, the need for mitigation, based on public perceptions, can become less important.
- Projects and concepts that have very little public support are not usually implemented.
- The capability to implement, execute, govern, and enforce zoning laws can be very limited.
- Townships have zoning authority, so this can make county-level zoning difficult if not impossible.
- Many jurisdictions do not have a clear understanding of program requirements (such as acquisition and the NFIP).
- Local NFIP enforcement can be difficult and politically charged.
- Problems often result when a lack of clear and consistent direction from federal and state government is present.
- The local match requirements of many grants can be cost prohibitive in some communities.
- The inability of local jurisdictions to execute land use mandates or recommendations without state or federal incentives.

Emerging Local and Tribal Capabilities

- Growing and improving relationships with the regional councils and the associated regional mitigation plan possibilities.
- Local officials are continuing to grasp the importance of mitigation, its definition, and program eligibility requirements.

Additional Needs

- Qualified local contractors for mitigation planning assistance.
- Continued mitigation and grant application training.

7.4 Local and Tribal Mitigation Planning

Even prior to the Disaster Mitigation Act of 2000, local and statewide mitigation planning has been a high priority in North Dakota. In fact, most counties already had mitigation plans before the regulations were created. Many of those plans were then modified to reflect the new federal requirements. As of November 2010, 30 counties, as shown in Map 7.4A, and 2 colleges/universities (North Dakota State University and Sitting Bull College) in North Dakota have state and FEMA approved mitigation plans. The State of North Dakota is comprised of 53 counties and 4 tribal reservations. The local hazard mitigation plans are normally stand-alone documents covering the entire county. Any jurisdiction within a county or tribe may prepare a mitigation plan specific to that jurisdiction, separate from the county mitigation plan. (The terms "county plan" and "local plan," as used in this plan, refer to the hazard mitigation plan for the mentioned county or tribe and all incorporated jurisdictions within that county, unless otherwise stated.)

Because most jurisdictions require some form of assistance in developing their local hazard mitigation plans, North Dakota DES has a mitigation section available to provide technical assistance to jurisdictions in the development of their local plans. The technical assistance provided by the North Dakota Department of Emergency Services (DES) for local and tribal mitigation planning includes the following:

- Hazard mitigation planning workshops that provide opportunities for an exchange of ideas and the development of mitigation initiatives based on evaluations of state and local needs.
- Technical assistance on team building, risk assessment, private and public sector relationships, and viable mitigation projects.
- Annual workshops with county/tribal emergency managers. Topics include mitigation planning, risk assessment, cost benefit, and public/private partnerships.
- Applicant briefings for disaster programs. Applicants are provided information on disaster programs, the planning process, and viable mitigation projects.
- State and local mitigation planning how-to guides. All 53 counties and 4 tribal governments have copies of the planning guide.

North Dakota DES will continue to provide similar types of technical assistance with local and tribal mitigation planning to those jurisdictions lacking approved plans and those requiring updates.

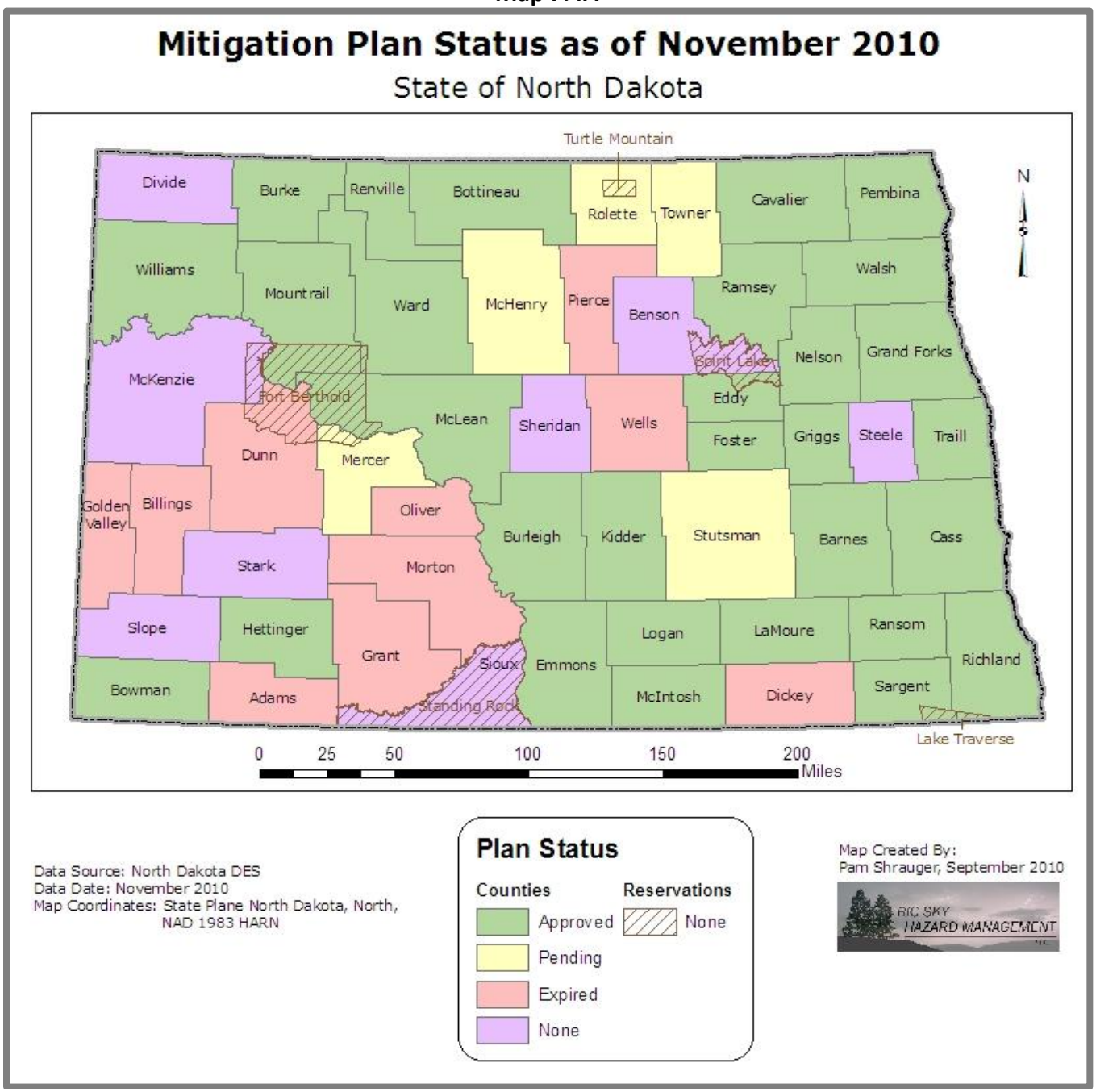
Funding sources that can be used to develop local hazard mitigation plans include the Pre-Disaster Mitigation (PDM) Program, the Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance (FMA) Program. Technical assistance will continue for local plan updates, and the data and strategies provided in this updated state plan will likely benefit the local jurisdictions in collecting hazard data and developing mitigation projects.

Reviews of the plans are conducted by North Dakota DES mitigation staff (except for during extended disaster situations when additional assistance is requested). All local hazard mitigation plans must meet the federal plan requirements, address the specific hazard mitigation needs of the applicable jurisdictions, and complement the state hazard mitigation plan. DES mitigation staff use the FEMA crosswalk to ensure the federal requirements are met. If the reviewer decides the plan meets the requirements, the plan is signed by the State Hazard Mitigation Officer and then forwarded on to FEMA

for approval. If the plan does not meet the criteria, the plan is returned to the jurisdiction with specific comments on changes or additions that need to be made. Reviews by the state are completed within 60 days of receipt, usually sooner.

Once the local plan has gone through the review and coordination phase of its development, all recommended changes have been made, and the plan has received conditional state and federal approval, the plan must be formally adopted by the local jurisdictions.

Map 7.4A



All levels of government understand that the success of the North Dakota mitigation program depends on the degree to which everyone works together toward a common goal. This is accomplished by involving as many interested groups as possible in the planning process. State mitigation staff meets with local jurisdictions throughout the planning process, as requested by the jurisdictions.

Once the local plans are approved, they are integrated into the state plan by:

- Updating risk classifications and potential loss estimations in the hazard profiles
- Listing any considerations for future growth and development
- Cumulatively serving as the basis for the hazard prioritizations
- Adding initiatives that have proven successful at the local level
- Researching development of mitigation initiatives that solve local concerns
- Reviewing existing state initiatives to determine if they are still meeting the overall mitigation needs of the state
- Changing or eliminating existing mitigation initiatives that have not produced the anticipated results

The results of the reviews are incorporated into the state multi-hazard mitigation plan at a minimum during the regular three-year update process. Changes can be implemented sooner, depending on circumstances involved.

Future mitigation projects and initiatives will be based on the local plans; however, it is understood that funding, situations, and priorities change. Jurisdictions will be allowed to have the needed flexibility to add or subtract established mitigation projects as priorities, funding, and situations change. Because of this, the review and incorporation process is a vital part of the overall mitigation strategy for the state and local jurisdictions.

7.5 Project Management

Most mitigation projects are managed and implemented at the local level; however, the state does provide a fair amount of coordination, prioritization, grant management, technical assistance, and oversight for the mitigation projects. Table 7.5A shows the most common mitigation grant programs that offer funding for mitigation projects and planning and the state agency that manages that program.

Table 7.5A Mitigation Programs Administered by State Agencies

Program	Lead Agency
Pre-Disaster Mitigation (PDM) Program	ND Department of Emergency Services
Hazard Mitigation Grant Program (HMGP)	ND Department of Emergency Services
Flood Mitigation Assistance (FMA) Program	ND Department of Emergency Services
Repetitive Flood Claims (RFC) Program	ND Department of Emergency Services
Severe Repetitive Loss (SRL) Program	ND Department of Emergency Services
Map Modernization Program / RiskMAP	ND State Water Commission
National Fire Plan Program	ND Forest Service
Living Snow Fence Program	ND Forest Service ND Department of Transportation
Hazardous Materials Emergency Preparedness Program	ND Department of Emergency Services

Each program has its own set of eligibility criteria and priorities; however, the information outlined in this section provides a general overview of the project management system for the programs. Much of this information is also available in the North Dakota Hazard Mitigation Grant Program Administrative Plan. A timeline for the HMGP follows as an example:

- HMGP Applicant Briefings – within 60 days of the declaration
- Request for HMGP Notice of Intent – within 90 days of the declaration
- Assembly of the State Hazard Mitigation Team to Review HMGP Applications – within 6 months of the declaration
- Community Meetings on Mitigation – within 6 months of the declaration, as needed
- HMGP Project Application Submissions – within 1 year of declaration

Source: North Dakota Department of Emergency Services, 2010e.

The process for tracking the initiation, status, and completion of mitigation activities has not changed since 2005; however, more detail was added to the plan during the 2007 update to clarify the process. The primary exception is the addition of the annual "Mitigation Year in Review" reports found in Appendix J; these reports consolidate information on an annual basis found in other reporting mechanisms such as quarterly grant reports and mitigation success stories.

7.5.1 Technical Assistance

For the various Federal Emergency Management Agency (FEMA) mitigation grant programs, local government entities (or certain private non-profit entities) must apply through the state for approval on proposed projects. This process necessitates the interaction between the state and the applicant and

the state and FEMA. Local governments and other applicants may require technical assistance to successfully develop and apply for mitigation grants. FEMA provides technical information and guidance for specific types of projects and programs that then needs to be passed on to the local applicants. State agencies, specifically the Department of Emergency Services and the State Water Commission, fulfill these roles by providing technical assistance.

Specific to the Hazard Mitigation Grant Program (HMGP), following the disaster, the state gets the funding numbers from FEMA, presents information at the applicant briefings, notifies the public of the availability of funds, and requests notices of interest from those organizations interested in the program. From there, the state can provide technical assistance to those organizations and agencies interested in submitting an application.

Similarly, when FEMA issues guidance for the pre- and post-disaster programs, that information is passed on to the counties and tribes. Those jurisdictions expressing an interest in applying for a particular grant are then given technical assistance regarding their project development and application. Reminders are periodically sent to the jurisdictions encouraging them to participate in the pre-disaster programs and advising them of important deadlines.

7.5.2 Eligibility Criteria

The ultimate goal in North Dakota is to fund projects that:

- Are cost effective
- Are designed to solve a problem to reduce injuries, loss of life, and damage or destruction of property (including damage to critical state or local government services and facilities)
- Complement current state and local mitigation goals and objectives

If these basic criteria are met, the proposed projects can be evaluated for eligibility through the various mitigation grant programs. In addition to the following criteria listed, projects must also meet the specific eligibility criteria outlined in the grant guidance of the grant for which they are applying; this guidance may change from year to year and vary from program to program.

Federal Eligibility Criteria

All hazard mitigation projects submitted for consideration must meet the Hazard Mitigation Grant Program criteria outlined in the Code of Federal Regulations (CFR) Title 44, §206.434. To meet these requirements, the project must:

- Be an eligible applicant (state, tribal, and local governments, private non-profit organizations).
- Have an approved local mitigation plan as outlined in 44 CFR 201.6 or approved tribal mitigation plan as outlined in 44 CFR 201.7.
- Be in conformance with this state and the local mitigation plan.
- Have a beneficial impact upon the designed disaster area, whether or not it is located in the designated area, if post-disaster.
- Be in compliance with 44 CFR Part 9, Flood Management and Protection of Wetlands, and 44 CFR Part 10, Environmental Considerations.

- Solve a problem independently or constitute a functional portion of a solution where there is assurance that the project as a whole will be completed. Projects that merely identify or analyze hazards or problems are not eligible.
- Be cost effective and substantially reduce the risk of future damage, hardship, loss, or suffering resulting from a major disaster by demonstrating that the project:
    1. Addresses a problem that has been repetitive, or a problem that poses a significant risk to public health and safety if left unsolved.
    2. Will not cost more than the anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if future disasters were to occur.
    3. Has been determined to be the most practical, effective, and environmentally sound alternative after consideration of a range of options.
    4. Contributes to a long-term solution to the problem it is intended to address.
    5. Considers long-term changes to the areas and entities it protects.
    6. Has manageable future maintenance and modification requirements.

Please check the specific federal sections for additional information and exceptions.

State Eligibility Criteria

Additional criteria established by the state include:

- The project must complement existing or proposed state mitigation goals and objectives.
- The project must complement existing or proposed mitigation goals and objectives for the jurisdiction submitting the project.
- The jurisdiction requesting the project must be able to complete the project as submitted.
- The jurisdiction submitting the project must be able to meet any matching funds requirements.
- The project must be able to make a bigger impact on the local and state mitigation program than other non-selected projects.
- Local and tribal governments must be in good standing in the NFIP (or have not yet been mapped), and otherwise eligible to receive federal funding.
- All projects must be managed in accordance with local, state, and federal ordinances, laws, and regulations.
- Individual property owners are not eligible to receive federal funds directly as a grantee or sub-grantee and are not authorized to manage grant projects.

Acquisition Projects

While acquisitions are not the only mitigation projects considered and undertaken by the state and local governments, they have been the type of project most frequently submitted and approved and are the top hazard mitigation priority in the state. In addition to the eligibility criteria listed, acquisition projects must also meet the following criteria:

- The application must specifically identify the properties to be included in the project.
- The sellers' participation must be voluntary, and the sellers must be able to prove ownership of the property involved in the project.
- The offer must be based on pre-flood fair market value, determined by a State of North Dakota board certified appraiser or a post-flood sales contract value.

- Duplication of benefits, Small Business Administration (SBA) loans, and private mortgages must be satisfied from proceeds first.
- The acquisition property must be removed within 90 days of the closing.
- Local government entities, or certain non-profit entities, must accept all acquisition property titles that are officially annotated to comply (in perpetuity) with federal open space deed restrictions.
- The acquisition property becomes ineligible for any future federal assistance, except possibly federal crop insurance.

Elevation Projects

The elevation option may be used when elevation is more cost effective and desirable over the long term, such as when the cost of the land is so high that an acquisition is impractical. To be eligible to participate, the local governmental/non-profit entity must meet the following criteria:

- The application must specifically identify the properties to be included in the project.
- The owners' participation must be voluntary, and the owners must be able to prove ownership of the property involved in the project.
- The elevation must be practical, structurally sound, and in compliance with local building codes and zoning rules.
- The project must elevate the lowest floor to or above the flood level or as designated by the local floodplain ordinance if more stringent by:
    - Extending the walls of the house upward and raising the lowest floor.
    - Converting the existing lower area of the house to non-habitable space and building a new second story for living space.
    - Lifting the entire house, with the floor slab attached, and building a new foundation to elevate the house.
- In A zones, where flood hazards are less severe, property owners may elect to elevate buildings either on an open foundation or on continuous foundation walls that extend below the base flood elevation (BFE). If continuous walls are used below the BFE, they must be equipped with openings that allow floodwaters to flow into and out of the area enclosed by the walls.
- Owners of substantially damaged houses in special flood hazard areas must be willing to voluntarily demolish the remnants of the house and build a new house on the same site with an elevated lowest floor at or above the flood level or in compliance with the local floodplain ordinance if more stringent. As an alternative, owners of substantially damaged houses in special flood hazard areas may elect to repair the house and elevate the lowest floor at or above the flood level or in compliance with the local floodplain ordinance if more stringent, as part of the repair process.

Relocation Projects

Relocation may be used when relocating a structure is more practical and cost effective, or when the threat is so repetitive and/or severe that it is more advantageous to relocate a structure or structures, up to and including entire communities, entirely out of harm's way. To be eligible to participate, the local governmental/non-profit entity must meet the following criteria:

- The application must specifically identify the properties to be included in the project.
- The owners' participation must be voluntary, and the owners must be able to prove ownership of the property involved in the project.
- Structures relocated from acquired property must be placed entirely outside of the 100-year floodplain. (Note: Relocation site must be pre-identified and annotated within the grant application.)
- Structures generally must be relocated from acquired property within 90 days of closing.
- Ownership of acquired property may not be conveyed to private citizens or entities; ownership may be conveyed to other public entities or non-profit organizations with the approval of the state and FEMA.
- Local governmental entities, or certain non-profit entities, must accept any acquired property titles that are officially annotated to comply (in perpetuity) with federal open space deed restrictions.
- Any acquisition property (e.g., any vacated lot acquired through the project) becomes ineligible for any future federal disaster assistance, except possibly federal crop insurance.

Floodproofing Projects

Floodproofing may be the most practical option in limited danger areas. To be eligible to participate, the local governmental/non-profit entity must demonstrate that this measure will best resolve the danger to the property based on the following criteria:

- The property is in an area that is not subject to flash flooding.
- Extensive cleanup normally is not required after a flood event.
- One of the two floodproofing processes described below is the most advantageous measure to employ over the long term.
    - Wet floodproofing allows water to enter the structure, thereby equalizing pressure on walls and floors. Building contents such as furnaces and appliances are located out of reach of the floodwaters.
    - Dry floodproofing is a process that uses waterproofing compounds, sheeting, or other impermeable materials to prevent floodwaters from entering the structure.

Structural Mitigation Projects

Structural mitigation applies to infrastructure-type mitigation projects. To be eligible under the Public Assistance Program, the jurisdiction must meet all of the eligibility criteria of the program including, but not limited to:

- The project is required as a result of the declared event.
- The project is within the designated disaster area.
- The project is the legal responsibility of an eligible applicant.

Tornado Safe Rooms

Projects designed to protect people from tornadoes and high winds must comply with FEMA Publications 320, *Taking Shelter from the Storm: Building a Safe Room Inside Your House*, and 361, *Design and Construction Guidance for Community Shelters*.

Other Mitigation Projects

The majority of North Dakota's approved mitigation projects have been generated by flood related disasters. Other projects may be approved, depending on the availability of funds, state and local priorities, proof of cost-benefit, and project submissions.

The criteria listed in this section of the plan are the basic criteria for each type of project. These criteria may be modified based on any of the following issues:

- The specific disaster situation
- Location of the affected areas
- Availability of funds
- Unique program requirements of the funding source
- Current state and/or local hazard mitigation priorities
- Number/type of mitigation projects submitted by local governments

7.5.3 Project Review

When applications for grant funding are submitted, the Department of Emergency Services performs a basic review each of the proposed projects for eligibility, cost effectiveness, and environmental considerations. Often more information is needed, and a dialogue between the applicant and the state results in a more complete application. Once a project is deemed eligible based on federal, state, and grant specific criteria, the project is further considered in detail for cost effectiveness (see Section 7.5.4) and environmental review (see Section 7.5.6). If needed, the State Hazard Mitigation Team (SHMT) or elements thereof are convened to review the project for technical feasibility and effectiveness. The SHMT may conduct field reviews and consider alternatives.

Certain types of projects are eligible for streamlined reviews to keep the process moving quickly and efficiently. These include:

- Acquisition of real property in a hazard area
- Relocation of structures from a hazard area
- Elevation of structures above the base flood elevation in accordance with local ordinances
- Retrofit of residential/commercial buildings
- Minor structural flood control measures
- Vegetation management
- Phase I design, engineering, or impact studies
- Five percent initiative projects

During these streamlined reviews, the state will:

- Ensure all projects are consistent with current codes, standards, and permit requirements.
- Ensure all costs included in the budget are eligible.
- Ensure that all project application data, including cost-benefit and environmental reviews, are input into NEMIS or other management system.
- Ensure funding is not duplicated with other sources.

7.5.4 Benefit-Cost Analysis

The benefit-cost analysis (BCA) is an assessment of the mitigation project application data to determine whether the cost of investing federal, state, and local funds in a hazard mitigation project is justified by the prevented or reduced damages from future disasters. A key criterion for mitigation projects is that they must be cost effective. If the project benefits are higher than the projects costs, then the project is cost-effective. With limited project data and streamlined benefit-cost methods, a cost effectiveness determination can usually be made relatively quickly and accurately.

In 2009, the state began using the Benefit-Cost Analysis (BCA) Took Kit software to conduct benefit-cost analyses for FEMA mitigation grants. This software streamlines the analysis process. In the past, the state would collect data and conduct the analyses using modules provided by FEMA. With this new software, local officials can input their data and conduct the analyses which are then validated by the state before being sent to FEMA.

Generally, a positive benefit cost ratio (> 1.0) does not necessarily guarantee that a hazard mitigation project will be approved; however, by applying project specific information, the mitigation potentials associated with that project become evident. The results of this analysis can also help communities evaluate current and future mitigation projects and adjust their overall mitigation strategy accordingly.

Conducting a BCA through the BCA Tool Kit can determine three things: the project is cost effective (BCA > 1.0), the project is not cost effective (BCA < 1.0), or additional data is required. If the project is cost effective, the application moves to the next level in the funding process. If it is not cost effective, the project is rejected or may be considered if amended. In some cases, additional information may be requested, or the applicant may be shown how the mitigation effort can be redirected.

7.5.5 Prioritization

Historically, North Dakota has not had to use prioritization schemes to an extensive level. By the time the possible projects are reduced down to those that are within the eligibility criteria, meet the benefit-cost minimums, and are environmentally feasible, funding is generally available to fund all of the projects or submit them on for federal analysis. Should prioritizations be needed, the State Hazard Mitigation Team is convened to review and prioritize the projects. This team, made up of representatives from many agencies, provides an objective prioritization based on the criteria set forth as follows. To date, this approach for prioritization has worked well in North Dakota. The greatest challenge is having enough projects that meet the funding requirements and need prioritization.

Prioritization of Projects

The State of North Dakota has established priorities for hazard mitigation projects. These priorities are established by the Governor based on recommendations provided by the IHMT or the SHMT. At any time, the Governor may change these priorities, but typically follows the recommendations of the IHMT, SHMT, or DES mitigation team.

Following a disaster, a priority list for the Hazard Mitigation Grant Program is developed. An example for a flood disaster follows:

- Acquisition and relocation of private and public structures and land (the state targets repetitive loss structures based upon the National Flood Insurance Program (NFIP) repetitive loss structure list)
- Acquisition of vacant land
- Infrastructure protective measures (road and bridges)
- Other non-construction
- Storm water management (culverts, diversions, flap gates, floodgates, detention/retention basins, and other local flood control measures)
- Elevation of private and public structures
- Water and sanitary sewer system protective measures
- Vegetation management
- Wet and dry floodproofing of private and public structures
- Equipment purchases and installation to facilitate all-hazard mitigation
- Generators
- Utility protective measures
- Mitigation planning (state, local, and tribal)
- Public awareness activities
- Flood control
- Retrofitting of structures
- Safe rooms
- Management costs
- Warning systems (as a component of a planned, adopted, and exercised risk reduction plan)
- Engineering studies, codes enforcement, and applied research
- Landslide and shoreline stabilization
- Wetland restoration
- Miscellaneous

Acquisitions are the top priority on the above list because generally, acquisitions have a 100% mitigation success rate. Priority is also given to government entities; non-profit organizations receive lower priority.

In addition to the type of project, prioritization of specific projects, when needed, considers the following:

- Does the project addresses repetitive loss properties?
- Which community has the highest risk from the hazard being mitigated?

- Will the project mitigate losses to future development and is the project in a community experiencing or potentially experiencing growth and/or intense development pressure?
- Which project has the greatest benefit-cost ratio?

Prioritization of Planning Grants

Since funding for mitigation planning grants is limited, available funds must be distributed to those communities that have clearly demonstrated both the ability and the desire to complete the plan and to follow through with the initiatives developed in the plan. The desire to comply with the initiatives in the local mitigation plan should not be dependent on the availability of state or federal funds. In an effort to allow some flexibility in the distribution of mitigation planning funds, the following general guidelines have been developed. These guidelines are not all inclusive, and compliance with all of the issues listed below may not be required for approval of a planning grant. The SHMT and/or DES will consider:

- If the community meets the criteria for the specific source of funds.
- Past experience in dealing with the community on other grants (such as disaster grants, mitigation projects, etc.).
- The susceptibility of the community to natural and human-caused disasters by reviewing the state and local risk assessments.
- Previous Presidential disaster declarations to determine the number of times the requesting community has been impacted by declared disasters and the magnitude of damage resulting from those disasters. This review considers the impact to community infrastructure as well as families and businesses.
- The number of non-declared disasters that have impacted the community. This review considers the impact to community infrastructure as well as families and businesses.
- NFIP participation.
- The number of insured repetitive loss structures in the community.
- The community's status as a small and impoverished community and communities with special developmental pressures, if applicable.
- If the community has identified hazards in areas under its jurisdiction.
- If the community has demonstrated its ability to form effective public-private hazard mitigation partnerships.

Prioritization of State Technical and Financial Assistance

North Dakota strives to meet all of the technical and financial assistance requests it receives for hazard mitigation; however, the state's personnel and finances do have limitations, so when prioritization is needed, such as may be the case following a major disaster, the following criteria are considered:

- The extent and nature of the hazards to be mitigated.
- The degree of commitment of the local government to reduce damage from future disasters.
- The degree of commitment of the local government to support the hazard mitigation measures to be carried out using the technical and financial assistance.
- The extent to which the hazard mitigation measures to be carried out, using the technical and financial assistance, contribute to established state and local mitigation goals and priorities.

- The extent to which prioritized cost-effective mitigation activities that produce meaningful and definable outcomes are clearly identified.
- The opportunity to fund activities that maximize net benefits to society.
- The extent to which assistance will fund activities in small, impoverished communities.

Provisions for Small, Impoverished Communities

A small, impoverished community is a community of 3,000 or fewer in population that is economically disadvantaged, as determined by the state. Additional criteria may also be established by FEMA and other federal agencies.

While the state does not maintain a list of communities specifically designated as small and impoverished, it does have communities that have been designated as distressed and targeted. North Dakota DES and other state agencies received assistance from the North Dakota Department of Commerce in determining those communities that meet the distressed and targeted criteria.

The President may increase the federal cost share to 90% of the total cost of mitigation activities carried out by small, impoverished communities; however, all other requirements will be the same as any other community participating in mitigation activities.

7.5.6 Environmental Review

Projects receive initial consideration of environmental impacts during the application's initial review. Unless significant environmental impacts are expected, most projects are evaluated for eligibility, cost effectiveness, and prioritization before moving on for environmental review. Once a project appears to be closer to approval and the scope of the project has been clearly identified, DES contacts the relevant agencies to collect information needed for the environmental review relevant to impacts the project may have on historic resources, endangered and threatened species, and other concerns. Applicable federal and state environmental laws and executive orders are identified, and coordination with FEMA environmental staff begins. Information for the environmental questionnaire is entered into NEMIS, FEMA's electronic information system, or other management system. FEMA then does the formal federal review and issues a categorical exclusion or performs additional levels of review in coordination with the state. Once reviewed, the conditions during the construction phase of the project are monitored to ensure compliance with the stated conditions.

7.5.7 Grant Management

Although no longer a concept used by FEMA, North Dakota was a managing state through the Hazard Mitigation Grant Program (HMGP) from August 1999 through 2009. By being a managing state, North Dakota was delegated additional authority in managing the HMGP, and through this designation, demonstrated its ability to manage the program and its commitment to mitigation.

The North Dakota Hazard Mitigation Grant Program Administrative Plan, quarterly reporting system, and HMGP applications have all been used as models for other states. North Dakota has an exceptional track

record for meeting established deadlines for submitting applications, quarterly financial and progress reports, hazard mitigation administrative plans, and state multi-hazard mitigation plans. In addition, the standard HMGP acquisition application and quarterly reports developed by North Dakota were used by FEMA Headquarters for use as the NEMIS standard.

Upon initiation of a mitigation grant program, DES determines the management costs and submits the related budgets and work plans to FEMA. For HMGP, the state ensures compliance with the standard disaster grant agreement articles. The state also completes an Application for Federal Assistance, SF-424. Even before formal applications are submitted, DES provides FEMA with advanced estimates of project funding amounts.

During the application process, DES provides FEMA with project summaries and the complete application. DES also assists local governments with the cost share and ensures the matching funds are committed.

Once awarded, each project gets its own individual file containing all of the relevant information regarding the project. Information about the project is entered into NEMIS or other management system. Each project also has its own accounting sheet that is linked to a summary sheet for each disaster/grant program. These sheets are also linked to FEMA's Smartlink account used for drawdowns.

DES monitors the progress of the projects through local contacts to ensure the projects are on time and within budget. DES submits quarterly reports for each disaster and grant program. Once work has commenced, invoices submitted by the subgrantees are verified by DES and paid. DES ensures project progress; the communication of such information is passed on through quarterly reports and regular conference calls with FEMA Region VIII.

