



# LOGAN COUNTY

## MULTI-JURISDICTIONAL ALL HAZARD PRE-DISASTER MITIGATION PLAN

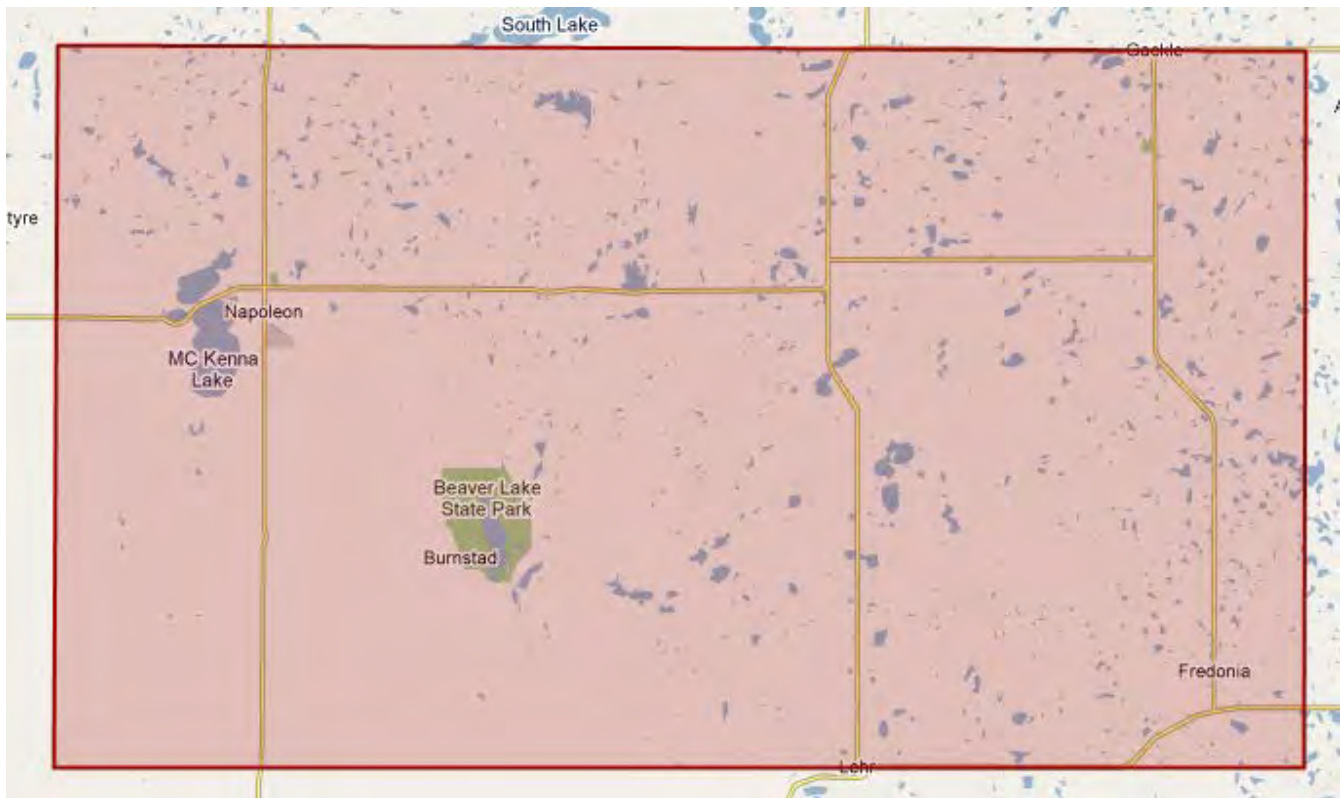


March 2010



# Logan County Multi-Jurisdictional All Hazard Pre-Disaster Mitigation Plan

March 2010



**Executive Summary:** The Logan County Multi Hazard Mitigation Plan was initially reviewed and discussed with the planning team to determine the status of the prior plan and what changes would need to be met to meet the current crosswalk guidelines. According to the findings it was agreed upon that the plan as a whole needed to be reformatted to be comparable to the North Dakota State plan and to make the changes to the different hazards included in the state plan due to changes they made to the hazards identified for North Dakota (i.e. Mass Casualty is now Transportation Accidents).

The initial plan was lacking information that was required for approval, which would apply to all sections of the plan.

Each section of the plan has been updated to include disaster information since the previous approval in 2003. It is understood by the planning team that this plan will need to be reviewed on a yearly basis with the possibility of becoming part of a regionalized plan in the next five years.

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

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

A summary of each section was added after the final planning meeting on July 9<sup>th</sup>, 2009.

**Logan County  
Multi-Jurisdictional All Hazard  
Pre-Disaster Mitigation Plan**

March 2010

Adoption by Local Governing Body: §201.6(c)(5)  
County of Logan

**LOGAN COUNTY**

**RESOLUTION**

By Virtue of the Authority vested in the Board of County Commissioners, We do hereby Order that the Logan County Multi-Hazard Mitigation Plan be adopted as part of its Long-Term Recovery Strategy which Promotes and Post Disaster Mitigation measures (E.G., Hazards involving Floods, Winter storms, Summer Storms, Hazardous Materials, Urban and Rural Fires, Drought, and Dam Failures) The overall intent of this plan to identify opportunities to reduce the impact of future Disaster at emergencies.



Attest: *Deanne R. Schumacher*  
County Auditor

Signed: *[Signature]*  
Chairman  
County Commission

*Steve C. [Signature]*  
Emergency Manager

Received 02-03-09  
LOGAN COUNTY SHERIFF  
Napoleon, North Dakota 58561  
Date \_\_\_\_\_ Time \_\_\_\_\_  
Served [Signature] Returned \_\_\_\_\_

Received 12-07-2000  
LOGAN COUNTY SHERIFF  
Napoleon, North Dakota 58561  
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Logan County  
Multi-Jurisdictional All Hazard  
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**COUNTY MULTI-HAZARD MITIGATION PLAN  
RESOLUTION**

WHEREAS, Logan County has adopted the Logan County Multi-Hazard Mitigation Plan that attempts to reduce natural, man-made or technological disasters that may occur; and

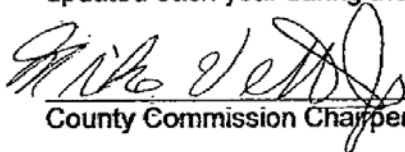
WHEREAS, the purpose of the County Multi-County Hazard Mitigation Plan is to provide a means to minimize damages caused by hazards that affect the lives and property of county residents; and

WHEREAS, each jurisdiction in the county has been provided the opportunity to participate and contribute to the development and adoption of the County Multi-Hazard Mitigation Plan; and

WHEREAS, the County Multi-Hazard Mitigation Plan was prepared and reviewed by all participating jurisdictions in Logan County; and

WHEREAS, public meetings were held to introduce the concept of Multi-Hazard Mitigation Planning to the general public and to solicit input regarding the components of the Multi-Hazard Mitigation Plan.

NOW THEREFORE BE IT RESOLVED, that the County of Logan has adopted the Logan County Multi-Hazard Mitigation Plan to be evaluated and updated each year during the month of March.

  
County Commission Chairperson

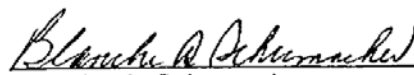
  
County Auditor

State of North Dakota)

: ss.

County of Logan )

I, Blanche A. Schumacher, Auditor of the County of Logan, do hereby certify that the foregoing Resolution was duly adopted by the Logan County Board of Commissioners at a Regular Meeting held on May 6, 2003, and is on file in the records of this office.

  
Blanche A. Schumacher,  
Logan County Auditor

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Adoption by Local Governing Body: §201.6(c)(5)  
City of Fredonia

**CITY MULTI-HAZARD MITIGATION PLAN  
RESOLUTION**

WHEREAS, the City of Fredonia has adopted the Logan County Multi-Hazard Mitigation Plan that attempts to reduce natural, man-made or technological disasters that may occur; and

WHEREAS, the purpose of the County Multi-County Hazard Mitigation Plan is to provide a means to minimize damages caused by hazards that affect the lives and property of city residents; and

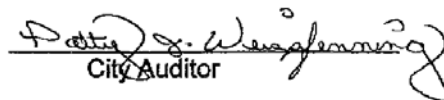
WHEREAS, each city department has been provided the opportunity to participate and contribute to the development and adoption of the County Multi-Hazard Mitigation Plan; and

WHEREAS, the County Multi-Hazard Mitigation Plan was prepared and reviewed by all interested public and private entities of the City of Fredonia; and

WHEREAS, public meetings were held to introduce the concept of County Multi-Hazard Mitigation Planning to the general public and to solicit input regarding the components of the County Multi-Hazard Mitigation Plan.

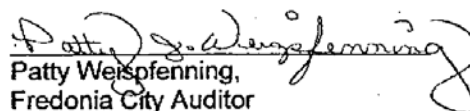
NOW THEREFORE BE IT RESOLVED, that the City of Fredonia has adopted the Logan County Multi-Hazard Mitigation Plan to be evaluated and updated each year during the month of March.

  
City Council Chairperson

  
City Auditor

State of North Dakota)  
: ss.  
City of Fredonia )

I, Patty Weisfenning, City Auditor of Fredonia, North Dakota, do hereby certify that the foregoing Resolution was duly adopted by the Fredonia City Council at the regular meeting held on March 2, 2003, and is on file in the records of this office.

  
Patty Weisfenning,  
Fredonia City Auditor

Logan County  
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Adoption by Local Governing Body: §201.6(c)(5)  
City of Gackle

**CITY MULTI-HAZARD MITIGATION PLAN  
RESOLUTION**

WHEREAS, the City of Gackle has adopted the Logan County Multi-Hazard Mitigation Plan that attempts to reduce natural, man-made or technological disasters that may occur; and

WHEREAS, the purpose of the County Multi-County Hazard Mitigation Plan is to provide a means to minimize damages caused by hazards that affect the lives and property of city residents; and

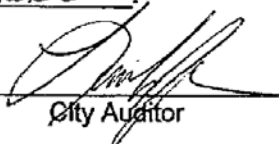
WHEREAS, each city department has been provided the opportunity to participate and contribute to the development and adoption of the County Multi-Hazard Mitigation Plan; and

WHEREAS, the County Multi-Hazard Mitigation Plan was prepared and reviewed by all interested public and private entities of the City of Gackle; and

WHEREAS, public meetings were held to introduce the concept of County Multi-Hazard Mitigation Planning to the general public and to solicit input regarding the components of the County Multi-Hazard Mitigation Plan.

NOW THEREFORE BE IT RESOLVED, that the City of Gackle has adopted the Logan County Multi-Hazard Mitigation Plan to be evaluated and updated each year during the month of March.

  
\_\_\_\_\_  
City Council Chairperson

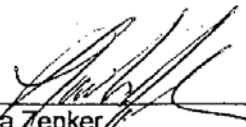
  
\_\_\_\_\_  
City Auditor

State of North Dakota)

: ss.

City of Gackle )

I, Linda Zenker, City Auditor of Gackle, North Dakota, do hereby certify that the foregoing Resolution was duly adopted by the Gackle City Council at the regular meeting held on March 10, 2003, and is on file in the records of this office.

  
\_\_\_\_\_  
Linda Zenker  
Gackle City Auditor

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Adoption by Local Governing Body: §201.6(c)(5)  
City of Lehr

**CITY MULTI-HAZARD MITIGATION PLAN  
RESOLUTION**

WHEREAS, the City of Lehr (within Logan County) has adopted the Logan County Multi-Hazard Mitigation Plan that attempts to reduce natural, man-made or technological disasters that may occur; and

WHEREAS, the purpose of the County Multi-County Hazard Mitigation Plan is to provide a means to minimize damages caused by hazards that affect the lives and property of city residents; and

WHEREAS, each city department has been provided the opportunity to participate and contribute to the development and adoption of the County Multi-Hazard Mitigation Plan; and

WHEREAS, the County Multi-Hazard Mitigation Plan was prepared and reviewed by all interested public and private entities of the City of Lehr (within Logan County); and

WHEREAS, public meetings were held to introduce the concept of County Multi-Hazard Mitigation Planning to the general public and to solicit input regarding the components of the County Multi-Hazard Mitigation Plan.

NOW THEREFORE BE IT RESOLVED, that the City of Lehr (within Logan County) has adopted the Logan County Multi-Hazard Mitigation Plan to be evaluated and updated each year during the month of March.

Clayton Nagel - Mayor  
City Council Chairperson

Arbadella Fiechtner  
City Auditor

State of North Dakota)  
  : ss.  
City of Lehr                    )

I, Arbadella Fiechtner, City Auditor of Lehr, North Dakota, do hereby certify that the foregoing Resolution was duly adopted by the Lehr City Council at the regular meeting held on March 3, 2003, and is on file in the records of this office.

Arbadella Fiechtner  
Arbadella Fiechtner,  
Gaekle City Auditor  
Lehr



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March 2010

Adoption by Local Governing Body: §201.6(c)(5)  
City of Napoleon

**CITY MULTI-HAZARD MITIGATION PLAN  
RESOLUTION**

WHEREAS, the City of Napoleon has adopted the Logan County Multi-Hazard Mitigation Plan that attempts to reduce natural, man-made or technological disasters that may occur; and

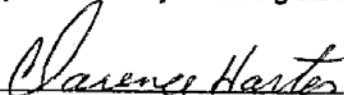
WHEREAS, the purpose of the County Multi-County Hazard Mitigation Plan is to provide a means to minimize damages caused by hazards that affect the lives and property of city residents; and

WHEREAS, each city department has been provided the opportunity to participate and contribute to the development and adoption of the County Multi-Hazard Mitigation Plan; and

WHEREAS, the County Multi-Hazard Mitigation Plan was prepared and reviewed by all interested public and private entities of the City of Napoleon; and

WHEREAS, public meetings were held to introduce the concept of County Multi-Hazard Mitigation Planning to the general public and to solicit input regarding the components of the County Multi-Hazard Mitigation Plan.


NOW THEREFORE BE IT RESOLVED, that the City of Napoleon has adopted the Logan County Multi-Hazard Mitigation Plan to be evaluated and updated each year during the month of February.

  
\_\_\_\_\_  
Clarence Harter  
City Council Chairperson

  
\_\_\_\_\_  
Lucille F. Schloss  
City Auditor

State of North Dakota)  
  : ss.  
City of Napoleon            )

I, Lucille F. Schloss, City Auditor of Napoleon, North Dakota, do hereby certify that the foregoing Resolution was duly adopted by the Napoleon City Council at the regular meeting held on March 3, 2003, and is on file in the records of this office.

  
\_\_\_\_\_  
Lucille F. Schloss,  
Napoleon City Auditor

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The MHMP from 2003 has been reformatted from three parts with appendices to combining the sections into seven identified sections in this update. The plan overall was reviewed by the planning team using the 2003 approved plan to determine that all sections of the plan needed to be addressed and changes made to meet the criteria of the new crosswalk guidelines.

After review of the previous MHMP the jurisdictions were determined as the same and will continue to participate in the plan update.

The goals from the previous Multi Hazard Mitigation Plan were re-evaluated and have changed to reflect the goals of the North Dakota State Multi Hazard Mitigation Plan.

This section was updated to contain to explain the purpose of the MHMP and how it affects each jurisdiction. This section was reviewed at a public meeting on July 9<sup>th</sup>, 2009 the results were favorable and no changes were requested and no comments were given. The planning team agreed to make no additional changes to the plan by majority vote.

**1. Purpose / Vision / Values**

**Purpose of MHMP**

Logan County and the participating Logan County jurisdictions of the City of Fredonia, City of Gackle, the City of Lehr, and the City of Napoleon have developed this Multi-Jurisdictional All Hazard Pre-Disaster Mitigation Plan (MHMP) to create a safer community. This MHMP is the representation of the commitment of the County and participating jurisdictions to reduce risks from natural and other hazards, and serves as a guide for decision-makers as they commit resources to reducing the effects of natural and other hazards. This MHMP serves as a basis for the North Dakota Department of Emergency Services (ND DES) to provide technical assistance and to prioritize project funding. (See IFR §201.6).

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

Unless otherwise specified, reference throughout this Plan to the MHMP or Logan County includes Logan County and the cities of Fredonia, Gackle, Lehr, and Napoleon. The jurisdictions have remained the same as the previous Multi Hazard Mitigation Plan and will continue to participate throughout the five years.

The County of Logan is required to adopt a federally-approved Hazard Mitigation Plan to be eligible for certain disaster assistance and mitigation funding. The purpose of this Multi-Hazard Mitigation Plan is to fulfill federal, state, and local hazard mitigation responsibilities; promote pre and post disaster mitigation measures, short and long range strategies that minimize suffering, loss of life, and damage to property resulting from hazardous or potentially hazardous conditions to which citizens and institutions within the county are exposed; eliminate or minimize conditions that would have an undesirable impact on the citizens, economy, environment, and well being of the county; serve as a consolidated, comprehensive source of hazard information; educate the

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communities, including government leaders and the public, on their vulnerabilities; prioritize and promote cost-effective mitigation solutions; support requests for grant funding; and encourage long-term community sustainability.

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

\*Source: State of North Dakota Enhanced Multi-Hazard Mitigation Plan

The Plan is a living document that will be reviewed and updated annually to reflect changing conditions and improvements by new information, especially information on local planning activities. The Multi-Jurisdictional Hazard Mitigation Plan is written to meet the statutory requirements of DMA 2000 (P.L. 106-390), enacted October 30, 2000 and 44 CFR Part 201 – Mitigation Planning, Interim Final Rule, published February 26, 2002. Once the Multi Hazard Mitigation Plan has been approved by FEMA the plan will remain approved pending adoption. The county and participating incorporated jurisdictions will sign new resolutions to approve the document and send them to North Dakota Department of Emergency Services for an approval date of the plan.