Once a project is completed, DES and/or the SHMT inspect the project site, collect open space certifications, and complete the NEMIS property site inventory, as applicable. DES then completes the paperwork required to closeout the project and eventually the disaster or program. If a project will not be completed within the performance period, DES works with the subgrantee to request an extension 60 days prior to the end of the performance period and subsequently encourages project completion. Projects are then monitored for future losses mitigated.

7.5.8 Project Monitoring and Evaluation

Projects through the PDM, HMGP, and NFIP programs are monitored by the North Dakota Department of Emergency Services (DES). DES uses spreadsheets, project files, quarterly reports, and other methods to track and monitor projects. If needed, DES contacts the subgrantees to ensure the projects will be completed on time or to determine if they will need an extension. Upon project completion, DES collects the documentation for project closeout.

Determining the actual cost avoidance and effectiveness of many mitigation projects during the development of the projects can be very difficult. Initially, the potential impact of these mitigation projects and initiatives can only be estimated; however, based on past experience with similar projects,

state agencies can make an educated determination as to the potential for success of the proposed mitigation project.

Evaluation of future disasters and their impact on a community is another means of evaluating the success of a mitigation project. This method is often used in evaluating the success of the acquisition program. In simple terms, removing a structure from a flood hazard area reduces the potential threat to that family and the associated disaster assistance costs. For example, the flood of 1997 was a catastrophic disaster for the State of North Dakota. This disaster caused an estimated $3.7 billion in economic losses. Following the flood, more than 800 flood-damaged structures were acquired through the HMGP and CDBG programs at a cost of approximately $75.7 million. Acquisitions dramatically reduce the costs of future floods because the properties are no longer there. The NFIP paid out approximately $6,390,987 in claims in the 1997 floods. In 2006, a similar magnitude flood (within 2 feet) occurred in the same area; economic losses in North Dakota totaled about $7 million, compared to $3.7 billion in 1997! (North Dakota Department of Emergency Services, 2007a) Much of the loss reduction has been attributed to the acquisition program.

North Dakota DES uses Geographic Information System (GIS) and Global Positioning System (GPS) technology to document acquisition and other projects and to further refine the monitoring of the projects. For example, flood models, including the use of HAZUS-MH, a FEMA loss estimation model, are used to predict the physical and economic losses saved due to flood mitigation projects. In just one flood event, the City of Grand Forks had a 107% return on the mitigation investment. An estimated $17.1 million in damages to homes were prevented in Grand Forks during the 2006 flood event. (North Dakota Department of Emergency Services, 2007a) Similarly, over $10 million in mitigated losses were estimated for the Fargo area during the 2009 flood due to the acquisition of 103 properties. (Federal Emergency Management Agency, 2010g)

In addition, North Dakota DES uses GIS coordinates to mark and map lots acquired through the acquisition programs to monitor compliance with open space deed restrictions. Several local floodplain managers are also implementing procedures for monitoring open space deed restrictions to ensure that at risk areas are not inappropriately re-developed.

These systems of monitoring and evaluating completed projects will continue as future events occur and projects are completed. DES is responsible for assessing the effectiveness of the mitigation activities but may be assisted by a variety of agencies relevant to the type of project. Typically, these assessments occur within 90 days of a declared disaster, if the disaster affected an area where relevant mitigation has taken place.

When significant mitigation successes can be demonstrated, such successes are documented. A good example is “The Red River of the North Flood Disaster, Ten Years Later” brochure published in 2007. Another example, “Journeys, North Dakota’s Trail towards Disaster Resistance,” published in January 2001, contains more than 20 mitigation success stories in North Dakota. The Association of State Floodplain Managers has also recorded North Dakota’s mitigation success stories in their publications dated December 2000 and January 2002. In 2010, the Federal Emergency Management Agency conducted a HAZUS analysis that demonstrated the losses avoided through the acquisition program in

the Fargo area during the 2009 and 2010 flood events. Similar publications will be used in the future, and if needed, a state database will be developed to track mitigation successes. Otherwise, the successes will be listed, where applicable, in FEMA's Mitigation Best Practices Portfolio.

7.6 Mitigation Implementation System Summary

Mitigation in North Dakota is an integrated, multi-agency concept that is achieved through a variety of federal and non-federal programs, laws, and policies. Each mitigation program is managed somewhat differently depending on the funding available and grant requirements. The more traditional Federal Emergency Management Agency (FEMA) mitigation programs are managed by the North Dakota Department of Emergency Services (HMGP, PDM, FMA, RLC, and SRL). DES relies on a State Hazard Mitigation Team, with representation from many state agencies, and an Interagency Hazard Mitigation Team, with state and federal representatives, to provide guidance and support in the implementation of mitigation.

Funding for mitigation activities varies from year to year, but improvements to legislation ensure some level of mitigation is performed on an annual basis. Each jurisdiction and agency has its own capabilities and limitations with respect to hazard mitigation, but technical assistance, training, and education attempt to overcome many of the obstacles.

North Dakota has a comprehensive mitigation planning program that encourages all jurisdictions in the state to create and maintain their own multi-hazard mitigation plan. These plans are integral to the statewide plan and serve as the basis for many locally driven mitigation actions.

The State of North Dakota encourages the successful implementation of hazard mitigation through clear grant and project management and technical assistance. A typical project funded through a grant program begins as a local concept, develops into a project, and is submitted to the state through an application, checked for eligibility, reviewed by several agencies, analyzed for cost effectiveness through a benefit cost analysis, prioritized against other projects if needed, reviewed for environmental impacts, and ultimately may be awarded funding. Once awarded, the jurisdiction implements the project while the state provides grant management and technical support. Eventually, the project is completed, the grant is closed out, and the project is monitored for its success in mitigating future impacts. Through all of these steps, the State of North Dakota has been and continues to be successful in facilitating and implementing mitigation initiatives that save lives, property, and money.

8. PLAN MAINTENANCE

An important aspect of any useable plan is the maintenance and upkeep of the document. Plans are adapted in order to keep pace with an ever-changing world. To facilitate and ensure this plan will remain viable for the State of North Dakota for many years, the plan maintenance responsibilities lie with the North Dakota Department of Emergency Services and the State Hazard Mitigation Team.

These plan maintenance concepts were updated in 2010 to better reflect the maintenance process used in recent years and to allow for more manageable maintenance during disaster periods, given the current three year update cycle. During the 2007 plan revision, more detail was added to the plan maintenance process such as identifying which sections should be updated post-disaster, annually, or every three years. In 2007, the concept of a "Mitigation Year in Review" meeting and report was added and then subsequently removed in 2010. The agencies meet on a regular basis already and another meeting was not warranted. The plan update cycle is generally too short to allow for annual updates. This is an example of how the plan is evaluated and changes are made as necessary.

8.1 Plan Monitoring

The plan will be monitored by the North Dakota Department of Emergency Services (DES). At a minimum, the plan is reviewed after each disaster, or in the absence of such, annually. Each time the State Hazard Mitigation Team convenes, the team discusses mitigation progress. The project statuses are reported on and any new project ideas are discussed. Each agency maintains its own list of projects completed, and these projects are added to the plan during the state plan update process. As part of the monitoring process, DES and/or the team:

- Review hazard mitigation projects and initiatives to ensure that there are no potential conflicts with ongoing agency initiatives.
- Review hazard mitigation projects and initiatives to ensure that they complement the statewide mitigation strategy.
- Review existing state/federal programs to ensure that the state takes full advantage of possible funding sources in implementing the state hazard mitigation program.

8.2 Plan Evaluation

After each disaster, or annually in the absence of such, the North Dakota Department of Emergency Services mitigation team will conduct a review of the plan. Changes to the plan will be made during the plan update cycle. All disaster or emergency incidents will be evaluated for general/specific mitigation recommendations that should be added to the plan. Coordination within the North Dakota Department of Emergency Services mitigation team is accomplished on a monthly basis.

A general evaluation of the plan is conducted as needed by the State Hazard Mitigation Team. Methods of implementing and maintaining the plan are evaluated for successes and improvements. Changes to the implementation schedule or plan maintenance will be made as needed to ensure hazard mitigation activities continue. New stakeholders and interested parties will be identified and invited to participate

in the implementation process. Should a hazard event have occurred in which a mitigation project was a factor, either positive or negative, a summary report, including avoided losses, will be written and included in Appendix J.

8.3 Plan Updates

As disasters occur, projects are completed, and hazard information is improved, the State of North Dakota Multi-Hazard Mitigation Plan will need to be updated. To remain an active and approved plan, an updated plan must be submitted to the Federal Emergency Management Agency every three years. The next formal submission is required in March 2014. Table 8.3A shows the schedule of plan updates. Updates will be based on the applicability of new technologies and methods.

Table 8.3A Schedule of Plan Updates

Plan Section	Post-Disaster or Annually	Every 3 Years
Adoption Documentation		X
Introduction		X
Planning Process		X
Statewide Inventory		X
Risk Assessment / Hazard Profiles		X
Mitigation Strategy	X	X
Mitigation Implementation System		X
Plan Maintenance		X
Appendices		X

8.4 Plan Update Process

The process for updating this plan is not a single-agency effort, rather a multi-agency, multi-jurisdictional effort that attempts to coordinate and integrate the data, observations, goals, objectives, actions, and capabilities from a wide variety of entities performing or desiring to perform mitigation activities. The plan update process generally takes about a year or more to be effectively completed. The following is a synopsis of the steps to be taken when updating this plan:

- Begin tracking communications associated with the plan update.
- Review existing plan and crosswalk and identify needed updates.
- Identify who will be responsible for updating the plan (i.e. agency personnel, contractors, etc.) and the timeframe for completing the update.
- Secure any necessary funding sources.
- If necessary, develop a request for proposals, evaluate proposals, and award contract(s).
- Begin tracking significant plan changes.
- Evaluate and update the planning process.
- Review the stakeholder contact list, make necessary changes, and identify new stakeholders.
- Initiate plan outreach and discussion, including a stakeholder meeting.
- Consider the addition, removal, or modification of hazards identified in the plan.

- Update and revise membership of the mitigation planning committees.
- Evaluate risk assessment methodologies and data sources.
- Evaluate and update state inventory information.
- Evaluate and update the hazard profiles, including interaction with the mitigation planning committees.
- Evaluate and update the risk assessment summary.
- Evaluate and update the mitigation strategy, including interaction with the mitigation planning committees.
- Evaluate and update the mitigation implementation system, including interaction with relevant state agencies.
- Evaluate and update the plan maintenance.
- Develop the necessary annual mitigation reports.
- Integrate new and updated local and tribal mitigation plans.
- Integrate new and updated related state plans.
- Evaluate and update other plans sections (i.e. table of contents, adoption documentation, introduction, appendices, etc.)
- Identify and add any additional sections or information needed.
- Review updated plan in its entirety.
- Conduct updated plan outreach, including public information, comment period, and stakeholder meeting.
- Integrate additional comments received.
- Finalize plan document.
- Complete crosswalk and submit final plan to FEMA for review and approval.
- If necessary, make additional modifications as required.
- Obtain signed letter from the Governor adopting the plan.

Appendix A. MITIGATION PLANNING COMMITTEES

Communicable Disease

Name	Agency/Organization	Member Since
Susan Keller	ND Board of Animal Health	2010
Raymond Morrell	ND Department of Emergency Services	2010
Tim Wiedrich	ND Department of Health	2010
Randy Ehlis	US Bureau of Reclamation	2010
Dave Hartman	US Bureau of Reclamation	2007

Dam Failure

Name	Agency/Organization	Member Since
Jeff Savadel	National Weather Service	2010
Raymond Morrell	ND Department of Emergency Services	2010
Fred Anderson	ND Geological Survey	2010
Jason Johnston	ND Parks and Recreation Department	2010
Kelly Casteel	ND State Water Commission	2010
Karen Goff	ND State Water Commission	2007
Jon Kelsch	ND State Water Commission	2010
Randy Ehlis	US Bureau of Reclamation	2010
Dave Hartman	US Bureau of Reclamation	2007

Drought

Name	Agency/Organization	Member Since
Jeff Savadel	National Weather Service	2010
Raymond Morrell	ND Department of Emergency Services	2010
Adnan Akyuz	ND State Climate Office	2010
Darin Langerud	ND State Water Commission	2007
Leroy Kalpprodt	ND State Water Commission	2007
Pat Fridgen	ND State Water Commission	2007
Linda Weispfenning	ND State Water Commission	2010
Randy Ehlis	US Bureau of Reclamation	2010

Flood

Name	Agency/Organization	Member Since
Tim Mahoney	City of Fargo	2010
Jeff Savadel	National Weather Service	2010
Raymond Morrell	ND Department of Emergency Services	2010
Fred Anderson	ND Geological Survey	2010
Jason Johnston	ND Parks and Recreation Department	2007
Adnan Akyuz	ND State Climate Office	2010
Kelly Casteel	ND State Water Commission	2010
Pat Fridgen	ND State Water Commission	2007
Mike Hall	ND State Water Commission	2010
Jon Kelsch	ND State Water Commission	2010
Jeff Klein	ND State Water Commission	2007
Linda Weispfenning	ND State Water Commission	2010
Randy Ehlis	US Bureau of Reclamation	2010

Geologic Hazards

Name	Agency/Organization	Member Since
Raymond Morrell	ND Department of Emergency Services	2010
Fred Anderson	ND Geological Survey	2010

Hazardous Material Release

Name	Agency/Organization	Member Since
Gary Stockert	City of Bismarck Emergency Management	2007
Jeff Savadel	National Weather Service	2010
Ray DeBoer	ND Department of Emergency Services	2010
Raymond Morrell	ND Department of Emergency Services	2010
Tim Wiedrich	ND Department of Health	2010
Dave Hvinden	ND Department of Mineral Resources	2007
Renee Loh	ND Firefighter's Association	2010
Randy Ehlis	US Bureau of Reclamation	2010

Homeland Security Incident

Name	Agency/Organization	Member Since
Gary Stockert	City of Bismarck Emergency Management	2007
Jeff White	ND Attorney General's Office	2010
Kathleen Donahue	ND Department of Emergency Services	2010
Raymond Morrell	ND Department of Emergency Services	2010
Tim Wiedrich	ND Department of Health	2010
Eric Pederson	ND Highway Patrol	2010
Randy Ehlis	US Bureau of Reclamation	2010
Dave Hartman	US Bureau of Reclamation	2007

Shortage or Outage of Critical Materials or Infrastructure

Name	Agency/Organization	Member Since
Wally Kalmbach	ND Association of Rural Electric Cooperatives	2007
Jeff Rotenberger	ND Department of Commerce	2010
Raymond Morrell	ND Department of Emergency Services	2010

Summer Storm

Name	Agency/Organization	Member Since
Todd Schreiner	McLean County Emergency Management	2007
John Paul Martin	National Weather Service	2007
Jeff Savadel	National Weather Service	2010
Jeff Rotenberger	ND Department of Commerce	2010
Raymond Morrell	ND Department of Emergency Services	2010
Fred Anderson	ND Geological Survey	2010
Jason Johnston	ND Parks and Recreation Department	2007
Adnan Akyuz	ND State Climate Office	2010
Jon Kelsch	ND State Water Commission	2010
Darin Langerud	ND State Water Commission	2007

Transportation Accident

Name	Agency/Organization	Member Since
Raymond Morrell	ND Department of Emergency Services	2010
Brad Darr	ND Department of Transportation	2010
Eric Pederson	ND Highway Patrol	2010
Cliff Whitman	Three Affiliated Tribes Emergency Management	2007
Mark Schrader	US Federal Highway Administration	2010

Urban Fire or Structure Collapse

Name	Agency/Organization	Member Since
Raymond Morrell	ND Department of Emergency Services	2010
Ray Lambert	ND Fire Marshal	2007
Renee Loh	ND Firefighter's Association	2010
Fred Anderson	ND Geological Survey	2010

Wildland Fire

Name	Agency/Organization	Member Since
Todd Schreiner	McLean County Emergency Management	2007
Jeff Savadel	National Weather Service	2010
Raymond Morrell	ND Department of Emergency Services	2010
Ray Lambert	ND Fire Marshal	2007
Renee Loh	ND Firefighter's Association	2010
David Geyer	ND Forest Service	2007
Geremy Olson	ND Forest Service	2010
Jason Johnston	ND Parks and Recreation Department	2007

Winter Storm

Name	Agency/Organization	Member Since
Todd Schreiner	McLean County Emergency Management	2007
Greg Gust	National Weather Service	2007
John Paul Martin	National Weather Service	2007
Jeff Savadel	National Weather Service	2010
Jeff Rotenberger	ND Department of Commerce	2010
Raymond Morrell	ND Department of Emergency Services	2010
Adnan Akyuz	ND State Climate Office	2010

Planning Process

Name	Agency/Organization	Member Since
Tim Mahoney	City of Fargo	2010
Jeff Savadel	National Weather Service	2010
Jeff Rotenberger	ND Department of Commerce	2010
Raymond Morrell	ND Department of Emergency Services	2010
Linda Weispfenning	ND State Water Commission	2010

Critical Facilities and Infrastructure

Name	Agency/Organization	Member Since
Gary Stockert	City of Bismarck Emergency Management	2007
Wally Kalmbach	ND Association of Rural Electric Cooperatives	2010
Jeff Rotenberger	ND Department of Commerce	2010
Kirk Hagel	ND Department of Emergency Services	2010
Raymond Morrell	ND Department of Emergency Services	2010
Brad Darr	ND Department of Transportation	2010
Jason Johnston	ND Parks and Recreation Department	2010

Land Use and Recent and Future Construction and Development

Name	Agency/Organization	Member Since
Raymond Morrell	ND Department of Emergency Services	2010
Fred Anderson	ND Geological Survey	2010
Jason Johnston	ND Parks and Recreation Department	2010
Gene Buresh	Roosevelt-Custer Regional Council	2010

Mitigation Strategy

Name	Agency/Organization	Member Since
Janel Schmitz	American Red Cross	2010
Tim Mahoney	City of Fargo	2010
Raymond Morrell	ND Department of Emergency Services	2010
Adnan Akyuz	ND State Climate Office	2010
Pat Fridgen	ND State Water Commission	2010
Linda Weispfenning	ND State Water Commission	2010

Mitigation Implementation System

Name	Agency/Organization	Member Since
Tim Mahoney	City of Fargo	2010
Raymond Morrell	ND Department of Emergency Services	2010
Linda Weispfenning	ND State Water Commission	2010

Appendix B. INVITED STAKEHOLDERS, PARTICIPATION, AND PUBLIC INFORMATION

Table B1. Invited Stakeholders and Participation

First Name	Last Name	Agency/Organization	2010 Participation
Libby	Gravning	Adams County Emergency Manager	
Michelle	Marthaller	Adams County Emergency Manager	
		Altru Hospital	
Stephen	Miller	American Planning Association, Western Central Chapter	
Megan	Kruger	American Red Cross, Mid-Dakota Chapter	
Allan	McGeough	American Red Cross, Mid-Dakota Chapter	
Marijo	Peterson	American Red Cross, Minn-Kota Chapter	
Tom	Tezel	American Red Cross, Minn-Kota Chapter	
Greg	Voss	American Red Cross, Minn-Kota Chapter	
Melanie	Moen	American Red Cross, West Dakota Chapter	
Janel	Schmitz	American Red Cross, West Dakota Chapter	Meeting Committee(s)
Julie	Dahle	Bank of North Dakota	
Janice	Pratt	Bank of North Dakota	
Kimberly	Franklin	Barnes County Emergency Manager	
Kathi	Risch	Basin Electric Power Cooperative	
Dawn	Flemmer	Benson County Emergency Manager	
Pam	Shrauger	Big Sky Hazard Management LLC	Oversight Meetings
Pat	Rummel	Billings County Emergency Manager	
Gary	Stockert	Bismarck Emergency Manager	Committee(s) Review Comments
Rick	Hummel	Bottineau County Emergency Manager North Dakota Emergency Management Association	
Karla	Germann	Bowman County Emergency Manager	
Dean	Pearson	Bowman County Emergency Manager	
Barry	Jager	Burke County Emergency Manager	
Mary	Senger	Burleigh County Emergency Manager Emmons County Emergency Manager	
Amy	McBeth	Burlington Northern Santa Fe Railroad	
Gus	Melonas	Burlington Northern Santa Fe Railroad	
Mark	Seland	Canadian Pacific Soo Line Railroad	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Dave	Rogness	Cass County/Fargo Emergency Manager	
Leon	Schlafmann	Cass County/Fargo Emergency Manager	
		Cass County/Fargo Emergency Manager	
Karen	Kempert	Cavalier County Emergency Manager	
		Central Dakota Humane Society	
Timothy	Mahoney	City of Fargo Innovis Health	Committee(s)
		Dakota Missouri Valley & Western Railroad	
Charlie	Russell	Dickey County Emergency Manager	
Rob	Melby	Divide County Emergency Manager	
Denise	Brew	Dunn County Emergency Manager	
Tammy	Roehrich	Eddy County Emergency Manager	
Dana	Allen	Environmental Protection Agency	
John	Stumpf	Excel Energy	
Douglas	Bausch	Federal Emergency Management Agency	Data
Julie	Baxter	Federal Emergency Management Agency	Meeting
Barbara	Fitzpatrick	Federal Emergency Management Agency	
Rich	Hansen	Federal Emergency Management Agency	
Michael	Hillenburg	Federal Emergency Management Agency	
Jeanine	Neipert	Federal Emergency Management Agency	Meeting
Wade	Nofziger	Federal Emergency Management Agency	Meeting
Ryan	Pietramali	Federal Emergency Management Agency	
Donna	Rakocy	Federal Emergency Management Agency	
Jesse	Rozelle	Federal Emergency Management Agency	Data
Ron	Hartl	Federal Highway Administration	
Mark	Schrader	Federal Highway Administration	Meeting Committee(s) Review
Dale	Townsend	Foster County Emergency Manager	
Carrie	Law	Golden Valley Emergency Manager	
Jim	Campbell	Grand Forks Emergency Manager	
Donna	Flaten	Grand Forks Emergency Manager	Comments
JoAnn	Ozbun	Grant County Emergency Manager	
Roger	Rohrer	Great River Energy	Webinar
Robert	Hook	Griggs County Emergency Manager	
Ilene	Hardmeyer	Hettinger County Emergency Manager	
Cherie	Abrahams	Holland America Line	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
		Humane Society of Fargo	
		Humane Society of Grand Forks	
		James River Humane Society	
Martin	Richman	Jamestown Hospital	
Maren	Daley	Job Service of North Dakota	
Jim	Albrecht	Kidder County Emergency Manager	
Irv	Rustad	Lake Agassiz Regional Council	
Amber	Schaan	Lake Agassiz Regional Council	
Sheri	Gartner	LaMoure County Emergency Manager	
Paul	Rechlin	Lewis and Clark Regional Council	
Cynthia	Doll	Logan County Emergency Manager	
Marvin	Sola	McHenry County Emergency Manager	
DeLoris	Rudolph	McIntosh County Emergency Manager	
Jerry	Samuelson	McKenzie County Emergency Manager	
Todd	Schreiner	McLean County Emergency Manager	Committee(s) Review Comments
Luke	Steen	McLean Electric Cooperative, Inc.	Webinar
		Medcenter One	
Carmen	Reed	Mercer County Emergency Manager	
Kerry	Monson	Mercy Medical Center	
Tami	Solberg	Mercy Medical Center	
Roger	Gilbertson	Meritcare Health System	
David	Loer	Minnkota Power Cooperative/Square Butte Electric Cooperative	
Gary	Paulson	Montana-Dakota Utilities	
Dan	Sharp	Montana-Dakota Utilities	
Art	Thompson	Montana-Dakota Utilities	
Tammy	Lapp-Harris	Morton County Emergency Manager	
Don	Longmuir	Mountrail County Emergency Manager	
Mark	Holter	Mountrail-Williams Electric Cooperative	Webinar
John Paul	Martin	National Weather Service, Bismarck	Meeting Committee(s) Data Review Comments

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Jeff	Savadel	National Weather Service, Bismarck	Meeting Committee(s) Review Comments
Greg	Gust	National Weather Service, Grand Forks	Committee(s)
Michael	Lukes	National Weather Service, Grand Forks	
Dennis	Reep	Natural Resources Conservation Services	
Doug	VanDaalen	Natural Resources Conservation Services	
Sharon	Young	Nelson County Emergency Manager	
Rick	Anderson	North Central Regional Planning Council	
Lawrence	Taborsky	North Dakota Aeronautics Commission	
Bradley	Fields	North Dakota Aeronautics Commission	Meeting
Malinda	Weninger	North Dakota Aeronautics Commission	
Gary	Knutson	North Dakota Agricultural Association	
Doreen	Riedman	North Dakota Association of Builders	
Mark	Johnson	North Dakota Association of Counties	
Jim	Mott	North Dakota Association of Fire Chiefs	
		North Dakota Association of Nonprofit Organizations	
		North Dakota Association of Realtors	
Wally	Kalmbach	North Dakota Association of RECs/RETs	Meeting Committee(s) Review Comments
Thomas	Hanson	North Dakota Association of Soil Conservation Districts	
David	Crothers	North Dakota Association of Telecommunications Cooperative	
Matt	Sagsveen	North Dakota Attorney General's Office	Meeting Webinar
Jeff	White	North Dakota Attorney General's Office	Committee(s)
Steven	Edwardson	North Dakota Barley Council	
Nancy Jo	Bateman	North Dakota Beef Commission	
Beth	Carlson	North Dakota Board of Animal Health	
Susan	Keller	North Dakota Board of Animal Health	Committee(s)
Dave	MacIver	North Dakota Chamber of Commerce	
Andy	Peterson	North Dakota Chamber of Commerce	
		North Dakota Child Support Enforcement	
Karl	Altenburg	North Dakota Civil Air Patrol	
Darrel	Pittman	North Dakota Civil Air Patrol	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Jan	Webb	North Dakota Council on the Arts	
		North Dakota County Commissioners Association	
Wayne	Carlson	North Dakota Department of Agriculture	
Kenneth	Junkert	North Dakota Department of Agriculture	
Betty	Nelson	North Dakota Department of Agriculture	
Tom	Silbernagel	North Dakota Department of Agriculture	
Gary	Wagner	North Dakota Department of Agriculture	
Wayne	Kutzer	North Dakota Department of Career and Technical Education	
Brenda	Schuler	North Dakota Department of Career and Technical Education	
Leigh Ann	Huether	North Dakota Department of Commerce	Data
Jeff	Rotenberger	North Dakota Department of Commerce	Meeting Committee(s)
Jim	Boyd	North Dakota Department of Commerce, Division of Community Services	
Wayne	Glaser	North Dakota Department of Commerce, Division of Community Services	
Myles	Noon	North Dakota Department of Corrections and Rehabilitation	
Corky	Stromme	North Dakota Department of Corrections and Rehabilitation	
Paul	Lucy	North Dakota Department of Economic Development	
Amy	Anton	North Dakota Department of Emergency Services	Review Comments
Raymond	DeBoer	North Dakota Department of Emergency Services	Webinar Committee(s) Data
Tom	Doering	North Dakota Department of Emergency Services	Webinar Review Comments
Kathleen	Donahue	North Dakota Department of Emergency Services	Committee(s) Review Comments
Cecily	Fong	North Dakota Department of Emergency Services	Webinar Comments
Kirk	Hagel	North Dakota Department of Emergency Services	Committee(s) Data
Brandon	Hoechst	North Dakota Department of Emergency Services	Webinar

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Lonnie	Hoffer	North Dakota Department of Emergency Services	Oversight Meetings
Sean	Johnson	North Dakota Department of Emergency Services	Oversight Meetings
Cherie	Merrick	North Dakota Department of Emergency Services	Oversight Meeting
Paul	Messner	North Dakota Department of Emergency Services	Review
Raymond	Morrell	North Dakota Department of Emergency Services	Oversight Meetings Data Review Comments
Rick	Robinson	North Dakota Department of Emergency Services	Webinar
Greg	Wilz	North Dakota Department of Emergency Services	Meeting Review Comments
Bob	Entringer	North Dakota Department of Financial Institutions	
Lois	Hartman	North Dakota Department of Financial Institutions	
Tim	Karsky	North Dakota Department of Financial Institutions	
Terry	Dwelle	North Dakota Department of Health	
Dave	Glatt	North Dakota Department of Health	
Aaron	Russell	North Dakota Department of Health	Meeting
Brenda	Vossler	North Dakota Department of Health	
Tim	Wiedrich	North Dakota Department of Health	Committee(s) Review Comments
Kathy	Kulesa	North Dakota Department of Human Rights	
Joseph	Crawford	North Dakota Department of Human Services	
Julie	Leer	North Dakota Department of Human Services	
Tara	Skjee Hoffmann	North Dakota Department of Human Services	
Robin	Bosch	North Dakota Department of Labor	
Lisa	Fair McEvers	North Dakota Department of Labor	
Fred	Anderson	North Dakota Department of Mineral Resources, Geological Survey	Meeting Committee(s) Data Review Comments

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Dave	Hvinden	North Dakota Department of Mineral Resources, Oil & Gas	Webinar Committee(s) Review Comments
Valeria	Fischer	North Dakota Department of Public Instruction	
Bob	Marthaller	North Dakota Department of Public Instruction	
Wayne	Sanstead	North Dakota Department of Public Instruction	
Brad	Darr	North Dakota Department of Transportation	Meeting Committee(s) Data Review Comments
Gary	Doerr	North Dakota Department of Transportation	Data
Ed	Ryen	North Dakota Department of Transportation	
Lonnie	Wangen	North Dakota Department of Veterans Affairs	
Jim	Crow	North Dakota Division of State Radio	
Mike	Lynk	North Dakota Division of State Radio	
Carol	Goodman	North Dakota Economic Development Association	
		North Dakota Emergency Medical Services Association	
Ronda	Berg	North Dakota Facilities Management	
John	Boyle	North Dakota Facilities Management	
Renee	Loh	North Dakota Firefighters Association	Meetings Committee(s) Review Comments
Thomas	Claeys	North Dakota Forest Service	Meeting
David	Geyer	North Dakota Forest Service	Committee(s)
Larry	Kotchman	North Dakota Forest Service	
Geremy	Olson	North Dakota Forest Service	Committee(s) Data Review Comments
Sarah	Tunge	North Dakota Forest Service	Meeting
Steve	Dyke	North Dakota Game & Fish	
Mike	McKenna	North Dakota Game & Fish	
Roger	Rostvet	North Dakota Game & Fish	
Steve	Strege	North Dakota Grain Dealers Association	
Dan	Wogsland	North Dakota Grain Growers Association	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Neil	Johnson	North Dakota Highway Patrol	
Kathy	Loreen Nelson	North Dakota Highway Patrol	
Eric	Pederson	North Dakota Highway Patrol	Meeting Committee(s) Review Comments
James	Prochniak	North Dakota Highway Patrol	
Brad	Smith	North Dakota Highway Patrol	
Mike	Anderson	North Dakota Housing Finance Agency	
Celeste	Burke	North Dakota Housing Finance Agency	
Chad	Kramer	North Dakota Indian Affairs Commission	
Lynn	Helms	North Dakota Industrial Commission, Oil & Gas Division	
Mike	Ressler	North Dakota Information Technology Department	
Jeff	Bitz	North Dakota Insurance Department	
Laurie	Scully	North Dakota Insurance Department	Data
Judie	Lee	North Dakota Interagency Program for Assistive Technology	
Connie	Sprynczynatyk	North Dakota League of Cities	
Thomas	Balzer	North Dakota Motor Carriers Association	
Jon	Erickson	North Dakota National Guard	
Daryl	Roerick	North Dakota National Guard	
		North Dakota Natural Resources Trust	
Allen	Hoberg	North Dakota Office of Administrative Hearings	
Terry	Milas	North Dakota Office of Management and Budget, Risk Management	
Glenna	Ellison	North Dakota Office of the Attorney General	
Wayne	Stenehjem	North Dakota Office of the Attorney General	
Robert	Peterson	North Dakota Office of the State Auditor	
Mark	Bohrer	North Dakota Oil and Gas Division	
Karen	Assel	North Dakota Parks and Recreation	
Jason	Johnston	North Dakota Parks and Recreation	Meetings Committee(s) Review Comments
Doug	Prchal	North Dakota Parks and Recreation	
Maureen	Trnka	North Dakota Parks and Recreation	
Mark	Zimmerman	North Dakota Parks and Recreation	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Lori	Malafa	North Dakota Peace Officers Association	
		North Dakota Petroleum Council	
Steve	Zimmer	North Dakota Planning Association	
Mike	Rud	North Dakota Propane Gas Association North Dakota Retail Association	
Lois	Mackey	North Dakota Public Health Association	
Patrick	Fahn	North Dakota Public Service Commission	
Melody	Kruckenberg	North Dakota Rural Water Systems Association	
Adnan	Akyuz	North Dakota State Climate Office	Committee(s)
John	Elstad	North Dakota State Fire Marshal's Office	
Linda	Hippen	North Dakota State Fire Marshal's Office	Data
Ray	Lambert	North Dakota State Fire Marshal's Office	Committee(s) Review
Merlan	Paaverud, Jr.	North Dakota State Historical Society	
Carol	Cwiak	North Dakota State University	
Duane	Hauck	North Dakota State University Extension Service	
Kelly	Casteel	North Dakota State Water Commission	Meetings Committee(s)
Bruce	Engelhardt	North Dakota State Water Commission	
Pat	Fridgen	North Dakota State Water Commission	Meetings Committee(s) Data Review Comments
Dale	Frink	North Dakota State Water Commission	
Karen	Goff	North Dakota State Water Commission	Committee(s) Data Review Comments
Mike	Hall	North Dakota State Water Commission	Committee(s)
Jon	Kelsch	North Dakota State Water Commission	Meeting Committee(s) Review Comments
Lee	Klapprodt	North Dakota State Water Commission	Committee(s)
Jeff	Klein	North Dakota State Water Commission	Committee(s) Data
Bruce	Lange	North Dakota State Water Commission	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Darin	Langerud	North Dakota State Water Commission	Meeting Committee(s) Data Review Comments
Todd	Sando	North Dakota State Water Commission	
Linda	Weispfenning	North Dakota State Water Commission	Meeting Committee(s) Review
Julie	Ellingson	North Dakota Stockmen's Association	
Nancy	Walz	North Dakota Technology Policy and Planning	
Patricia	Gisinger	North Dakota Telephone Association	
Sara	Otte Coleman	North Dakota Tourism Division	
Ken	Yantes	North Dakota Township Officers Association	Meeting
William	Goetz	North Dakota University System	
Kit	O'Neill	North Dakota Voluntary Organizations Active in Disaster	
Bonnie	Turner	North Dakota Voluntary Organizations Active in Disaster	
G	Padmanabhan	North Dakota Water Resources Research Institute	
Paul	Govig	North Dakota Workforce Development Division	
James	Hirsch	North Dakota Workforce Development Division	
Tammy	Dolan	North Dakota Workforce Safety and Insurance	
Bryan	Klipfel	North Dakota Workforce Safety and Insurance	
Jeff	Boyce	Northern Border Pipeline	
Beth	Jensen	Northern Border Pipeline	
		Northern Plains Railroad	
Lisa	Reichenberg	Oliver County Emergency Manager	
Marlowe	Johnson	Otter Tail Power Company	
Ryan	Smith	Otter Tail Power Company	
Monica	Brusseau	Pembina County Emergency Manager	Webinar
Jill	Pedersen	Pembina County Emergency Manager	
Duane	Veach	Pierce County Emergency Manager	
Daniel	Holli	Plains Pipeline, L.P.; North Dakota Pipeline Association	
Tim	Heisler	Ramsey County Emergency Manager	
Teresa	Rotenberger	Ransom County Emergency Manager	
Janet	Dvorak	Red River Regional Council	
Julius	Wangler	Red River Regional Council	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Cynthia	Olson	Red River Valley & Western Railroad	
Andy	Thompson	Red River Valley & Western Railroad	
Kristy	Titus	Renville County Emergency Manager	
Brett	Lambrecht	Richland County Emergency Manager	
Eldon	Moors	Rolette County Emergency Manager	
Gene	Buresh	Roosevelt-Custer Regional Council	Meeting Committee(s)
Rod	Landblom	Roosevelt-Custer Regional Council	
Harold	Baugh	Salvation Army	
James	Castor	Salvation Army	
Dale	Hale	Salvation Army	
Chuck	Hendrickson	Salvation Army	
Timothy	Miller	Salvation Army	
Adam	Moore	Salvation Army	
Sandra	Hanson	Sargent County Emergency Manager	Comments
Wayne	Houston	Sheridan County Emergency Manager	
Frank	Landeis	Sioux County Emergency Manager	
Leonica	Alkire	Sitting Bull College	
Dick	Frederick	Slope County Emergency Manager	
Greg	Hagen	Souris Basin Regional Council	
		Souris Valley Humane Society	
Mary	Geffre	South Central Dakota Regional Council	
Deb	Kantrud	South Central Dakota Regional Council	Webinar
Duane	Spooner	South Central Dakota Regional Council	
Joe	Alberts	Spirit Lake Sioux Emergency Manager	
Christine	Moresfield	SRT Communications	
Nancy	Willis	St. Alexius Medical Center	
Tamala	Anderson	St. Joseph's Hospital	
Becky	Elkins	St. Joseph's Hospital	
Everett	Iron Eyes	Standing Rock Sioux Emergency Manager	
Brent	Pringle	Stark County Emergency Manager	
Don	Huso	Steele County Emergency Manager	
Jerry	Bergquist	Stutsman County Emergency Manager	
Cliff	Whitman	Three Affiliated Tribes Emergency Manager	Committee(s)
Larry	Halverson	Towner County Emergency Manager	
Mike	Crocker	Traill County Emergency Manager	
Everette	Enno	Tri-County Regional Development Council	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
		Trinity Hospital	
Anita	Blue	Turtle Mountain Chippewa Emergency Manager	
Tom	Barnett	Upper Missouri G & T Electric	
Randall	Behm	US Army Corps of Engineers	
Tim	Bertschi	US Army Corps of Engineers	
Bill	Csajko	US Army Corps of Engineers	
Craig	Evans	US Army Corps of Engineers	
Bonnie	Greenleaf	US Army Corps of Engineers	
Greg	Johnson	US Army Corps of Engineers	
Paul	Kosterman	US Army Corps of Engineers	
Joseph	Mose	US Army Corps of Engineers	
Mark	Nelson	US Army Corps of Engineers	
Becky	Shipman	US Army Corps of Engineers	
Aaron	Snyder	US Army Corps of Engineers	
Tom	Sully	US Army Corps of Engineers	
Pam	Vedros	US Army Corps of Engineers	
Dana	Werner	US Army Corps of Engineers	
Terryl	Williams	US Army Corps of Engineers	
Michael	Wyatt	US Army Corps of Engineers	
Lonny	Bagley	US Bureau of Land Management	
Dennis	Brietzman	US Bureau of Reclamation	
Randy	Ehlis	US Bureau of Reclamation	Meeting Committee(s) Review
Dave	Hartman	US Bureau of Reclamation	Committee(s)
Myron	Lepp	US Department of Agriculture, Rural Development	
Dale	Van Eckhout	US Department of Agriculture, Rural Development	
Donald	Warren	US Department of Agriculture, Rural Development	
		US Department of Housing and Urban Development	
Terry	Ellsworth	US Fish and Wildlife Services	
Gregg	Wiche	US Geological Survey	
Andrew	Banta	US National Park Service, Fort Union Trading Post	
Brian	McCutchen	US National Park Service, Knife River Indian Villages	
Valerie	Naylor	US National Park Service, Theodore Roosevelt National Park	
Brent	Nelson	Walsh County Emergency Manager	
Alan	Reynolds	Ward County Emergency Manager	

Table B1. Invited Stakeholders and Participation (continued)

First Name	Last Name	Agency/Organization	2010 Participation
Tammy	Roehrich	Wells County Emergency Manager	
Mike	Hallesy	Williams County Emergency Manager	
Kevin	Connell	Williston Basin Interstate Pipeline	
Don	Johnson	Williston Basin Interstate Pipeline	Webinar
Craig	Wagner	Williston Basin Interstate Pipeline	

Department of Emergency Services

Post Office Box 5511 ~ Bismarck, ND 58506-5511
Tel: 701-328-8154 ~ Fax: 701-328-8181
www.nd.gov/des

FOR IMMEDIATE RELEASE
December 13, 2007

Contact: Cecily Fong
(701) 328-8100
Cell - (701) 391-8158
Email – cfong@nd.gov

ND DEPARTMENT OF EMERGENCY SERVICES UPDATES STATEWIDE DISASTER MITIGATION PLAN

BISMARCK, N.D. – Floods, tornadoes, wild fires, and terrorism are only some of the hazards profiled in the recently released State of North Dakota Enhanced Multi-Hazard Mitigation Plan. In total, twelve hazards are profiled in the plan, with winter storms, summer storms, drought, and floods identified as the hazards with the greatest potential to cause significant damages and overwhelm the communities.

The plan considers many aspects of each hazard such as the probability of it occurring, the potential for the loss of life and property, and possible impacts on the economy. The plan does not stop at profiling hazards, however. It also focuses on long-term initiatives and strategies that could prevent or reduce future losses. Most of the initiatives are projects that can be done in local communities such as home acquisitions in hazard areas, building code adoption and enforcement, road and drainage improvements, and public education programs. Each of the initiatives relate to at least one of the seven goals listed in the plan. Many communities are eligible to apply for funding through various grant programs offered by the state and federal governments.

North Dakota is required to have a statewide multi-hazard mitigation plan and is required to review the plan every three years. If the enhanced plan is approved by the Federal Emergency Management Agency (FEMA), North Dakota will be one of only six states with this type of plan. An enhanced plan will provide an additional five percent in funding for hazard mitigation and disaster recovery back to North Dakota communities.

Representatives from across the state have been evaluating and updating the plan for several months and encourage the public to provide additional comment. Sections of the plan can be read and downloaded from the internet at: www.nd.gov/des. Comments are due by January 2, 2008 and can be submitted to nddes@nd.gov or ND Department of Emergency Services, PO Box 5511, Bismarck, ND 58506-5511.

###

The following public notice was placed in each of the North Dakota daily newspapers twice during the weeks of December 16, 2007 and December 23, 2007.

Public Notice

The ND Department of Emergency Services is seeking public comment on the North Dakota Enhanced Multi-Hazard Mitigation Plan that was recently completed. The plan is located at www.nd.gov/des. Comments should be received by January 2, 2008 and should be directed to:

NDDES
PO Box 5511
Bismarck, ND
58506-5511
Tel: 701-328-8100
Fax: 701-328-8181
Email: nddes@nd.gov

For Immediate Release
November 1, 2010

Contact: Cecily Fong, 701-328-8100

State Updates Disaster Mitigation Plan

Bismarck, ND – The ND Department of Emergency Services has recently reviewed and updated the state's multi-hazard mitigation plan. North Dakota is required to have a statewide mitigation plan that is reviewed and updated every three years. The plan is available at www.nd.gov/des and the department seeks public comment on the plan. A public forum will be held November 17, 2010 at the ND Association of Counties at 9:00 am.

The Federal Emergency Management Agency (FEMA) also reviews the plan and provides approval. An approved plan is a pre-requisite for using federal dollars available for disaster recovery such as the Public Assistance program and the various Hazard Mitigation Grant programs.

Floods, tornadoes, wildfires, and terrorism are only some of the hazards profiled. In total, thirteen hazards are identified in the plan with winter storms, summer storms, drought, and floods identified as the hazards with the greatest potential to cause significant damage and overwhelm communities.

The plan considers many aspects of each hazard such as the probability of it occurring, the potential for the loss of life and property, and possible impacts on the economy. The plan does not stop at profiling hazards, however. It also focuses on long-term initiatives and strategies that could prevent or reduce future losses. Most of the initiatives are projects that can be done in the local communities such as home acquisitions in hazard areas, building code adoption and enforcement, road and drainage improvements, and public education programs. Each of the initiatives relate to at least one of the seven goals listed in the plan. Many communities are eligible to apply for funding through various grant programs offered by the state and federal governments.

Representatives from across the state have been evaluating and updating the plan for several months and encourage the public to provide additional comment. The plan can be read and downloaded at: www.nd.gov/des. Comments are due by January 2, 2011 and can be submitted to nddes@nd.gov or ND Department of Emergency Services, PO Box 5511, Bismarck, ND 58506-5511.

###

The following public notice was placed in each of the North Dakota daily newspapers between October 29, 2010 and November 1, 2010. The example that follows was in the Devils Lake Journal on October 29, 2010, page 11.

PUBLIC NOTICES

Public Notice

The ND Department of Emergency Services is seeking public comment on the North Dakota Enhanced Multi - Hazard Mitigation Plan that was recently completed. The plan is located at www.nd.gov/des.

Comments should be received by January 2, 2011 and should be directed to:
NDDES
PO Box 5511
Bismarck, ND
58506-5511
Tel: 701-328-8100
Fax: 701-328-8181
Email: nddes@nd.gov

(c10:29)

Appendix C. MEETING ATTENDANCE RECORDS

REGISTRY
ND STATE MULTI-HAZARD MITIGATION PLAN UPDATE MEETING
JUNE 19th, 2007

	NAME	AGENCY	PHONE NUMBER	EMAIL ADDRESS
1	BRUCE LANGE	WATER COMM	328-2759	blange@ND.Gov
2	Ryan Smith	OHERTA-I POWER	218-739-8508	rsmith@ortco.com
3	GARY NESS	ND AERO	328-9650	gness@ND.GOV
4	Connie Wetzel	Mortonctty	667-3307	Cwetzel@nd.gov
5	Shawna Paul	Emmons Co.	254-4486	Smpaul@nd.gov
6	Jason Johnston	NDPRD	328-5376	jjohnston@nd.gov
7	Pam Shrauger	BSHM	406-581-4512	pam@bigskyhazards.com
8	LONNIE HOFFER	DES	328-8100	lhoffer@ND.gov.
9	DAVE HUINDEN	DMR	328-8037	dhuinden@nd.gov.
10	FRED ANDERSON	DMR	328-8013	fjanderson@nd.gov
11	Terry Milas	Risk Management	328-7582	tmilas@nd.gov
12	TODD A. SCHREINER	Sullivan Co	462-8541	tschreiner@ndgov
13	Brent Pringle	Stark Co	456-7912	BPringle@nd.gov
14	Bonnie Turner	VOAD	800-950-2901	bTurner@LSSnd.org
15	ED LODNIG	DES	572-7707	
16	Rick Hummel	DES	228-5916	
17	Wayne Hokenson	NDDES	328-8167	whokenso@nd.gov
18	Glenna Ellison	AG	328-1256	gellison@nd.gov
19	DAVID MASSEY	DPI	328-2393	dmassey@nd.gov.
20	[illegible]	NDSWC	701-328-4898	jjklein@nd.gov

REGISTRY
ND STATE MULTI-HAZARD MITIGATION PLAN UPDATE MEETING
JUNE 19th, 2007

	NAME	AGENCY	PHONE NUMBER	EMAIL ADDRESS
1	ELDON KREIN	NDHRA	328-7070	EKREIN@NDHRA.ORG
2	Wally Kalmbach	NDARECC	667-6401	WKalmbach@ndarec.co
3	Cliff Whitman	TAT Emergency Mgmt	701-627-4805	cwhitman@mhanation.com
4	Gary Stockert	Bis EM	222-6727	gstockert@nd.gov
5	Ray Lambert	Fire marshal	328-5555	RLambert@ND.gov
6	Cynthia Olson	RRVW Railroad	218-643-4994	Cynthia.olson@rrvw.net
7	Doug Van Daele	NRCS	530-2094	doug.vandaele@nd.usda.gov
8	Jan Pratt	BND	328-5764	jpratt@nd.gov
9	Nan Johnson	FEMA R8	(303)235-4838	nan.johnson@dhs.gov
10	David Geyer	ND Forest Service	701-328-9944	David.Geyer@ndsu.edu
11	WES WIEDENMEYER	NRCS	701-530-2086	WES.WIEDENMEYER@nd.usda.gov
12	Tara Skjoe Hoffman	NDDHS	701-328-2311	SOSKJ@ndi.gov
13	Janna Charnier	ND-DES	328-8262	jcharnier@nd.gov
14	Dave Hartman	USBR	701-250-4242	dhartman@GP.USBR.GOV
15	Deidre Qual	BoAH	701-328-2354	dqual@nd.gov
16				
17				
18				
19				
20				

REGISTRY
ND STATE MULTI-HAZARD MITIGATION PLAN UPDATE MEETING
JUNE 19th, 2007

	NAME	AGENCY	PHONE NUMBER	EMAIL ADDRESS
1	GARY KOSTELECKY	STARK COUNTY	456-7605	GRKOST@ND.GOV
2	Cody Schulz	DES	328-8256	cjschulz@nd.gov
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

North Dakota Enhanced State Multi-Hazard Mitigation Plan Workshop
Tuesday, November 6, 2007 from 10am – 3pm CST
Comfort Inn, 1030 East Interstate Avenue, Bismarck, North Dakota

Name	Title(s) and Organization(s)	E-mail and Phone Number
Mark Schrader	Environmental Engineer FHWA	Mark.Schrader@dot.gov (701) 250-4343 x 111
Betty Nelson	Admin off. ND Agriculture Dept	bnelson@nd.gov 701 328 4158
Todd Schreiner	[illegible]	tschreiner@nd.gov 701-462.8541
Rick Hummel	Bottineau Co EM	Rhummel@ND.gov 701-228 5916
Ron Hartl	Assistant Division Administrator Federal Highway Administration	Ronny.Hartl@fhwa.dot.gov 701-250-4343 x107
Tammy Lapp-Harris	Morton County Emergency Manager	tlapp@nd.gov 701-667-3307
Terry Milas	Loss control Analyst Risk Management	TMilas@nd.go 701-328-7582
Jan Pratt	Bus. Continuity Adm. BND	jpratt@nd.gov 701-328-5764
Linda Weispfenning	ND State Water Comm.	lweispfenning@nd.gov 701-328-4968
DENNIS REEP	USDA. NRCS	DENNIS.REEP@ND.USDA.GOV 701-530-2091

North Dakota Enhanced State Multi-Hazard Mitigation Plan Workshop
Tuesday, November 6, 2007 from 10am – 3pm CST
Comfort Inn, 1030 East Interstate Avenue, Bismarck, North Dakota

Name	Title(s) and Organization(s)	E-mail and Phone Number
Wayne Hokenson	Hazard Mitigation Specialist ND Dept. of Emergency Services	whokenso@nd.gov 701-328-8167
John Elstad	ND State Fire Marshal	jelstad@nd.gov 328-5555
Pam Shrauger	consultant Big Sky Hazard Mgmt	pam@bigskyhazards.com 406-581-4512
JEFF KLEIN	STATE NFIP COORDINATOR NDSWC	701-328-4898 jjklein@nd.gov
DARIN LANGERUD	DIRECTOR, ND ATMOSPHERIC RESOURCE BOARD, ND STATE WATER COMM.	dlangerud@nd.gov 701.328.2788
PATRICK FRIDGEN	Natural Resource Economist State Water Commission	pfridgen@nd.gov 701-328-4964
ELDON KREIN	DIRECTOR, PROPERTY MANAGEMENT ND HOUSING FINANCE AGENCY	EKREIN@NDHFA.ORG 701-328-8080
TINA BEACH	Pipeline Safety Awareness Coordinator Williston Basin Interstate Pipeline	tina.beach@wbip.com 406-359-7316
Susan Keller	State Veterinarian - BOAH / NDDA	skeller@nd.gov 701-328-2655

North Dakota Enhanced State Multi-Hazard Mitigation Plan Workshop
Tuesday, November 6, 2007 from 10am – 3pm CST
Comfort Inn, 1030 East Interstate Avenue, Bismarck, North Dakota

Name	Title(s) and Organization(s)	E-mail and Phone Number
Wade Nofziger	Mitigation Specialist FEMA R8	wade.nofziger@dhs.gov 303-235-7945
Myron C Lepp	Administrative Officer - USDA Rural Development	701-530-2054
GARY KOSTELECKY	STARK COUNTY E. MGR.	GRKOST@ND.GOV 701 456 7605
Jeff Boyce	Senior O&M Tech Northern Border Pipeline	Jeff_Boyce@TransCanada.Com 701 870 0348
Greg Wilz	Director, Homeland Security	gwilz@nd.gov. 701 328-8100
Daniel Holli	Environmental Specialist/Remediation Plains Pipeline, L.P. North Dakota Pipeline Assoc.	dholli@paalp.com 701-575-4254
Mary Senger	Burleigh Co Emergency Mgt	msenger@nd.gov 701-222-6727
LONNIE HOFFER	DIV OF HOMELAND SECURITY	lhoffer@ND.gov 701 328-8100

North Dakota Enhanced State Multi-Hazard Mitigation Plan Workshop
Tuesday, November 6, 2007 from 10am – 3pm CST
Comfort Inn, 1030 East Interstate Avenue, Bismarck, North Dakota

Name	Title(s) and Organization(s)	E-mail and Phone Number
Bruce Flange	WATER RESOURCE PROG. ADMIN ND STATE WATER COMMISSION	701 328 2759 bflange@ND.gov
Lee Klapprodt	Director Planning & Ed Division ND SWC	lklapprodt@nd.gov.
Jesse L Vollmer	Board Animal Health	328-2412 jlvollmer@nd.gov

State of North Dakota Multi-Hazard Mitigation Plan Stakeholder Meeting

National Energy Center for Excellence, Bismarck State College, Bismarck, North Dakota

March 3, 2010, 9:00-11:30 a.m.

Name	Title(s) & Organization(s)	E-mail or Mailing Address
Jon Kelsch	NDSWC	JKelsch@nd.gov
PATRICK FRIDGEN	ND STATE WAT. COMM.	pfridgen@nd.gov
DARIN LANGERUD	ND SWC	dlangerud@nd.gov
JULIE BAXTER	FEMA RVIII	julie.baxter@dhs.gov
Renee Loh	NDFA	renee@mfa.net
Kelly Casteel	ND SWC	Kcasteel@ND.gov
Mark Schrader	FHWA	mark.schrader@dot.gov
Dave Hartman	USBR	DHartman@USBR.gov
Pam Shrauger	Big Sky Hazard Management LLC	pam@bigskyhazards.com

State of North Dakota Multi-Hazard Mitigation Plan Stakeholder Meeting

National Energy Center for Excellence, Bismarck State College, Bismarck, North Dakota

March 3, 2010, 9:00-11:30 a.m.

Name	Title(s) & Organization(s)	E-mail or Mailing Address
Gene Buresh	Roosevelt-Custer Regional Council	buresh@rooseveltcuster.com
Lonnie Hoffer	ND Dept of Emergency Services	lhoffer@nd.gov
Jason Johnston	ND Parks & Recreation	jjohnston@nd.gov
Sean Johnson	ND Div of Homeland Security	sdjohnson@nd.gov
Wally Kalmbach	ND Assoc. of RECs	wkalmbach@ndarec.com
Jeff Savadel	NOAA/National Weather Service	jeffrey.savadel@noaa.gov
Wade Nofziger	Mitigation Specialist FEMA Region 8, Denver	wade.nofziger@dhs.gov
Randy Ehlis	Emergency Management Plan Coordinator Bureau of Reclamation	Rehlis@usbr.gov

State of North Dakota Multi-Hazard Mitigation Plan Stakeholder Meeting

National Energy Center for Excellence, Bismarck State College, Bismarck, North Dakota

March 3, 2010, 9:00-11:30 a.m.

Name	Title(s) & Organization(s)	E-mail or Mailing Address
Linda Weispfenning	Planner - ND State Water Commission	lweispfenning@nd.gov
FRED ANDERSON	N.D. GEOLOGICAL SURVEY	fjanderson@nd.gov
Ray Morrell	Mitigation Specialist ND Dept of Emergency Services	rmorrell@nd.gov
Jeff Rotenberger	Energy Program Mgr. ND Dept of Commerce	jprotenberger@nd.gov
Matt Sagsveen	N.D. Attorney Gen. Office	masagsve@nd.gov.
Eric Pedersen	ND Highway Patrol	ejpeders@nd.gov
Jamie Schmitz	American Red Cross	jschmitz@redcross.org

11 Nov 10 Stakeholder / Public Meeting for State MHMP
0900-1100 ND Association of Counties

Name	Agency/Organization	E-Mail	Phone
Jason Johnston	ND Parks & Recreation	jjohnston@nd.gov	328-5376
Cheri Merrick	ND Dept of Emergency Svcs	Cmerrick@nd.gov	328-8100
Lonnie Hoffer	ND DES	lhoffer@nd.gov	328-8100
Tom Claeys	ND Forest Service	THOMAS.CLAEYS@NDSU.EDU	328-9945
Sarah Tunge	ND Forest Service	sarah.tunge@ndsu.edu	228-4169
Pam Shrauger	Big Sky Hazard Mgmt	pam@bigskyhazards.com	406-581-4512
Ray Morell	NDDES	rmorell@nd.gov	328-8107
Sean M. Johnson	NDDES	smjohnson@nd.gov	328-8266
Ken Yantes	ND Township Officers Assn	KEN@NDTOA.com	701-655-3513
Jeanine Neiprto	FEMA, Region VIII	jeanine.neiprto@dhs.gov	3038547607
Kelly Casteel	ND SWC	Kcasteel@nd.gov	701-328-2762
Patrick Fridgen	ND SWC	pfridgen@nd.gov	701-328-4964
Aaron Russell	ND DOH EPR	amrussell@nd.gov	328-9758
Bradley Fields	ND Aeronautics Commission	bdfields@nd.gov	328-8650
Brad Darr	ND DOT	bdarr@nd.gov	328 9943
Renee Lohr	ND FA Exec Dir Fire Fighters	renee@ndfa.com	222-2799
John Paul Martin	~~NWS~~ NOAA - NWS	JOHN.PAUL.MARTIN@NOAA.GOV	250-4495
Rick Robinson	SEOC		
Tom	SEOC		
Brandon	SEOC		
Ray DeBoer	SEOC		
Deb Kantrud			
	Dept Mineral Resources		
Roger	Red River		
Mark	Mountrail		
Greg Wilz	NDDES		

WEBINAR

State of North Dakota Multi-Hazard Mitigation Plan, Stakeholder / Public Meeting

Wednesday, November 17, 2010 from 9 – 11 am CST

Webinar Attendees

Attendees			PIN
			-
Brandon Hoechst	(guest)	bhoechst@nd.gov	-
Cecily Fong	(guest)	cfong@nd.gov	-
David Hvinden	(guest)	dhvinden@nd.gov	-
Deb Kantrud	(guest)	dkantrud@scdrc.org	-
Don Johnson	(guest)	don.johnson@wbip.com	-
Luke Steen	(guest)	lukeds@mcleanelectric.com	-
Mark Holter	(guest)	mholter@mwec.com	-
Matthew Sagsveen	(guest)	masagsve@nd.gov	-
Monica Brusseau	(guest)	emplanner@nd.gov	-
Ray DeBoer	(guest)	rdeboer@nd.gov	-
Richard Robinson	(guest)	rnrobinson@nd.gov	-
Roger Rohrer	(guest)	rrohrer@grenergy.com	-
Tom Doering	(guest)	tdoering@nd.gov	-
			-

Appendix D. MEETING SUMMARIES

North Dakota Enhanced Multi-Hazard Mitigation Plan
Workshop Notes
Tuesday, June 19, 2007 from 10am-3pm CDT
Kelly Inn, 1800 North 12th Street, Bismarck, North Dakota

Attendees:

Fred Anderson	ND Department of Mineral Resources
Janna Charrier	ND Department of Emergency Services
Glenna Ellison	ND Office of Attorney General
David Geyer	ND Forest Service
Dave Hartman	US Bureau of Reclamation
Lonnie Hoffer	ND Department of Emergency Services
Wayne Hokenson	ND Department of Emergency Services
Rick Hummel	Bottineau County Emergency Management
Dave Hvinden	ND Department of Mineral Resources
Nan Johnson	US Federal Emergency Management Agency, Region 8
Jason Johnston	ND State Parks and Recreation Department
Wally Kalmbach	ND Association of Rural Electric Cooperatives
Jeff Klein	ND State Water Commission
Gary Kostelecky	Stark County Emergency Management
Eldon Krein	ND Housing Finance Agency
Ray Lambert	ND Fire Marshal
Bruce Lange	ND State Water Commission
Ed Lodwig	Williams County Emergency Management
David Massey	ND Office of Public Instruction
Terry Milas	ND Office of Management and Budget, Risk Management Division
Gary Ness	ND Aeronautics Commission
Cynthia Olson	Red River Valley and Western Railroad
Shawna Paul	Emmons County Emergency Management
Jan Pratt	Bank of North Dakota
Brent Pringle	Stark County Emergency Management
Deidre Qual	ND Department of Agriculture
Todd Schreiner	McLean County Emergency Management
Cody Schulz	ND Department of Emergency Services
Pam Shrauger	Big Sky Hazard Management LLC
Tara Skjee Hoffman	ND Department of Human Services
Ryan Smith	Otter Tail Power Company
Gary Stockert	City of Bismarck Emergency Management
Bonnie Turner	ND Voluntary Organizations Active in Disaster
Doug Van Daalen	US Natural Resources Conservation Service

Connie Wetzel	Morton County Emergency Management
Cliff Whitman	Three Affiliated Tribes Emergency Management
Wes Wiedenmeyer	US Natural Resources Conservation Service

Plan Background

Lonnie Hoffer, North Dakota State Hazard Mitigation Officer, provided background on mitigation planning and activities in the State of North Dakota. The concept of mitigation planning has been around for many years. In fact, North Dakota had a multi-hazard mitigation plan long before they became more formalized and required through the Disaster Mitigation Act of 2000.