**Goals for Logan County's Multi-Hazard Mitigation Plan**

Logan County's MHMP supports the following goals:

- Goal 1: Save Lives and Reduce Injuries
- Goal 2: Avoid Damages to Property
- Goal 3: Protect the Environment
- Goal 4: Promote Hazard Mitigation as an Integrated Policy

The goals from the previous Multi Hazard Mitigation Plan were re-evaluated and have changed to goals that will address all hazards that affect the county, and will remain the same until the plan is updated in five years.

**Support of Broader County Vision**

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

**Mission**

Provide quality service with dignity, integrity and respect.

**Vision**

To ensure basic health, safety, and protection of people.

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To facilitate commerce and trade in order to promote a high quality of life.  
To promptly resolve issues in an honest and consistent manner.  
To provide useful and effective service utilizing both public and private means.

**Values**

*Fiscal Responsibility*

We respect our obligation to the taxpayer and shall act in a fiscally responsible manner.

*Pride In Service*

We take pride in our mission, our organization, and the unique abilities of each individual employee to deliver quality service.

*Integrity/Ethics*

We shall conduct our business through honest and direct communication with integrity, trust, and a high standard of ethics and respect.

*Decisive Leadership and Accountability*

We value initiative and leadership, and are accountable for our performance.

*Innovation*

We encourage innovative programs to increase efficiency and streamline operations.

*Working Together*

We encourage partnerships and cooperative agreements which enhance our ability to accomplish our mission.

This section was updated to contain to explain the planning process of the MHMP and how each jurisdiction participated in the process. Additions to the planning process were tables of how process was completed, dates of meetings that took place, specific bullet points of what was to be completed, resource capabilities, and to make the necessary changes to the planning team were it was decided by majority vote to complete. This section was reviewed at a public

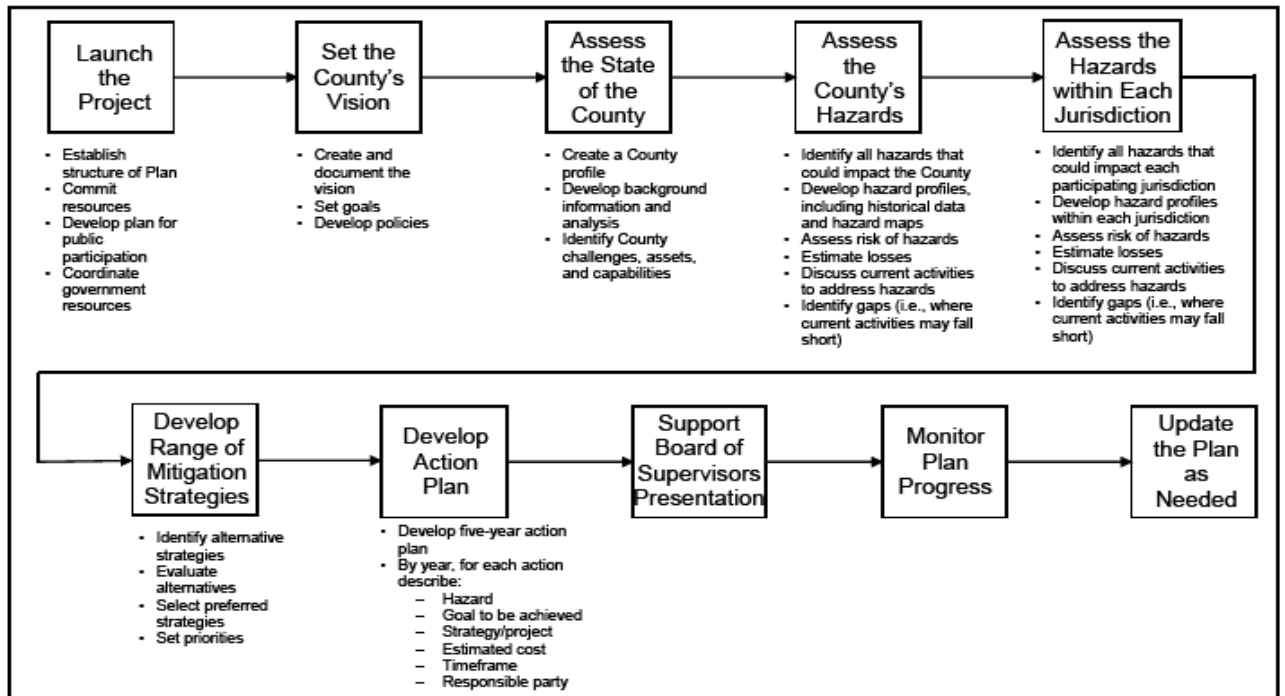
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**2. The Planning Process**

Logan County Department of Emergency Management is responsible for the development of the MHMP. The County Department of Emergency Management hired a consultant, Nick of Time, LLC, to assist in the preparation of the Plan. Logan County and the cities of Fredonia, Gackle, Lehr, and Napoleon utilized a community effort for planning to design an effective mitigation plan. The input from a variety of stakeholders that will be part of the disaster recovery were involved in the process, these include elected officials, first responders, emergency management, health care providers, public works, road departments, businesses, and the public.

2.1 The planning process utilized by Logan County is depicted in the following figure.



Following the County Board of Supervisors' approval of the project, *Nick of Time, LLC* was retained to assist in the development of the MHMP. The effort was launched in October 2008 in a meeting of the Planning Team to have *Nick of Time, LLC* complete the mitigation process that had previously been on going. The Planning Team has participated actively in the MHMP's



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development, meetings have been conducted throughout the process to review draft documents and assess progress on the plan.

In addition to numerous meetings of the stakeholders group and the general steps shown in the diagram above, throughout the process of developing the MHMP, numerous activities were continuously undertaken in the County and within each city to solicit public input. This was done through e-mail postings, newspaper announcements, and general community meetings. Public comments and input included neighboring communities, agencies, and other interested parties. The typical agenda for this interactive information sharing and input gathering sessions with the public included:

An overview of the MHMP purpose and process, a broad overview of the Draft Plan as it stood at that time, a detailed interactive discussion of each hazard, solicitation of all comments, and an interactive discussion of the next steps.

Early on in the planning process Logan County Department of Emergency Management determined that mitigation strategy development would be enhanced by inviting other stakeholders to participate in the planning process. Representatives from key agencies were offered the opportunity to provide comments and/or participate in the planning process and their appropriate responses were integrated into the final draft of the plan. Logan County participants provided project worksheets and attended meetings. Sign in sheets are provided as attachments of those that attended.

The following table identifies key agencies/entities that were provided the opportunity to provide comments and/or participate in the planning process, whether they participated, how they were contacted, and what their contributions were. All projects and contact information is included in the attachments.

**2.2 Logan County Key Agencies Participation and Contribution**

<b>Agency/Entity Contacted</b>	<b>How was the Agency/Entity asked to participate</b>	<b>Did the Agency/Entity Participate</b>	<b>What was/were the Agency/Entity's contributions to the plan update</b>
North Dakota Department of Emergency Services	Requested a copy of the North Dakota State Hazard Mitigation Plan	Yes	DES provided a copy of the plan for review. The planning team agreed to utilize information from the plan to make changes to the hazards and goals.
National Weather Service	Requested verification of the weather events for hazards	Yes	NWS confirmed information was verified and added to the hazards in the plan.
North Dakota Department of Health Division of Disease Control	Requested history of all reported cases of illnesses applicable to the communicable disease hazard	Yes	Kirby Krueger provided specific information for the county reported cases to be added to the hazard.
North Dakota Department of Health Division of Waste Management (Scott Radig)	Requested Hazardous Materials Release Report showing all reported spills for the last 5 years	Yes	Scott Radig provided a report showing data for the county as far back as his database would allow. The report was added to the hazard.
North Dakota State Water Commission	Requested water retention and reported loss information for the	Yes	Provided information for larger dams and EAP's No information from them was

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	county		received regarding the loss report.
Logan County Public Information Officer Connie Olson	Contacted to request county public awareness information and projects	Yes	Provided information for projects for county public awareness
Logan County Public Health Jean Johnson	Requested information regarding projects for communicable disease	Yes	Provided information for projects for public health
Logan County NDSU Extension Office Sheldon Gerhardt	Requested information for county projects for communicable disease for animals and crops	Yes	Verified information for hazard definition of incidents provided by the Health Dept.
Logan County Highway Department Marvin Lang	Requested information for county road projects	Yes	Provided information for projects for county roads and streets for flooding
Regional Health District from Jamestown	Requested regional information for health hazards	No	No additional information was provided was received from local health unit

The County has begun a comprehensive update to the General Plan. This will include updating all of the elements, preparation of an environmental impact report and zoning ordinance. The MHMP will serve as an important resource in the General Plan update process. The Emergency Manager is involved with the General Plan updates.

Logan County has also completed a Hazardous Materials Response Plan to provide guidance to agencies and the public responsible for and interested in protecting life, property, and livestock.

Existing plans in Logan County include the HazMat Plan, the Mass Evacuation and Shelter in Place Plan, the Zoning Ordinance from 2006 and the Local Emergency Operations Plan (the LEOP will be updated in 2011). The process to be implemented for incorporating existing plans into the MHMP would include the County Commissioners holding a meeting to set up a committee to review the above existing plans and reference sections of the plans pertaining to mitigation within the MHMP. In Logan County zoning board members will be the committee to review zoning ordinances and reference sections pertaining to the MHMP.

Logan County utilized the 2003 Multi-Hazard Mitigation Plan as a guideline for support and development in the completion of their Hazardous Materials Response Plan, references and updates have been added to the plan for federal grant programs such as the Assistance to Firefighters Grant Program. Logan County also utilized the 2003 MHMP to develop a evacuation, sheltering, and mass care plans. With the lack of economic, land use, residential, or commercial development in the county, it has not been a key element when discussing comprehensive community plans. Much of the information contained in the 2003 Plan was developed based upon federal criteria and available information. Therefore, its overall use has been limited due to a lack of relevance to the needs of local government, Logan County's proposed projects, and/or availability of project funding. The county has pursued mitigation efforts mostly through their own initiatives. Logan County discusses mitigation activities during exercises, emergency operations planning activities, and during actual incidents. This, however, does not diminish the recognized need for the county to utilize federal programs for support for projects as identified in the current mitigation planning efforts.

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Logan County includes 4 incorporated Cities: Fredonia, Gackle, Lehr, and Napoleon. The plans for Logan County and the other plans form the foundation for this integrated multi-hazard mitigation plan. The following government jurisdictions have adopted this plan by the official method of approval based upon their legal authority.

Logan County Department of Emergency Management formed a Planning Team by inviting representatives from all participating jurisdictions to attend meetings pertaining to the plan:

Logan County Emergency Management  
Cities of Fredonia, Gackle, Lehr, and Napoleon  
    Mayors' Offices  
    Auditors' Offices  
    City Shops  
Logan County Commissioners  
Logan County Highway Department  
Central Valley District Health Unit  
Logan County Sheriff's Department  
Fredonia Fire Protection District  
Gackle Fire Protection District  
Lehr Rural Fire Department  
Napoleon Fire Protection District  
Logan County Extension Service  
Napoleon City Police Department  
Logan County Public Health  
Napoleon County Ambulance  
Gackle Ambulance

Organizations within Logan County that are eligible for future Hazard Mitigation Grant Programs or Pre Disaster Mitigation Grant Programs have participated in the planning process or have been sponsored by an organization that has done so. Currently, Logan County is submitting as a multiple jurisdiction. Proof of adoption will be kept under corresponding jurisdiction's records management program (Resolutions are in Attachments Section). Resolutions of adoption that are not current will be provided once the Logan County MHMP has been approved by FEMA Region VIII. Since the previous plan approval the Emergency Manager personal has changed from Steve Englehardt to Cindy Doll. The previous Emergency Manager participated in the update of the MHMP.

**2008**

Memo inviting Cities and mitigation team to initial planning meeting.

September 30: Kick off meeting for County Risk Assessment and review previous Mitigation plan to be updated.

November 20: Convening meeting for planning team

**2009**

April-May Meetings with cities to discuss mitigation actions on a individual basis. Met with cities and fire departments to discuss mitigation actions.

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July: Memo to Cities requesting review and approval of County Risk Assessment and Mitigation Plan update, relative to each City.

July 9: Final Meeting to review all sections of MHMP and prioritize projects

**2.3 Planning Team Tasks Chart**

<b>Title</b>	<b>Agency</b>	<b>Tasks assigned/completed</b>
Councilman Athena Dunn	Napoleon	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Emergency Manager	Logan County – Cindy Doll Previous Emergency Manager - Steve Englehardt	<input type="checkbox"/> Facilitated meeting <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed plan updates <input type="checkbox"/> Collected information
Representative Sheldon Gerhardt	Logan County NDSU	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Nurse Jean Johnson	Logan County Public Health	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Representative	Regional Health	<input type="checkbox"/> Participated in planning meetings
Mayor Kyle Haas Ritchie Jacobson	City of Napoleon, Lehr, Gackle, Fredonia	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Fire Department Marvin Lang Ardell Schmidt	Cities of Napoleon, Gackle	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Commissioner Dean Entzminger	Nelson County	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Ambulance Debbie Sperle James Owen	City of Napoleon and Gackle	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Sheriff Steve Englehardt	Logan County	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Auditor Blanche Schumacher	City of Logan	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Emergency Planner Logan County	Logan County	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates

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Terry Schwartzberg		<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Township Representative Chuck Fettig	Redlake Township	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections
Representative Rod Kleppe Lucy Schlan	City of Napoleon	<input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Reviewed Plan updates <input type="checkbox"/> Participated in planning meetings <input type="checkbox"/> Participated in final meeting of all sections

This team includes representatives from several communities and agencies within Logan County. In addition to the jobs listed, each person reviewed the plan and offered comments. Most of the participants attended the meetings and participated in discussions at public meetings and email.

Information from existing plans, studies, reports, and technical information related to hazards, mitigation, and community planning was gathered by Nick of Time, LLC by contacting individuals throughout the planning process and reviewing the 2003 plan. Background information for the plan was collected from state reports, plans, and studies. Information from each resource is sourced below each section.

To validate potential mitigation options and to coordinate outcome from the Plan with existing mitigation strategies and plans, the Planning Team reviewed hazard studies, emergency planning reports and other information currently covering prioritized hazards within Logan County. Each section of the plan was addressed if changes were applicable from the previously approved plan. The plan was available for review at the Logan County Emergency Management Office where it was updated as needed by the coordinator. Each participating jurisdiction utilized the plan if an event would occur and update the plan with the information regarding the event and possible mitigation actions.

The five year update of the plan featured a complete overhaul of all sections to improve readability, usability, and methodologies. Specifically, the following major changes were part of the plan's update:

- Addition of an executive summary.
- Development of a new plan layout and table of contents.
- A complete review of the 2003 plan; extraneous information was removed or placed in the appropriate new section.
- Geographic Information System (GIS) mapping will be added as completed, currently the county is working on this project.
- The planning process was updated to include the five-year revision.
- The risk assessment methodology was modified to evaluate hazards on the structure and parcel scale to better estimate losses.
- A hazard identification section was added.
- New hazards were identified and others were modified.
- Sections specific to critical facilities and infrastructure, the population, structures, and economic, ecologic, historic, and social values were added.
- Evaluations of current land use, new development, and future development were added and updated.

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- More detail was added to each hazard profile, including updated and more detailed descriptions, histories, probabilities, magnitudes, maps, vulnerabilities, data limitations, and other factors.
- Mitigation activities were consolidated into a mitigation strategy section.
- Mitigation goals and strategies were focused on mitigation and on preparedness and response.
- Mitigation objectives were added.
- New mitigation strategies and concepts were added and completed projects were reviewed and lessons learned provided.
- The projects were prioritized based on estimated costs and benefits.
- Goal timeframes were reviewed, coordinating agencies/partners and added resources were included.
- A funding sources section was added.
- Details regarding the county and community planning and resource capabilities were added.
- The plan maintenance procedures were updated with an emphasis on annual reviews.
- Appendices were added.

**Risk Assessment Methodologies**

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

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

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

Critical facilities and infrastructure will be mapped by Logan County utilizing the county GIS program. The mapping shows the proximity of facilities for each identified hazard throughout the plan.

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

**2.4 Local Capabilities Assessment**

This section list the County’s and participating jurisdiction’s strategy to utilized resources to achieve goals of reducing losses from future hazard events.

<b>Administrative and Technical Capability</b>	
<b>Human Resources</b>	<b>Department/Agency</b>
Emergency Managers	Department of Emergency Services County Managers City Managers Fire Departments Police Departments Department Heads
Planner(s) or Engineers(s) with knowledge of land development, land management practices, construction practices related to buildings and/or infrastructure	Development Services Departments Public Works, Land Development

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Floodplain Managers	Watershed Groups
GIS Expertise	GIS Mapping Products and Services
Grant Writers	Sub Contractors, County Emergency Manager, City Auditors Office

**Logan County Fire/Ambulance Resource List**

RESOURCE NAME	DESCRIPTION	QUANTITY	OWNER
AMBULANCE	1990 FORD	1	GACKLE CITY
PUMPER	1979 FORD FMC 850 GAL 850 GPM	1	GACKLE FIRE DEPT
TANKER	1982 GMC 2400 GAL	1	GACKLE FIRE DEPT
PUMPER	1973 DODGE 850 GAL 750GPM	1	GACKLE FIRE DEPT
BRUSH RIG	1990 CHEVY 3500 300 GAL, PUMP	1	GACKLE FIRE DEPT
AMBULANCE	2005 FORD CUTAWAY E450 SUPER DUTY	1	NAPOLEON AMBULANCE SERVICE
PUMPER	1982 F800 FORD,800 GAL,750 GPM,2000'2.5"HOSE,1000' 1.5"HOSE,400' 1"HOSE,P6	1	NAPOLEON FIRE DEPT
TANKER	2005 STERLING ACTERRA TANDEM 3500 GAL 250 GPM	1	NAPOLEON FIRE DEPT
BRUSH RIG	1996 GMC 3500 CREW CAB, 250 GAL,225 GPM	1	NAPOLEON FIRE DEPT
BRUSH RIG	1993 CHEV EXCAB, 300 GAL, 275 GPM	1	NAPOLEON FIRE DEPT
BRUSH RIG	1991 CHEV REG CAB, 225 GAL, 175 GPM	1	NAPOLEON FIRE DEPT
DUMP TRUCK	1984 INTERNL 3T SINGLE AXLE 6CY	1	CITY OF NAPOLEON
WHEEL LDR-M	2004 JD 544J 3YD 175 HP PAYLOADER	1	CITY OF NAPOLEON
WHEEL LDR-SM	1995 JD 544G 2.5CY 115HP PAYLOADER	1	LOGAN COUNTY
WHEEL LDR-SM	1995 JD 544G 2.5CY 115HP PAYLOADER	1	LOGAN COUNTY
WHEEL LDR-SM	1995 JD 544G 2.5CY 115HP PAYLOADER	1	LOGAN COUNTY
BACKHOE LDR	CASE 580 SUPER E 4T-390	1	LOGAN COUNTY
DUMP TRUCK	1981 INT 3.5 T SINGLE AXLE 6CY	1	LOGAN COUNTY
DUMP TRUCK	1972 FORD 2.5 T TANDEM 12CY	1	LOGAN COUNTY
DUMP TRUCK	1978 GMC 3.5 T TANDEM 12CY	1	LOGAN COUNTY
DUMP TRUCK	1983 CHEV 3.5T SINGLE AXLE 6CY	1	LOGAN COUNTY
TRAILER	1964 WISCONSIN G-NECK TILT-BED 30'	1	LOGAN COUNTY
TRACK DOZER	1970 D7F CAT TRACK-TYPE 180 HP	1	LOGAN COUNTY
TRACK DOZER	1969 D7E CAT TRACK-TYPE 160 HP	1	LOGAN COUNTY
**NOTE: GACKLE CITY AND FREDONIA CITY – NO TYPEABLE RESOURCES			

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For the County Community Profile section information for population, climate, economy, transportation systems, recreation areas, historical sites, and land use and development trends were updated to have current information. The updated information was reviewed by the planning team and they were interested in the references utilized to find the information they were not familiar with some of the resources used. After reviewing the changes added to the section the planning team agreed to accept the changes by a majority vote.

## 3. County Community Profiles

### Logan County

Logan County is located in the south east portion of North Dakota. Logan County is 1,011 square miles making it the 38<sup>th</sup> largest county in the state. It is 24 miles from north to south and 42 miles from east to west. Logan County is bordered by Stutsman and Kidder Counties on the north, Emmons County on the west, McIntosh and Emmons Counties on the south and LaMoure County on the east. Napoleon is the county seat and incorporated towns include Fredonia, Gackle, Lehr, and Napoleon. Beaver Creek is the principal drainage system in Logan County. *Table 3.1* presents a location map of the Plan area.



**Table 3.1**

According to the 2000 census, the population of Logan County is 2,308. This represents a 16.1% decline in population utilizing the 2008 estimate in population. The median age in Logan County is 46.4 years old (U.S. Bureau of the Census, 2000 in DO1, 2002).



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**3.2 Logan County City Populations**

<b>Town</b>	<b>Population</b>	<b>Town</b>	<b>Population</b>
Fredonia	66	Gackle	450
Lehr	44	Napoleon	930

**Climate**

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

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

**Summary**

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

**Seasonally Average Expectations**

Though no single year is likely to have “average” weather through its entire course of seasons there are certain weather expectations we may anticipate in an average or normal year. Several years in the 60’s, the early 70’s, mid-80’s and early 90’s may fit this description best.

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- Winter – Typically 35-40 inches of snow, with 2.5 to 3.0 inches of water equivalent. Perhaps 6-8 winter storms, with 2-3 reaching Blizzard intensity, the remainder having a combination of heavy snow, freezing rain, or wind blown snow. These storms may generally last from 6 to 24 hours. Extremely cold Wind Chills of less than – 40F (old scale – 60F) usually occur a few times a winter.
- Spring – Typically the spring will bring one or two late season heavy snow or Blizzard events, and perhaps another high wind event affecting most of the county. An average season's snowmelt will generally cause minor river flooding, though it may be aggravated by heavier rains or heavier snowfall in upstream portions of the river and reach to moderate levels. Prior to spring green-up there is typically a slight wildfire risk, especially for grassland acreages and roadsides.
- Summer – Typical summer season precipitation will fall from the nearly 100 thunderstorms which occur on around 30 days (from late spring through fall). Of these, perhaps 20 storms will reach severe intensity and produce 10-15 distinct large hail events (events separated by 10 miles or 15 minutes), a half-dozen damaging wind events, and perhaps one weak tornado or flash flood each year.
- Autumn – Typically the fall will transition from thunderstorms, to widespread rain storms, to winter storms, with a month or so of dry and pleasant weather. A typical fall will have one or two high wind periods, each lasting from 4 to 20 hours.

**Extreme Wet Cycle Expectations**

Though the overall record of weather observations across Logan County is relatively short (around 100 years), the protracted wet cycle of 1992-2002 has resulted in several different seasons where the number of weather events likely reached near extreme levels. Thus the winter of 1996-97 was an extreme event with nearest kin in recent years being perhaps the winter 1995-96, 1982-83, 1977-78, or 1976-77. The summers of 2001 and 2002 have likely equaled or exceeded the intensity of summers such as 1983, 1978, and 1975.

- Winter – An extreme winter may reach 80-100 inches of snow, with 5-7 inches of water equivalent. In 1996-97 there were 12 winter storms, with 8 reaching Blizzard intensity, and two severe ice storms which caused widespread tree and power line damage. These winter storms may last for 1-3 days, with nearly continuous wind driven snows and drifting making travel nearly impossible for many days on end. Temperatures can easily remain well below zero Fahrenheit for many days and even weeks. Extremely cold Wind Chills of less than – 40F (old scale – 60F) can occur several times through this period.
- Spring – Typically the wet cycle spring will bring two or more late season heavy snow or Blizzard events, followed quickly by ice storms, and then heavy rains on top of melting ice and snow. The spring flood of 1997 established new records along most rivers in the Red River Basin Watershed. Cool and wet conditions will generally mean a low wildfire threat.
- Summer – An extreme winter does not always mean an extreme summer, and vice versa. However, under wet cycle conditions the summer could be cool and wet or hot and wet. If it is hot and wet, like the summers of 2001 and 2002, there could be a 50 percent increase in the number of thunderstorms, each storm could cover a larger area, and the occurrence of large hail and damaging winds could easily double to around 30 distinct events. The highest number of reported tornadoes in Logan County was three in 1999, one of which was rated as

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F4 (devastating). Perhaps 2 or 3 events will produce flash flooding or protracted overland flooding.

- Autumn – An extreme fall will continue the typical transition from thunderstorms, to widespread rain storms, to winter storms, but with little or no dry-period. The fall may produce 2-3 high wind events then hit with early season winter storms. The heaviest and wettest snowfalls will likely be in the late fall or early spring.

**Annual EAS Activations**

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

Wet Cycle – During years with extremely active weather there could be nearly twice the number of real severe events, resulting in perhaps 150 EAS activations overall.

**3.3 NAPOLEON 1 SE, NORTH DAKOTA (326255)**

**Period of Record Monthly Climate Summary**

**Period of Record: 1/ 1/1893 to 12/31/2007**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	18.1	22.5	35.4	54.3	67.3	76.0	83.8	82.4	71.4	57.9	38.1	24.1	52.6
Average Min. Temperature (F)	-2.6	1.3	14.1	29.2	40.5	50.9	55.8	53.4	43.5	31.7	17.2	4.4	28.3
Average Total Precipitation (in.)	0.47	0.43	0.89	1.52	2.45	3.43	2.74	2.15	1.59	1.17	0.64	0.43	17.91
Average Total SnowFall (in.)	6.3	5.2	7.2	4.2	0.9	0.0	0.0	0.0	0.2	1.5	5.2	5.5	36.2
Average Snow Depth (in.)	7	9	5	0	0	0	0	0	0	0	1	4	2

**Percent of possible observations for period of record:**

Max. Temp.: 99.3% Min. Temp.: 99.2% Precipitation: 99.5% Snowfall: 97% Snow Depth: 96.3%  
\*Source: High Plains Regional Climate Center

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**Economy**

As of the census of 2000, there were 2,308 people, 963 households, and 659 families residing in the county. The population density was 2 people per square mile (1/km<sup>2</sup>). There were 1,193 housing units at an average density of 1 per square mile (0/km<sup>2</sup>). The racial makeup of the county was 99.18% White, 0.09% Black or African American, 0.13% Native American, 0.17% Asian, 0.13% from other races, and 0.30% from two or more races. 0.69% of the population were Hispanic or Latino of any race. 75.0% were of German, 7.0% Norwegian and 5.6% American ancestry according to Census 2000.

There were 963 households out of which 25.80% had children under the age of 18 living with them, 63.10% were married couples living together, 3.10% had a female householder with no husband present, and 31.50% were non-families. 29.20% of all households were made up of individuals and 16.00% had someone living alone who was 65 years of age or older. The average household size was 2.32 and the average family size was 2.88.

In the county the population was spread out with 22.60% under the age of 18, 3.60% from 18 to 24, 21.80% from 25 to 44, 25.00% from 45 to 64, and 27.00% who were 65 years of age or older. The median age was 46 years. For every 100 females there were 98.30 males. For every 100 females age 18 and over, there were 95.60 males.

The median income for a household in the county was \$27,986, and the median income for a family was \$33,125. Males had a median income of \$23,750 versus \$18,269 for females. The per capita income for the county was \$16,947. About 12.60% of families and 15.10% of the population were below the poverty line, including 16.20% of those under age 18 and 18.80% of those age 65 or over.

\*Source: U.S. Bureau of the Census, 2001 in DO1, 2002 and Wikipedia.org

**Transportation Systems**

Because of its rural nature, the county is highly dependent upon its network of federal, state, and county roads, and highways. State Highways 13, 34, and 46 are the major east-west routes across the county. State Highways 3, 30, and 56 are major north-south routes. These state and federal highways along with the hard surfaced and graveled county and township roads provide a good transportation network.

Community airports: Gackle and Napoleon. The nearest major airline facilities are located in Burleigh County. The Dakota Missouri Valley and Western Railroad, and numerous motor transport carriers support freight needs.

**Major Recreation Areas**

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The major recreation area for Logan County is Beaver Lake State Park there are developed facilities for activities such as fishing, boating, swimming, softball, basketball, camping, picnicking, and rodeos. Logan County offers county hunting areas.

**Historical Setting**

Before developing areas for construction of homes, businesses, and recreation resources such as parks, camping, water recreation, etc. and when planning mitigation measures it must be established that historic archeological sites will not be negatively impacted. According to the North Dakota Historical Society Logan County contains 21 historic/archeological sites. According to the National Register of Historic Places the following sites are listed:

Abell, Robert, Round Barn (added 1986) ND 38 Burnstad

Logan County Courthouse (added 1985) 301 Broadway, Napoleon

\*Source: National Register of Historic Places and State Historical Society of ND

**Land Use and Development Trends**

Census data shows that the County has approximately 472 farms that average 1,269 acres. Soil erosion due to wind and water is a problem. On steep gradients, rain washes out gullies in cultivated fields, and fields cultivated in the fall suffer extensive damage from wind. The county has 47,148 acres enrolled in the Conservation Reserve Program (CRP) which has helped mitigate the erosion problem. However, the county continues to study a variety of mitigation activities. Soil erosion, water supply, and water quality are major land use concerns of the county.

Land use concerns regarding fish and wildlife include draining of wetlands, construction of dams and levees, loss of habitat through the clearing for construction (encroachment), the management of major industry, transportation of hazardous materials over bridges, pesticides, and overgrazing.

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

<b>Housing Unit Building Permits for: Logan County, ND</b>					
	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
<b>Total Units</b>	2	0	0	1	2
<b>Units in Single-Family Structures</b>	2	0	0	1	2

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<b>Units in All Multi-Family Structures</b>	0	0	0	0	0
<b>Units in 2-unit Multi-Family Structures</b>	0	0	0	0	0
<b>Units in 3- and 4-unit Multi-Family Structures</b>	0	0	0	0	0
<b>Units in 5+ Unit Multi-Family Structures</b>	0	0	0	0	0

Water resources are an economic concern due to the lack of development along Beaver Creek and not taking full advantage of irrigation resources. The development of water and irrigation resources is essential to the stabilization of the agriculture industry.

**3.4 Logan County Building Permits from 2004 to 2008**

This section was updated to identify all hazards that affect Logan County. The hazards were discussed and explained to the planning team. The changes for some of the hazards according to the ND State MHMP were addressed since they were different from the previous approved plan. The tables were shown and described in detail to the team on how they were to be addressed according to the crosswalk guidelines. Declared disasters were updated to 2009. The planning team noticed that Communicable Disease was a new hazard they agreed it was a positive addition to the plan. The planning team agreed that for the new hazard of Transportation Accidents is changed from Mass Casualty. The changes reviewed at the meeting were accepted by the planning team by a majority vote.

**4. Hazards Facing Logan County and the Participating Jurisdictions**

**Identification of Hazards**

With its varying topography; mix of urban and rural areas; rapidly growing permanent, transient, and recreational populations, Logan County and the participating jurisdictions is subject to potential negative impacts from a broad range of hazards and threats. There are three broad categories of hazards that threaten the County, namely:

- Natural hazards
- Technological hazards
- Domestic security threats

- Natural hazards include:
- Urban and Rural Fires
  - Floods
  - Earthquake

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Landslide, Volcano, and Insect Infestation were also reviewed as hazards for this plan  
Extreme Weather (drought/heavy rain/hailstorm/windstorm/tornado)  
Communicable Diseases

Technological hazards include:

- Dam Failure
- Hazardous Materials (Hazmat) Incidents
- Power Outages

Domestic security threats include:

Terrorism (CBRNE)

- Chemical
- Biological
- Radiological
- Nuclear
- Explosive

Human-Caused hazards (direct purposeful actions of humans) civil unrest/riots

**4.1 Hazards Excluded from or Minimally Addressed in this Plan**

Hazard	Why Excluded/Where Addressed
Avalanche	<ul style="list-style-type: none"> <li>• Avalanches generally require long stretches of slope of 25-55 degrees; Logan County has no areas that meet this criteria</li> <li>• North Dakota does not have a National Avalanche Center.</li> <li>• Logan County does not have a history of any declared state or federal avalanche disasters.</li> </ul>
Coastal Erosion	<ul style="list-style-type: none"> <li>• Logan County does not have an ocean coastline.</li> </ul>
Coastal Storm	<ul style="list-style-type: none"> <li>• Logan County does not have an ocean coastline.</li> </ul>
Earthquake	<ul style="list-style-type: none"> <li>• Earthquake tremors have been felt in North Dakota, but none have exceeded intensity IV on the Modified Mercalli Scale.</li> <li>• Logan County does not have a history of any significant earthquake damages.</li> <li>• North Dakota does not have a history of any declared state or federal earthquake disasters.</li> <li>• The North Dakota Enhanced Multi Hazard Mitigation Plan does not include earthquakes in hazard planning at this time.</li> </ul>
Expansive Soils	<ul style="list-style-type: none"> <li>• North Dakota does have expansive soils, including clay with swelling potential, but the impacts of such are generally limited to a small scale, not applicable in a statewide plan.</li> <li>• Good building practices generally mitigate damages from expansive soils.</li> <li>• Logan County does not have a history of any declared state or federal expansive soil disasters.</li> </ul>
Extreme Heat	<ul style="list-style-type: none"> <li>• Logan County does experience high summertime temperatures, but the impacts generally do not exceed local capabilities.</li> <li>• Logan County does not have a history of any declared state or federal extreme heat disasters.</li> <li>• Some elements of the extreme heat hazard are included in the drought hazard profile and Mitigation strategy.</li> </ul>
Hurricane	<ul style="list-style-type: none"> <li>• Logan County does not have an ocean coastline, nor is it located in a potential hurricane impact area.</li> </ul>
Land Subsidence	<ul style="list-style-type: none"> <li>• North Dakota has a minimal land subsidence hazard, usually only related to mining activities and is typically recognized and mitigated.</li> <li>• Logan County does not have a history of any declared state or federal land subsidence disasters.</li> </ul>
Landslide	<ul style="list-style-type: none"> <li>• North Dakota does have localized landslide hazards, but the impacts generally do not exceed local</li> </ul>