North Dakota successfully completed a "standard" mitigation plan in 2005 and is now looking to upgrade to an "enhanced" mitigation plan. By having an approved "enhanced" mitigation plan, the state will be eligible for 20% of the total federal disaster assistance to be provided for the Hazard Mitigation Grant Program. With a "standard" plan, the percentage is 15%.

Enhanced Mitigation Plan Outline

Pam Shrauger, the consultant with Big Sky Hazard Management LLC hired to coordinate the plan's enhancement, distributed a draft outline for the updated plan and reviewed many of its major components. For a copy of this outline, please contact Pam at 406-581-4512 or pam@bigskyhazards.com.

Hazard Identification

Through discussions during the workshop and additional recommendations from Department of Emergency Services staff, the following hazards were identified for inclusion in the plan:

- Communicable Disease (this is a new addition)
- Dam Failure
- Drought
- Flood
- Hazardous Material Release
- Homeland Security Incident (renamed from Terrorism/National Security Incident)
- Shortage or Outage of Critical Materials or Infrastructure (renamed to broaden scope)
- Summer Storm
- Transportation Accident (this is a new addition)
- Urban Fire or Structure Collapse (the structure collapse component was added)
- Wildland Fire (renamed from Rural Fire and includes all vegetation fires)
- Winter Storm

The Mass Casualty/Fatality hazard was eliminated and will be integrated into the hazard profiles of the hazards that could cause mass casualties or fatalities.

Hazard Review Committees:

The following people signed up (or were nominated) to sit on the following hazard review committees. These committees will be used to review hazard profiles and come up with mitigation strategies for the hazards. Feel free to submit additional names and contact information to pam@bigskyhazards.com.

Communicable Disease

Dave Hartman	US Bureau of Reclamation
Terry Milas	ND Office of Management and Budget, Risk Management Division
Jan Pratt	Bank of North Dakota
Deidre Qual	ND Department of Agriculture

Dam Failure

Dave Hartman	US Bureau of Reclamation
Karen Goff	ND State Water Commission
Bruce Lange	ND State Water Commission
Cliff Whitman	Three Affiliated Tribes Emergency Management
Wes Wiedenmeyer	US Natural Resources Conservation Service

Drought

Leroy Kalpprodt	ND State Water Commission
Darin Langerud	ND State Water Commission
Shawna Paul	Emmons County Emergency Management
Deidre Qual	ND Department of Agriculture
Doug Van Daalen	US Natural Resources Conservation Service

Flood

Jason Johnston	ND State Parks and Recreation Department
Jeff Klein	ND State Water Commission
Bruce Lange	ND State Water Commission
Deidre Qual	ND Department of Agriculture

Hazardous Material Release

Dave Hvinden	ND Department of Mineral Resources
Ed Lodwig	Williams County Emergency Management
Brent Pringle	Stark County Emergency Management
Gary Stockert	City of Bismarck Emergency Management
Cliff Whitman	Three Affiliated Tribes Emergency Management

Homeland Security Incident

Dave Hartman	US Bureau of Reclamation
Terry Milas	ND Office of Management and Budget, Risk Management Division
Gary Stockert	City of Bismarck Emergency Management
Cliff Whitman	Three Affiliated Tribes Emergency Management

Shortage or Outage of Critical Materials or Infrastructure

Nominated…

Wally Kalmbach	ND Association of Rural Electric Cooperatives
Ryan Smith	Otter Tail Power Company

Summer Storm

Jason Johnston	ND State Parks and Recreation Department
Wally Kalmbach	ND Association of Rural Electric Cooperatives
Gary Kostelecky	Stark County Emergency Management
Bruce Lange	ND State Water Commission
Darin Langerud	ND State Water Commission
Shawna Paul	Emmons County Emergency Management
Jan Pratt	Bank of North Dakota
Deidre Qual	ND Department of Agriculture
Todd Schreiner	McLean County Emergency Management

Transportation Accident

Ed Lodwig	Williams County Emergency Management
Cliff Whitman	Three Affiliated Tribes Emergency Management

Urban Fire or Structure Collapse

David Geyer	ND Forest Service
Rick Hummel	Bottineau County Emergency Management
Leroy Kalpprodt	ND State Water Commission
Ray Lambert	ND Fire Marshal

Wildland Fire

David Geyer	ND Forest Service
Rick Hummel	Bottineau County Emergency Management
Jason Johnston	ND State Parks and Recreation Department
Ray Lambert	ND Fire Marshal
Ed Lodwig	Williams County Emergency Management
Todd Schreiner	McLean County Emergency Management

Winter Storm

Jason Johnston	ND State Parks and Recreation Department
Wally Kalmbach	ND Association of Rural Electric Cooperatives
Shawna Paul	Emmons County Emergency Management
Deidre Qual	ND Department of Agriculture
Todd Schreiner	McLean County Emergency Management

Critical Facilities and Infrastructure Issues (not a hazard)

Eldon Krein	ND Housing Finance Agency
Brent Pringle	Stark County Emergency Management
Don Ronsberg	ND Department of Emergency Services
Ryan Smith	Otter Tail Power Company
Gary Stockert	City of Bismarck Emergency Management

New Information Sources

The following were identified as important information and data sources for the plan's update:

- Local and Tribal Pre-Disaster Mitigation Plans
- Local Hazardous Material Teams
- ND Association of Builders
- ND Association of Counties
- ND Continuum of Government Team
- ND Department of Agriculture
- ND Division of Community Services, State Building Code
- ND Department of Emergency Services
- ND Department of Health
- ND Department of Human Services
- ND Department of Transportation
- ND Fire Marshal Division
- ND Geographic Information Systems
- ND Insurance Department
- ND League of Cities
- ND National Guard
- ND Office of Attorney General (for plan review)
- ND State Emergency Response Commission
- ND Forest Service, State Forest Plan
- ND State Highway Patrol, Motor Carrier Services
- ND State Water Commission
- Pipeline Owners
- US Army Corps of Engineers
- US Bureau of Reclamation
- US Department of Agriculture, Farm Service Agency
- US Environmental Protection Agency
- US Federal Aviation Administration
- US Federal Railroad Administration
- US Federal Highway Administration
- US Geological Survey
- US National Weather Service

Existing Mitigation Programs

The following mitigation programs and funding mechanisms were identified as active within the State of North Dakota:

- Bureau of Indian Affairs
- Community Development Block Grant
- Dam Safety
- Flood Mitigation Assistance
- Hazard Mitigation Grant Program
- Hazardous Materials Emergency Preparedness Planning Grants
- Homeland Security, Critical Infrastructure Protection Program

- Housing and Urban Development
- Local and Tribal Mitigation Programs
- National Flood Insurance Program Map Modernization
- National Flood Insurance Program Repetitive Loss
- North Dakota Department of Transportation
- Pre-Disaster Mitigation Competitive
- Public Assistance/Individual Assistance
- Private and Industry Programs
- Rural Development Administration
- Small Business Administration
- State Building Code Program
- State Fire Assistance
- Voluntary Organizations Active in Disaster

Review of Existing Mitigation Strategies

A listing of the mitigation strategies in the 2005 state mitigation plan was reviewed in groups, and the following changes were recommended. Additional opportunities to make suggestions to the mitigation strategies will be available throughout the planning process.

Dam Failure

- Combine the strategies of: Emergency Action Plans, Emergency Preventative Response, and Comprehensive Emergency Operational Planning
- Add a strategy related to Downstream Zoning
- Clarify the Legislation strategy

Drought

- Add a strategy related to Water Rights and include Irrigation
- Expand upon the Weather Modification Research strategy. This is funded through a state program, but is it practical?

Flood

- Emphasize that there are alternatives other than rip-rap bank stabilization
- Consider environmental strategies that prevent fish species crossovers that destroy fisheries during floods
- Add a strategy related to encouraging National Flood Insurance Program Participation

Hazardous Material Release

- Drop the Develop and Manage a Haz-Mat Database if this is already completed
- Add Groundwater Considerations to the Develop Plume Data and Flow Patterns strategy
- Expand the Vehicle Inspection Program to include Planes and Trains
- Add Disposal Regulations to the Development of a State Haz-Mat Collection Program
- Add a strategy related to Storage Tank Regulations
- Add a strategy related to Security for Industrial and Power Plants and Oil Fields

Shortage or Outage of Critical Materials or Infrastructure

- Combine the strategies of: Relaxation of Vehicle Weight and Size Restrictions, Public Transit, and Lower Speed Limits
- Update the strategy related to Renewable Energy Generation
- Transfer the Emergency Medical Stockpile strategy to Communicable Disease
- Consider dropping the Food and Shelter strategy
- Add a strategy related to Power Outage Prevention

Summer Storm

- Combine the Public Awareness, Training, and Education strategy with Encourage Participation in the Federal Crop Insurance Program
- Drop the Measures to Protect Equipment from Damage of Lightning Strikes strategy
- Add a strategy related to Building Safe Rooms and Tornado Shelters
- Add a strategy related to Anchoring Mobile Homes
- Add a strategy related to Building Code Improvements
- Add a strategy related to NOAA Weather Radios
- Add a strategy related to Warning Sirens
- Add a strategy related to the Emergency Alert System

Transportation Accident

- Add a strategy related to Developing a Hazard Analysis
- Add a strategy related to Transportation Engineering
- Add a strategy related to Transportation Barriers

Urban Fire or Structure Collapse

- Add a strategy related to Training Firefighters
- Add a strategy related to Identifying Available Resources, Alliances, and Mutual Aid
- Add a strategy related to Fire and Building Code Improvements
- Add a strategy related to Special Needs Transportation
- Add a strategy related to Road Closures

Wildland Fire

- Update strategies related to Training, Response, and Intergovernmental Cooperation
- Add a strategy related to Building Partnerships with Other Agencies
- Add a strategy related to Community Wildfire Protection Plans
- Add a strategy related to Fire Restrictions and Education

<u>Possible Mitigation Program Improvements</u>

These items were generally brought up throughout the meeting or through written comments:

- The issue of the FEMA benefit-cost requirement of 1:1 being difficult for rural counties to meet was brought up. Some small amounts of discretionary funds may be available for these types of projects.
- Guidance is needed regarding critical facilities and infrastructure. PDM rules require them to be analyzed and presented in the state, tribal, and local plans, yet the security concerns and

requirements of DHS to keep those protected makes it difficult. The conflicting federal requirements need to be recognized, and guidance is needed to clarify what the best practice is.
- Without a Mass Casualty hazard, emphasize those consequences in the individual hazard profiles.
- Living snow fences (tree shelter belts) to block snow is a good strategy. Have North Dakota State University do research on hydrophilic crops that could be flooded by water using the Waffle® plan in the Red River Valley.
- Stress enforcement and make determinations of who will do it. With this mandated in a plan, it may further funding.

Next Steps

Look for future information through e-mails to stakeholders. Those on the hazard review committees will be asked to review and provide guidance and expertise on specific sections. Conference calls may be needed. Another full stakeholders meeting will be held to solicit comments on the draft plan towards the end of the year.

North Dakota Enhanced Multi-Hazard Mitigation Plan
Workshop Notes
Tuesday, November 6, 2007 from 10am-3pm CST
Comfort Inn, 1030 East Interstate Avenue, Bismarck, North Dakota

Attendees:

Tina Beach	Williston Basin Interstate Pipeline
Jeff Boyce	Northern Border Pipeline
John Elstad	ND State Fire Marshal
Pat Fridgen	ND State Water Commission
Ron Hartl	Federal Highway Administration
Lonnie Hoffer	ND Department of Emergency Services
Wayne Hokenson	ND Department of Emergency Services
Daniel Holli	Plains Pipeline, L.P.; ND Pipeline Association
Rick Hummel	Bottineau County Emergency Management
Susan Keller	ND Board of Animal Health
Lee Klapprodt	ND State Water Commission
Jeff Klein	ND State Water Commission
Gary Kostelecky	Stark County Emergency Management
Eldon Krein	ND Housing Finance Agency
Bruce Lange	ND State Water Commission
Darin Langerud	ND State Water Commission
Tammy Lapp-Harris	Morton County Emergency Management
Myron Lepp	US Department of Agriculture, Rural Development
Terry Milas	ND Office of Management and Budget, Risk Management Division
Betty Nelson	ND Department of Agriculture
Wade Nofziger	Federal Emergency Management Agency
Jan Pratt	Bank of North Dakota
Dennis Reep	US Department of Agriculture, Natural Resources Conservation Service
Mark Schrader	Federal Highway Administration
Todd Schreiner	McLean County Emergency Management
Mary Senger	Burleigh County Emergency Management
Pam Shrauger	Big Sky Hazard Management LLC
Jesse Vollmer	ND Board of Animal Health
Linda Weispfenning	ND State Water Commission
Greg Wilz	ND Division of Homeland Security

Purpose

Lonnie Hoffer, North Dakota State Hazard Mitigation Officer, and Wade Nofziger, Federal Emergency Management Agency, gave a brief history of mitigation in North Dakota and emphasized the benefits of hazard mitigation. Flood acquisitions in Grand Forks are a great example of how mitigation can save taxpayers' money. Substantial savings were seen during the 2006 Red River flood because of mitigation done after the 1997 flood.

Mitigation, not to be confused with preparedness, response, or recovery, is the primary focus of the North Dakota Enhanced Multi-Hazard Mitigation Plan. The plan will follow the requirements of the Disaster Mitigation Act of 2000. Once "enhanced" status is achieved, the state with will be eligible for 20% of the total federal disaster assistance through the Hazard Mitigation Grant Program, as opposed to 15% with a "standard" designation.

Comments on Draft Plan Sections

Substantial changes have been made to the 2005 standard plan during its update. The plan was re-organized for readability. Enhancements to meet federal requirements were made; additional and updated data were incorporated into the plan. Many of the preparedness and response elements were removed to give the plan a clearer mitigation focus. The updated draft plan sections are also being reviewed by a wider group of hazard experts; organizations providing comments to date include:

- Federal Emergency Management Agency (from 1 person)
- National Weather Service (from 3 people)
- ND Department of Agriculture (from 2 people)
- ND Department of Emergency Services (from 4 people)
- ND State Water Commission (from 4 people)
- US Fish and Wildlife Service (from 1 person)

Draft sections of the plan can be reviewed at: http://www.bigskyhazards.com/draftplans.asp. Note that changes are continuously being made based on comments and information received. A notice will be e-mailed out when a completely reviewed draft is posted, followed by a 30-day comment period. The plan will then be submitted to FEMA for approval. Once conditional approval is received, the Governor's approval and assurances will be sought.

A sampling of maps was shown at the meeting. Additional digital data sources that will be investigated include: the ND Atmospheric Resource Board Hail database, the ND Department of Health Chemical Release database, the ND Department of Transportation traffic fatality database, the ND Forest Service Wildland Fire database, and the ND Fire Marshal Structure Fire database.

Hazard Prioritizations

A handout summarizing historic and potential losses from each of the hazards was distributed. The addition of state declared disasters and emergencies would benefit the historical information. Lonnie Hoffer will try to compile this information.

Several ways of prioritizing the hazards were discussed including group consensus, pairwise comparison and weighting, voting, and local risk class analyses. An analysis of the risk classes assigned in the local, FEMA-approved multi-hazard mitigation plans will be conducted to serve as the basis for the prioritization. The local jurisdictions used a consistent approach to classify the hazards. In the meantime, the general consensus listed the hazards as follows based on the frequency, historical and potential impacts, and other factors:

High Hazards:

- Flood
- Summer Storm

- Drought
- Winter Storm

Moderate Hazards:

- Dam Failure
- Communicable Disease
- Hazardous Material Release
- Wildland Fire

Low Hazards:

- Homeland Security Incident
- Urban Fire or Structure Collapse
- Shortage or Outage of Critical Materials or Infrastructure (some discussion on being moderate)
- Transportation Accident

Note: These ratings may change slightly based on the results of the local risk class analysis. The updated ratings will be listed in the Risk Assessment Summary section.

Mitigation Strategy

The goals, objectives, and initiatives were reviewed. Most of the types of projects that would be completed in the state are listed. More importantly, local plans should have their desired projects listed in their plans.

From Planning Into Action

The local/tribal mitigation capabilities and limitations were identified as follows:

- Funding (+/-)
- Jurisdictions/Authorities (+/-)
- Funding/Fiscal Responsibilities (+/-)
- Personnel/Time (+/-)
- Mitigation and Grant Application Training/Expertise (+/-)
- Priority Differences/Other Priorities (+/-)
- Proximity of (Time Since) a Major Event/"See it and Believe it"/Other National and Statewide Events going on in the Media (+/-)
- People that Care about the Communities (+)
- Lots of/Lack of Community Support (+/-)
- Lack of Clear and Consistent Direction from Feds and State (-)

Most mitigation activities take place at the local level. A handout was distributed outlining the initiatives that could be conducted at the state government level. All initiatives are worthwhile, otherwise they wouldn't be in the plan, but they were assigned high, moderate, and low priorities, as required by FEMA. The "hazardous material regulations" project will be renamed to "household waste regulations."

One identified problem is that many of the initiatives do not have a good funding source. The Mitigation Funding Sources section will list several possible funding options. The lead agencies will probably need to get creative with finding funding or integrating the initiatives into existing programs. Many activities also hinge on legislative changes that may or may not occur.

Many other state plans and programs were considered and integrated into the mitigation plan. The next challenge is to take the Enhanced Multi-Hazard Mitigation Plan and integrate it into other plans and programs. The pipeline companies generally get mitigation information through training provided by their respective companies but would also like to see critical facilities and special needs populations kept from areas near their pipelines. Zoning may be the local land use mechanism to achieve this. Data from the mitigation plan, particularly the risk assessment, may also be useful in emergency operations plans and other related documents. The ultimate integration goal is to change the way people think about hazard mitigation and integrate it into their everyday thinking and practices.

State of North Dakota Multi-Hazard Mitigation Plan, Stakeholder Meeting Notes
Wednesday, March 3, 2010 from 9 – 11:30 am CST
National Energy Center for Excellence, Bismarck State College, Bismarck, North Dakota

Attendees:

- Fred Anderson — North Dakota Geological Survey
- Julie Baxter — Federal Emergency Management Agency
- Gene Buresh — Roosevelt-Custer Regional Council
- Kelly Casteel — North Dakota State Water Commission
- Randy Ehlis — US Bureau of Reclamation
- Pat Fridgen — North Dakota State Water Commission
- Dave Hartman — US Bureau of Reclamation
- Lonnie Hoffer — North Dakota Department of Emergency Services
- Sean Johnson — North Dakota Department of Emergency Services
- Jason Johnston — North Dakota Parks and Recreation
- Wally Kalmbach — North Dakota Association of Rural Electric Cooperatives
- Jon Kelsch — North Dakota State Water Commission
- Darin Langerud — North Dakota State Water Commission
- Renee Loh — North Dakota Firefighter's Association
- Ray Morrell — North Dakota Department of Emergency Services
- Wade Nofziger — Federal Emergency Management Agency
- Eric Pederson — North Dakota Highway Patrol
- Jeff Rotenberger — North Dakota Department of Commerce
- Matt Sagsveen — North Dakota Attorney General's Office
- Jeff Savadel — National Weather Service
- Janel Schmitz — American Red Cross
- Mark Schrader — Federal Highway Administration
- Pam Shrauger — Big Sky Hazard Management LLC
- Linda Weispfenning — North Dakota State Water Commission

Introductions, Welcome, and Purpose:

Following introductions and administrative items, Lonnie Hoffer provided a welcome, emphasizing the importance of the state mitigation plan and a bit of its history. Pam Shrauger explained that state mitigation plans are required to be updated every three years and is not a one agency effort. We are trying to integrate mitigation into all levels and facets of government. Participants were asked to fill out a Participant Survey.

Defining Mitigation:

What is disaster mitigation?
Long term, sustainable actions that reduce or eliminate the impacts of hazards.
Examples:

- Building codes
- Land use regulations (including flood ordinances)
- Planning and education
- Property acquisition and relocation

- Physical modifications to structures, infrastructure, and landscapes

Mitigation is often the "unsung hero" in disasters.

Overview of the Plan Update Process and Timeline:

A consultant, Big Sky Hazard Management LLC, has been hired to facilitate and do the "hard" work such as researching, writing, mapping, documenting, and making sure the requirements are met, but the "process" is the most important part because:

- Buy-in and acceptance is critical
- Plans can easily become doorstops if not useful
- Cross agency/jurisdiction relationships are important in emergencies and non-emergencies
- Mitigation is an education process and "cultural" shift for some
- You are the agents for bringing this to decision makers and the general public

See handout titled "Plan Update Process". Please contact Pam Shrauger with questions or comments at any point during the planning process.

All interested stakeholders, even those that were unable to attend the meeting, are encouraged to sign up for one or several Mitigation Planning Committees. Mitigation Planning Committees are sub-groups that allow more focused discussion and review of a particular topic. These committees will primarily be asked to review information and perhaps participate in a conference call or other discussion if needed. Participation shouldn't be too time consuming, but is extremely important for that ownership component, education, and accuracy. Last update was focused only on the hazards, but this time, would like committees for the overall planning process, land use and future construction/development, mitigation strategies and implementation system. Committee categories include: Communicable Disease, Dam Failure, Drought, Flood, Hazardous Material Release, Homeland Security Incident, Shortage or Outage of Critical Materials or Infrastructure, Summer Storm, Transportation Accident, Urban Fire or Structure Collapse, Wildland Fire, Winter Storm, Landslide and Other Geologic Hazards, Planning Process, Critical Facilities and Infrastructure, Land Use and Recent and Future Construction and Development, Mitigation Strategy, and Mitigation Implementation System.

Existing Plan and Methodologies:

See handout titled "Existing Plan (January 2008) Abbreviated Table of Contents".

Existing Plan Basics

- Adoption by the Governor
- Planning Process
  - Still a team concept
  - Expanded stakeholder list
  - Public document
- Risk Assessment: 2 major subsections
  - Statewide Inventory
  - Hazard Profiles

Risk Assessment Methodologies

- For each hazard profile:
  - Characteristics (description)
  - History

- Probability: based on history, where feasible
- Magnitude: realistic worst case scenario
- Mapping: generally by county
- Vulnerabilities to:
  - State-Owned Buildings and Property: ND State Tornado and Fire Fund data, may try to integrate some GIS
  - Critical Facilities and Infrastructure: some ND State Tornado and Fire Fund data and qualitative descriptions, may try to integrate some Critical Infrastructure Program data
  - Jurisdictions (counties and reservations): based on impacts to property, population, and values; each jurisdiction is given a very high, high, moderate, or low rating, and risk classes from local plans are also listed. The concept is to give a statewide picture of where the most vulnerable and least vulnerable areas are in the state for that particular hazard, not to say whether or not the hazard is significant in a particular location. Flood is a good example since it is a formidable hazard statewide, but some areas are just more prone than others. So, a county may get a "low" hazard rating when compared to other counties in the state, but it is still a "high" hazard for that particular county. The local mitigation plans should address these ratings through the "risk class" system. See tables that follow.
  - Future Development: based on mechanisms currently in place to limit or regulate development in hazardous areas (i.e. flood ordinances, zoning, etc.)
- Data limitations and other key documents

- Risk Assessment Summary
  - General estimated historical vs. estimated potential losses statewide
  - All hazard ratings for each county/reservation
  - Statewide hazard rankings

Used in local mitigation plans and also state operations:

Table 4.1B Local Risk Analysis Criteria

FREQUENCY	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year, or at least 1 chance in the next 10 years
Possible	1-10% probability next year, or at least 1 chance in the next 100 years
Unlikely	Less than 1% probability in the next 100 years
SEVERITY	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Table 4.1C Local Risk Analysis Classifications

		SEVERITY			
		Negligible	*Limited*	*Critical*	*Catastrophic*
FREQUENCY	*Highly Likely*	**C**	**B**	**A**	**A**
	Likely	**C**	**C**	**B**	**A**
	Possible	**D**	**C**	**B**	**B**
	Unlikely	**D**	**D**	**C**	**C**

Statewide Hazard Rankings (based on the rankings provided in local plans)

- High Hazards:
  - Winter Storm
  - Summer Storm
  - Drought
  - Flood
- Moderate Hazards:
  - Communicable Disease
  - Hazardous Material Release
  - Wildland Fire
  - Shortage or Outage of Critical Materials or Infrastructure
- Low Hazards:
  - Urban Fire or Structure Collapse
  - Homeland Security Incident
  - Transportation Accident
  - Dam Failure

Mitigation Strategy

- *Goal 1: Encourage sound state and local planning related to hazard understanding and mitigation.*
  Examples: Mitigation Planning, Data Collection and Improvements, Field Studies, Mapping Improvements
- *Goal 2: Enhance the public's awareness of hazards.*
  Examples: Public Education, Education of Local Officials
- *Goal 3: Reduce the impact future development has on potential losses and vulnerabilities.*
  Examples: Building Codes, Zoning and Ordinances
- *Goal 4: Reduce impacts of flooding to people and property in North Dakota.*
  Examples: Flood Control, Bank Stabilization, Acquisitions, Relocations, Storm Water Management, Roadway Protection, Floodproofing, Dam Safety
- *Goal 5: Mitigate the effects severe summer and winter weather have on people and property.*
  Examples: Warning Systems, Weather Spotter Training, Tornado Safe Rooms and Shelters, Window Films, Electric Infrastructure Protection, Snow Fences
- *Goal 6: Reduce impacts of drought and wildland fires on North Dakota communities.*
  Examples: Water Management, Agriculture Practices, Weather Modification, Water Supply Issues, Firewise Programs, Firebreaks, Emergency Haying and Grazing
- *Goal 7: Reduce population and property losses from human-caused hazards.*
  Examples: Inspection Programs, Regulations, Security, Back-up Power, Fire Safety Systems, Transportation Improvements

The plan breaks the initiatives out further based on ones performed at the state level vs. local level and prioritizes state initiatives and identifies lead agencies, potential funding, and timeframes.

Mitigation Implementation System

- Outlines how mitigation is implemented in the state
- Lists the programs through which mitigation is currently performed, including strengths, weaknesses, and changes
- Lists state laws and regulations that promote or limit mitigation

- Project Management essentially outlines the grant process and includes descriptions of the state's technical assistance, eligibility criteria, project review, benefit-cost analysis, prioritization, environmental review, grant management, and project monitoring and evaluation

See handout titled "Mitigation Programs".

Existing Plan Basics

- Plan Maintenance responsibilities lie with the State Hazard Mitigation Team and ND DES (may need to re-evaluate)
- Appendices
  - Planning Committees
  - Invited Stakeholders
  - Public Information and Outreach
  - Meeting Attendance Records
  - Meeting Agendas and Summaries
  - References
  - Acronyms
  - Plan Crosswalks
  - Annual Reports
  - Interagency Reports (by listing)
  - Local and Tribal Mitigation Plans (by listing)

Disaster and Mitigation Highlights 2008-2010:

Ray Morrell provided a summary of the disasters and mitigation work since 2008.

In 2007, the Northwood tornado disaster (1726) provided about $1.8 million in Hazard Mitigation Grant Program (HMGP) funds. Some of this funding was used to bury utility lines and some was used for planning.

In 2009, the flood disaster (1829) provided about $21.2 million in HMGP funds. Many acquisition projects in 17 jurisdictions are planned.

On Friday, the southwest North Dakota winter storm was declared (1879). Notices about the availability of HMGP funds just went out and applicant briefings are being scheduled.

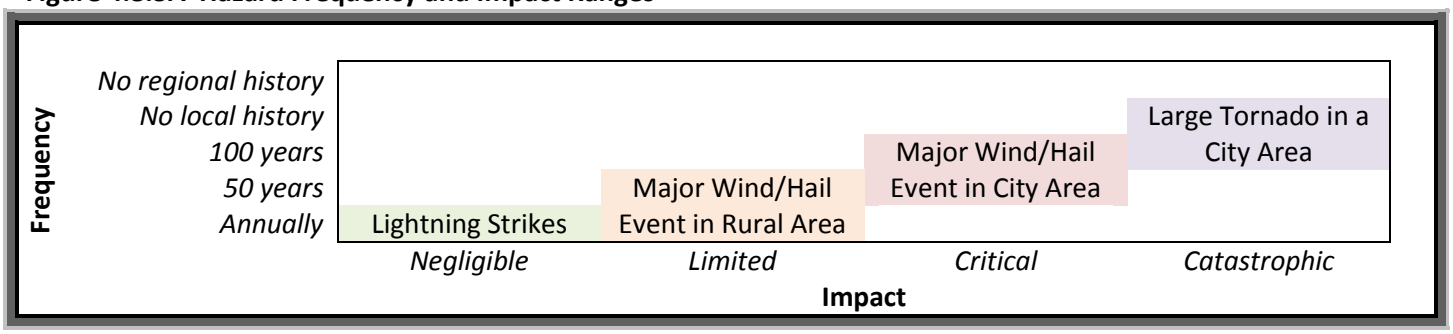
Through nationally available funding in the Flood Mitigation Assistance (FMA) Program, the acquisitions of about 44 structures in Cass County are proposed for acquisition totaling about $11 million.