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	<p>capabilities.</p> <ul style="list-style-type: none"> <li>• Only one county has listed landslide as a hazard in its mitigation plan.</li> <li>• In the past, mitigation activities have addressed erosion problems, typically along riverbeds, in parts of the state through flood hazard programs; these high erosion areas may also be categorized as landslide areas but are typically on a rather small scale.</li> <li>• Logan County does not have a history of any declared state or federal landslide disasters.</li> <li>• If future research or conditions warrant, a separate landslide hazard profile and strategy may be added.</li> <li>• The North Dakota Enhanced Multi Hazard Mitigation Plan does not include landslides in hazard planning at this time.</li> </ul>
Levee Failure	<ul style="list-style-type: none"> <li>• 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.</li> </ul>
Tsunami	<ul style="list-style-type: none"> <li>• Logan County does not have an ocean coastline.</li> </ul>
Volcano	<ul style="list-style-type: none"> <li>• Volcanic ash fall can occur over North Dakota, but the frequency is relatively rare and the potential impacts are not expected to exceed local capabilities.</li> <li>• Logan County does not have a history of any declared state or federal volcano disasters.</li> </ul>

**4.2 Hazards Addressed in this Plan**

The following table describes how and why the hazards listed above were identified by Logan County in preparing its MHMP. (\*Source: State of North Dakota Enhanced Multi-Hazard Mitigation Plan)

<b>Hazard</b>	<b>Jurisdiction</b>	<b>How Identified</b>	<b>Why Identified</b>
Urban and Rural Fires	All jurisdictions (Napoleon, Lehr, Gackle, Fredonia)	<ul style="list-style-type: none"> <li>• U.S. Fire Administration</li> <li>• National Fire Protection Association</li> <li>• North Dakota Forest Service</li> <li>• Center for International Disaster Information</li> <li>• Farm Service Agency</li> </ul>	<ul style="list-style-type: none"> <li>• History of urban, rural and wildfires.</li> <li>• Potential for structure collapse</li> <li>• Government lands and Conservation Reserve Program</li> </ul>
Flooding	All jurisdictions (Napoleon and its townships are more susceptible to flooding than other jurisdictions )	<ul style="list-style-type: none"> <li>• National Climatic Data Center</li> <li>• National Weather Service</li> <li>• U.S. Army Corps of Engineers</li> <li>• Federal Emergency Management Agency</li> </ul>	<ul style="list-style-type: none"> <li>• History of riverine, ice jam, and flash floods</li> </ul>
Extreme Weather (Drought, Winter Storms, Summer Storms)	All jurisdictions (Napoleon, Lehr, Gackle, Fredonia)	<ul style="list-style-type: none"> <li>• National Drought Mitigation Center</li> <li>• National Climatic Data Center</li> <li>• National Weather Service</li> <li>• U.S. Department of Agriculture</li> <li>• High Plains Regional Climate Center</li> </ul>	<ul style="list-style-type: none"> <li>• History of droughts</li> <li>• Importance of agriculture to the local economy</li> <li>• History of tornadoes, severe thunderstorms, hail, and strong winds</li> <li>• History of Severe winter storms</li> <li>• Probability of blizzards and other potentially damaging storms</li> </ul>
Dam Failure	No cities are at risk of loss from dam failure. Townships may be affected.	<ul style="list-style-type: none"> <li>• North Dakota State Water Commission</li> </ul>	<ul style="list-style-type: none"> <li>• Several dams throughout the county</li> </ul>
Hazardous Materials Hazmat Incidents	All jurisdictions (Napoleon, Lehr, Gackle, Fredonia)	<ul style="list-style-type: none"> <li>• U.S. Department of Transportation Emergency Response Guidebook</li> <li>• National Response Center</li> <li>• Environmental Protection Agency</li> </ul>	<ul style="list-style-type: none"> <li>• Regular truck and rail traffic transport goods through the county</li> <li>• Facilities containing hazardous materials exist throughout the</li> </ul>



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		<ul style="list-style-type: none"> <li>North Dakota Department of Health Division of Waste Management</li> </ul>	county
Communicable Diseases (Including animal, plant, and human diseases)	All jurisdictions (Napoleon, Lehr, Gackle, Fredonia)	<ul style="list-style-type: none"> <li>Centers for Disease Control and Prevention</li> <li>Pandemic studies</li> <li>U.S. Department of Agriculture</li> <li>North Dakota Department of Agriculture</li> <li>World Health Organization</li> <li>North Dakota Department of Health</li> </ul>	<ul style="list-style-type: none"> <li>Global disease threat</li> <li>History of pandemic</li> <li>Dependence on agricultural economy</li> </ul>
Homeland Security Incident	All jurisdictions (Napoleon, Lehr, Gackle, Fredonia)	<ul style="list-style-type: none"> <li>Federal Bureau of Investigation</li> <li>Memorial for the Prevention of Terrorism</li> <li>Southern Poverty Law Center</li> </ul>	<ul style="list-style-type: none"> <li>National indications and foreign threats of future terrorist attacks</li> <li>Potential for school violence and other domestic attacks</li> </ul>
Transportation Accidents	Napoleon, Lehr, and Fredonia due to railroads transporting chemicals through county would be more susceptible	<ul style="list-style-type: none"> <li>National Transportation Safety Board</li> <li>Federal Railroad Administration</li> <li>North Dakota Aeronautics Commission</li> </ul>	<ul style="list-style-type: none"> <li>History of transportation accidents</li> <li>Potential for larger transportation accidents leading to mass casualties</li> </ul>
Shortage of Critical Materials	All jurisdictions (Napoleon, Lehr, Gackle, Fredonia)	<ul style="list-style-type: none"> <li>North Dakota Department of Emergency Services</li> <li>Community input</li> </ul>	<ul style="list-style-type: none"> <li>Dependence on energy resources</li> <li>History of power, communications, and water outages</li> <li>History of critical material shortages</li> </ul>

As noted in the table below, each of the jurisdictions may be affected by fires, winter storms, summer storms, drought, communicable disease, homeland security incident, and shortage of critical materials. Although flash flooding could occur anywhere Napoleon is more susceptible to flooding than the rest of the county. Since the previously approved MHMP vulnerabilities for fires, winter storms, summer storms, drought, hazardous materials, homeland security and shortage of critical materials has not increased or decreased. The vulnerabilities have increased for flooding due to two events since the previous plan approval. Transportation accidents are more likely to occur in Napoleon and Lehr, there have been no changes in vulnerability since 2003. A new hazard of communicable disease was included a table was added to show effect on the county of occurrences.

<b>Jurisdictions▶ Hazards▼</b>	Napoleon	Lehr	Gackle	Fredonia
Urban and Rural Fires	X	X	X	X
Flooding	X			
Extreme Weather (Drought, Winter Storms, Summer Storms)	X	X	X	X
Dam Failure				
Hazardous Materials Hazmat Incidents	X	X	X	X
Communicable Diseases (Including animal, plant, and human diseases)	X	X	X	X
Homeland Security Incident	X	X	X	X
Transportation Accidents	X	X		X
Shortage of Critical Materials	X	X	X	X

For the rating of **probability** of occurrence, for each of the following hazards, the participants in the workshop for the Logan County MHMP were asked to provide ratings of the likelihood that an event would occur in the future. The ratings that were used were:

High Probability (highly likely to occur)

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Medium Probability (likely to occur)  
Low Probability (not very likely to occur)

These were subjective, order-of- magnitude ratings that participants could relate to whether they were highly skilled in a hazards area (e.g., members of a fire department) or not. This approach facilitated utilizing a consensus approach with the participating group.

For the rating of **severity**, the participants in the workshop for the Logan County MHMP were asked to provide ratings of the likely severity of an event, assuming one occurred in the future. The ratings that were used were:

High Severity (extensive loss of life and/or property)  
Medium Severity (moderate loss of life and/or property)  
Low Severity (relatively modest loss of life and/or property)

These were subjective, order-of-magnitude ratings that participants could relate to whether they were highly skilled in a hazards area (e.g., members of a fire department) or not. This approach facilitated utilizing a consensus approach with the participating group.

**4.3 DECLARED DISASTERS IN LOGAN COUNTY**

<b>Year</b>	<b>DECLARED DISASTERS IN LOGAN COUNTY</b>	<b>Disaster Number</b>
2009	Severe Storms and Flooding	1829
2007	Severe Storms and Flooding	1713
2001	Flooding	1376
2000	Severe storms and flooding	1334
1999	Ground Saturation, Ice Storm, Landslide, Severe Storm, Snow Storm, Tornado, Flooding	1279
1997	Severe Winter Storms / Blizzards	1157
1997	Severe Storms / Flooding	1174
1996	Flooding	1118
1995	Sever Storms, Flooding, Ground Saturation	1050
1994	Sever Storm, Flooding	1032
1993	Flooding, Severe Storms	1001

\*Source: FEMA Disaster Declarations

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**Vulnerability Overview**

Each of the following identified hazards in this section contains maps of jurisdictions and the vulnerable facilities highlighted that would be affected. Critical facilities and concern area maps for hazards are shown as an attachment. Communicable Disease is a new hazard for the county and has been added with how it has impacted the county with reported cases. Tier II Facilities have been mapped and shown in the Hazardous Materials hazard to show location to populations at risk within jurisdictions.

**Hazard: Urban, Rural and Wildfire**

**Jurisdictions Affected by Wildfire (Urban and Rural)**

<b>Probability: Urban Low</b>	<b>Severity: Urban Low</b>
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<b>Probability: Rural Medium</b>	<b>Severity: Rural Medium</b>
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**Hazard Definition**

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.

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

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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)

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/urban interface is defined as the zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel. In northeast North Dakota, the wildland/urban interface typically is where the edge of local communities adjoins agricultural fields, many of which are in CRP.

U.S. Forest Service (USFS) data for 1990 indicate that 25.7 percent of reported wildfires were caused by arson. Other ignition sources were debris burns (24 percent); lightning (13.3 percent); and other (16.7 percent). Lightning can present particularly difficult problems when dry thunderstorms move across an area suffering from seasonal drought. In northeast North Dakota, the railroad is a relatively common ignition source of wildfires.

Multiple fires can be started simultaneously, as is often the case in northeast North Dakota. In dry fuel areas, these fires can cause massive damage before containment. Dry grass, associated with farmland in CRP, is the primary fuel for northeast North Dakota wildfires. The rate of spread of a fire varies directly with wind speed. Numerous wildfires have impacted residents in northeast North Dakota. The generally windy conditions typical to the region cause wildfires to spread rapidly. Wooden structures preserved for historic purposes are particularly at risk from wildfire.

The county experiences rural fires every year. Factors that influence the potential for rural fires include: type, amounts and conditions of fuel supply (vegetation); temperatures; wind conditions; 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 quickly flare out of control and cause major damage to habitat, crops, livestock, wildlife, people, and structural property.

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

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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. Urban blocks, commercial structures, and apartment buildings are especially vulnerable. 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 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.

## **Hazard Threat**

**Urban Fires:** Among the rational motives for arson is profit, (accomplished through insurance fraud), revenge, labor trouble, racial or religious strife, and concealment of another crime such as murder, burglary, or vandalism. Burning for profit is probably the most common arson motive. When trouble comes, especially serious financial trouble, normal law-abiding citizens may see arson as a way to collect money, and as an easy way out of the problem. Arsonists are very

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seldom convicted. With little threat of being caught hanging over the perpetrator's head, arson continues unabated.

The increasing costs of natural gas and fuel oil have caused families to rediscover alternate heating methods to heat their homes. As a result, the use of space heaters, fireplaces, and wood burning stoves has created a new fire hazard.

Many portable LP (propane) gas or kerosene heaters with self contained fuel supplies are a hazardous appliance; even when used according to the manufacturer's instructions. It is a potential fire hazard because of its open flame. Leakage of fuel from its container could cause an explosion. The fuel vapor is also a source of indoor pollution.

Most of us have a very limited experience with wood burners. As a result, a number of fires are caused by faulty installation of stoves and chimneys. Wood heat has a poor safety record. Wood heat required extra attention and work. The misuse of wood burning stoves has increase at an alarming rate.

The hazardous materials situation in this country is a steadily growing phenomenon. Chemical plant fires may pose an unreasonable risk to the safety and health, the environment, and the property of citizens. The term "hazardous materials" covers a wide array of products, from relatively innocuous ones such as hairspray in aerosol dispensers and wash preservatives to extremely hazardous materials. It is often difficult for officials to gather information on the size of the structure; the types of products sold; number of employees, if during working hours, whether there are any explosives, what high pile stock the business may have.

**Rural Fires:** Numerous fires are reported annually which result from the use of farm machinery in fields and pastures. For example, anytime after swathing until stubble is worked or snow cover exists, machinery or other vehicles and equipment can create a dangerous fire potential.

Logan County is mostly agricultural vegetation. Grass fires will burn very fast and cover great distances. By contrast to grassland fires, fires in the timber areas burn hotter but spread slower. There are several tree rows and CRP land but there are also many natural and man made fire breaks that can contain the risk of large wildfires.

## Urban and Rural Fire History

**Urban Fires:** Urban fire mitigation is a concern to emergency management officials because it can be a killer of people, while it destroys property and critical resources need for both the residents of the urban and rural areas. Because of limited resources within the county, it is necessary for several agencies representing local, state, and federal governments to share responsibility for both fire mitigation measures and fire response operations.

**Rural Fires:** There are two basic fire seasons. Generally, conditions are monitored very closely from April 1 – June 15. During this spring period of potential fire, unseasonable hot, dry, windy conditions are experienced and occasionally increase fire danger for short periods of time.

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The main fire season normally begins about July 15<sup>th</sup>, when summer weather warms significantly and precipitation is usually limited to that resulting from thunderstorm activity. This longer and more dangerous season extends until about October 30<sup>th</sup> or to the first significant snow cover.

Most rural fires result from acts of human carelessness during activities such as: controlled burns of sloughs, ditches, and fields by landowners; recreational activity such as camping, hunting, and other off-road vehicle travel; and use of fireworks preceding and immediately following the 4<sup>th</sup> of July. History of rural fires is available from the North Dakota Forest Service.

Wildfire will continue to be a high risk hazard for Logan County. The potential for loss of life and property from urban structure fires is greatest in places where large groups of people gather, such as offices, stores, hotels, and theaters. Uses which may suffer large monetary losses due to a major fire include businesses, factories, and shopping areas. The history of wildfires is depicted in the map below.

There was no history for wildfires reported in the SHEL DUS database. However Logan County retained records of the following fires from 2002 to 2008.

**2002**

April 16	75 acres	NFD	
April 17	50 acres	NFD	
April 17	1000 acres	NFD	
May 20	50 acres	Loss of \$3000	NFD
May 28	50 acres	NFD	
May 29	5 acres	Loss of \$100	NFD
May 29	100 acres	Loss of \$2000	NFD
June 29	50 acres	Loss of \$2000	NFD
July 4	50 acres	Loss of \$17,500	NFD

**2003**

There were a large number of hay bale fires with large dollar losses that are not listed.

August 16	10 acres	NFD	
August 17	50 acres	NFD	
August 17	30 acres	NFD	
August 18	40 acres	NFD	
August 19	40 acres	NFD	
August 20	100 acres	NFD	
August 24	60 acres	NFD	
September 8	350 acres	Loss of \$30,000	NFD
September 9	9 acres	NFD	
October 8	10 acres	Loss of \$1800	NFD

**2004**

March 22	40 acres	NFD	
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**2005**

May 3	30 acres	NFD
May 4	10 acres	NFD
May 12	Barn fire at Howard Retzlaff farm (SR)	

**2006**

April 4	700 acres	Prairie fire NW of Lehr near Wetzel/Zeigenhagel farm (SR)
March 22	200 acres	NFD
March 23	400 acres	NFD
July 8	20 acres	NFD
August 4	1100 acres	Loss of \$80,000 240 round bales, crop, hay and pasture land burned near Feist Bros farm, Burnstad, Wishek FD, area farmers with equipment assisted (SR)
August 4	5 acres	NFD

**2007**

There was a great deal of combine fires that were not listed.

April 10	40 acres	NFD
April 13	10 acres	NFD
July 24	25 acres	Loss of \$6000 NFD

**2008**

April 1	40 acres	smoldering wood pile ignited in field fire west of F. Wald farmstead, Kintyre (SR)
April 4	15 acres	Hayland fire ignited by individual using cutting torch on machinery 2.5 miles W NAP (SR)
April 22	Minimal	Tractor fire ignited in field, 12 miles E of Napoleon (SR)
May 14	10 acres	Farmer burning straw, 2 miles E, 1 mile S of Napoleon (SR)
May 21	10 acres	NFD
May 24	10 acres	NFD
October		Drug Store burned as result of starting of furnaces

**4.4 Residential Fires/Other Fires (ND State Fire Marshall)**

This report is based on incidents submitted to the National Fire Incident Reporting System (NFIRS), which is the national all-incident reporting system. Not all North Dakota fire departments and fire districts report their incidents. Among those who do report, not all departments and districts report every incident.

Residential includes single-family dwellings, multiple-family dwellings, boarding houses, hotels/motels, dormitories, sorority houses, fraternity houses, and barracks.

Logan County had a total of 196 calls from January 1, 2003 through December 31, 2009.

155	Fires
73	Natural vegetation fires (This does not include any other outside fires, such as outside rubbish fires or cultivated vegetation (crop) fires.)
2	Overpressure ruptures, explosions, overhear
13	Rescue calls



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- 10 Hazardous condition
- 6 Service calls
- 4 Good intent calls
- 2 Special incident
- 4 False calls

**4.5 Wildfire Report from ND Forest Service 2005-2009**

County	Fire Department	Fire Location	Cause	Legal Description	Fire size (acres)	Fire Class	Year
Logan	GACKLE FIRE PROTECTION DISTRICT	Hwy 46 West mile marker 5	Debris Burning	Township 137 N Range 68 W Section 35 SW 1/4	2	B	2005
Logan	GACKLE FIRE PROTECTION DISTRICT	5 miles N 1/2 E	Debris Burning	Township 137 N Range 67 W Section 10 NW 1/4	3	B	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	4312 Hwy 34 E farm yard	Debris Burning		2	B	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	5 miles N and 2 miles E of Napoleon	Miscellaneous		30	C	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	5 miles N and 2 miles E of Napoleon	Miscellaneous		10	C	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	2 miles N and 1 mile W of Napoleon	Equipment Use		0.25	A	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	7722 25th Ave SE Kintyre	Natural		1	B	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	15 miles N and 1 mile East of Napoleon Tree row	Debris Burning		2	B	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	2055 67 St SE Kintyre	Natural		10	C	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	2055 67 St SE Kintyre	Natural		30	C	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	George Sperle Farm stubble field	Equipment Use		2	B	2005
Logan	NAPOLEON FIRE PROTECTION DISTRICT	farm - garbage pit 5941 28th Ave SE Kintyre	Miscellaneous		1	B	2005
Logan	Gackle Volunteer Fire District	4855 57th Ave SE	Debris Burning	Township 137 N Range 68 W Section 4 SE 1/4	11	C	2006
Logan	Gackle Volunteer Fire District	1/4 mi east of Gackle T 136N R 66 W	Debris Burning	Township 136N Range 66W Section 5	10	C	2006
Logan	Gackle Volunteer Fire District	1/2 M N of Junction Hwy 34 & 56	Natural	Township 135N Range 66W Section 5 SW 1/4	1	B	2006
Logan	Gackle Volunteer Fire District	8 mi east .5 N of Gackle	Natural	Township 137N Range 65W Section 35 NE 1/4	10	C	2006

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Logan	Gackle Volunteer Fire District	5 mi N 1.5 M E of Gackle	Natural	Township 137N Range 66W Section 11 NE 1/4	15	C	2006
Logan	Gackle Volunteer Fire District	1.5 N 1 W of Gackle	Natural	Township 137N Range 67W Section 28 SW 1/4	5	B	2006
Logan	Gackle Volunteer Fire District	2.5 mi E 2 mi N. of Gackle	Natural	Township 137N Range 66W Section 24 NE 1/4	20	C	2006
Logan	Gackle Volunteer Fire District	2 mi W 1 mi N of Gackle	Natural	Township 137N Range 67W Section 29 NW 1/4	1	B	2006
Logan	Gackle Volunteer Fire District	2 mi W 1 mi N of Gackle	Natural	Township 137N Range 67W Section 29 NW 1/4	1	B	2006
Logan	Gackle Volunteer Fire District	9 mi east of Gackle	Debris Burning	Township 137N Range 66W Section 36 SW 1/4	15	C	2006
Logan	Lehr Fire Department	2 miles west and 1 mile north of Lehr ND	Debris Burning	Township 30&31 N Range 70 W Section 31&30 S1/2 SE 1/4 30-133-69 S1/2 31-133-69	750	E	2006
Logan	Lehr Fire Department	10 miles N & 2 miles W of Lehr	Natural	Township 134N Range 69W Section 30 SE 1/4	15	C	2006
Logan	Napoleon Fire Protection District	3491 71st St SE Napoleon ND	Miscellaneous		1	B	2006
Logan	Napoleon Fire Protection District	Hwy 3 north	Natural		0.25	A	2006
Logan	Napoleon Fire Protection District	10 W & 6 E of Napoleon	Natural		0.25	A	2006
Logan	Napoleon Fire Protection District	14 N & 3 east of Napoleon	Equipment Use		20	C	2006
Logan	Napoleon Fire Protection District	4 mi S & E of Napoleon	Natural		1200	F	2006
Logan	Napoleon Fire Protection District	12 mi W Emmons County of Napoleon	Natural		5	B	2006
Logan	Napoleon Fire Protection District	11 mi N 7 1/2 E of Napoleon	Natural		0.25	A	2006
Logan	Napoleon Fire Protection District	Landfill owned by city - compost burning and wind became a concern as to a spread of fire	Debris Burning		0.25	A	2006
Logan	Napoleon Fire Protection District	4 mi S 1 E 1/2 S of Napoleon	Debris Burning		0.25	A	2006
Logan	Lehr Fire Department	1 mile east of Lehr	Equipment Use	Township 132N Range 69W Section 4 NE 1/4	0.25	A	2007
Logan	Napoleon Fire Protection District	3 miles E of Napoleon	Miscellaneous		10	C	2007
Logan	Napoleon Fire Protection District	2120 63 SE Kintyre ND	Equipment Use		25	C	2007
Logan	Napoleon Fire Protection District	3241 67th St SE of Napoleon	Not Specified		1	B	2007
Logan	Napoleon Fire Protection District	3241 67th St SE of Napoleon	Not Specified		1	B	2007
Logan	Napoleon Fire Protection District	5 miles N 3 East 1 north of Napoleon	Equipment Use		0.25	A	2007
Logan	Napoleon Fire Protection District	5 miles n 3 east 1 north of Napoleon	Equipment Use		0.25	A	2007
Logan	Napoleon Fire Protection District	9 south 5 west sunflowers	Equipment Use		0.25	A	2007
Logan	Napoleon Fire Protection District	203 Ave C Napoleon	Equipment Use		1	B	2008

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Logan	Napoleon Fire Protection District	7722 25th Ave SE Kintyre	Debris Burning		40	C	2008
Logan	Napoleon Fire Protection District	3 miles west of Napoleon	Miscellaneous		40	C	2008
Logan	Napoleon Fire Protection District	5932 25th ave SE	Equipment Use		1	B	2008
Logan	Napoleon Fire Protection District	2 miles east 1 mile south of Napoleon	Debris Burning		10	C	2008
Logan	Napoleon Fire Protection District	8 south 3 east of Napoleon railroad right of way burned	Railroad		10	C	2008
Logan	Napoleon Rural Fire Protection District	2350 69th St SE Kintyre, ND 58549	Not Specified	Township 140 N Range 49 W Section 32 NE 1/4	1	B	2008
Logan	Napoleon Rural Fire Protection District	E and S of Napoleon	Equipment Use		0.25	A	2008
Logan	Napoleon Fire Protection District	7341 26th Ave SE Kintyre ND 58549	Equipment Use		0.25	A	2009
Logan	Napoleon Fire Protection District	422 3rd St W Napoleon	Miscellaneous		1	B	2009
Logan	Napoleon Fire Protection District	16 1/2 mi E of Napoleon	Equipment Use		1	B	2009
Logan	Napoleon Fire Protection District	7 mi S & 2 mi of Napoleon	Equipment Use		1	B	2009
Logan	Napoleon Fire Protection District	10 mi S - 2 mi E & 2 mi S of Napoleon	Equipment Use		1	B	2009
Logan	Napoleon Fire Protection District	10 mi W & 1 N on Hwy 34	Equipment Use		20	C	2009
Logan	Napoleon Fire Protection District	Napoleon-Elevator	Debris Burning		1	B	2009
Logan	Napoleon Fire Protection District	10 mi S of Napoleon	Equipment Use		1	B	2009
Logan	Napoleon Fire Protection District	City dump ground	Miscellaneous		5	B	2009
Logan	Napoleon Fire Protection District	4 N 5 E & 2 N of Napoleon	Not Specified		75	C	2009

## Wildfire Occurrence in North Dakota



Wildfire occurrence in North Dakota is weather dependent, and highly variable from year to year. On average, our state experiences well over 722 wildfires that burn in excess of 37,828 acres annually. Fire season generally runs from April 1<sup>st</sup> through October 31<sup>st</sup>. Within the general fire season, there are three distinct peaks of fire activity. The first peak occurs during the spring

# Logan County Multi-Jurisdictional All Hazard Pre-Disaster Mitigation Plan

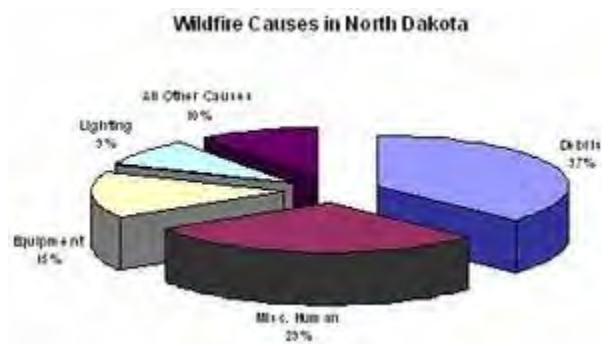
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before vegetation turns green. This tends to be a very critical time due to the fuel buildup from the previous growing season, drying winds, decreasing humidity, warmer temperatures, and increased human activity outdoors. The month of April accounts for twenty percent 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 1<sup>st</sup> and October 31<sup>st</sup> 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.

Since the 1998 fire season, North Dakota has experienced more fires than usual. The average size of fires and amount of acreage burned has increased. Extended weather outlooks call for a continuation of the current drought, so the trend towards more and larger fires will likely continue.

Nearly nine out of every ten wildfires in North Dakota are the result of humans and their activities. The single leading cause of wildfires is debris burning at 47%. This includes agricultural and other open land burning activities, ditch burning, and burning of household refuse.

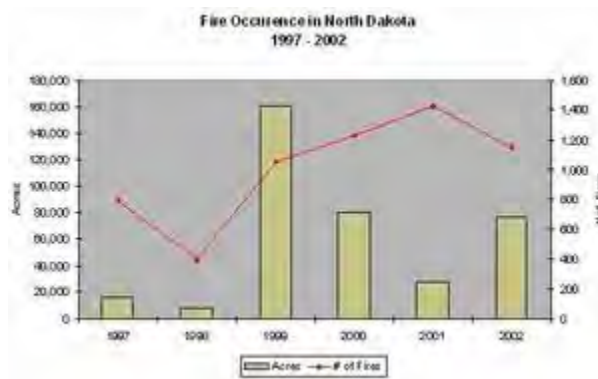


## Wildfire Causes in North Dakota

- Debris burning causes 47 percent of all Fires
- Equipment operation causes 12 percent of all fires
- Lightning causes 12 percent of all fires
- Miscellaneous human activities cause 22 percent of all fires
- All other causes amount to 7 percent of all fires

# Logan County Multi-Jurisdictional All Hazard Pre-Disaster Mitigation Plan

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## Fire Occurrence in North Dakota 1997-2002

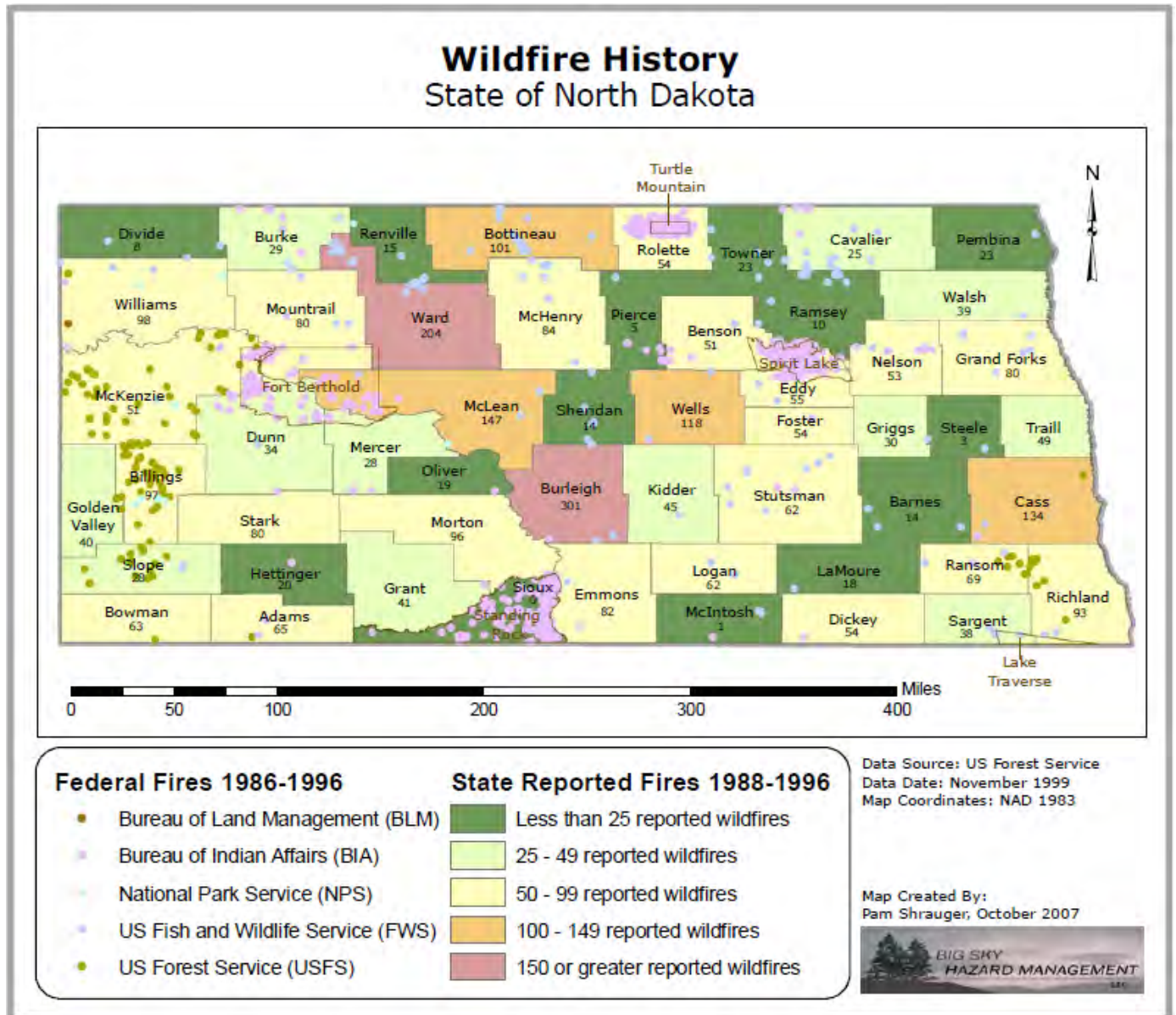
- In 1997, N D reported about 800 fires that burned about 18,000 acres
- In 1998, N D reported about 400 fires that burned about 10,000 acres
- In 1999, N D reported about 1050 fires that burned about 160,000 acres
- In 2000, N D reported about 1200 fires that burned about 85,000 acres
- In 2001, N D reported about 1,400 fires that burned about 25,000 acres
- In 2002, N D reported about 1150 fires that burned about 80,000 acres

\*Source: [http://www.ndsu.edu/ndfs/fire\\_management/wildfire\\_occurance/](http://www.ndsu.edu/ndfs/fire_management/wildfire_occurance/)

## 4.6 Wildfire History Map

**Logan County  
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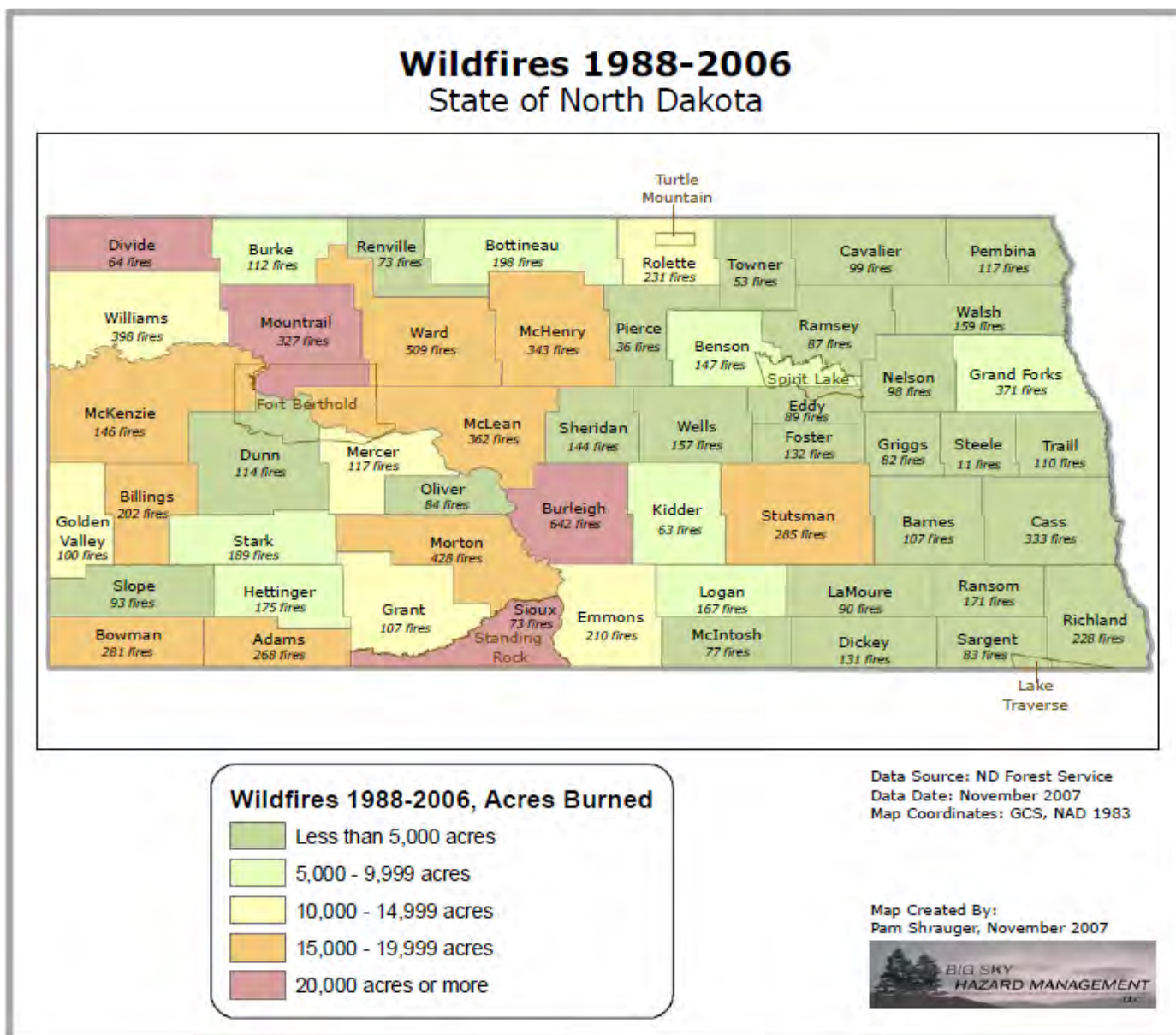


\*Source: State of North Dakota Enhanced Multi-Hazard Mitigation Plan

**4.7 Wildfires from 1988-2006 Map**

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\*Source: State of North Dakota Enhanced Multi-Hazard Mitigation Plan

**Plans and Programs**

The responsibility for the prevention and suppression of wildfires in Logan County belongs to the North Dakota Department of Forestry and Fire Protection, the Logan County Fire Departments and to individual cities within their incorporated areas.