Plan Updates:

Proposed updates include the following:

- Some format changes to improve usability.
- Addition of new disaster info, mitigation work completed, planning process updates, etc.
- Data and associated mapping and analysis updates, where applicable and available.
- Map projections.
- Lots of little things identified in the FEMA crosswalk.
- Addition of some new features developed by Big Sky Hazard Management LLC, such as the following summer storm example from the Ramsey County Plan.

Figure 4.8.3A Hazard Frequency and Impact Ranges



Source: Ramsey County Multi-Hazard Mitigation Plan, January 2010

Ideas from Meeting Participants:

- Identify Subject Matter Experts for Mitigation Planning Committees from state emergency plan lead and support agencies.
- Consider landslide, earthquake, and other geologic/mining hazards for inclusion. At a minimum, add information to the Hazard Identification section. They may be able to be covered under another hazard.
- Idea for mitigation: building Park and Recreation comfort stations to safe room standards.
- Add considerations for new oil fields and related transportation problems in the Hazardous Material Release hazard profile.
- Add Level 1 HAZUS data for flood completed by FEMA for each county.

Program Improvements:

Ideas from Meeting Participants:

- Document best practices and successes.
- Develop Losses Avoided studies, such as the 2009 flood event and perhaps some articles from the Rural Electric Cooperatives. The Red River study from 2006 showed a 7:1 ratio for losses avoided to mitigation dollars spent.
- Highlight non-structural mitigation measures such as National Weather Service Storm Ready program and communities that adopt standards higher than the minimums for the National Flood Insurance Program
- State Water Commission will provide a study done by North Dakota State University on losses avoided through the Weather Modification Program. Ratios of 15-25:1 were found.
- Legislation that would allow more flexible county and township relationships (examples: counties could assist townships in clearing snow blocked roads, counties could more readily host mitigation grants for townships).
- Demonstrate the losses that could be avoided using various land use regulations and educate local leaders and the public.
- Work through the Department of Transportation to consider road improvements and maintenance as new oil resource development occurs.

Next Steps:

Update work will begin with Mitigation Planning Committees. The next stakeholder meeting won't be until the fall when a draft updated plan is available. Please contact Big Sky Hazard Management LLC with questions, comments, or data in the meantime.

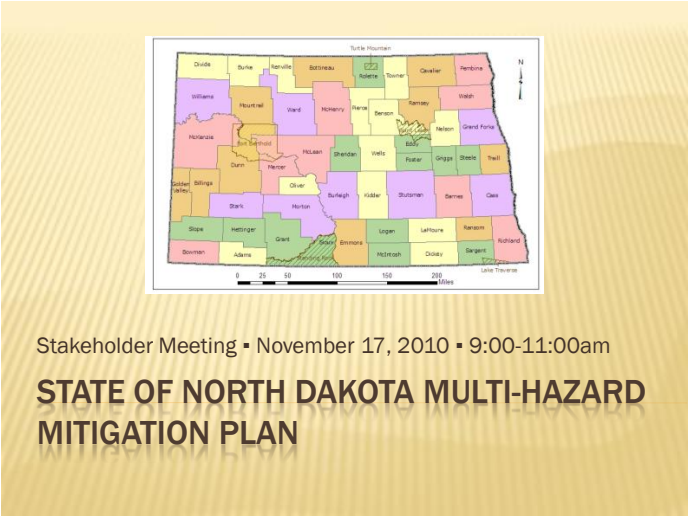
State of North Dakota Multi-Hazard Mitigation Plan, Stakeholder / Public Meeting Notes
Wednesday, November 17, 2010 from 9 – 11 am CST
North Dakota Association of Counties, 1661 Capitol Way, Bismarck, North Dakota

Attendees:

Monica Brusseau	Pembina County Emergency Management	Webinar
Kelly Casteel	North Dakota State Water Commission	
Tom Claeys	North Dakota Forest Service	
Brad Darr	North Dakota Department of Transportation	
Ray DeBoer	North Dakota Department of Emergency Services	Webinar
Tom Doering	North Dakota Department of Emergency Services	Webinar
Bradley Fields	North Dakota Aeronautics Commission	
Cecily Fong	North Dakota Department of Emergency Services	Webinar
Patrick Fridgen	North Dakota State Water Commission	
Brandon Hoechst	North Dakota Department of Emergency Services	Webinar
Lonnie Hoffer	North Dakota Department of Emergency Services	
Mark Holter	Mountrail-Williams Electric Cooperative	Webinar
Dave Hvinden	North Dakota Department of Mineral Resources	Webinar
Don Johnson	Williston Basin Interstate Pipeline Company	Webinar
Sean Johnson	North Dakota Department of Emergency Services	
Jason Johnston	North Dakota Parks and Recreation	
Deb Kantrud	South Central Dakota Regional Council	Webinar
Renee Loh	North Dakota Firefighter's Association	
John Paul Martin	National Weather Service	
Cherie Merrick	North Dakota Department of Emergency Services	
Ray Morrell	North Dakota Department of Emergency Services	
Jeanine Neipert	Federal Emergency Management Agency, Region VIII	
Rick Robinson	North Dakota Department of Emergency Services	Webinar
Roger Rohrer	Great River Energy	Webinar
Aaron Russell	North Dakota Department of Health	
Matthew Sagsveen	North Dakota Attorney General's Office	Webinar
Pam Shrauger	Big Sky Hazard Management LLC	
Luke Steen	McLean Electric Cooperative, Inc.	Webinar
Sarah Tunge	North Dakota Forest Service	
Greg Wilz	North Dakota Department of Emergency Services	
Ken Yantes	North Dakota Township Officers Association	

Presentation:

This meeting and webinar consisted primarily of a presentation on the plan and significant changes to the plan since 2007. When needed, additional information was provided by meeting attendees. The slides from the presentation follow, along with any questions or additional notes.



Individual introductions: name, organization
Administrative: fire exits, restrooms, sign-in sheet, webinar
Welcome: Brief welcome provided by Lonnie Hoffer and Greg Wilz. Thank you for participating. Comments accepted at anytime.
Planning Purpose: The state mitigation plan is required to be updated every 3 years, is not a 1 agency effort, and we are attempting to integrate into all levels and facets of government. Update process began about 9 months ago.
Meeting Purpose: Provide an overview and educate those that may not be entirely familiar with the plan contents or are new. Highlight the key plan changes for those that are more familiar. Allow opportunity for comments.

WHAT IS DISASTER MITIGATION?

- Long term, sustainable actions that reduce or eliminate the impacts of hazards.
- Examples:
  - Building codes
  - Land use regulations (including flood ordinances)
  - Planning and education
  - Property acquisition and relocation
  - Physical modifications to structures, infrastructure, and landscapes
- Mitigation is often the "unsung hero" in disasters.

Items in purple are new or significantly changed.

PLAN CONTENTS

- Adoption Documentation
- Introduction
- Planning Process
- Statewide Inventory
- Risk Assessment / Hazard Profiles
- Mitigation Strategy
- Mitigation Implementation System
- Plan Maintenance
- Appendices

ADOPTION DOCUMENTATION

- Adoption through a letter signed by the Governor
- "Demonstrates the state's commitment to fulfilling mitigation objectives outlined in the Plan"
- Authorizes identified agencies to execute responsibilities
- Assures compliance with federal statutes and regulations

INTRODUCTION

- Purpose
  - Serve as a consolidated, comprehensive source of statewide hazard information
  - Educate government leaders and the public on their vulnerabilities
  - Prioritize and promote cost-effective mitigation solutions
  - Provide guidance to organizations and agencies statewide regarding hazard mitigation
  - Support requests for grant funding
  - Encourage long-term community sustainability
  - Improve coordination of mitigation efforts across the state
- Scope
- Authority
- North Dakota Overview

PLANNING PROCESS

- Background
- Roles and Responsibilities (DES, SHMT, Mitigation Planning Committees, etc.)
- Workshops
- Public Participation and Comment Integration
- Integration of Other Plans and Programs
- Risk Assessment Methodologies
- Hazard Identification

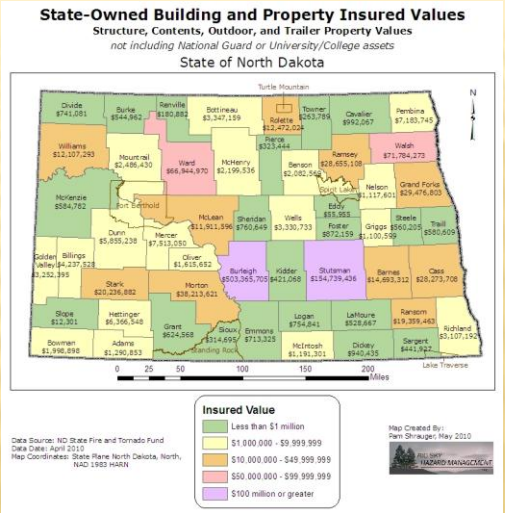
HAZARD IDENTIFICATION

- Communicable Disease
- Dam Failure
- Drought
- Flood
- Geologic Hazards
- Hazardous Material Release
- Homeland Security Incident
- Shortage or Outage of Critical Materials or Infrastructure
- Summer Storm
- Transportation Accident
- Urban Fire or Structure Collapse
- Wildland Fire
- Winter Weather

STATEWIDE INVENTORY

- State-Owned Buildings and Property

Data provided by the North Dakota Insurance Department, State Fire and Tornado Fund. State-owned buildings are not in GIS format yet but this is listed as an initiative in the mitigation strategy.



STATEWIDE INVENTORY

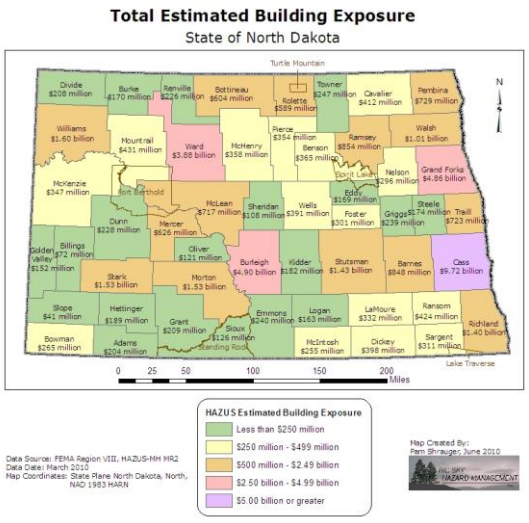
- Critical Facilities and Infrastructure
  - Selected Critical Infrastructure Program data (Food/Agriculture, Energy, Public Health, Transportation, Emergency Services, Communications, Water)
  - Local Government
  - Essential State-Owned Facilities
  - Hospitals
  - Military / National Guard
  - Energy
  - Transportation
  - Colleges and Universities
  - Schools
  - Large Special Needs Facilities

New data provided by the North Dakota Critical Infrastructure Program.

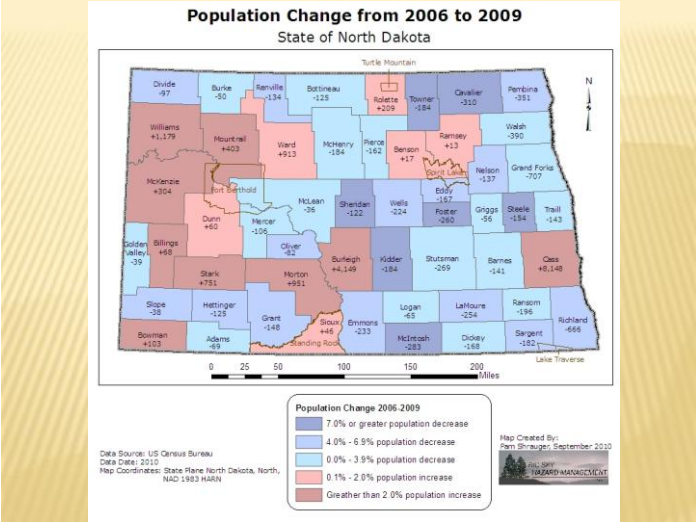
STATEWIDE INVENTORY

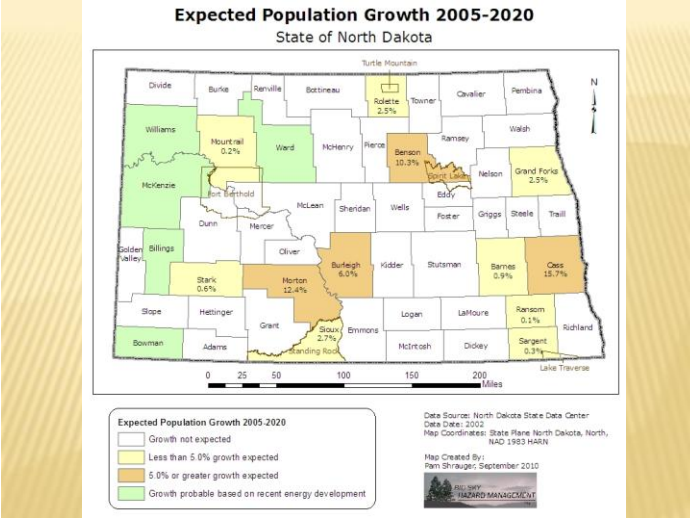
- Population
- Buildings
- Economic, Ecologic, Historic, and Social Values
- Land Use
- New Development
- Future Development

New and future development is important because losses can often be mitigated through land use regulations. New development since 2007 is highlighted.



Data for this graphic was obtained from HAZUS-MH loss estimation software.

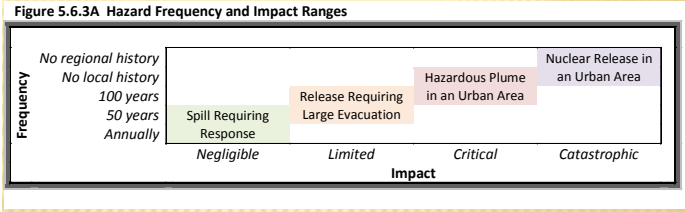




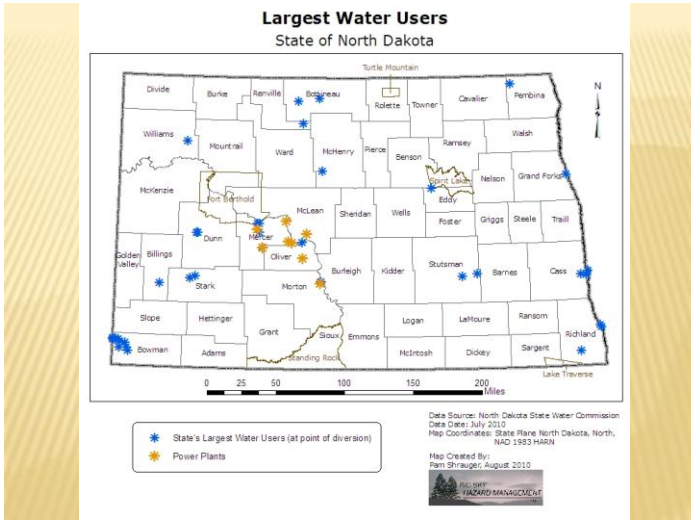
Estimates of growth in brown and tan were based on studies produced with 2000 Census data. Clearly, the oil boom was not anticipated at the time of the study, so the counties in green were added to the list of counties with expected population growth.

RISK ASSESSMENT / HAZARD PROFILES

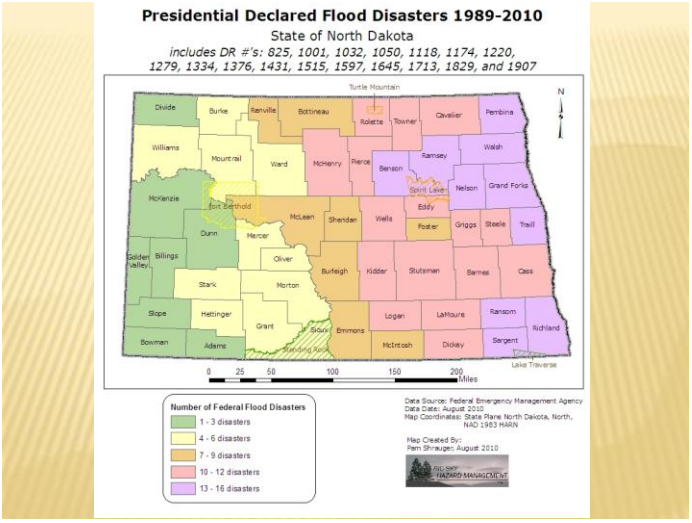
- For each hazard:
  - Characteristics
  - History
  - Probability and Magnitude
  - Mapping
  - Vulnerabilities to Jurisdictions
  - Vulnerabilities of State-Owned Buildings and Property
  - Vulnerabilities of Critical Facilities and Infrastructure
  - Vulnerabilities to New and Future Development
  - Data Limitations and Other Key Documents

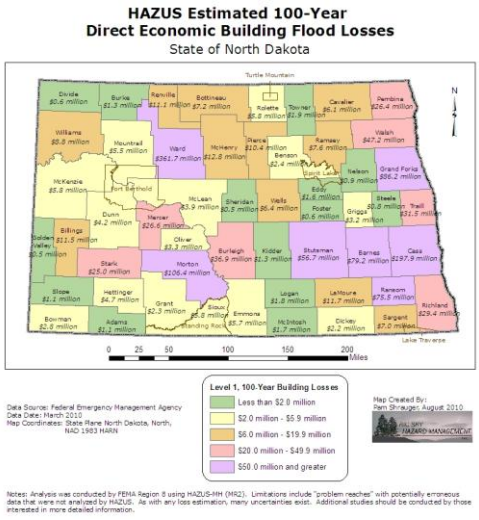


Example of a new graphic used to show the variations of incident frequency and impacts. This graphic is from the hazardous material release profile, but all hazard profiles have one.



Example of new data provided by the State Water Commission used to profile the drought hazard.



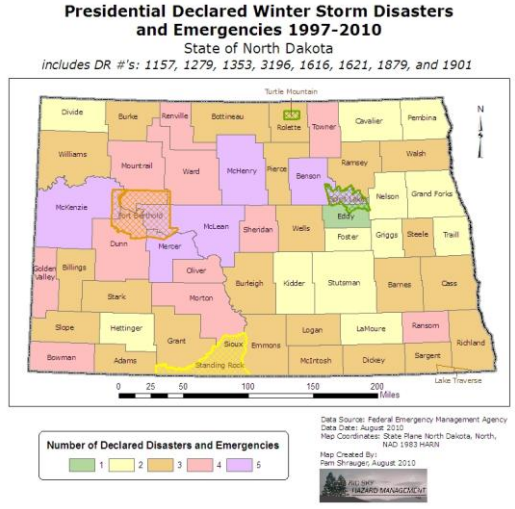


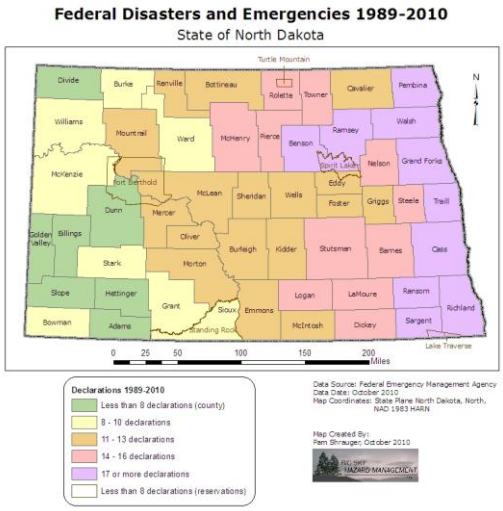
FEMA Region VIII conducted Level 1 HAZUS analyses for flood for each county in the state. This data, that takes many hours of computer processing time, was integrated into the flood hazard profile.

Table 5.9.2K Summer Storm Events Summary from 1995-2009

Event Type	North Dakota
Reported Tornadoes	542 events Highest Magnitude: F4/EF4 (F5 since 1950) $91,888,000+ property damage $5,860,000+ crop damage 2 fatalities 34 injuries
Reported Severe Hail	4,257 events Highest Magnitude: 5.00" $457,455,000+ property damage $176,085,000+ crop damage 20 injuries
Reported Severe Thunderstorm Winds	1,891 events Highest Magnitude: 143 mph $214,940,000+ property damage $185,448,000+ crop damage 2 fatalities 28 injuries
Reported Damaging Lightning Strikes	92 events $1,793,000+ property damage 1 fatality 7 injuries

Note: Flash flood events related to summer storms are addressed in Section 5.4.
Source: National Climatic Data Center, 2010.





RISK ASSESSMENT SUMMARY

Statewide Hazard Rankings

- High Hazards:
  - Winter Storm
  - Summer Storm
  - Drought
  - Flood
- Moderate Hazards:
  - Communicable Disease
  - Hazardous Material Release
  - Wildland Fire
  - Shortage or Outage of Critical Materials or Infrastructure
- Low Hazards:
  - Homeland Security Incident
  - Geologic Hazards
  - Urban Fire or Structure Collapse
  - Dam Failure
  - Transportation Accident

Basis for these are the rankings is a compilation of the rankings provided in the local mitigation plans. The hazards are also listed by priority within the high, moderate, and low listings.

MITIGATION STRATEGY

- *Goal 1: Encourage sound state and local planning related to hazard understanding and mitigation.*
- *Goal 2: Enhance the public's awareness of hazards.*
- *Goal 3: Reduce the impact future development has on potential losses and vulnerabilities.*
- *Goal 4: Reduce impacts of flooding to people and property in North Dakota.*
- *Goal 5: Mitigate the effects severe summer and winter weather have on people and property.*
- *Goal 6: Reduce impacts of drought and wildland fires on North Dakota communities.*
- *Goal 7: Reduce population and property losses from human-caused hazards.*

GOAL 1: ENCOURAGE SOUND STATE AND LOCAL PLANNING RELATED TO HAZARD UNDERSTANDING AND MITIGATION.

- *Objective 1.1:* Increase and improve mitigation planning efforts at the state, tribal, and local levels through technical assistance, plan development, and plan updates.
  - Mitigation Planning
  - Basin-Wide Water Management Planning
- *Objective 1.2*: Improve hazard understanding and risk assessments through individual hazard studies and analyses using digital data.
  - Data Digitization
  - Impacts Database
  - Hazardous Materials Field Study
  - Utility and Critical Material Studies
  - Transportation Database
  - Wildland Fire Database
  - Floodplain Map Modernization

GOAL 2: ENHANCE THE PUBLIC'S AWARENESS OF HAZARDS.

- *Objective 2.1:* Provide the public with information that allows individuals to make sound personal and financial decisions before a disaster threatens.
  - Public Education
  - Situational Awareness
  - Insurance Education

GOAL 3: REDUCE THE IMPACT FUTURE DEVELOPMENT HAS ON POTENTIAL LOSSES AND VULNERABILITIES.

- *Objective 3.1:* Use land management tools to mitigate disasters before construction occurs.
  - Building Codes
  - Zoning and Ordinances
  - Restrictive Covenants

GOAL 4: REDUCE IMPACTS OF FLOODING TO PEOPLE AND PROPERTY IN NORTH DAKOTA.

- *Objective 4.1:* Prevent floodwaters from entering developed areas.
  - Bank Stabilization
  - Flood Control
- *Objective 4.2:* Reduce property and infrastructure losses to developed areas during periods of flood.
  - Property Acquisition, Relocation, and Elevation
  - Storm Water Management and Roadway Protection
  - Floodproofing
- *Objective 4.3:* Prevent flood losses due to dam failures.
  - Dam Safety
- *Objective 4.4:* Improve financial protection from flood while minimizing the risk to future development.
  - National Flood Insurance Program

GOAL 5: MITIGATE THE EFFECTS SEVERE SUMMER AND WINTER WEATHER HAVE ON PEOPLE AND PROPERTY.

- *Objective 5.1:* Improve severe weather warnings and public notifications to increase personal protective actions during severe summer and winter weather.
  - Warning Systems
  - Weather Spotter Training
- *Objective 5.2:* Provide safe places for the public to take protective actions during extreme weather events.
  - Tornado Safe Rooms and Shelter
  - Window Safety Film
- *Objective 5.3:* Protect critical facilities and infrastructure from strong wind, heavy snow, and hail events.
  - Electric Infrastructure Protection
  - Snow Fences
  - Impact Resistant Building Materials

GOAL 6: REDUCE IMPACTS OF DROUGHT AND WILDLAND FIRES ON NORTH DAKOTA COMMUNITIES.

- *Objective 6.1:* Support practices that reduce drought losses and impacts.
  - Drought Water Management
  - Drought Land and Crop Practices
  - Weather Modification
  - Water Supply Intakes
- *Objective 6.2:* Reduce the vulnerability of homes and businesses from approaching wildland fires.
  - Firewise Programs
  - Firebreaks
  - Emergency Haying and Grazing

GOAL 7: REDUCE POPULATION AND PROPERTY LOSSES FROM HUMAN-CAUSED HAZARDS.

- *Objective 7.1:* Prevent intentional and accidental acts through observations, regulations, and enforcement.
  - Transportation Inspection Programs
  - Household Hazardous Waste Regulations
  - Facility Hardening and Security
- *Objective 7.2:* Reduce the impact of human-caused hazards by lessening the probability of disasters or by keeping a small disaster from becoming larger.
  - Back-up Power
  - Transportation Engineering and Systems
  - Smoke Detectors and Sprinkler Systems

MITIGATION IMPLEMENTATION SYSTEM

- State Capability Assessment
  - All-Hazard Mitigation Programs
    - Pre-Disaster Mitigation Program
    - Hazard Mitigation Grant Program
    - Public Assistance Program
    - Community Development Block Grant
    - Building Code Program

Added sections for "Changes since 2007" and "Ideas for Improvement" to each of the mitigation program sections

MITIGATION IMPLEMENTATION SYSTEM

- State Capability Assessment
  - Flood-Specific Programs
    - Silver Jackets Program
    - National Flood Insurance Program
    - Community Assistance Program
    - Map Modernization Program
    - Community Rating System
    - Flood Mitigation Assistance
    - Repetitive Flood Claims Program
    - Severe Repetitive Loss Program

The Silver Jackets Program is a new program that facilitates communication of flood problems through state and federal agencies.
The Community Assistance Program is not a new program but was broken out from the National Flood Insurance Program to evaluate separately.

MITIGATION IMPLEMENTATION SYSTEM

- State Capability Assessment
  - Other Hazard-Specific Programs
    - Transportation Improvements
    - National Fire Plan/Firewise North Dakota/State Fire Assistance Program
    - Living Snow Fence Program
    - Dam Safety Program
    - Hazardous Materials Emergency Preparedness Program
    - Cloud Modification Program

MITIGATION IMPLEMENTATION SYSTEM

- State Capability Assessment
  - Mitigation Legislation, Regulations, and Policies
  - Integration into Other State Plans and Programs
  - Current and Emerging State Capabilities
- Mitigation Funding Sources
- Local and Tribal Capability Assessment
  - Current and Emerging Local and Tribal Capabilities
- Local and Tribal Mitigation Planning

Added a table to highlight important state mitigation policies
Added a table for recommended legislative changes
Provides opportunities for other agencies

MITIGATION IMPLEMENTATION SYSTEM

- Project Management
  - Technical Assistance
  - Eligibility Criteria
  - Project Review
  - Benefit-Cost Analysis
  - Prioritization
  - Environmental Review
  - Grant Management
  - Project Monitoring and Evaluation

PLAN MAINTENANCE

- Plan Maintenance responsibilities lie with the State Hazard Mitigation Team and ND DES.
- Plan Monitoring - after each disaster, or in the absence of such, annually.
- Plan Evaluation
- Plan Updates – every 3 years
- Plan Update Process

Added a plan update process checklist so the process can be replicated.

APPENDICES

- Mitigation Planning Committees
- Invited Stakeholders, Participation, and Public Information
- Meeting Attendance Records
- Meeting Summaries
- Communications
- Plan Changes
- References
- Acronyms
- Annual Reports
- Interagency Reports
- Local and Tribal Mitigation Plans
- FEMA Crosswalks

State of North Dakota Multi-Hazard Mitigation Plan

ADDITIONAL PUBLIC AND STAKEHOLDER COMMENTS

No additional comments provided.

State of North Dakota Multi-Hazard Mitigation Plan

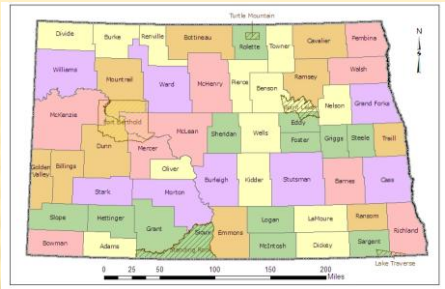
NEXT STEPS

NEXT STEPS

- Comment Period Ends: JANUARY 2, 2011
  - May be emailed to: pam@bigskyhazards.com
  - May be mailed to: ND DES
    PO Box 5511
    Bismarck, ND 58506-5511
- Comments Reviewed and Integrated
- Final Plan is then submitted to FEMA
- INTEGRATE and IMPLEMENT

The draft plan can be found online at:
www.nd.gov/des

Comments can also be emailed to:
nddes@nd.gov



Thank you for attending! Drive safe.