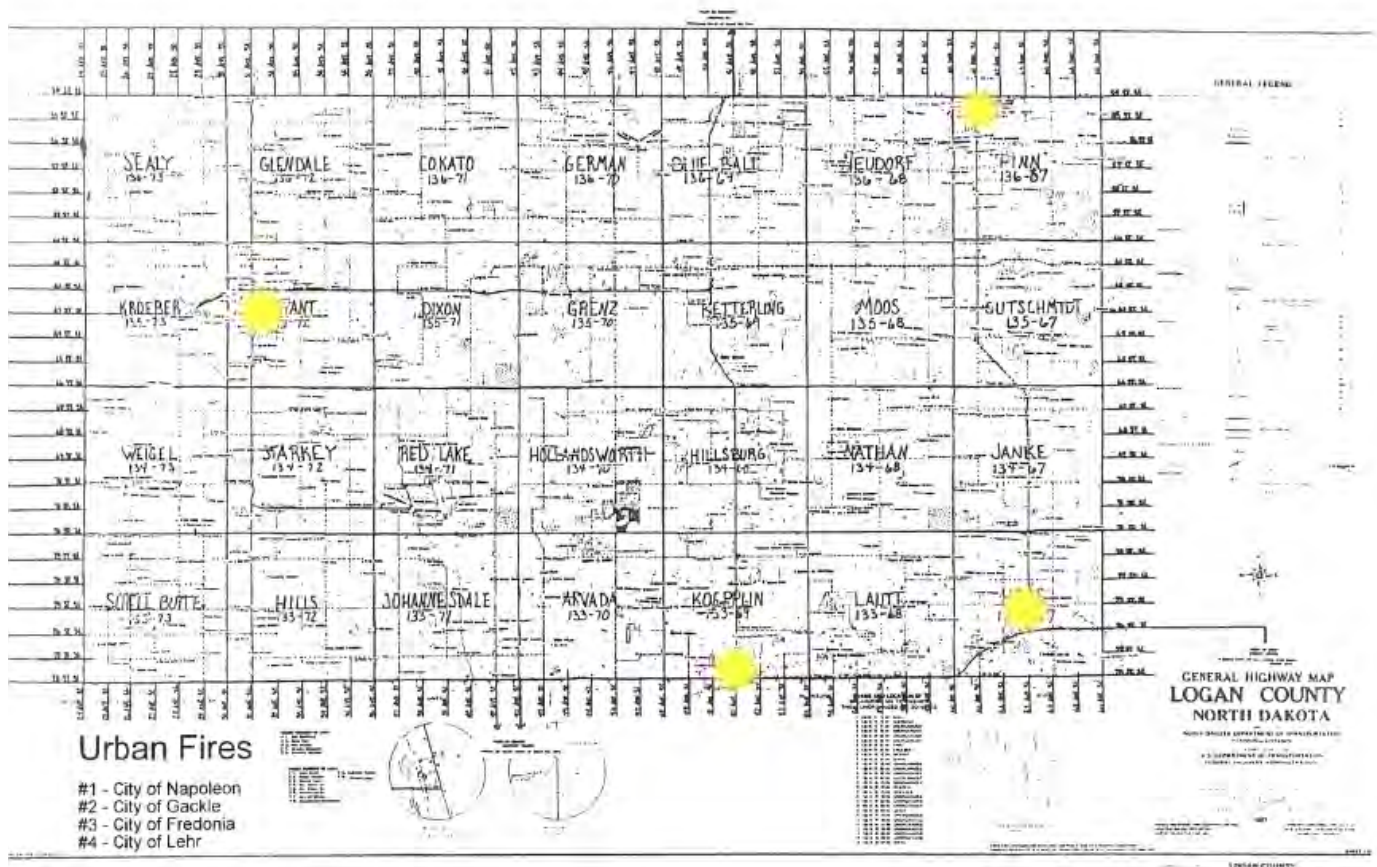
As the major fire fighting force in the County, maintains four fire stations and support facilities either fully or cooperatively. Logan County also maintain a fleet of fire fighting equipment in Logan County, including engines, squads/rescues, water tenders, and rescue vehicles. The following maps show specific areas of vulnerabilities for Logan County highlighted. The

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maps indicate critical facilities which were also part of the previous 2003 plan. All the indicated facilities and areas for fire hazards have not changed as seen in the following maps.

**4.8 Map of Logan County Urban Fires**

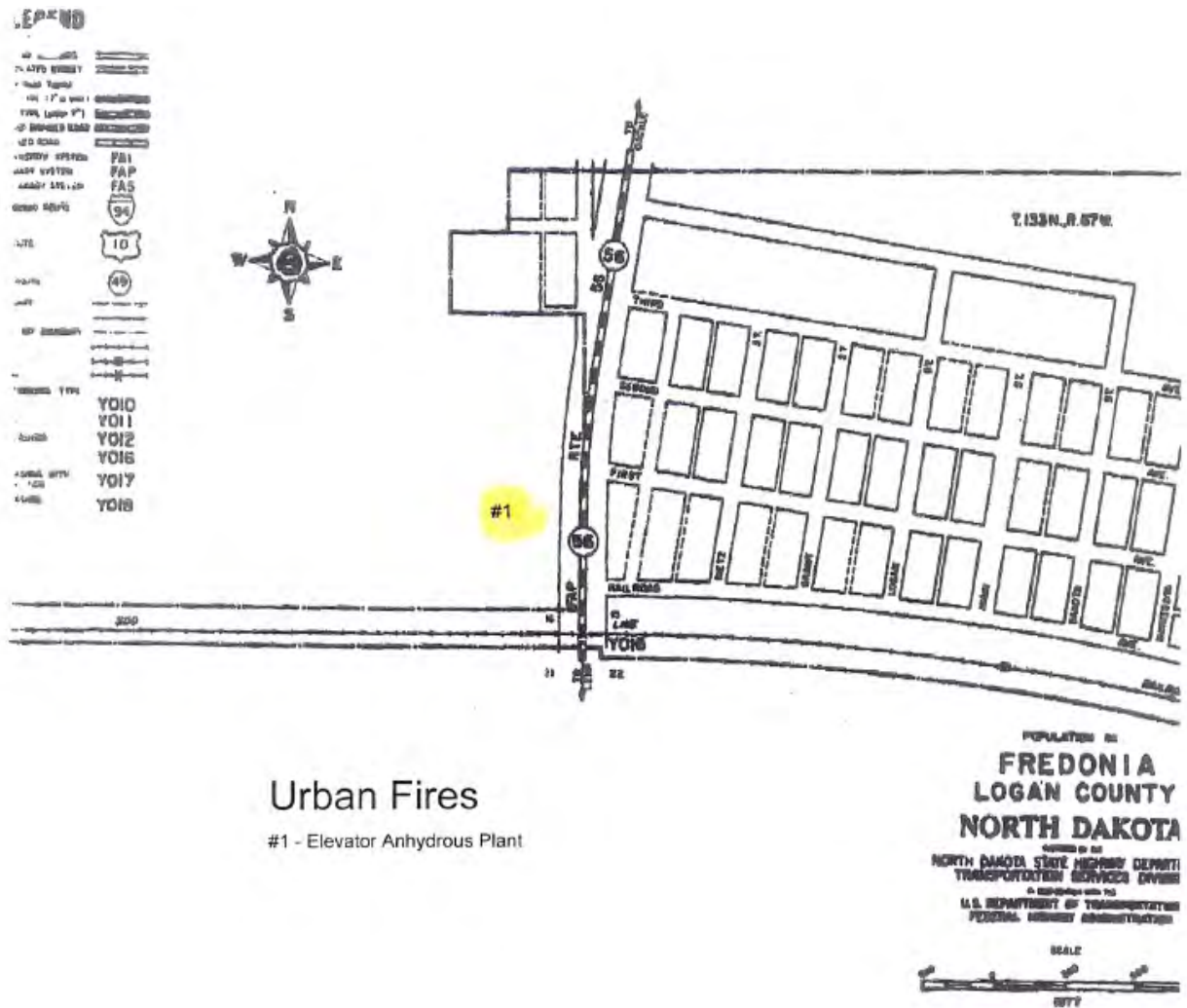


**4.9 Map of Fredonia Urban Fires**



# Logan County Multi-Jurisdictional All Hazard Pre-Disaster Mitigation Plan

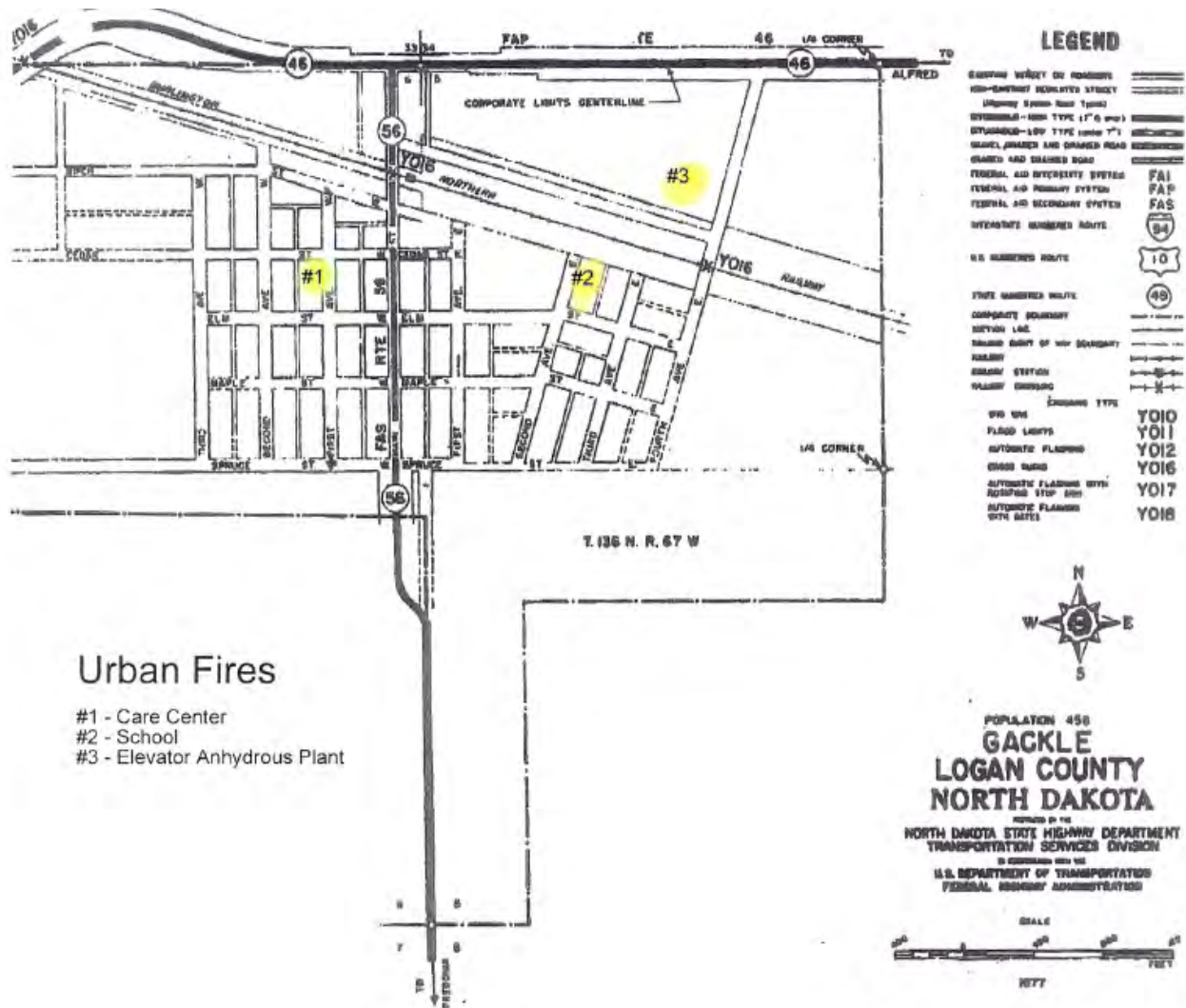
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4.10 Map of Gackle Urban Fires

# Logan County Multi-Jurisdictional All Hazard Pre-Disaster Mitigation Plan

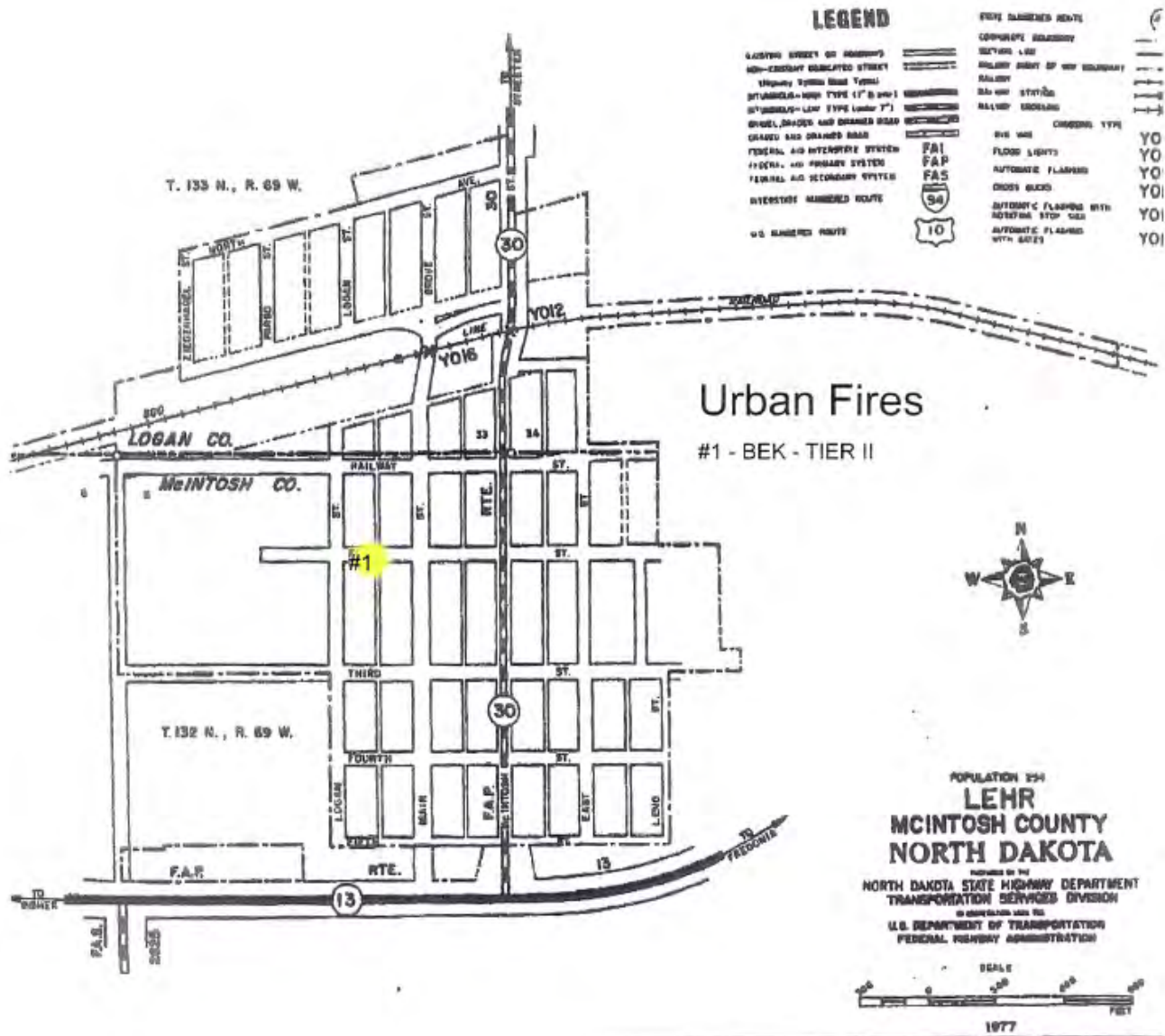
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**4.11 Map of Lehr Urban Fires**



**4.12 Map of Critical Facilities Napoleon Urban Fire Hazard**



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**Identified Risks for Urban Fires**

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

**Identified Risks for Rural Fires**

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

**Hazard: Flooding**

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<b>Probability: Medium</b>	<b>Severity: High</b>
----------------------------	-----------------------

**Hazard Definition**

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

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

For floodplain management purposes, the following discussion describes the Federal Emergency Management Agency (FEMA) definition of 100-year flood. The term "100-year flood" is misleading. It is not a flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1 percent chance of being equaled or exceeded each year. Thus, a 100- year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. A structure located within a special flood hazard area shown on a map has a 26 percent chance of suffering flood damage during the term of a 30- year mortgage.

Logan County will continue to comply with the regulations by identifying flood plains on new subdivision proposals and final plats. Building permit requirements mandate Flood Plain permits where identified on the Flood Insurance Rate Maps (FIRM). Sanitation permits also require compliance with the ordinance.

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

- Advanced Hydrologic Prediction Services (AHPS) Long Range Probabilistic Outlook: The outlook shows the probability of a river rising above and falling below various stages over the next ninety days. The probabilities are called "exceedance" and "non-exceedance" probabilities, respectively.
- Spring Flood and Water Resources Outlook: Issued each spring, the spring flood and water resources outlook outlines the potential for snowmelt and spring flooding.
- Significant River Flood Outlook: The flood outlook provides a general assessment of the potential significant river flooding over the next five days.
- Flood Watch: Flood watches inform the public of conditions which may cause flooding within the next thirty-six hours, but the flooding is neither certain nor imminent. Flood watches are also issued for potential dam failure.
- Flood Warning: Flood warnings are issued when flooding is expected to occur more than six hours after

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- the causative event (i.e. heavy precipitation, snow melt, ice jams. Or reservoir releases).
- Flash Flood Warning: Flash flood warnings are issued when flooding is imminent during short term events requiring immediate action. Flash flooding occurs when the water level rises rapidly to inundation within six hours of a causative event (i.e. heavy precipitation, snow melt, dam failure, or ice jams).
- Urban and Small Stream Flood Advisory: Small stream flood advisories are issued when flooding of small streams, streets, and low-lying areas is occurring or imminent.

\*Source: National Weather Service, 2005; National Weather Service, 2007a)

Full documentation of the Multi-Year Flood Hazard Identification Plan (MHIP) is available at:

[http://www.fema.gov/fhm/mh\\_mhip.shtm](http://www.fema.gov/fhm/mh_mhip.shtm)

**History**

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

Floods of record occurred along the low lying areas, small culverts, creeks, and sloughs. Flooding has occurred in 1995, 1999, and 2001.

According to SHELDUS, Logan County has had three significant flood events from 1950 to 2008. Property damage from these events is estimated at \$1492051.28 in property damage as shown in the table below.

**4.13 Flood Events**

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
4/12/1979	Flooding	ND	Logan	0.00	0.00	1282051.28	0.00
3/21/1997	Flooding	ND	Logan	0.00	0.00	200000.00	0.00
8/17/2005	Flooding	ND	Logan	0.00	0.00	10000.00	0.00
Total				0.00	0.00	1492051.28	0.00

According to the National Climatic Data Center the following flood events were recorded:

**March 1, 1995**, Flooding affected much of central and eastern North Dakota. Record high temperatures led to a rapid snowmelt. This in addition to saturated soil and above normal precipitation led to flooding in much of eastern and central North Dakota. Several homes were evacuated and many homes and businesses experienced water seepage. Also many city streets and county, state, and United States highways were closed because of water over the roadway and due to washouts. Some residents had to use boats to get to and from their homes. In addition, water flooded thousands of acres of cropland, pasture, and residential property. One city had their drinking water contaminated and several had damage to their sewage lift stations.

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**March 21, 1997**, Warm weather toward the end of March lead to rapid snow melt across south North Dakota. This in turn lead to flooding across much of the area. Near the confluence of Spring Creek and the Knife River, the town of Beulah (Mercer County) had 150 families evacuated. Sewer lines backed up when the lift stations failed. Up to 4 feet of water flooded streets and lawns. Also in Mercer County 1 person was injured when he drove over a section of road that the Knife River washed out. Along the Cannonball River in Hettinger County. 50 families in the town of Mott were evacuated. In Grant County, 20 residents along the Cannonball River had to be evacuated. One farmer reported losing 50 hogs due to the flooding. In LaMoure County, the Bonehill and Cottonwood creeks flooded, washing out at least 7 bridges. A 41 yr. old female and her 17 yr. old daughter were killed when they drove their pickup off a section of road washed out by the Bonehill Creek. There was a 50-75 foot section of road missing with the pickup falling approximately 15 feet into the water. Two horses that were in the horse trailer they were pulling also perished. In the town of Edgeley, Water lines were forced up by the floodwaters and broke, leaving much of the town without water for a while. Also in LaMoure County, it's estimated that there were 600 washouts sites to either dirt or paved roads. The Maple River in Dickey County isolated 2 farm families. Twelve families were without power for a day when ice sheared off a power pole. Minor flooding in Sioux, Morton and Burleigh Counties resulted in overland flooding and a few wet basements. The James River in Stutsman, LaMoure and Dickey Counties also had some minor overland flooding with some residents reporting wet basements or washed out county roads.

**August 17, 2005, 3:05 PM CST – August 17, 2005, 5:47 PM CST**

Hail reported 5 miles southwest of Gackle at .75 inches. Flash flooding south and east of Gackle. There was two feet of water over some county roads. Water washed into the basement of a farm house. Four inches of rain reported. Property damage estimated at \$10.0K. Tornado briefly touched down in open country in a farm field 2 miles east, southeast of Fredonia. No damage.

**June 17, 2007**

Storm Data and Unusual Weather Phenomena - June 2007

Location	Date/Time	Deaths & Injuries	Property & Crop Dmg	Event Type and Details
<b>LOGAN COUNTY</b>				
6.2 NNW LEHR	06/17/07 20:00 CST		0	Thunderstorm Wind (EG 52 kt)
	06/17/07 20:08 CST		0	46.3632N, 99.3999W
<b>LOGAN COUNTY</b>				
GACKLE	06/17/07 20:05 CST		9K	Thunderstorm Wind (EG 56 kt)
	06/17/07 20:13 CST		0	46.63N, 99.13W

Five large pines blown over in the north city park of Gackle.

**President Declares Major Disaster for North Dakota**

Release Date: July 17, 2007  
Release Number: HQ-07-128b



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WASHINGTON, D.C. -- The head of the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) announced that federal disaster aid has been made available for North Dakota to supplement state and local recovery efforts in the area struck by severe storms and flooding during the period of June 2-18, 2007.

FEMA Administrator David Paulison said federal funding is available to state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe storms and flooding. Areas covered by the declaration include Barnes, Bowman, Dickey, Grant, LaMoure, Logan, McHenry, Ransom, Richland, Sargent, and Stutsman counties.

**March 6, 2009, 00:00 AM CST – March 31, 2009, 11:59 PM CST**

Western and central North Dakota experienced a snowy winter of 2008-2009. Bismarck, for example, had the snowiest December on record, which was also the snowiest month ever on record, with 33.3 inches of snow in December 2008. March 2009 was the fifth snowiest month on record with 29.7 inches. For the entire season Bismarck ended up the second snowiest on record with 100.3 inches. A similar scenario played out all across the west and central parts of North Dakota with locations receiving two to three times the normal snowfall. This set the stage for devastating flooding. A warm up over the southwest early in March resulted in flooding there. It occurred ahead of a storm that brought thunderstorms and heavy rain that resulted in rapid snow melt and ice jams, followed by heavy snow and a blizzard. For most areas the flooding, some of it river and stream related and some overland flooding away from rivers and streams, was the worst in a dozen years, rivaling and in some cases surpassing that following the winter of 1996-1997. Ice jams, which occur most springs in North Dakota, were more numerous and severe than what would be considered normal. Losses were tremendous with hundreds of homes flooded, some completely destroyed, and many roads and some bridges washed out. County and township roads, already damaged by the winter plowing of snow, suffered more damage by the flooding. Sections of major state highways were closed due to flooding, including interstate 94. Agriculture was hard hit. It has been estimated by the Farm Services Agency that because of the flooding over west and central North Dakota, around 1.7 million acres would not be planted in 2009. Using an average value of \$300 an acre, that amounts to a potential loss through non planting of around \$490 million. The ranching industry was also hard hit. It has been estimated by the Farm Services Administration that the harsh winter, including blizzards, and the flooding, resulted in 78,000 calves being killed, along with 19,100 cows, 180 horses, and 3,000 other farm and ranch animals. It was estimated that this number of beef cows, had they lived to slaughter, could have fed 800,000 people for one year. The cost loss would be around \$50 million. Economic impact to society, impact on communities, uses a multiplier of four to seven times the loss, so \$200 million to \$350 million.

Overland flooding damaged state, county and township roads from 10 miles northwest of Napoleon to 3 miles east southeast of Gackle. Four homes were flooded. Property damage was estimated at 121.0K. Flooding continued into April.

**April 1, 2009, 00:00 AM CST – April 21, 2009, 11:59 PM CST**

Heavy runoff from snowmelt resulted in additional overland flooding which further damaged several county and local roads. Property damage estimated at 50.0K. See entries for the month of March as well.

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**Identified Risks**

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

**4.14 Communities in Logan County Participating in the NFIP**

<u>Jurisdiction</u>	<u>CID #</u>	<u>Entry Date</u>	<u>Mapped</u>
City of Gackle	380334	03/24/78	(NSFHA)
City of Napoleon	380044	03/24/78	02/19/87
County of Logan	380691		(NSFHA)

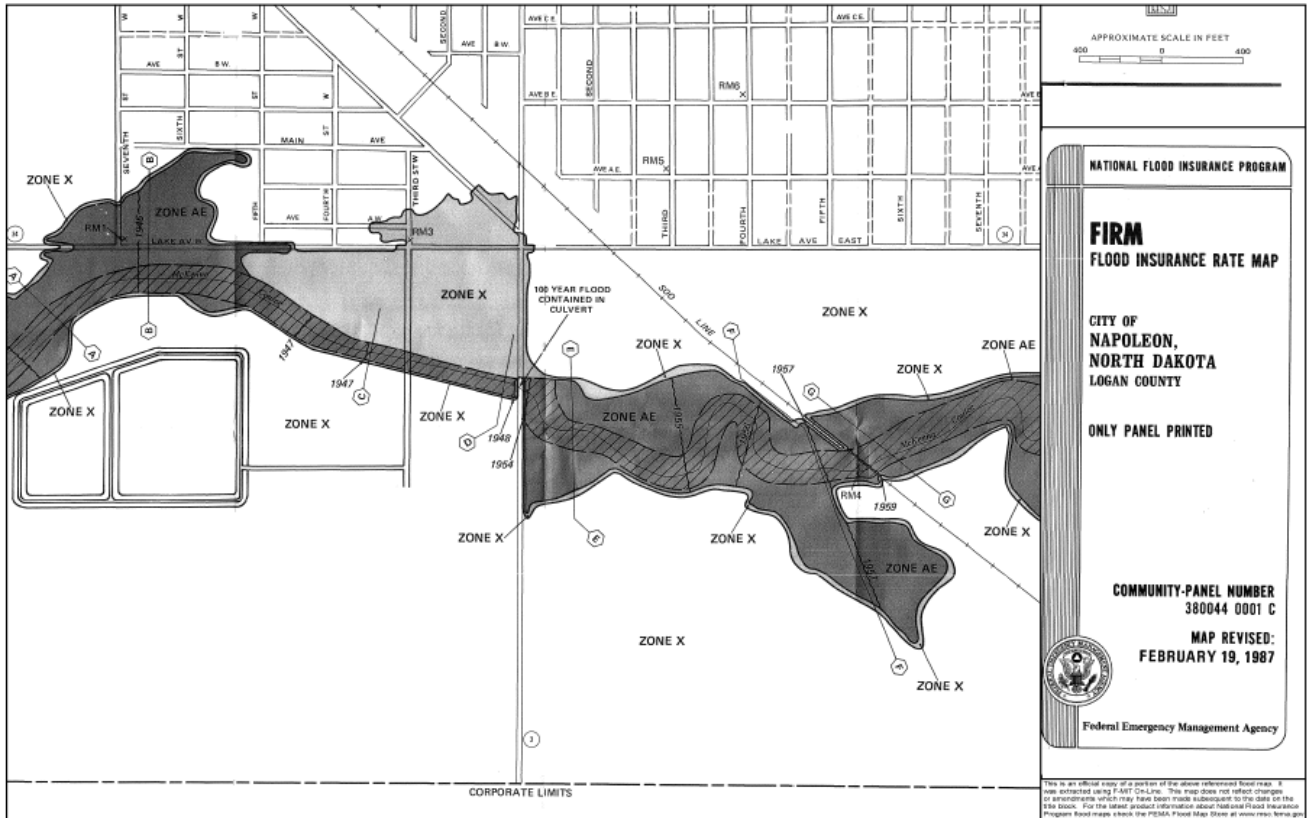
Source: FEMA Community Status Book Report

Participation from the previously approved plan remains the same and the emergency manager and county commissioners will work with the participating jurisdictions to improve participation within the NFIP program. Since the previously approved plan Fredonia and Lehr have chosen not to participate in the NFIP no reason was given.

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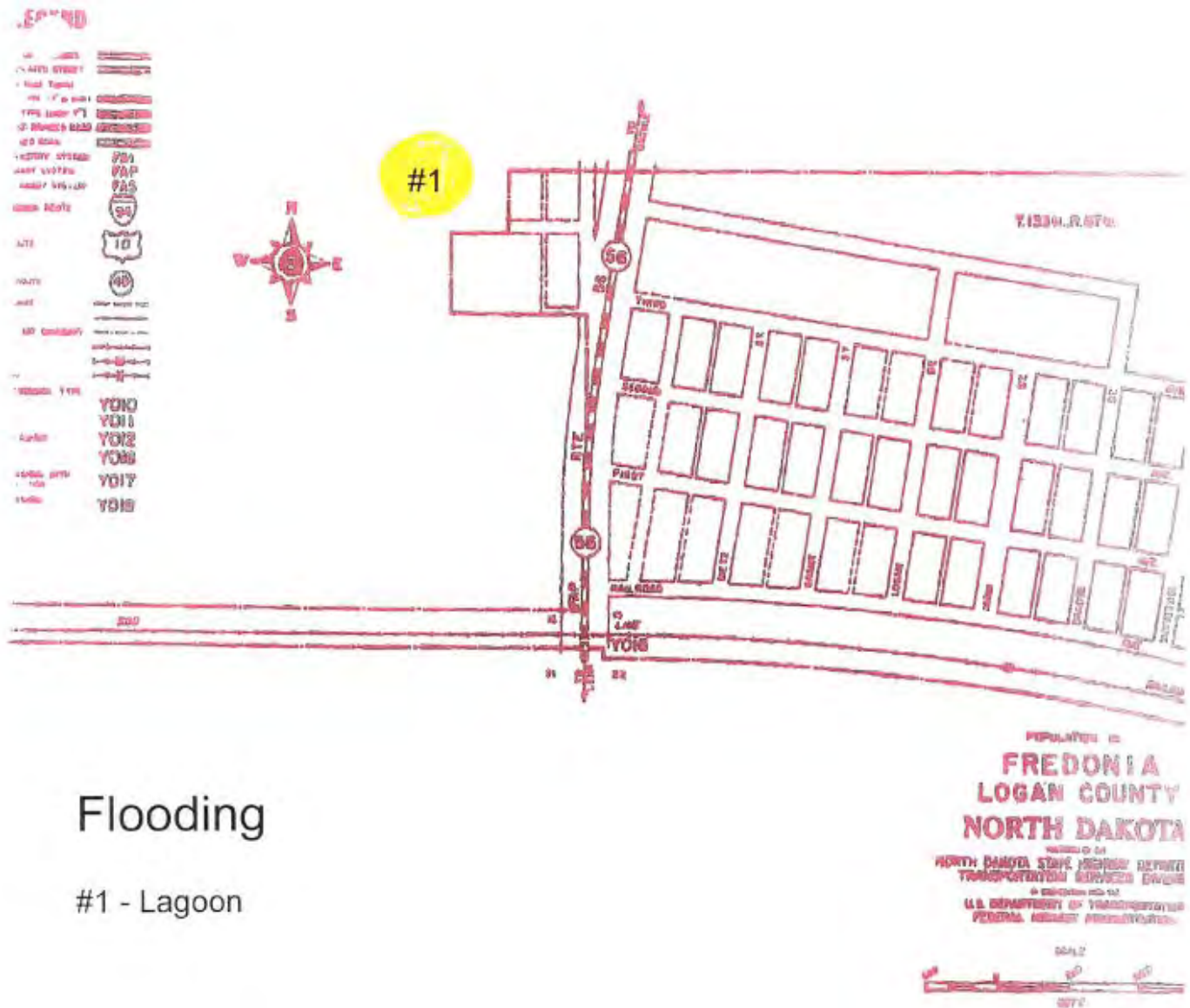
## 4.15 Logan County Flood DFIRM Maps Source: FEMA Map Service Center



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**4.16 Map of Fredonia Flood Hazard**