STATE OF NORTH DAKOTA MULTI-HAZARD MITIGATION PLAN

Appendix E. COMMUNICATIONS

Data and comments were provided by the following agencies in 2007:

- Environmental Protection Agency
- Farm Service Agency
- Federal Railroad Administration
- National Climatic Data Center
- National Park Service
- National Response Center
- National Transportation Safety Board
- National Weather Service
- North Dakota Department of Emergency Services
- North Dakota Department of Health
- North Dakota Department of Public Instruction
- North Dakota Department of Transportation
- North Dakota Forest Service
- North Dakota Insurance Department
- North Dakota State Fire and Tornado Fund
- North Dakota State Fire Marshal
- North Dakota State Water Commission
- US Army Corps of Engineers
- US Census Bureau
- US Department of Agriculture
- US Fish and Wildlife Service
- US Geological Survey

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications

Name / Agency	Date	Type	Reason(s)
Fred Anderson Dave Hvinden ND Geological Survey	01/04/2008	Email	Recommend studying and/or adding a landslide hazard to the next plan update. ND DOT may already have some information for transportation corridors. Recommend using an alternate map projection (Lambert Conformal Conic or Equal Area equivalent) for more "representative" maps and to reduce spatial distortion of the maps in the plan.
Cherie Abrahams Holland America	01/11/2010	Phone	Request for ND MHMP for use in business continuity of operation planning
Raymond Morrell ND DES	01/19/2010	Phone	Initial planning process discussions
Raymond Morrell ND DES	01/20/2010	Email	Stakeholder meeting logistics
Raymond Morrell ND DES	01/27/2010	Email	Updates to the state mitigation stakeholder list

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Raymond Morrell ND DES	02/01/2010	Email	Meeting invitation review and modifications
All Stakeholders	02/03/2010	Email	Meeting invitation
Donna Flaten Grand Forks County Emergency Management	02/03/2010	Email	Uncertainties on how townships that do their own planning and zoning should be handled – own jurisdiction in local mitigation plans and grant subgrantees? Statewide consistency is needed.
Raymond Morrell ND DES	02/24/2010	Email	Stakeholder meeting materials Data collection
All Stakeholders	03/01/2010	Email	Meeting reminder
Janice Pratt Bank of North Dakota	03/01/2010	Email	Discussion about reviewing the existing plan
John Paul Martin National Weather Service	03/01/2010	Email	Updating of ND weather statistics maps
Sandra Hanson Sargent County	03/01/2010	Email	Concerns over the cost of updating mitigation plans
SRT Communications	03/01/2010	Email	Mitigation planning point of contact
Debra Ball-Kilbourne United Methodist Disaster Response	03/02/2010	Email	Concerns regarding the distribution of individual assistance applications through voluntary agencies
Raymond Morrell ND DES	03/02/2010	Meeting	Updated data, document, and local mitigation plan collection Discussion related to program and legislative changes
	03/03/2010	Meeting	Stakeholder meeting
Raymond Morrell ND DES	03/03/2010	Email	Updated state Emergency Operations Plan Legislative changes
John Paul Martin National Weather Service	03/04/2010	Email	Updating of ND weather statistics maps
2007 Hazard Committee Members	03/05/2010	Email	Invitations to participate on the mitigation planning committees in 2010
All Stakeholders	03/05/2010	Email	Stakeholder meeting notes
Dana Mount ND Department of Health	03/05/2010	Email	Not interested in participating on a mitigation planning committee
Tina Beach Williston Basin Interstate Pipeline	03/05/2010	Email	Updating stakeholder and contact information
Brent Pringle Stark County	03/07/2010	Email	Not interested in participating on a mitigation planning committee
Dave Hvinden North Dakota Geological Survey	03/08/2010	Email	Participation on hazardous material release mitigation planning committee
David Hartman US Bureau of Reclamation	03/08/2010	Email	Participation on several mitigation planning committees
Janice Pratt Bank of ND	03/08/2010	Email	Not interested in participating on a mitigation planning committee

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
John Paul Martin National Weather Service	03/08/2010	Email	Participation on summer storm mitigation planning committee
Karen Goff ND State Water Commission	03/08/2010	Email	Participation on dam failure mitigation planning committee
Lee Klapprodt ND State Water Commission	03/08/2010	Email	Participation on drought mitigation planning committee, but not the urban fire / structure collapse committee
Tim Mahoney City of Fargo	03/08/2010	Email	Participation on several mitigation planning committees
Todd Schreiner McLean County	03/08/2010	Email	Participation on several mitigation planning committees
Wally Kalmbach ND Association of RECs	03/08/2010	Email	Participation on shortage/outage of critical materials/infrastructure mitigation planning committee
Cliff Whitman Three Affiliated Tribes	03/09/2010	Email	Participation on transportation accident mitigation planning committee
Lonnie Hoffer ND DES	03/11/2010	Email	Information on enhanced review process
Bob Marthaller ND Department of Public Instruction	03/12/2010	Email	Updating stakeholder and contact information
Gary Stockert City of Bismarck	03/12/2010	Email	Information on mitigation planning committees
Gregory Gust and John Paul Martin National Weather Service	03/12/2010	Email	Participation on winter storm mitigation planning committee
Mark Schrader Federal Highway Administration	03/16/2010	Email	Participation on transportation accident mitigation planning committee
David Geyer ND Forest Service	03/22/2010	Phone Email	Participation on wildland fire mitigation planning committee
Gary Doerr ND DOT	03/26/2010	Email	Updated bridge data
Laurie Scully ND Insurance Department	03/26/2010	Email	Updated insurance fund data
Ray Morrell Rebecca Ault ND DES	03/26/2010	Email	Search and rescue input
Ray Morrell ND DES	03/26/2010	Email	Updated critical facility, state-owned building, new development, and future development data
Amy Anton ND DES	03/31/2010	Email	Subject matter expert for homeland security incident
Brad Darr ND DOT	03/31/2010	Email	Subject matter expert for transportation accident

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Jeff Klein ND State Water Commission	03/31/2010	Email	Subject matter expert for flood
Jeff White ND Dept. of Criminal Investigation	03/31/2010	Email	Subject matter expert for homeland security incident
Ken Junkert ND Dept. of Agriculture	03/31/2010	Email	Subject matter expert for communicable disease
Peggy Anderson ND DOT	03/31/2010	Phone	Updated bridge data
Ray Lambert ND Fire Marshal	03/31/2010	Email	Subject matter expert for urban fire/structure collapse and wildland fire
Ray Morrell ND DES	03/31/2010	Email	Subject matter experts
Susan Keller ND Board of Animal Health	03/31/2010	Email	Subject matter expert for communicable disease
Tim Wiedrich ND Dept. of Health	03/31/2010	Email	Subject matter expert for several hazards
Douglas Bausch FEMA	04/01/2010	Email Mail	HAZUS Flood Level I Runs
Ray Morrell ND DES	04/01/2010	Email	Subject matter experts
Ray Morrell ND DES	04/20/2010	Email	Agency contacts
Laurie Scully ND Insurance Department	04/27/2010	Email	Updated insurance fund data
Joel Leapaldt ND Facilities Mgmt Div	04/30/2010	Email	State building data
Kirk Hagel ND DES	04/30/2010	Email	Critical facilities data
Connie Sprynczynatyk ND League of Cities	05/05/2010	Email	Recent growth and development
Jeff Bitz ND Insurance Department	05/05/2010	Email	State building data
Leigh Ann Huether ND Dept of Commerce	05/05/2010	Email	Recent growth and development
Mark Johnson ND Association of Counties	05/05/2010	Email	Recent growth and development
Kirk Hagel ND DES	05/07/2010	Email Phone	Critical facilities data
Geremy Olson ND Forest Service	05/26/2010	Email	Wildland fire hazard profile updates
Gary Doerr ND DOT	05/27/2010	Email	Updated scour critical bridge data
Brad Darr ND DOT	06/11/2010	Email	Critical Facilities and Infrastructure section reviewed

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Critical Facilities and Infrastructure Mitigation Planning Committee Members	06/11/2010	Email	Draft section review
Jason Johnston ND Parks and Recreation	06/11/2010	Email	Critical Facilities and Infrastructure section reviewed and comments received and integrated
Geremy Olson ND Forest Service	06/17/2010	Phone	Wildland fire hazard profile updates
Land Use and Recent and Future Construction and Development Mitigation Planning Committee Members	06/18/2010	Email	Draft sections review
Fred Anderson ND Geological Survey	06/21/2010	Email	Landslide mapping
Fred Anderson ND Geological Survey	06/21/2010	Email	Land Use, New Development, and Future Development sections reviewed and comments received and integrated
Randy Ehlis US Bureau of Reclamation	06/24/2010	Email	Communicable Disease section reviewed
Fred Anderson ND Geological Survey	07/02/2010	Email	Landslide mapping
Gary Stockert City of Bismarck Emergency Management	07/02/2010	Email	Critical Facilities and Infrastructure section reviewed and comments received and considered
Tim Wiedrich ND Department of Health	07/02/2010	Phone	Communicable disease hazard profile discussion
Tim Wiedrich ND Department of Health	07/07/2010	Email	Mitigation strategy section
Drought Mitigation Planning Committee Members	07/08/2010	Email	Brainstorming ideas for capturing drought risk
Karen Goff ND SWC	07/08/2010	Email	Dam failure hazard profile updates
Geremy Olson ND Forest Service	07/14/2010	Email	Fire start data and crop insurance data usefulness
Jeff Klein ND SWC	07/14/2010	Email	NFIP data updates
Patrick Fridgen ND SWC	07/14/2010	Email	Drought hazard profile updates
Ray Morrell ND DES	07/14/2010	Email	New earthquake monitoring system
Fred Anderson ND Geological Survey	07/15/2010	Email	Geologic hazards hazard profile reviewed and comments received and integrated
Patrick Fridgen ND SWC	07/15/2010	Email	Drought hazard profile reviewed and comments received and integrated

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Karen Goff ND SWC	07/16/2010	Email	Issues with National Inventory of Dams and state data
Karen Goff ND SWC	07/19/2010	Email	Dam GIS data
Adnan Akyuz State Climatologist, NDSU	07/22/2010	Email	Invitation to participate
Jeffrey Savadel National Weather Service	07/22/2010	Email	Add State Climatologist to stakeholder list
Karen Goff ND SWC	07/22/2010	Email	Dam GIS data
Patrick Fridgen ND SWC	07/22/2010	Email	Drought hazard profile updates
Adnan Akyuz State Climatologist, NDSU	07/23/2010	Email	Add to Drought, Flood, Summer Storm, Winter Storm, and Mitigation Strategy mitigation planning committees
Ray Morrell ND DES	07/23/2010	Email	2009 and 2010 flood events information
Ray Morrell ND DES	07/26/2010	Email	Hazardous material incident data
Patrick Fridgen ND SWC	07/28/2010	Email	Data on high industrial water users
Kathleen Donahue ND DES	08/02/2010	Email	Homeland security tiers
Ray DeBoer ND DES	08/02/2010	Email	Hazardous material incident data
Shortage or Outage of Critical Materials or Infrastructure Mitigation Planning Committee Members	08/02/2010	Email	Draft section review
Karen Goff ND SWC	08/03/2010	Email	Dam inventory
Wally Kalmbach ND Association of RECs	08/03/2010	Email	Shortage or outage of critical materials or infrastructure hazard profile reviewed and comments received and integrated
Patrick Fridgen ND SWC	08/04/2010	Email	High industrial water users clarifications
Ray DeBoer ND DES	08/04/2010	Email	Hazardous material incident data
Ray Morrell ND DES	08/04/2010	Email	Fargo flood control update
Transportation Accident Mitigation Planning Committee Members	08/05/2010	Email	Draft section review
Brad Darr ND DOT	08/06/2010	Email	Transportation accident section reviewed

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Mark Schrader Federal Highway Administration	08/06/2010	Email	Transportation accident section reviewed
John Elstad ND Fire Marshall's Office	08/09/2010	Email	Fire statistics
Ray Morrell ND DES	08/09/2010	Email	Repetitive loss data
Ray Morrell ND DES	08/18/2010	Email	Local plan integration
Darin Langerud ND SWC	08/19/2010	Email	Cloud modification program information
Summer Storm Mitigation Planning Committee Members	08/19/2010	Email	Draft section review
Todd Schreiner McLean County Emergency Management	08/19/2010	Email	Winter storm and summer storm sections reviewed
Winter Storm Mitigation Planning Committee Members	08/19/2010	Email	Draft section review
Jon Kelsch ND SWC	08/20/2010	Email	Summer storm hazard profile reviewed and comments received and integrated
Geremy Olson ND Forest Service	08/24/2010	Email	Wildfire risk ratings
John Paul Martin National Weather Service	08/24/2010	Email	Summer and winter storm hazard profiles reviewed and comments received and integrated
Ray Morrell ND DES	08/27/2010	Email	Facilitation of remaining risk assessment data collection
Ray Morrell ND DES	08/27/2010	Email Mail	Updated local and tribal plans
Drought Mitigation Planning Committee Members	08/30/2010	Email	Draft section review
Ray DeBoer ND DES	08/30/2010	Email	Hazardous material incident data
Jason Johnston ND Parks and Recreation	08/31/2010	Email	Summer storm hazard profile reviewed and comments received and integrated
Linda Hippen ND Fire Marshall's Office	08/31/2010	Email	NFIRS fire data
Pat Fridgen ND SWC	08/31/2010	Email	Drought hazard profile reviewed and comments received and integrated
Bonnie Malo ND Division of Community Services	09/02/2010	Email	Mitigation program updates
Brad Darr ND DOT	09/02/2010	Email	Mitigation program updates

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Darin Langerud ND SWC	09/02/2010	Email	Mitigation program updates. Updated information provided.
Geremy Olson ND Forest Service	09/02/2010	Email	Mitigation program updates
Jeff Klein ND SWC	09/02/2010	Email	Mitigation program updates
John Diem ND Division of Community Services	09/02/2010	Email	Mitigation program updates
Karen Goff ND SWC	09/02/2010	Email	Mitigation program updates
Ray Morrell ND DES	09/02/2010	Email	Mitigation program updates. Updated information provided.
Brad Darr ND DOT	09/03/2010	Email	Mitigation program update feedback
Brad Darr ND DOT	09/07/2010	Email	Bridge data clarification
Dam Failure Mitigation Planning Committee Members	09/07/2010	Email	Draft section review
Gary Doerr ND DOT	09/07/2010	Phone Email	Bridge data
Jason Johnston ND Parks and Recreation	09/07/2010	Email	Dam failure hazard profile reviewed and comments received and integrated
Jeff Savadel National Weather Service	09/07/2010	Email	Summer storm hazard profile reviewed
Jeff Savadel National Weather Service	09/07/2010	Email	Winter storm hazard profile reviewed and comments received and integrated
Jeff Savadel National Weather Service	09/07/2010	Email	Dam failure hazard profile reviewed and comments received and integrated
Hazardous Material Release Mitigation Planning Committee Members	09/08/2010	Email	Draft section review
Geremy Olson ND Forest Service	09/09/2010	Phone Email	Community wildfire risk
Fred Anderson ND Geological Survey	09/10/2010	Email	Dam failure hazard profile reviewed and comments received and integrated
Fred Anderson ND Geological Survey	09/13/2010	Email	Urban fire and structure collapse hazard profile reviewed and comments received and integrated
Ray Morrell ND DES	09/13/2010	Email	Final public meeting
Renee Loh North Dakota Firefighter's Association	09/13/2010	Email	Hazardous material release, urban fire and structure collapse, and wildland fire hazard profiles reviewed

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Todd Schreiner McLean County Emergency Management	09/13/2010	Email	Wildland fire hazard profile reviewed
Urban Fire or Structure Collapse Mitigation Planning Committee Members	09/13/2010	Email	Draft section review
Wildland Fire Mitigation Planning Committee Members	09/13/2010	Email	Draft section review
Communicable Disease Mitigation Planning Committee Members	09/14/2010	Email	Communicable disease mitigation review
Doug Bausch FEMA	09/14/2010	Email	2009 Flood Losses Avoided Study
Drought Mitigation Planning Committee Members	09/14/2010	Email	Drought mitigation review
Eric Pederson ND Highway Patrol	09/14/2010	Email	Homeland security incident hazard profile reviewed and comments received and integrated
Flood Mitigation Planning Committee Members	09/14/2010	Email	Draft section review
Geologic Hazards Mitigation Planning Committee Members	09/14/2010	Email	Geologic hazards mitigation review
Homeland Security Incident Mitigation Planning Committee Members	09/14/2010	Email	Draft section review
Jason Johnston ND Parks and Recreation	09/14/2010	Email	Summer storm mitigation strategy reviewed
Kathleen Donahue ND DES	09/14/2010	Email	Homeland security incident hazard profile
Ray Morrell ND DES	09/14/2010	Email	Final public meeting
Shortage or Outage of Critical Materials or Infrastructure Mitigation Planning Committee Members	09/14/2010	Email	Shortage or outage of critical materials or infrastructure mitigation review
Summer Storm Mitigation Planning Committee Members	09/14/2010	Email	Summer storm mitigation review
Transportation Accident Mitigation Planning Committee Members	09/14/2010	Email	Transportation accident mitigation review
Amy Anton ND DES	09/15/2010	Email	Homeland security incident hazard profile reviewed and comments received and integrated

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Brad Darr ND DOT	09/15/2010	Email	Transportation accident mitigation strategy reviewed and comments integrated
Jason Johnston ND Parks and Recreation	09/15/2010	Email	Flood hazard profile reviewed and comments received and integrated
Karen Goff ND SWC	09/15/2010	Email	Mitigation program updates
Karen Goff ND SWC	09/16/2010	Email	Dam failure profile reviewed and comments received and integrated
Jesse Rozelle FEMA	09/17/2010	Email	Fargo Region 2009/2010 HAZUS Losses Avoided Study
Dam Failure Mitigation Planning Committee Members	09/20/2010	Email	Dam failure mitigation review
Flood Mitigation Planning Committee Members	09/20/2010	Email	Flood mitigation review
Hazardous Material Release Mitigation Planning Committee Members	09/20/2010	Email	Hazardous material release mitigation review
Homeland Security Incident Mitigation Planning Committee Members	09/20/2010	Email	Homeland security incident mitigation review
Ray Morrell ND DES	09/20/2010	Email	Mitigation interagency teams
Urban Fire or Structure Collapse Mitigation Planning Committee Members	09/20/2010	Email	Urban fire or structure collapse mitigation review
Wildland Fire Mitigation Planning Committee Members	09/20/2010	Email	Wildland fire mitigation review
Winter Storm Mitigation Planning Committee Members	09/20/2010	Email	Winter storm mitigation review
Pat Fridgen ND SWC	09/21/2010	Email	Drought mitigation strategies reviewed
Gary Doerr ND DOT	09/21/2010	Email	Bridge summary review
Brad Darr ND DOT	09/21/2010	Email	Bridge summary review and living snow fence program
Ray Morrell ND DES	09/21/2010	Email	Dam map
Karen Goff ND SWC	09/21/2010	Email	Dam map
Ray Morrell ND DES	09/22/2010	Email	Dam map

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Gary Stockert Bismarck Emergency Management	09/22/2010	Email	Hazardous material release profile reviewed and comments received and integrated
Tom Doering ND DES	09/22/2010	Email	Mitigation strategy comments received and integrated
Kathleen Donahue ND DES	09/23/2010	Email	Coordination with State Emergency Operations Plan
Ray Morrell ND DES	09/23/2010	Email	Public meeting set-up and quarterly report data
Gary Stockert Bismarck Emergency Management	09/23/2010	Email	Homeland security incident profile reviewed and comments received and integrated
Mitigation Strategy Committee	09/23/2010	Email	Overall mitigation strategy review
Karen Goff ND SWC	09/24/2010	Email	Dam map
Ray Morrell ND DES	09/28/2010	Email	Mitigation implementation system review
Pat Fridgen ND SWC	09/28/2010	Email	Silver Jackets program review
Geremy Olson ND Forest Service	09/28/2010	Phone	Fire mitigation program review
Jesse Rozelle FEMA	09/28/2010	Email	Fargo Region 2009/2010 HAZUS Losses Avoided Study
Fred Anderson ND Geological Survey	09/29/2010	Email	Dam failure, flood, geologic hazards, and summer storm mitigation strategies reviewed
Karen Goff ND SWC	09/29/2010	Email	Dam safety mitigation strategy comments received and integrated
Geremy Olson ND Forest Service	09/30/2010	Phone	Fire mitigation program review
Ray Morrell Sean Johnson Lonnie Hoffer Cherie Merrick ND DES	09/30/2010	Phone	Mitigation implementation system
Ray Morrell ND DES	09/30/2010	Email	Legislative initiatives
Fred Anderson ND Geological Survey	10/01/2010	Email	Flood hazard profile comment received and integrated
Karen Goff ND DES	10/04/2010	Email	Dam safety funding
Geremy Olson ND Forest Service	10/04/2010	Email	National Fire Plan funding
Brad Darr ND DOT	10/04/2010	Email	Living snow fence funding

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Ray Morrell Sean Johnson Lonnie Hoffer Cherie Merrick ND DES	10/04/2010	Email	New mitigation implementation system subsections
Pat Fridgen ND SWC	10/04/2010	Email	Flood mitigation strategy comments received and integrated
Brad Darr ND DOT	10/06/2010	Email	Living snow fence funding
Renee Loh North Dakota Firefighter's Association	10/07/2010	Email	Hazardous material release, urban fire and structure collapse, and wildland fire mitigation strategies reviewed and integrated
Kathleen Donahue ND DES	10/07/2010	Email	Homeland security mitigation strategy comments received and integrated
Karen Goff ND SWC	10/08/2010	Email	Dam safety funding
Mitigation Planning Process Committee	10/12/2010	Email	Planning process review
Paul Messner ND DES	10/12/2010	Email	Public assistance program information reviewed
Linda Weispfenning ND SWC	10/12/2010	Email	Planning process section reviewed
Ray Morrell ND DES	10/13/2010	Email	Floodplain structures
Kirk Hagel ND DES	10/14/2010	Email	Homeland security mitigation
Jeff Savadel National Weather Service	10/19/2010	Email	Planning process section reviewed
Ray Morrell ND DES	10/19/2010	Email	Completed PDM and FMA projects
Ray Morrell ND DES	10/21/2010	Email	Project and briefing summaries
Ray Lambert ND Fire Marshal	10/26/2010	Email	Plan reviewed
Ray Morrell ND DES	10/26/2010	Email	Stakeholder letters
Ray Morrell ND DES	10/26/2010	Email	Local mitigation plans
Ray Morrell ND DES	11/01/2010	Email	Draft plan reviewed and comments integrated Stakeholder updates
All Stakeholders	11/01/2010	Email	Draft plan review and public meeting
Dave Hvinden ND Department of Mineral Resources	11/02/2010	Email	Draft plan reviewed and comments integrated

Table E1. 2010 Multi-Hazard Mitigation Plan Update Communications (continued)

Name / Agency	Date	Type	Reason(s)
Sarah Tunge ND Forest Service	11/04/2010	Email	Contact information update
Ray Morrell ND DES	11/04/2010	Email	Contact information update
Amy McBeth BNSF Railway	11/09/2010	Email	Contact information update
Ray Morrell ND DES	11/15/2010	Email	Mitigation success
Fred Anderson ND Geological Survey	11/15/2010	Email	Bakken-Three Forks formation graphic
Greg Wilz ND DES	11/17/2010	Person	Sections of the draft plan reviewed and comments integrated
Ray Morrell ND DES	11/17/2010	Email	Repetitive loss data
Jeanine Neipert FEMA	11/19/2010	Email	Meeting presentation
Ray Morrell ND DES	11/19/2010	Email	Draft plan reviewed and comments integrated
Scott Heck Citizen	12/09/2010	Letter	Draft plan reviewed and comments integrated
Tim Solberg Cass County Planner	12/16/2010	Email	Draft plan reviewed and comments integrated

Appendix F. PLAN CHANGES

Plan changes during the 2007 revision process included:

- Reorganization of the plan for readability and format
- Updates and improvements to all sections of the previous plan
- Development of a comprehensive integrated process to connect local and state mitigation planning
- Incorporation of information and comments collected at two stakeholder meetings and through other means
- Additional detail regarding the 2007 plan update process
- Description of the hazard identification process
- Changes to and additional documentation of the hazard analysis and loss estimation methodologies
- Update of the historical, facility, infrastructure, and development data
- Additional GIS mapping using new and updated data
- Statements and reports highlighting the changes that have occurred since 2005
- Further documentation and evaluation of the state's pre- and post-disaster policies and programs
- Further documentation of the local mitigation policies and programs
- Update and refinement of the mitigation strategy based on changes since 2005 and locally identified actions
- Update of the list of possible mitigation funding sources and mitigation-related laws
- Additions and improvements to the plan to meet enhanced state plan criteria

Table F1. 2010 Plan Changes

2007 Section	Changes	2010 Section
1	Added adoption information to the text of the plan.	1
1	Added a more direct statement regarding 44CFR13.11 in the adoption letter and at the front of the document.	1
2.4	Updated climate and population statistics.	2.4
3	Added 2010/2011 planning process information.	3
3	Ensured participation by EOP lead agencies within mitigation planning committees as subject matter experts.	3
3	Added descriptions of how FEMA assists following a disaster.	3.2
3	Added information regarding how input received is used.	3.4
3	Added an appendix outlining specific agency and individual participation and communications.	E
3.5	Updated plan integration information.	3.5
4.1	Moved the Risk Assessment Methodology section to the Planning Process section .	3.6
4.1	Added a discussion on how changes in development patterns have not significantly affected potential loss estimates.	3.6
4.2	Moved the Hazard Identification section to the Planning Process section.	3.7
4.2	Added a description of the process to identify new hazards.	3.7

Table F1. 2010 Plan Changes (continued)

2007 Section	Changes	2010 Section
4.3 4.4	Made the Statewide Inventory and Hazard Profiles their own major sections.	4 5
4.3	Updated the State Fire and Tornado Fund data and associated mapping.	4
4.3	Added a "New Development" section to describe development over the past three years.	4.7
4.3.2	Added a summary of the Critical Infrastructure Program data.	4.2
4.3.2	Updated the ND DOT Bridge Rating data.	4.2
4.3.2	Updated the school enrollment figures.	4.2
4.3.2	Re-evaluated and updated the North Dakota Critical Facilities and Infrastructure Summary.	4.2
4.3.3	Updated the population estimates and information.	4.3
4.3.4	Renamed the "Housing Units" section to "Buildings" to also capture commercial values.	4.4
4.3.4	Added HAZUS-MH building exposure data.	4.4
4.3.5	Updated data from agriculture census.	4.5
4.3.5	Updated crop insurance data.	4.5
4.3.5	Updated per capital personal income and poverty data.	4.5
4.3.5	Updated National Register of Historic Places and endangered species data.	4.5
4.3.5	Removed county National Register of Historic Places data due to difficulties with the online database search criteria.	4.5
4.3.6	Simplified the section title to Land Use rather than Current Land Use.	4.6
4.3.6	Added a discussion regarding changes in development and land use since last plan update.	4.7
4.3.7	Moved information related to recent development from the Future Development section to the New Development section to highlight recent changes in land use.	4.7
4.3.7	Updated population change and building permit data.	4.7
4.3.7	Added information on business start-ups and expansions.	4.7
4.3.7	Added information on the oil boom in the state.	4.7
4.3.7	Updated future development identified in local plans.	4.8
4.3.7	Updated building code and NFIP mapping.	4.8
4.3.7	Updated data on growing communities.	4.8
4.4	Integrated data from local and tribal plans since 2008.	5
4.4	Added probability and magnitude charts showing range.	5
4.4	Moved Vulnerabilities to Jurisdictions in front of other vulnerabilities.	5
4.4	Changed Vulnerabilities to Future Development to Vulnerabilities to New and Future Development to highlight the impacts new development has on the vulnerabilities.	5
4.4	Listed future development projects that may be vulnerable to specific hazards in the hazard profile "New and Future Development" sections.	5
4.4	Added a Geologic Hazards hazard profile to include landslide, earthquake, and other geologic/mining hazards.	5.5
4.4.X.2	Updated the hazard and disaster histories since 2008.	5
4.4.1.4	Updated the population, agriculture, and crop insurance data and mapping.	5.1
4.4.1.4	Used market value instead of livestock numbers to assess the vulnerability more concisely.	5.1.4
4.4.1.4	Removed the crop insurance mapping due to limited usefulness.	5.1.4
4.4.1.7	Re-evaluated and updated the jurisdictional risk ratings.	5.1.5
4.4.2	Updated dam data.	5.2
4.4.3.2	Updated drought impact reports map.	5.3.2

Table F1. 2010 Plan Changes (continued)

2007 Section	Changes	2010 Section
4.4.3.4	Updated drought mapping.	5.3
4.4.4.1	Added emphasis on Devils Lake flooding and Red River Valley flooding.	5.4.1
4.4.4.1	Added more information regarding Devils Lake flooding.	5.4.1
4.4.4.2	Added more information regarding recent floods.	5.4.2
4.4.4.2	Updated NCDC and USACE data on floods.	5.4.2
4.4.4.4	Updated NFIP data.	5.4
4.4.5	Added toxic release inventory information.	5.6
4.4.5.2	Changed the hazardous material release incident data from the National Response Center to Department of Emergency Services data.	5.6.2
4.4.5.2	Updated hazardous material release incident data and mapping.	5.6
4.4.6.1	Updated hate group types.	5.7
4.4.7.7	Updated the categories for vulnerabilities by jurisdiction.	5.8.5
4.4.8.2	Updated NCDC and crop insurance data and mapping on summer storms.	5.9
4.4.9.2	Updated traffic, railroad, and aircraft accident data.	5.10
4.4.10	Updated ND fire statistics.	5.11
4.4.11	Updated ND wildland fire statistics and maps.	5.12
4.4.12	Updated NCDC and crop insurance data on winter storms.	5.13
4.5	Updated risk assessment summaries.	5.14
4.5	Added a table and map for declared disasters and emergencies locations.	5.14.1
5	Listed specific changes to goals, objectives, and strategies.	6.1
5	Added an objective and initiative specific to the National Flood Insurance Program.	6.1
5	Added an initiative specific to impact resistant building materials.	6.1
5	Added information regarding the integration of STAPLEE methods to identify cost-effective, environmentally sound, and technically feasible actions.	6.2
5.3	Updated mitigation activities in local plans.	6.3
6	Changed the grant management for the FMA, RLS, and SRL grant programs from SWC to DES.	7
6	Added sections for “Changes since 2007” and “Ideas for Improvement” to each of the mitigation program sections.	7.1.1
6	Added the state’s 1 foot above BFE policy/requirement.	7.1.1
6	Added a section for the NFIP Community Assistance Program.	7.1.1
6	Added the Silver Jackets program.	7.1.1
6	Updated building codes and NFIP maps.	7.1.1
6	Added information on how state policies, programs, regulations, and laws have changed since 2007.	7.1.2
6	Identified laws, regulations, and policies that should be amended and/or removed to improve mitigation efforts. Put in matrix.	7.1.2
6	Added a table to highlight important state mitigation policies.	7.1.2
6	Added strengths and weaknesses of state capabilities.	7.1.4
6	Added discussions of existing and emerging capabilities.	7.1.4
6	Added a table for recommended legislative changes.	7.1.2
6	Discussed positive and negative aspects of state funding capabilities.	7.2
6	Added strengths and weaknesses of local and tribal capabilities.	7.3.1

Table F1. 2010 Plan Changes (continued)

2007 Section	Changes	2010 Section
6	Added discussions of existing and emerging capabilities.	7.3.1
6	Added references to the HMGP administrative plan.	7.5
6.5.4	Updated the cost-benefit section to reflect the use of the new software.	7.5.4
6.5.5	Added more specific language for "intense development pressure".	7.5.5
7	Added a plan update process checklist so the process can be replicated.	8.4
A	Updated Planning Committees and added "Member Since" column to track continuity and new membership.	A
B	Extended invitations to more non-agency, non-profit, and business-industry organizations.	B
B	Updated Invited Stakeholders List and indicated which planning processes involved in.	B
B	Added a distinction between invited and participated.	B
B	Added 2010 public information.	B
C	Added 2010 meeting sign-in sheets.	C
D	Added 2010 meeting summaries.	D
	Added a Communications appendix.	E
	Added a Plan Changes appendix.	F
E	Updated references.	G
F	Updated acronyms.	H
H	Added Annual Reports for 2008, 2009, and 2010.	J
J	Updated local and tribal plan list.	L
All	Changed margins to allow for double-sided printing. Updated plan date. Changed page numbering format for easier navigation and updates.	All
All	Removed the word "Enhanced" from the plan title for simplification purposes and future uncertainties regarding enhanced status.	All
All maps	Updated mapping with data improvements, where applicable, and improved map projections.	All maps

Appendix G. REFERENCES

American College of Surgeons. (2010). *Committee on Trauma, Verified Trauma Centers*. Retrieved May 2010, from http://www.facs.org/trauma/verified.html.

Amtrak. (2010). *Stations*. Retrieved May 2010, from http://www.amtrak.com/servlet/ContentServer/Page/1237608346798/1237405732508#North Dakota.

Anti-Defamation League. (2010). *Extremism in America.* Retrieved August 2010, from http://www.adl.org/learn/ext_us/.

Association of American Railroads. (2008). *Freight Railroads in North Dakota*. 2008. Retrieved May 2010, from http://www.aar.org/~/media/AAR/InCongress_RailroadsStates/NorthDakota.ashx.

Barnes County. (2010). *Multi-Jurisdictional All Hazard Pre-Disaster Mitigation Plan*. March 2010.

Billings, Molly. (1997). *The Influenza Pandemic of 1918*. Retrieved June 2010, from http://www.stanford.edu/group/virus/uda/.

Bismarck Tribune. (2010a). *One Killed, One Injured in Railroad Engine Derailment South of Washburn*. March 25, 2010. Retrieved June 2010, from http://www.bismarcktribune.com/news/local/article_dc740438-3840-11df-a689-001cc4c03286.html?mode=story.

Bismarck Tribune. (2010b). *North Dakota Floods 2010.* Retrieved August 26, 2010, from http://www.bismarcktribune.com/news/flood2010/.

Cass County. (2010). *Riverbank Slumping*. Retrieved December 2010, from http://www.casscountynd.gov/county/depts/planning/Pages/RiverbankSlumping.aspx.

Changnon, Stanley. (1997). *Trends in Hail in the United States*. Proc. Workshop on the Societal and Economic Impacts of Weather, Boulder, CO, NCAR, 19–31.

City of Fargo Fire Department. (2007). *Early Fire Department History*. Retrieved October 2007, from http://www.ci.fargo.nd.us/CityInfo/Departments/Fire/AboutUs/History/.

Centers for Disease Control and Prevention. (2010). *Emergency Preparedness and Response, Bioterrorism Agents/Diseases*. Retrieved June 2010, from http://www.bt.cdc.gov/agent/agentlist-category.asp#adef.

Farm Service Agency. (2004). *Conservation Reserve Program Haying and Grazing of Acreage Fact Sheet*. June 2004. Retrieved August 2010, from http://www.fsa.usda.gov/Internet/FSA_File/haygraze04.pdf.

Farm Service Agency. (2007). *Agricultural Assistance Act of 2007*. Retrieved September 2007, from http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing.

Farm Service Agency. (2010a). *Emergency Designation News Releases*. Retrieved July 2010, from http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=edn&newstype=ednewsrel.

Farm Service Agency. (2010b). *CRP Contract Summary and Statistics*. July 2010. Retrieved August 2010, from http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=rns-css.

Federal Emergency Management Agency. (2001). *Understanding Your Risks, Identifying Hazards and Estimating Losses*. FEMA 386-2. August 2001.

Federal Emergency Management Agency. (2003). *Developing the Mitigation Plan, Identifying Mitigation Actions and Implementation Strategies*. FEMA 386-3. April 2003.

Federal Emergency Management Agency. (2004). Taking *Shelter From the Storm: Building a Safe Room Inside Your House*. FEMA Publication 320. Second Edition. March 2004.

Federal Emergency Management Agency. (2006). *Final Programmatic Environmental Assessment Devils Lake Region, North Dakota*. May 11, 2006.

Federal Emergency Management Agency. (2007). *North Dakota Disaster History*. Retrieved September 2007, from http://www.fema.gov/news/disasters_state.fema?id=38.

Federal Emergency Management Agency. (2010a). *Resources: Flood Facts*. Retrieved July 2010, from http://www.floodsmart.gov/floodsmart/pages/flood_facts.jsp.

Federal Emergency Management Agency. (2010b). *North Dakota Disaster History*. Retrieved August 2010, from http://www.fema.gov/news/disasters_state.fema?id=38.

Federal Emergency Management Agency. (2010c). *Policy Statistics.* Retrieved August 2010, from http://bsa.nfipstat.com/reports/1011.htm.

Federal Emergency Management Agency. (2010d). *Severe Repetitive Loss Program*. Retrieved August 2010 from http://www.fema.gov/government/grant/srl/index.shtm.

Federal Emergency Management Agency. (2010e). *The National Flood Insurance Program Community Status Book*. Retrieved June 2010, from http://www.fema.gov/cis/ND.html.

Federal Emergency Management Agency. (2010f). *Community Rating System*. Retrieved August 2010, from http://www.fema.gov/business/nfip/crs.shtm.

Federal Emergency Management Agency. (2010g). *HAZUS Analysis of Economic Loss and Losses Avoided – Fargo Region, North Dakota*. 2010.

Federal Railroad Administration. (2010). *Ten Year Accident/Incident Overview*. Retrieved August 2010, from http://safetydata.fra.dot.gov/officeofsafety/.

Grand Forks County. (2009). *Multi-Hazard Mitigation Plan.* May 2009.

Gulf South Research Institute. (1980). *Red River of the North Reconnaissance Report*. December 1980.

Healthy Forests and Rangelands. (2010). *Fuels Treatment Accomplishments Report.* Retrieved September 2010, from http://www.forestsandrangelands.gov/resources/reports/fuel-treatments.cfm?statename=North%20Dakota.

High Plains Regional Climate Center. (2007). *Climate Atlas Maps*. Retrieved September 2007, from http://www.hprcc.unl.edu/index.php.

INFORUM. (2010). *Fewer Sandbags to be Needed Thanks to Mitigation Projects.* November 15, 2010. Retrieved November 2010, from http://www.inforum.com/event/article/id/298502/.

Laird, K.R., S.C. Fritz, K.A. Maasch, and B.F. Cumming. (1996). *Greater Drought Intensity and Frequency Before A.D. 1200 in the Northern Great Plains Summary*. Retrieved July 2010, from http://www.ncdc.noaa.gov/paleo/drought/drght_laird96.html.

Minot Daily News. (1969). *The Flood of 1969*. 1969. Retrieved October 2007, from http://pages.minot.k12.nd.us/nodak/flood/news.php.

Multihazard Mitigation Council. (2005). *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*. 2005. Retrieved October 2007, from http://www.nibs.org/MMC/MitigationSavingsReport/natural_hazard_mitigation_saves.htm.

National Climatic Data Center. (2010). *Storm Events*. Retrieved July 2010, from http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms.

National Drought Mitigation Center. (2010a). *About Drought*. Retrieved July 2010, from http://www.drought.unl.edu/index.htm.

National Drought Mitigation Center. (2010b). *Drought Impact Reporter.* Retrieved July 2010, from http://droughtreporter.unl.edu/map.jsp.

National Earthquake Hazards Reduction Program. (2010). *Earthquake Coordinators Web Site*. Retrieved June 2010, from http://www.training.fema.gov/emiweb/EarthQuake/index.htm.

National Fire Protection Association. (2010). *Printable Fact Sheets*. Retrieved August 2010, from http://www.nfpa.org/itemDetail.asp?categoryID=1867&itemID=44071&URL=Research/Fire%20statistics/Printable%20fact%20sheets.

National Interagency Coordination Center. (2010). *Incident Management Situation Report (IMSR) Archives.* Retrieved August 2010, from http://www.predictiveservices.nifc.gov/intelligence/archive.htm.

National Memorial Institute for the Prevention of Terrorism. (2007). *Terrorism Incidents and Significant Dates*. Retrieved October 2007, from http://www.mipt.org/incidentcalendar.asp.

National Oceanic and Atmospheric Administration. (1992). *Flash Floods and Floods…the Awesome Power!*. July 1992. Retrieved July 2010, from http://www.nws.noaa.gov/om/brochures/ffbro.htm.

National Oceanic and Atmospheric Administration. (2003). *North American Drought: A Paleo Perspective*. November 12, 2003. Retrieved July 2010, from http://www.ncdc.noaa.gov/paleo/drought/drght_home.html.

National Oceanic and Atmospheric Administration. (2007). *NOAA Photo Library*. Retrieved October 2007, from http://www.photolib.noaa.gov/htmls/wea00958.htm.

National Park Service. (2010). *National Register of Historic Places*. Retrieved June 2010, from http://www.nps.gov/history/nr/.

National Severe Storms Laboratory. (2007). *Hail Climatology*. Retrieved November 2007, from http://www.nssl.noaa.gov/primer/hail/hail_climatology.html.

National Transportation Safety Board. (2004). *Derailment of Canadian Pacific Railway Freight Train 292-16 and Subsequent Release of Anhydrous Ammonia Near Minot, North Dakota, January 18, 2002*. Railroad Accident Report NTSB/RAR-04/01. March 9, 2004.

National Transportation Safety Board. (2010). *Aviation Accident Database and Synopses*. Retrieved August 2010, from http://www.ntsb.gov/ntsb/query.asp#query_start.

National Weather Service. (1935). *NOAA Photo Library*. Retrieved September 2007, from http://www.photolib.noaa.gov/.

National Weather Service. (2007a). *North Dakota Tornadoes*. Retrieved October 2007, from http://www.crh.noaa.gov/bis/ndtornadoes.php.

National Weather Service. (2007b). *The Fargo Tornado of June 20, 1957*. Retrieved October 2007, from http://www.crh.noaa.gov/fgf/?n=fargojune1957f5.

National Weather Service. (2007c). *Lightning Safety*. Retrieved January 2006, from http://www.lightningsafety.noaa.gov/science.htm.

National Weather Service. (2007d). *NWS Wind Chill Temperature Index*. Retrieved October 2007, from http://www.nws.noaa.gov/om/windchill/.

National Weather Service. (2007e). E-mail Correspondence with Gregory Gust, Warning Coordination Meteorologist, Grand Forks National Weather Service Office, dated October 31, 2007 and December 6, 2007.

National Weather Service. (2010a). E-mail Correspondence with John Paul Martin, Warning Coordination Meteorologist, Bismarck National Weather Service Office, dated March 1, 2010, March 4, 2010, and August 24, 2010.

National Weather Service. (2010b). *Weather Fatalities*. Retrieved August 2010, from http://www.weather.gov/os/hazstats.shtml#.

North Dakota Association of Rural Electric Cooperatives. (2010). E-mail Correspondence with Wally Kalmbach, dated August 3, 2010.

North Dakota Department of Commerce. (2010a). E-mail Correspondence with Leigh Ann Huether, Research Manager, Department of Commerce, dated May 6, 2010.

North Dakota Department of Commerce. (2010b). *Trucking*. Retrieved May 2010, from http://www.business.nd.gov/businessInformation/infrastructure/trucking/.

North Dakota Department of Emergency Services. (2007a). *The Red River of the North Flood Disaster, 10 Years Later*. Brochure. 2007.

North Dakota Department of Emergency Services. (2007b). Data collected in Bismarck, ND on June 20, 2007.

North Dakota Department of Emergency Services. (2007c). *Situation Reports*. Retrieved October 2007, from http://www.nd.gov/des/reports/sitrep2007.html.

North Dakota Department of Emergency Services. (2007d). E-mail Correspondence with Don Ronsberg, Division of Homeland Security, Department of Emergency Services, dated October 22, 2007.

North Dakota Department of Emergency Services. (2007e). E-mail Correspondence with Lonnie Hoffer, dated November 16, 2007.

North Dakota Department of Emergency Services. (2007f). Data collected in Bismarck, ND on November 5, 2007.

North Dakota Department of Emergency Services. (2007g). E-mail Correspondence with Debbie LaCombe, dated November 27, 2007.

North Dakota Department of Emergency Services. (2009). *2009 Flood Overview*. Presentation from the North Dakota Department of Emergency Services Workshop. June 23-25, 2009.

North Dakota Department of Emergency Services. (2010a). E-mail Correspondence with Kirk Hagel, Critical Infrastructure Program Manager, Division of Homeland Security, dated May 7, 2010.

North Dakota Department of Emergency Services. (2010b). Documents provided by Ray Morrell on March 2, 2010, September 2, 2010, and October 19, 2010.

North Dakota Department of Emergency Services. (2010c). E-mail Correspondence with Holly Gaugler, dated August 26, 2010.

North Dakota Department of Emergency Services. (2010d). E-mail Correspondence with Raymond DeBoer, dated August 3, 2010, August 4, 2010, August 5, 2010, August 30, 2010, and August 31, 2010.

North Dakota Department of Emergency Services. (2010e). *North Dakota Administrative Handbook for Federal Disaster Assistance and Pre-Disaster Mitigation Assistance.* March 2010.

North Dakota Department of Health. (2005). *Out of Sight, Not Out of Mind*. March 11, 2005. Retrieved July 2010, from http://www.health.state.nd.us/WQ/GW/awarenessweek/Article%201%20-%20Safeguarding%20ground%20water.htm.

North Dakota Department of Health. (2007). *West Nile Virus Data*. Retrieved October 2007, from http://www.ndhealth.gov/WNV/Data/.

North Dakota Department of Health. (2010). *2009-2010 Reported Influenza Activity in North Dakota*. Retrieved June 2010, from http://www.ndflu.com/default.aspx.

North Dakota Department of Mineral Resources. (2010). E-mail Correspondence with Fred Anderson, dated November 15, 2010.

North Dakota Department of Public Instruction. (2009). *North Dakota Educational Directory 2009-2010*. Retrieved May 2010, from http://www.dpi.state.nd.us/resource/directry/secb.pdf.

North Dakota Department of Transportation. (2007). *TransAction II, North Dakota's Statewide Strategic Transportation Plan*. 2007. Retrieved May 2010, from http://www.dot.nd.gov/public/transaction.htm.

North Dakota Department of Transportation. (2008). *North Dakota 2008 Crash Summary*. Retrieved August 2010, from http://www.dot.nd.gov/divisions/safety/docs/crash-summary.pdf.

North Dakota Department of Transportation. (2009). *Statewide Transportation Improvement Program 2010-2013 Final Document*. October 2009.

North Dakota Department of Transportation. (2010a). *North Dakota Department of Transportation Facts*. Retrieved May 2010, from http://www.dot.nd.gov/public/nddot-facts.htm.

North Dakota Department of Transportation. (2010b). *North Dakota Bridge Information*. Retrieved May 2010, from http://www.dot.nd.gov/divisions/bridge/bridges-08.htm.

North Dakota Department of Transportation. (2010c). E-mail Correspondence with Gary L. Doerr, Bridge Management Section, Department of Transportation, dated September 7, 2010.

North Dakota Department of Transportation. (2010d). *Strategic Highway Safety Plan*. January 2010.

North Dakota Division of Community Services. (2008). *2008 Building Code Enforcing Jurisdictions in North Dakota*. Retrieved June 2010, from http://www.communityservices.nd.gov/uploads/resources/602/north-dakota-2008-voting-jurisdictions.pdf.

North Dakota Fire Marshal. (2007). E-mail Correspondence with John M. Elstad, dated November 21, 2007.

North Dakota Fire Marshal. (2010). E-mail Correspondence with Linda Hippen, dated August 31, 2010.

North Dakota Forest Service. (2007). E-mail Correspondence with David Geyer, dated November 28, 2007.

North Dakota Forest Service. (2010a). *Fire Management*. Retrieved August 2010, from http://www.ndsu.edu/ndfs/fire_management/.

North Dakota Forest Service. (2010b). E-mail Correspondence with Geremy Olson, dated July 13, 2010.

North Dakota Forest Service. (2010c). *Statewide Assessment of Forest Resources and Forest Resource Strategy*. May 5, 2010.

North Dakota Geological Survey. (2007). *Earthquakes in North Dakota?*. John P. Bluemle. Updated July 27, 2007. Retrieved June 2010, from https://www.dmr.nd.gov/ndgs/ndnotes/Earthquakes/earthquakes.htm.

North Dakota Geological Survey. (2010a). *Landslide in North Dakota: An Overview of the Landslide Inventory Mapping Program at the North Dakota Geological Survey, Presentation Abstract*. Presentation by Fred J. Anderson at the Geologic Hazards of the Rocky Mountains and Great Plains Conference on April 21, 2010 in Rapid City, South Dakota.

North Dakota Geological Survey. (2010b). E-mail Correspondence with Fred Anderson, dated July 15, 2010.

North Dakota Geological Survey. (2010c). *Earthquakes in North Dakota*. Geologic Investigations No. 94. March 2010.

North Dakota Insurance Department. (2007). E-mail Correspondence with Kathy Wolf, dated November 19, 2007.

North Dakota Oil and Gas Division. (2010). *North Dakota Drilling and Production Statistics*. Retrieved July 2010, from https://www.dmr.nd.gov/oilgas/stats/statisticsvw.asp.

North Dakota State Board of Animal Health. (2010). Email Correspondence with Susan Keller, State Veterinarian. April 1, 2010.

North Dakota State Climate Office. (2010a). *North Dakota Annual 1971-2000 Normal Precipitation (inches)*. Retrieved July 2010, from http://www.ndsu.edu/ndsco/precip/monthly/2010.html.

North Dakota State Climate Office. (2010b). *Bismarck Annual Precipitation 1880-2009*. Retrieved July 2010, from http://www.ndsu.edu/ndsco/precip/summary/graph/images/bismarck.png.

North Dakota State Data Center. (2002). *North Dakota Population Projections*. September 2002. Retrieved June 2010, from http://www.ndsu.edu/sdc/data/projections/ProjectionsReport2002/ProjectionsReport2002updated.pdf.

North Dakota State Engineer. (1985). *North Dakota Dam Design Handbook*. June 1985. Retrieved July 2010, from http://www.swc.state.nd.us/4dlink9/4dcgi/GetContentPDF/PB-77/damdesign.pdf.

North Dakota State Fire and Tornado Fund. (2010). E-mail Correspondence with Laurie Scully, North Dakota Insurance Department, State Fire and Tornado Fund, dated April 27, 2010.

North Dakota State Water Commission. (1994). *Climatic and Hydrologic Aspects of the 1988-1992 Drought and the Effect on People and Resources of North Dakota*. 1994. Retrieved July 2010, from http://nd.water.usgs.gov/pubs/wri/wri29/pdf/wri29.pdf.

North Dakota State Water Commission. (2007a). E-mail Correspondence with Karen Goff, North Dakota State Water Commission, dated October 9, 2007 and October 10, 2007.

North Dakota State Water Commission. (2007b). Correspondence with Lee Klapprodt, North Dakota State Water Commission, dated October 3, 2007.

North Dakota State Water Commission. (2007c). E-mail Correspondence with Darin Langerud, North Dakota Atmospheric Resources Board, dated November 2, 2007.

North Dakota State Water Commission. (2007d). E-mail Correspondence with Jeff Klein, North Dakota State Water Commission, dated November 30, 2007.

North Dakota State Water Commission. (2007e). E-mail Correspondence with Bruce Lange, North Dakota State Water Commission, dated December 3, 2007.

North Dakota State Water Commission. (2007f). *North Dakota Five-Year Floodplain Management Work Plan Outline – FY 2007*. 2007.

North Dakota State Water Commission. (2008). E-mail Correspondence with Jeff Klein, North Dakota State Water Commission, dated March 5, 2008.

North Dakota State Water Commission. (2009). *2009 North Dakota State Water Management Plan.* 2009.

North Dakota State Water Commission. (2010a). *Devils Lake Flooding*. Retrieved July 2010, from http://www.swc.state.nd.us/4dlink9/4dcgi/GetCategoryRecord/Devils%20Lake%20Flooding.

North Dakota State Water Commission. (2010b). E-mail Correspondence with Darin Langerud, North Dakota Atmospheric Resources Board, dated August 19, 2010.

North Dakota State Water Commission. (2010c). E-mail Correspondence with Karen Goff, North Dakota State Water Commission, dated August 3, 2010.

North Dakota State Water Commission. (2010d). *North Dakota State Water Commission and Office of the State Engineer Strategic Plan 2009-2011.* Retrieved October 2010, from http://www.swc.state.nd.us/4dlink9/4dcgi/GetSubCategoryPDF/43/StratPlan09.pdf.

North Dakota University System. (2009). *Reports and Information*. November 25, 2009, Retrieved May 2010, from http://www.ndus.edu/reports/details.asp?id=245.

Pacific Northwest Seismic Network. (2010). *Background Information on the ShakeMaps*. Retrieved July 2010, from http://www.pnsn.org/shake/about.html.

Qamar, Anthony. (2008). *Earthquake Hazards in the Pacific Northwest*. University of Washington. Cascadia Region Earthquake Workgroup. January 2008. Retrieved June 2010, from http://www.crew.org/ep/hazards.html.

Ramsey County. (2010). *Multi-Hazard Mitigation Plan*. January 2010.

Ramsey County Emergency Management Office. (2005). *Devils Lake Area Roads Acting as Dikes Action Plan*. March 2005.

Risk Management Agency. (2009). *2009 North Dakota Crop Insurance Profile*. January 11, 2010. Retrieved June 2010, from http://www.rma.usda.gov/pubs/2010/stateprofiles/northdakota09.pdf.

Risk Management Agency. (2010). *Cause of Loss Historical Data Files*. Retrieved June 2010, from http://www.rma.usda.gov/data/cause.html.

Schwartz, Robert. (2000). *Geography of Blizzards in the Continental United States, 1978-1999*. 57th Eastern Snow Conference. 2000. Retrieved October 2007, from http://www.easternsnow.org/proceedings/2000/schwartz.pdf.

Sell, Randall S. and F. Larry Leistritz. (1998). *Economic Impact of Reducing Hail and Enhancing Rainfall in North Dakota*. December 1998.

Sidell, Frederick R., M.D. (1996). *Chemical Agent Terrorism*. Annals of Emergency Medicine. August 1996.

Smith, Paul L., Ronald Johnson, David L. Priegnitz, Bruce A. Boe, and Paul W. Mielke Jr. (1997). *An Exploratory Analysis of Crop Hail Insurance Data for Evidence of Cloud Seeding Effects in North Dakota*. Journal of Applied Meteorology. Vol. 36, No. 5. May 5, 1997.

South Dakota Office of Emergency Management. (2007). *Listing of Past Natural Hazards Occurrences and Disasters*. Retrieved October 2007, from http://www.oem.sd.gov/Mitigation/hmgp/past_1.htm.

Southern Poverty Law Center. (2010). *Intelligence Project*. Retrieved August 2010, from http://www.splcenter.org/index.jsp.

State Historical Society of North Dakota. (2007). *North Dakota Chronology*. January 2007. Retrieved September 2007, from http://www.nd.gov/hist/chrono.htm.

Storm Prediction Center. (2007). *Enhanced F Scale for Tornado Damage*. Retrieved October 2007, from http://www.spc.noaa.gov/faq/tornado/ef-scale.html.

The Forum. (1999). *Local Tragedies Make Headlines*. December 19, 1999. Retrieved October 2007, from http://www.in-forum.com/specials/century/jan3/week52.html.

US Army Corps of Engineers. (1994). *Engineering and Design, Ice Jam Flooding: Causes and Possible Solutions*. Pamphlet EP 1110-2-11. November 30, 1994. Retrieved July 2010, from http://140.194.76.129/publications/eng-pamphlets/ep1110-2-11/entire.pdf.

US Army Corps of Engineers. (2007). *National Inventory of Dams*. Retrieved September 2007, from http://crunch.tec.army.mil/nidpublic/webpages/nid.cfm.

US Army Corps of Engineers. (2010a). *National Inventory of Dams*. Retrieved July 2010, from http://geo.usace.army.mil/pgis/f?p=397:1:2754922597950579::NO:::.

US Army Corps of Engineers. (2010b). *Ice Jam Database, Bulletins & Surveys*. Cold Regions Research and Engineering Laboratory. Retrieved July 2010, from http://www.crrel.usace.army.mil/icejams/page2.htm.

US Bureau of Economic Analysis. (2010). *Regional Economic Accounts*. Retrieved June 2010, from http://www.bea.gov/index.htm.

US Bureau of Reclamation. (2008). *Red River Valley Water Supply Project Comprehensive Report.* November 2008. Retrieved August 2010, from http://www.rrvwsp.com/rrvwsp_comp_report_1108.pdf.

US Census Bureau. (2010a). *US Census Bureau*. Retrieved April 2010, from http://www.census.gov/.

US Census Bureau. (2010b). *Manufacturing, Mining, and Construction Statistics*. Retrieved June 2010, from http://www.census.gov/mcd/.

US Department of Agriculture. (2007). *2007 Census of Agriculture*. Retrieved June 2010, from http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/North_Dakota/index.asp.

US Department of Health and Human Services. (2006). *The Great Pandemic of 1918: State by State*. March 2006. Retrieved September 2007, from http://www.pandemicflu.gov/general/greatpandemic2.html.

US Department of Homeland Security. (2009). *National Infrastructure Protection Plan*. 2009. p. 109.

US Department of Transportation. (2008). *Emergency Response Guidebook 2008*. Retrieved July 2010, from http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/erg2008_eng.pdf.

US Department of Transportation. (2010). *PHMSA Pipeline Safety Program, North Dakota Significant Incidents and Mileage Overview*. Retrieved December 2010, from http://primis.phmsa.dot.gov/comm/reports/safety/ND_detail1.html?nocache=2899.

US Energy Information Administration. (2005). *Changes in U.S. Natural Gas Transportation Infrastructure in 2004*. June 2005. Retrieved September 2007, from http://www.eia.doe.gov/pub/oil_gas/natural_gas/feature_articles/2005/ngtrans/ngtrans.pdf.

US Energy Information Administration. (2010). *North Dakota State Energy Profile*. Retrieved May 2010, from http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=ND.

US Environmental Protection Agency. (2010). *Envirofacts*. Retrieved July 2010, from http://www.epa.gov/enviro/html/multisystem_query_java.html.

US Fire Administration. (2006). *This is Fire!*. March 2006. Retrieved August 2010, from http://www.usfa.dhs.gov/downloads/pdf/fswy6.pdf.

US Fire Administration. (2010). *Fire Statistics*. Retrieved August 2010, from http://www.usfa.dhs.gov/statistics/.

US Fish and Wildlife Service. (2010). *Endangered Species*. Retrieved June 2010, from http://www.fws.gov/northdakotafieldoffice/endspecies/endangered_species.htm.

US General Accounting Office. (2003). *Capitol Hill Anthrax Incident*. June 2003. Retrieved June 2010, from http://www.gao.gov/highlights/d03686high.pdf.

US Geological Survey. (1997). *Earthquakes*. October 23, 1997. Retrieved February 2010, from http://pubs.usgs.gov/gip/earthq1/intro.html.

US Geological Survey. (2004a). *North Dakota Gap Analysis Land Cover Database*. August 2004. Retrieved June 2010, from http://gisdata.nd.gov/LandClass/GAP/.

US Geological Survey. (2004b). *Landslide Types and Processes*. Fact Sheet 2004-3072. July 2004. Retrieved June 2010, from http://pubs.usgs.gov/fs/2004/3072/fs-2004-3072.html.

US Geological Survey. (2004c). *1997 Red River Flood Photos*. February 2004. Retrieved July 2010, from http://nd.water.usgs.gov/photos/1997RedFlood/obelisk.html.

US Geological Survey. (2007). *North Dakota Water Science Center*. Retrieved October 2007, from http://nd.water.usgs.gov/.

US Geological Survey. (2008). *2008 United States National Seismic Hazard Maps*. May 2008. Retrieved June 2010, from http://earthquake.usgs.gov/hazards/products/conterminous/2008/maps/.

Wikipedia. (2010a). *North Dakota*. Retrieved May 2010, from http://en.wikipedia.org/wiki/North_Dakota.

Wikipedia. (2010b). *LGM-30 Minuteman*. Retrieved August 2010, from http://en.wikipedia.org/wiki/LGM-30_Minuteman.

World Health Organization. (2010). *Avian Influenza Frequently Asked Questions*. Retrieved June 2010, from http://www.who.int/csr/disease/avian_influenza/avian_faqs/en/#vaccine.

Appendix H. ACRONYMS

ACV – Actual Cash Value
BCA – Benefit Cost Analysis
BCI – Bureau of Criminal Investigation
BCR – Benefit Cost Ratio
BIA – Bureau of Indian Affairs
BLM – Bureau of Land Management
BFE – Base Flood Elevation
BNSF – Burlington Northern Santa Fe
BP = Building Property
BSE – Bovine Spongiform Encephalopathy
CAP – Community Assistance Program
CAP-SSSE – Community Assistance Program – State Support Service Element
CAV – Community Assistance Visit
CBRNE – Chemical Biological Radiological Nuclear Explosive
CDBG – Community Development Block Grant
CFR – Code of Federal Regulations
CIKR – Critical Infrastructure and Key Resources
CIS – Community Information System
CMI – Crop Moisture Index
CMP – Cloud Modification Project
COG – Continuum of Government
COOP – Continuity of Operations Plan
CRP – Conservation Reserve Program
CRREL – Cold Regions Research and Engineering Laboratory
CRS – Community Rating System
CTP – Cooperating Technical Partner
DCS – Division of Community Services
DES – Department of Emergency Services
DFIRM – Digital Flood Insurance Rate Map
DHS – Department of Homeland Security
DMA2K – Disaster Mitigation Act of 2000
DMVW – Dakota Missouri Valley and Western
DOJ – Department of Justice
DOT – Department of Transportation
DR - Disaster
EAP – Emergency Action Plan
EDA – Economic Development Administration
EO – Executive Order
EOC – Emergency Operations Center
EOP – Emergency Operations Plan
EM - Emergency

EMAP – Emergency Management Accreditation Program
EMPG – Emergency Management Performance Grants
EMS – Emergency Medical Services
EPA – Environmental Protection Agency
FAA – Federal Aviation Administration
FALN – Armed Forces of National Liberation (translated)
FAS – Federal Aid System
FBI – Federal Bureau of Investigation
FEMA – Federal Emergency Management Agency
FHBM – Flood Hazard Boundary Map
FHWA – Federal Highway Administration
FIRM – Flood Insurance Rate Map
FIS – Flood Insurance Study
FMA – Flood Mitigation Assistance
FWS – Fish & Wildlife Service
FY – Fiscal Year
GIS – Geographic Information System
GPS – Global Positioning System
HAZUS-MH – Hazards United States Multi-Hazard
HMA – Hazard Mitigation Assistance
HMEP – Hazardous Materials Emergency Program
HMGP – Hazard Mitigation Grant Program
HUD – Housing and Urban Development
HVAC – Heating, Ventilating, and Air Conditioning
IA – Individual Assistance
IHMT – Interagency Hazard Mitigation Team
LP – Liquefied Petroleum
MOU – Memorandum of Understanding
NCDC – National Climatic Data Center
ND – North Dakota
NDCC – North Dakota Century Code
NDSU – North Dakota State University
NDUS – North Dakota University System
NEMIS – National Emergency Management Information System
NFIP – National Flood Insurance Program
NFP – National Fire Plan
NID – National Inventory of Dams
NIFC – National Interagency Fire Center
NOAA – National Oceanic and Atmospheric Administration
NRCS – Natural Resources Conservation Service
NTSB – National Transportation & Safety Board
NWS – National Weather Service
OMB – Office of Management and Budget
OP – Outdoor Property

PA – Public Assistance
PCB – Polychlorinated Biphenyl
PDM – Pre-Disaster Mitigation
PDM-C – Pre-Disaster Mitigation Competitive
PDSI – Palmer Drought Severity Index
PL – Public Law
PP – Personal Property
RDI – Reclamation Drought Index
RFA – Rural Fire Assistance
RFC – Repetitive Flood Claims
RiskMAP – Risk Mapping, Assessment, and Planning
RV – Replacement Value
SARA – Superfund Amendment Reauthorization Act
SARS – Severe Acute Respiratory Syndrome
SBA – Small Business Administration
SF – Standard Form
SFA – State Fire Assistance
SFHA – Special Flood Hazard Area
SHELDUS – Spatial Hazard Events and Losses Database for the United States
SHMO – State Hazard Mitigation Officer
SHMT – State Hazard Mitigation Team
SPI – Standardized Precipitation Index
SRL – Severe Repetitive Loss
STAPLEE – Social, Technical, Administrative, Political, Legal, Economic, and Environmental
SWAT – Special Weapons and Tactics
SWC – State Water Commission
SWSI – Surface Water Supply Index
TP – Trailer Property
UND – University of North Dakota
US – United States
USACE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
USGS – United States Geological Survey
USFA – United States Fire Administration
USFS – United States Forest Service
WMD – Weapons of Mass Destruction
WPDG – Wetland Program Development Grants
WRD – Water Resource District
WUI – Wildland Urban Interface

Appendix J. ANNUAL REPORTS

North Dakota Mitigation Year in Review – 2005

Disasters/Funding
DR 1616: HMGP Federal Share = $160,697
DR 1621: HMGP Federal Share = $153,321
PDM-C Grants: Federal Share Awarded = $2,763,075

Projects

- Minnkota Project ($141,000) in which three electric transmission structures were replaced with stronger ones was completed as planned on June 9, funded through HMGP (DR 1483). *Linked to 2005 MHMP Goal #4.*
- Walsh Acquisition Project ($555,676) in which 10 properties were acquired was completed as planned on June 30, funded through HMGP (DR 1376). *Linked to 2005 MHMP Goal #2.*
- Barnes Acquisition Project ($483,840) in which 13 properties were acquired was completed as planned on June 30, funded through HMGP (DR 1376). *Linked to 2005 MHMP Goal #2.*
- Living Snow Fences were planted across the state through the ND Forest Service program, funded by HMGP (DR 1174) and the North Dakota Department of Transportation. The program continues as planned. *Linked to 2005 MHMP Goal #4.*

Note: "Completed as planned" indicates the project was completed within an acceptable time frame, including those projects that received approved extensions, and the extent of the project completed was within the required scope of work. The completion date indicates the conclusion of the physical work; project closeout may have occurred at a later date.

Planning

- The State of North Dakota Multi-Hazard Mitigation Plan was approved by FEMA on March 9, 2005.
- Seven local multi-hazard mitigation plans were approved by FEMA for:
  - Adams County
  - Eddy County
  - Hettinger County
  - McHenry County
  - Ramsey County
  - Renville County
  - Traill County

Technical Assistance

- The Annual North Dakota Emergency Managers Workshop was held on January 26-28, 2005. Meetings at this workshop included many topics including hazard mitigation.
- The Annual North Dakota Emergency Managers Association Workshop was held on September 14-16, 2005. Meetings at this workshop included many topics including hazard mitigation.

- Meetings were held to discuss HMGP with applicants at the same time as the Public Assistance meetings for DR 1597.
    - Met in Minot on 7/28/2005
    - Met in Devils Lake on 7/28/2005
    - Met in Ellendale on 7/29/2005
- Meetings were held to discuss HMGP with applicants at the same time as Public Assistance meetings for DR 1616.
    - Met in Dickinson on 11/30/2005
    - Met in Rugby on 12/1/2005
- Burleigh County joined the National Flood Insurance Program.
- One floodplain management, flood mapping, and flood insurance training workshop was held. Benefiting groups included community floodplain managers, land surveyors, water resource district members, lenders, realtors, and insurance agents.
- Eleven Community Assistance Visits (CAVs) for the National Flood Insurance Program were conducted. Community development permit records and floodplain development permit procedures were reviewed during these visits.

Mitigation Successes
None identified.

Details on the process for reviewing progress on implementing mitigation activities can be found in the State of North Dakota Multi-Hazard Mitigation Plan, Section 7.5.8, Project Monitoring and Evaluation.

North Dakota Mitigation Year in Review – 2006

Disasters/Funding
DR 1645: HMGP Federal Share = $683,621
PDM-C Grants: Federal Share Awarded = $7,796

Projects

- Barnes County Minnkota Power Cooperative Project ($1,823,729) in which 31 electric transmission structures were replaced with stronger ones was completed as planned on March 31, funded through PDM-C. *Linked to 2005 MHMP Goal #4.*
- City of Minto Acquisition Project in which 4 properties were acquired was completed as planned on December 31, funded through HMGP (DR 1621) and FMA (2 properties each). *Linked to 2005 MHMP Goal #2.*
- Living Snow Fences were planted across the state through the ND Forest Service program funded by HMGP (DR 1174) and the North Dakota Department of Transportation. The program continues as planned. *Linked to 2005 MHMP Goal #4.*

Note: "Completed as planned" indicates the project was completed within an acceptable time frame, including those projects that received approved extensions, and the extent of the project completed was within the required scope of work. The completion date indicates the conclusion of the physical work; project closeout may have occurred at a later date.

Planning

- Three local multi-hazard mitigation plans were approved by FEMA for:
  - Bowman County
  - Griggs County
  - Mountrail County

Technical Assistance

- The Annual North Dakota Emergency Managers Workshop was held on January 24-26, 2006. Meetings at this workshop included many topics including hazard mitigation.
- The Annual North Dakota Emergency Managers Association Workshop was held on September 13-15, 2006. Meetings at this workshop included many topics including hazard mitigation.
- Meetings were held to discuss HMGP with applicants at the same time as the Public Assistance meetings for DR 1621.
  - Met in Fargo on 6/16/2006
- Meetings were held to discuss HMGP with applicants at the same time as the Public Assistance meetings for DR 1645.
  - Met in Grafton on 6/15/2006
  - Met in Fargo on 6/16/2006
- Three floodplain management, flood mapping, and flood insurance training workshops were held. Benefiting groups included community floodplain managers, land surveyors, water resource district members, lenders, realtors, and insurance agents.

- Twelve Community Assistance Visits (CAVs) for the National Flood Insurance Program were conducted. Community development permit records and floodplain development permit procedures were reviewed during these visits.

Mitigation Successes

Grand Forks Acquisition Project

The flood of 1997 was a catastrophic disaster for the State of North Dakota. This disaster caused an estimated $3.7 billion in economic losses. Following the flood, more than 800 flood-damaged structures were acquired through the HMGP and CDBG programs at a cost of approximately $75.7 million. In 2006, a similar magnitude flood (within 2 feet) occurred in the same area; economic losses in North Dakota totaled about $7 million, compared to $3.7 billion in 1997! In just one flood event, the City of Grand Forks had a 107% return on the mitigation investment. An estimated $17.1 million in damages to homes were prevented in Grand Forks during the 2006 flood event.

Details on the process for reviewing progress on implementing mitigation activities can be found in the State of North Dakota Multi-Hazard Mitigation Plan, Section 7.5.8, Project Monitoring and Evaluation.

North Dakota Mitigation Year in Review – 2007

Disasters/Funding
DR 1713: HMGP Federal Share = $501,250
DR 1725: HMGP Federal Share = $23,572
DR 1726: HMGP Federal Share = $1,777,847
PDM-C Grants: Federal Share Awarded = $ 373,091

Projects

- The City of Edgeley Acquisition Project ($126,407) in which 2 properties were acquired was completed as planned on June 30, funded through HMGP (DR 1616). *Linked to 2005 MHMP Goal #2.*
- The City of Souris Grade Raise and Improvement Project ($73,500) was completed as planned on September 30, funded through HMGP (DR 1621). This project consisted of a grade raise and drainage ditch realignment with the replacement of existing culverts with culverts of like size on township roads. *Linked to 2005 MHMP Goal #2.*
- The City of Grafton Acquisition Project ($261,396) in which 4 properties were acquired was completed as planned on December 12, funded through HMGP (DR 1597). *Linked to 2005 MHMP Goal #2.*
- The City of Fargo 23rd Avenue South Storm Sewer Relief Project was completed as planned on December 31, funded through HMGP (DR 1597). This project consisted of the enlargement of an existing storm water retention basin and improvements to the inflow/outflow piping system. *Linked to 2005 MHMP Goal #2.*
- The Pembina County Acquisition Project ($136,177) in which 2 properties were acquired was completed as planned on December 31, funded through HMGP (DR 1597). *Linked to 2005 MHMP Goal #2.*
- Minnkota Transmission Lines Project ($2,015,000) was completed as planned on March 31, funded through PDM-C. *Linked to 2005 MHMP Goal #4.*
- Living Snow Fences were planted across the state through the ND Forest Service program funded by HMGP (DR 1174) and the North Dakota Department of Transportation. The HMGP portion of the project was completed as planned on December 31, but the program will continue with alternate funding sources. *Linked to 2005 MHMP Goal #4.*
- Effective DFIRMs were produced for Barnes and Traill Counties. *Linked to 2005 MHMP Goal #2.*

Note: "Completed as planned" indicates the project was completed within an acceptable time frame, including those projects that received approved extensions, and the extent of the project completed was within the required scope of work. The completion date indicates the conclusion of the physical work; project closeout may have occurred at a later date.

Planning

- Two local multi-hazard mitigation plans were approved by FEMA for:
  - Cavalier County
  - Kidder County

- Meetings were held in Bismarck to discuss the state's Multi-Hazard Mitigation Plan update and enhancement on June 19, 2007 and November 6, 2007.

Technical Assistance

- The Annual North Dakota Emergency Managers Workshop was held on March 28-30, 2007. Meetings at this workshop included many topics including hazard mitigation.
- The Annual North Dakota Emergency Managers Association Workshop was held on September 12-14, 2007. Meetings at this workshop included many topics including hazard mitigation.
- Meetings were held to discuss HMGP with applicants at the same time as the Public Assistance meetings for DR 1713.
  - Met in Lisbon on 7/26/2007
  - Met in Bismarck on 7/27/2007
- Meetings were held to discuss HMGP with applicants at the same time as the Public Assistance meetings for DR 1725.
  - Met in Grand Forks @ Minnkota Power Cooperative Inc. on 9/12/2007
  - Met in Grand Forks @ NoDak Electric Cooperative Inc. on 9/13/2007
  - Met in Kindred on 9/14/2007
- Meetings were held to discuss HMGP with applicants at the same time as the Public Assistance meetings for DR 1726.
  - Met in Northwood on 9/11/2007
- Three floodplain management, flood mapping, and flood insurance training workshops were held. Benefiting groups included community floodplain managers, land surveyors, water resource district members, lenders, realtors, and insurance agents.
- Eleven Community Assistance Visits (CAVs) for the National Flood Insurance Program were conducted. Community development permit records and floodplain development permit procedures were reviewed during these visits.

Mitigation Successes

None identified.

Details on the process for reviewing progress on implementing mitigation activities can be found in the State of North Dakota Multi-Hazard Mitigation Plan, Section 7.5.8, Project Monitoring and Evaluation.

North Dakota Mitigation Year in Review – 2008

Disasters/Funding

PDM-C Grants: Federal Share Awarded = $539,377 (for underground electric lines and mitigation plans)

Projects

- The Pembina County Acquisition Project ($282,600) in which two flood prone properties were acquired was completed as planned on December 31, funded through HMGP (DR 1645). *Linked to 2008 MHMP Goal #4.*
- The Walsh County Acquisition Project ($205,540) in which two flood prone properties were acquired was completed as planned on December 31, funded through HMGP (DR 1645). *Linked to 2008 MHMP Goal #4.*
- Phase I of the Wahpeton Flood Control Project, including interior pumping stations, detention ponds, and other interior flood control features, was completed as planned, funded by the State Water Commission. *Linked to 2008 MHMP Goal #4.*
- Construction was completed as planned on 24 miles of pipeline, four pump stations, and two storage reservoirs that provide water services to Berthold, Minot's South Hill region, and North Prairie Rural Water District in August 2008 by the State Water Commission. *Linked to 2008 MHMP Goal #6.*
- Progress was made in the development of Emergency Action Plans for high hazard dams in the state. *Linked to 2008 MHMP Goals #1 and #4.*
- The federal government purchased NOAA weather radios for schools throughout the state in 2008. *Linked to 2008 MHMP Goal #2.*

Note: "Completed as planned" indicates the project was completed within an acceptable time frame, including those projects that received approved extensions, and the extent of the project completed was within the required scope of work. The completion date indicates the conclusion of the physical work; project closeout may have occurred at a later date.

Planning

- The State of North Dakota Multi-Hazard Mitigation Plan was approved by FEMA on March 18, 2008.
- Two local multi-hazard mitigation plans were approved by FEMA for:
  - Sargent County
  - Ward County

Technical Assistance

- The Annual North Dakota Emergency Managers Workshop was held on February 21, 2008 in Valley City and February 28, 2008 in Dickinson. Meetings at this workshop included many topics including hazard mitigation.
- The Annual North Dakota Emergency Managers Association Workshop was held on September 12, 2008 in Minot. Meetings at this workshop included many topics including hazard mitigation.
- The Department of Emergency Services conducted G318 Preparing and Review Local Plans courses in Bismarck on September 23-24, 2008 and in Fargo on September 25-26, 2008.

- The new Benefit-Cost Analysis course was conducted in Fargo by the Department of Emergency Services on October 9-10, 2008.
- The Department of Emergency Services continued with outreach meetings through the State Flood Coordination Center (Devils Lake Basin), educating and coordinating with city, county, tribal, legislative, and congressional officials regarding mitigation measures, projects, and program opportunities, in addition to providing technical assistance to local and tribal jurisdictions for mitigation plan activity and countless other activities.
- The City of Lincoln joined the National Flood Insurance Program in May 2008.

Mitigation Successes
None identified.

Details on the process for reviewing progress on implementing mitigation activities can be found in the State of North Dakota Multi-Hazard Mitigation Plan, Section 7.5.8, Project Monitoring and Evaluation.

North Dakota Mitigation Year in Review – 2009

Disasters/Funding

DR 1829: HMGP Federal Share = $21,200,000
PDM-C Grants: Federal Share Awarded = $435,109 (for underground electric lines and mitigation plans)
FMA Grants: Federal Share Awarded = $8,945,355 (for 44 acquisitions in Cass County)

Projects

- Pembina County Water Resource Board Emergency Action Plans ($20,000) were completed as planned on March 5, funded through PDM-C. *Linked to 2008 MHMP Goals #1 and #4.*
- Richland County / Dakota Valley Rural Electric Cooperative Project ($196,785) installed 3 miles of underground wire to replace an overhead power line that was destroyed during the November 2005 ice storm was completed as planned on March 7, funded through PDM-C. *Linked to 2008 MHMP Goal #5.*
- Fargo Drain 10 Improvement Project ($1,316,000) was completed as planned on September 30, funded through PDM-C. *Linked to 2008 MHMP Goal #4.*
- Fargo Southside Flood Control Project ($12,626,751), an extensive flood control project, was completed after substantial changes in scope and extensions on December 31, funded through HMGP (DR 1174). *Linked to 2008 MHMP Goal #4.*
- The Grand Forks County Acquisition Project ($62,900) in which one flood prone property was acquired was completed as planned on December 31, funded through HMGP (DR 1645). *Linked to 2008 MHMP Goal #4.*
- The City of Gardner Early Warning System Project ($21,648) was completed as planned on December 31, funded through HMGP (DR 1713). *Linked to 2008 MHMP Goal #5.*
- The City of Northwood Electric Lines Project ($663,322) in which 4 miles of overhead lines were buried was completed as planned on December 31, funded through HMGP (DR 1726). *Linked to 2008 MHMP Goal #5.*
- The Great River Energy Project ($885,862) in which 81 miles of overhead electric lines were reinforced was completed as planned on December 31, funded through HMGP (DR 1726). *Linked to 2008 MHMP Goal #5.*
- Progress was made in the development of Emergency Action Plans for high hazard dams in the state. *Linked to 2008 MHMP Goals #1 and #4.*

Note: "Completed as planned" indicates the project was completed within an acceptable time frame, including those projects that received approved extensions, and the extent of the project completed was within the required scope of work. The completion date indicates the conclusion of the physical work; project closeout may have occurred at a later date.

Planning

- Seven local multi-hazard mitigation plans were approved by FEMA for:
  - Cass County
  - Grand Forks County
  - LaMoure County
  - McIntosh County

- McLean County
- Richland County
- Walsh County

Technical Assistance

- The Annual North Dakota Emergency Managers Workshop was held on June 23-25, 2009 in Dickinson. Meetings at this workshop included many topics including hazard mitigation.
- The Annual North Dakota Emergency Managers Association Workshop was held on September 16-18, 2009 in Dickinson. Meetings at this workshop included many topics including hazard mitigation.
- Meetings were held to discuss HMGP with applicants at the same time as the Public Assistance meetings for DR 1829 in:
    - Bismarck on 5/4/2009
    - Jamestown on 5/6/2009
    - Fargo on 5/6/2009
    - Grand Forks on 5/7/2009
    - Minot on 5/7/2009
    - Carson on 5/8/2009
- The Department of Emergency Services began using the Benefit-Cost Analysis Tool Kit software.
- The Department of Emergency Services conducted a G318: Preparing and Reviewing Local Plans course in Bismarck on June 2-3, 2009.
- The Department of Emergency Services conducted a Benefit-Cost Analysis course in Valley City on June 23-24, 2009.
- Home Acquisition workshops and Individual Mitigation workshops were conducted in 21 jurisdictions by the Department of Emergency Services, State Water Commission, Federal Emergency Management Agency, and local governments on July 14-17, 2009.
- The Department of Emergency Services continued with outreach meetings through the State Flood Coordination Center (Devils Lake Basin), educating and coordinating with city, county, tribal, legislative, and congressional officials regarding mitigation measures, projects, and program opportunities, in addition to providing technical assistance to local and tribal jurisdictions for mitigation plan activity and countless other activities.

Mitigation Successes

Fargo Flood Control and Acquisition Projects

In 2009, the Red River peaked at 40.82 feet at Fargo, approximately the 500 year flood. FEMA conducted a HAZUS, level II, structure-by-structure analysis to calculate the losses avoided due to mitigation measures. Based on this assessment of a 41 foot crest, the estimated economic losses were $1,894,676 (plus about $80 million for flood fighting measures taken); if the flood protection measures failed, the estimated losses were $232,863,548. About $10,751,228 in losses were estimated for the 103 properties in the Fargo region that were acquired through FEMA programs; thus, these were losses directly avoided in the 2009 event. (Federal Emergency Management Agency, 2010g)

Details on the process for reviewing progress on implementing mitigation activities can be found in the State of North Dakota Multi-Hazard Mitigation Plan, Section 7.5.8, Project Monitoring and Evaluation.

North Dakota Mitigation Year in Review – 2010

Disasters/Funding

Note that the disaster funding figures are preliminary numbers and are subject to change.
DR 1879: HMGP Federal Share = $2,324,475
DR 1901: HMGP Federal Share = $3,375,606
DR 1907: HMGP Federal Share = $811,463

Projects

- Richland County / Dakota Valley Electric Cooperative Project ($255,450) in which 4 miles of ice storm damaged overhead three phase power line was replaced with underground power line was completed as planned on June 25, funded through PDMC. *Linked to 2008 MHMP Goal #5.*
- The Cass County Calendar Project ($24,170) which established a calendar using regional resources to promote mitigation measures for citizens and individuals was completed as planned on June 30, funded through HMGP (DR 1645). *Linked to 2008 MHMP Goal #2.*
- The Barnes County Acquisition Project ($920,620) in which 19 flood prone properties were acquired was completed with extensions on June 30, funded through HMGP (DR 1220). *Linked to 2008 MHMP Goal #4.*
- Living Snow Fences ($1,478,060) were planted at over 256 sites across the state through the ND Forest Service program funded by HMGP (DR 1174) and the ND Department of Transportation. The HMGP portion of the project was completed as planned on July 8, but the program will continue with alternate funding sources. *Linked to 2008 MHMP Goal #5.*
- The North Dakota portion of a transportable earthquake monitoring system was completed as planned in July 2010 by the North Dakota Geological Survey and other partners. Although the array will be moved every 24 months, one station will remain in the state permanently. *Linked to 2008 MHMP Goal #2.*
- A Devils Lake Decision Support System website (www.devilslake.noaa.gov) was developed and implemented as planned by the National Oceanic and Atmospheric Administration. *Linked to 2008 MHMP Goal #2.*
- Progress was made in the development of Emergency Action Plans (EAPs) for high hazard dams in the state. In 2010, 66.7% of high hazard dams in the state had EAPs, up from 40% in 2007. *Linked to 2008 MHMP Goals #1 and #4.*

Note: "Completed as planned" indicates the project was completed within an acceptable time frame, including those projects that received approved extensions, and the extent of the project completed was within the required scope of work. The completion date indicates the conclusion of the physical work; project closeout may have occurred at a later date.

Planning

- Fourteen local multi-hazard mitigation plans were approved by FEMA for:
  - Barnes County
  - Bottineau County
  - Burleigh County
  - Emmons County

  - Foster County
  - Hettinger County
  - Logan County
  - Nelson County
  - Pembina County
  - Ramsey County
  - Ransom County
  - Renville County
  - Traill County
  - Williams County
- Meetings were held in Bismarck to discuss the state's Multi-Hazard Mitigation Plan update on March 3, 2010 and November 17, 2010.

Technical Assistance

- The Annual North Dakota Emergency Managers Workshop was held on July 26-28, 2010 in Bismarck. Meetings at this workshop included many topics including hazard mitigation.
- The Annual North Dakota Emergency Managers Association Workshop was held on September 15-17, 2010 in Lake Metigoshe. Meetings at this workshop included many topics including hazard mitigation.
- Meetings were held to discuss HMGP with applicants at the same time as the Public Assistance meetings for DR 1879, DR 1901, and DR 1907 in:
  - Mandan on 5/10/2010
  - Valley City on 5/11/2010
  - Grand Forks on 5/12/2010
  - Devils Lake on 5/13/2010
- The Department of Emergency Services conducted a Benefit-Cost Analysis course in Mandan on July 21-22, 2010.
- The Department of Emergency Services conducted a G318: Preparing and Reviewing Local Plans course for about 35 people in Bismarck on September 21-22, 2010.
- The Department of Emergency Services conducted a L242: Local Mitigation Application Development workshop for about 30 people in Mandan on October 5-7, 2010.
- The Department of Emergency Services continued with outreach meetings through the State Flood Coordination Center (Devils Lake Basin), educating and coordinating with city, county, tribal, legislative, and congressional officials regarding mitigation measures, projects, and program opportunities, in addition to providing technical assistance to local and tribal jurisdictions for mitigation plan activity and countless other activities.
- Since 2007, 196 new jurisdictions now have NFIP policy holders and the number of policies has nearly tripled across the state with 8,131 new policies, likely due to the 2009 flood event.

Mitigation Successes

Fargo Flood Control and Acquisition Projects

In March 2010, the Red River peaked at 36.99 feet at Fargo. FEMA conducted a HAZUS, level II, structure-by-structure analysis to calculate the losses avoided due to mitigation measures. Based on this assessment of a 37 foot crest, the estimated economic losses were $968,919 (plus flood fighting

measures); if the flood protection measures failed, the estimated losses were $2,835,212. About $4,133,934 in losses were estimated for the 103 properties in the Fargo region that were acquired through FEMA programs; thus, these were losses directly avoided in the 2010 event. (Federal Emergency Management Agency, 2010g)

Although not completed yet, mitigation projects, including the acquisition of 20 properties in the Fargo area, are expected to reduce the need for sandbags by almost one million for protection to the same level as 2009, according to the City of Fargo Engineering Department. (INFORUM, 2010)

Details on the process for reviewing progress on implementing mitigation activities can be found in the State of North Dakota Multi-Hazard Mitigation Plan, Section 7.5.8, Project Monitoring and Evaluation.

Appendix K. INTERAGENCY REPORTS

- 1989 North Dakota Hazard Mitigation Plan FEMA-825-DR-ND, January 1990
- Interagency Hazard Mitigation Team Report, 1993 Flood Disaster FEMA-1001-DR-ND, September 1993
- Interagency Hazard Mitigation Team Report, FEMA-1032-DR-ND, no date
- Interagency Hazard Mitigation Team Report, FEMA-1050-DR-ND, June 1995
- Hazard Mitigation Team Strategy Report, FEMA-DR-1118-ND, June 5, 1996
- Interagency Hazard Mitigation Team Report, FEMA-DR-1174-ND, May 14, 1997
- Hazard Mitigation Interagency Team Report, 1220-DR-ND, September 1998
- Interagency Hazard Mitigation Team Report, DR-1279-ND, August 1999
- Hazard Mitigation Strategy Paper, FEMA 1376-DR-ND, December 26, 2001
- Hazard Mitigation Strategy Paper, FEMA 1431-DR-ND, October 28, 2002

Appendix L. LOCAL AND TRIBAL MITIGATION PLANS

County/Tribe	Approval Date
Adams	3/30/2005
Barnes	6/10/2010
Billings	11/26/2003
Bottineau	7/9/2010
Bowman	1/9/2007
Burke	12/17/2007
Burleigh	3/8/2010
Cass	1/14/2009
Cavalier	1/10/2007
Dickey	6/21/2004
Dunn	11/18/2003
Eddy	12/15/2005
Emmons	2/16/2010
Foster	9/30/2010
Golden Valley	10/23/2003
Grand Forks	6/26/2009
Grant	11/28/2003
Griggs	1/13/2006
Hettinger	11/1/2010
Kidder	4/10/2007
LaMoure	12/2/2009
Logan	6/10/2010
McHenry	pending

County/Tribe	Approval Date
McIntosh	11/20/2009
McLean	8/24/2009
Mercer	pending
Morton	10/30/2003
Mountrail	4/26/2006
Nelson	4/23/2010
Oliver	10/22/2003
Pembina	6/11/2010
Pierce	10/23/2003
Ramsey	3/10/2010
Ransom	3/30/2010
Renville	9/24/2010
Richland	11/5/2009
Rolette	pending
Sargent	11/20/2008
Stutsman	pending
Towner	pending
Traill	9/24/2010
Walsh	11/5/2009
Ward	9/10/2008
Wells	10/7/2003
Williams	6/21/2010

Appendix M. FEDERAL EMERGENCY MANAGEMENT AGENCY CROSSWALKS

State of
North Dakota
Office of the Governor

Jack Dalrymple
Governor

March 1, 2011

Robin Finegan
Regional Administrator
Federal Management Agency, Region VIII
Denver Federal Center, Building 710
PO Box 25267
Denver, CO 80255-0267

Dear Administrator Finegan;

The State of North Dakota's Multi-Hazard Mitigation Plan meets the requirements of the Disaster Mitigation Act of 2000 (DMA2K), Section 322. Section 322 of the Act requires States, as a condition of receiving federal disaster mitigation funds, have a mitigation plan in place which describes the planning process for identifying hazards, risk and vulnerabilities, identifies and prioritizes mitigation actions, encourages the development of local mitigation and provides technical support for these efforts.

The State of North Dakota assures it will continue to comply with all applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44CFR, Part 13.11(c). The State will amend the plan whenever necessary to reflect changes in the state or federal laws and statutes as required in 44CFR, Part 13.11(d). The adoption of this plan demonstrates the State of North Dakota's commitment to fulfilling the mitigation objectives outlined in the Plan and authorize the responsible agencies identified in the Plan to execute their responsibilities.

With the submission of the 2011 North Dakota Multi-Hazard Mitigation Plan, the Plan is hereby adopted by the State of North Dakota under the executive powers of the Governor.

Sincerely,

Jack Dalrymple

Jack Dalrymple
Governor

37:68:56

600 E Boulevard Ave • Bismarck, ND 58505-0001 • Phone: 701.328.2200 • Fax: 701.328.2205 • www.nd.gov