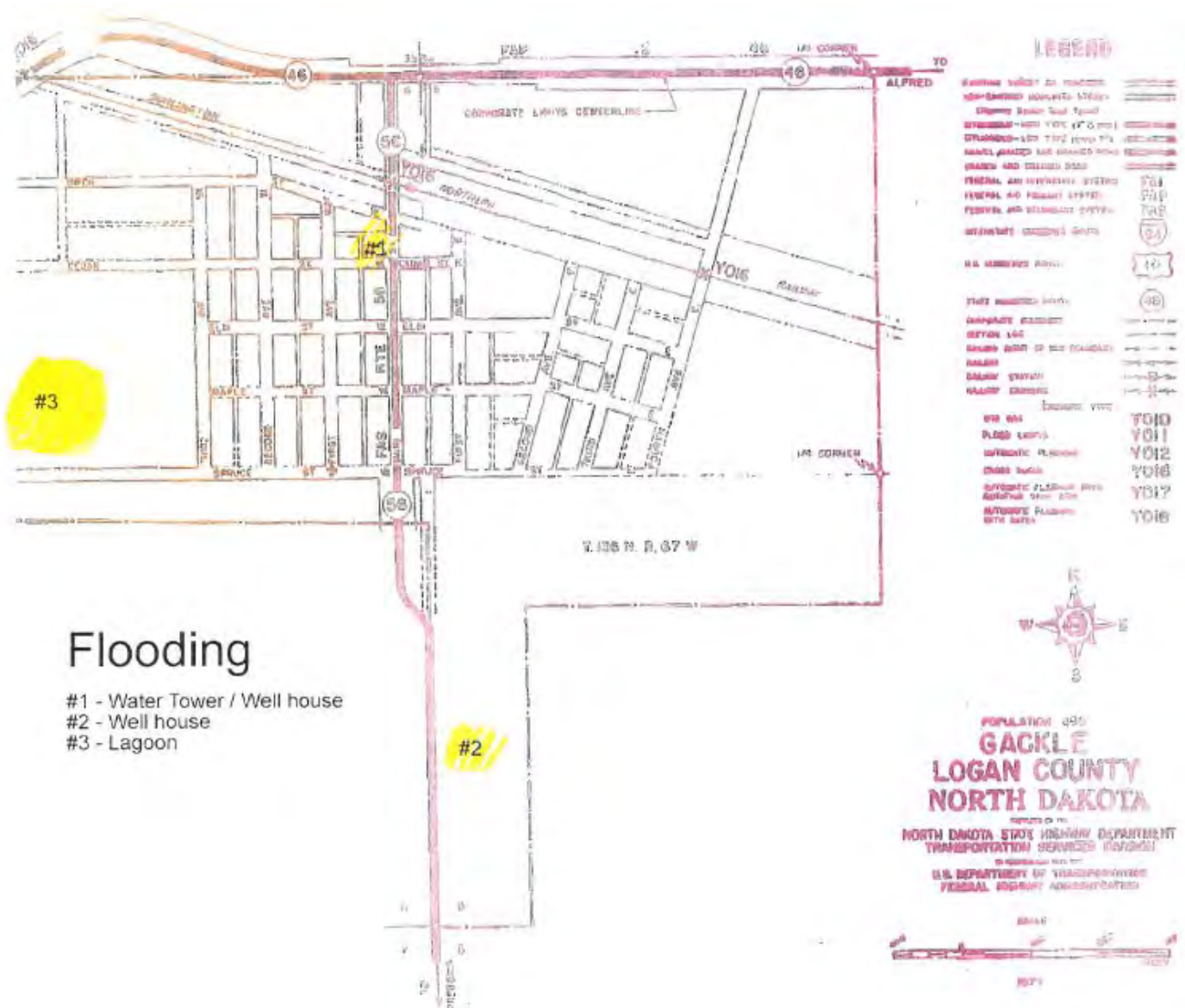
**Flooding**

#1 - Lagoon

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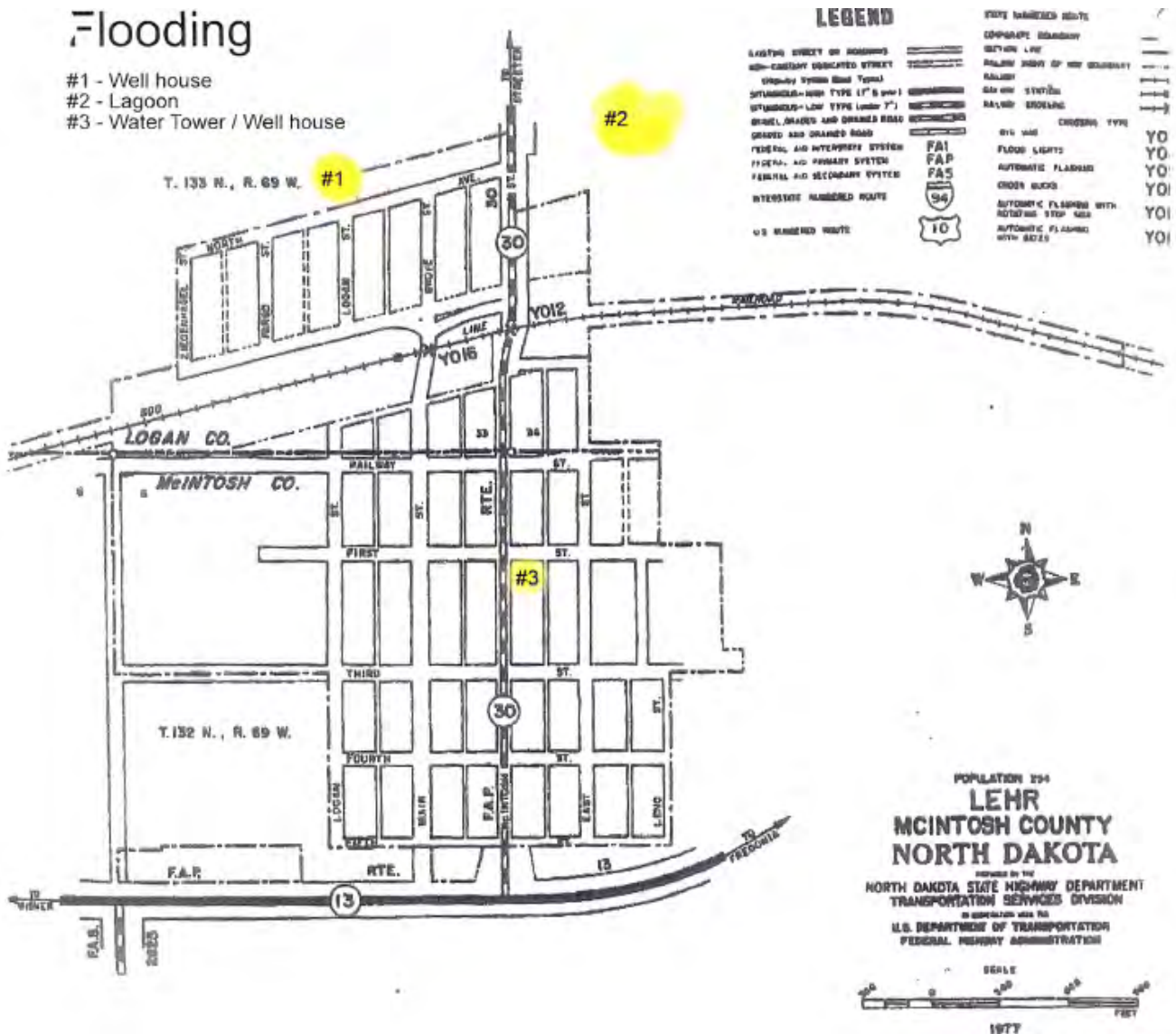
**4.17 Map of Gackle Flood Hazard**



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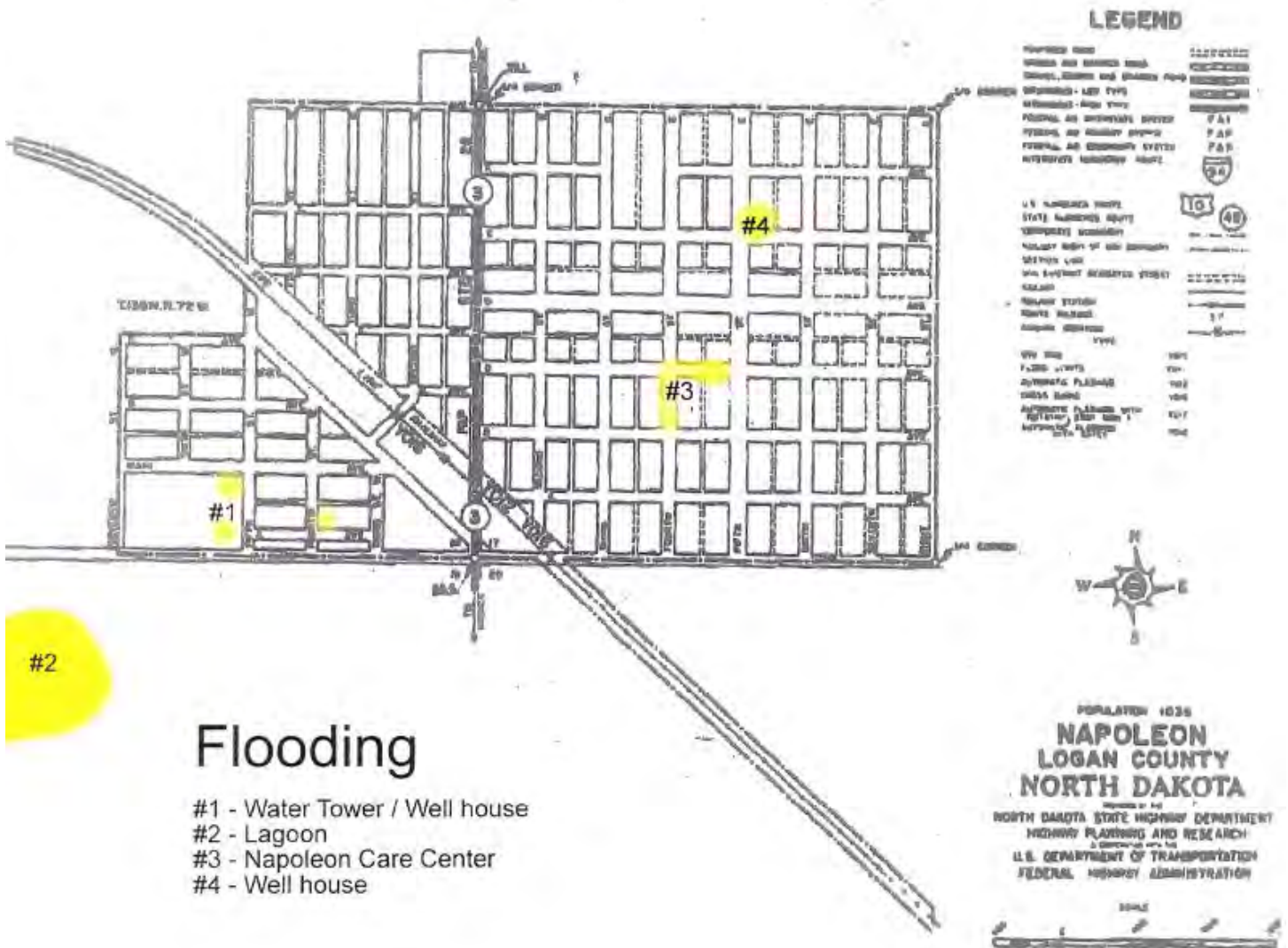
## 4.18 Map of Lehr Flood Hazard



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**4.19 Map of Napoleon Flood Hazard**



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**Hazard: Extreme Weather (Drought, Winter Storms, Summer Storms)**

<b>Probability: Drought Medium</b>	<b>Severity: Drought High</b>
<b>Probability: Winter Storms High</b>	<b>Severity: Winter Storms High</b>
<b>Probability: Summer Storms High</b>	<b>Severity: Summer Storms High</b>

**Hazard Definition**

**Drought**

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.

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. (Source: National Drought Mitigation Center)

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



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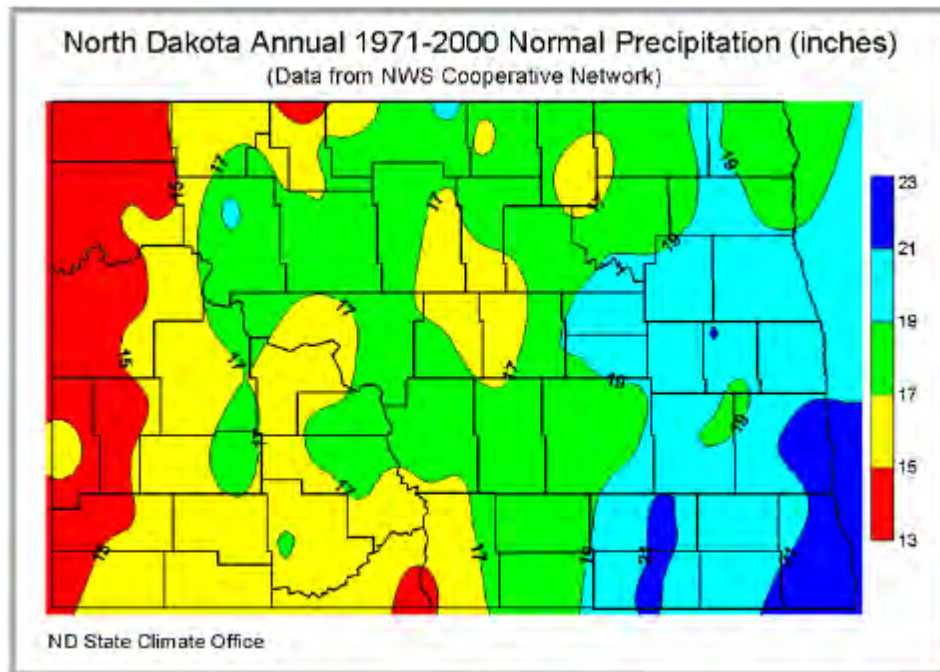
but before hydrological drought. Agriculture is usually the first economic sector to be affected by drought.

*Hydrological drought* refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow and as lake, reservoir, and groundwater levels. There is a time lag between lack of rain and less water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. When precipitation is reduced or deficient over an extended period of time, this shortage will be reflected in declining surface and subsurface water levels.

*Socioeconomic drought* occurs when physical water shortage starts to affect people, individually and collectively. Or, in more abstract terms, most socioeconomic definitions of drought associate it with the supply and demand of an economic good.  
(National Drought Mitigation Center, 2007)

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)

**4.20 North Dakota Annual Normal Precipitation**



Source: North Dakota State Climate Office. 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

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

A number of secondary hazards are generally associated with drought. Rural grassland fires increase due to dry vegetation. Reduction in vegetation will expose the soil to wind erosion. Reduced flow characteristics adversely affect chemical quality of lakes and rivers. Sediment transport regimes in streams and rivers are altered. Deterioration of water quality results in injury and death to plants and animals. Stagnant pools along rivers provide favorable habitat for insects, particularly mosquitoes. When normal rain patterns develop, the dry, unstable topsoil becomes vulnerable to gullies and flooding.

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

Effects of drought accumulate slowly but tend to persist over long periods. Determining whether conditions warrant drought status versus an extended dry spell is difficult and experts often disagree. However, a typical drought in North Dakota would most likely begin with limited winter snowfall, deficient spring precipitation accompanied by warmer than normal temperatures and windy conditions. At this point, normal spring greening does not occur causing a shortage of natural livestock feed. Spring planting plans most likely change. Fire danger to grasslands begins to increase. Growth and production of cash crops and feed grains become questionable. Continued drought negatively affects farm income, ultimately affecting agriculture-related businesses. Besides crop loss, recreational opportunities are reduced and hydroelectric power production is affected.

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

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**4.21 Drought Indices**

<b>Index</b>	<b>Use</b>
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, 2007.

**Extreme winter weather**

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

The winter season can begin as early as September and last into May. The bulk of North Dakota's winter weather is from mid-November until early April. On average, there are around ten winter storms (ice storms, heavy snow events, winter storms, and blizzards) each year. Three to four of these storms reach blizzard intensity, thus North Dakota typically leads the nation in blizzard frequency. (National Climatic Data Center, 2007; National Weather Service, 2007h)

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

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

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. The National Weather Service issues the following products for blizzards and blowing snow:

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

(National Weather Service, 2005)

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.

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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 of livestock is the major cause of casualties. Cattle can't lick enough snow to satisfy their thirst; they die of lack of water before succumbing to cold or suffocation.

Other hazardous winter storms also exist that do not meet the criteria of a blizzard. The National Weather Service has the ability to issue Winter Storm Watches and Warnings to alert the public of hazardous winter weather. The definitions of such are as follows:

- **Winter Storm Watch:** Winter storm watches are issued to give the public 12-48 hours of advance notice of the potential for hazardous winter weather that may threaten life or property.
- **Winter Weather Advisory:** Winter weather advisories are issued when a combination of winter weather elements that may cause significant inconveniences are occurring, imminent, or have a high probability of occurring.
- **Winter Storm Warning:** Winter storm warnings are generally issued when a combination of dangerous winter weather elements that may threaten life or property are occurring, imminent, or have a high probability of occurring.

(National Weather Service, 2005)

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. In addition to Winter Storm Watches and Warnings, the National Weather Service issues the following products for ice storms:

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

(National Weather Service, 2005)

Large quantities of snow may fall during winter storms. Six inches or more in 12 hours or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create

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hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. Heavy wet snow before the leaves fall from the trees in autumn or after the trees have leafed out in the spring may cause problems with broken tree branches and power outages. In addition to Winter Storm Watches and Warnings, the National Weather Service issues the following products for heavy snow events:

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

(National Weather Service, 2005)

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

Wind chill is how cold it feels when outside. Wind chill is based on the rate of heat loss on exposed skin from wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature, and eventually, internal body temperature. Therefore, the wind makes it feel much colder than the actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F. At this wind chill, exposed skin can freeze in 30 minutes. Wind chill does not affect inanimate objects. (National Weather Service, 2007f) Figure below shows the current wind chill chart. The wind chill index changed in 2001 to better reflect the conditions felt by humans. This chart depicts the new, more accurate representation.

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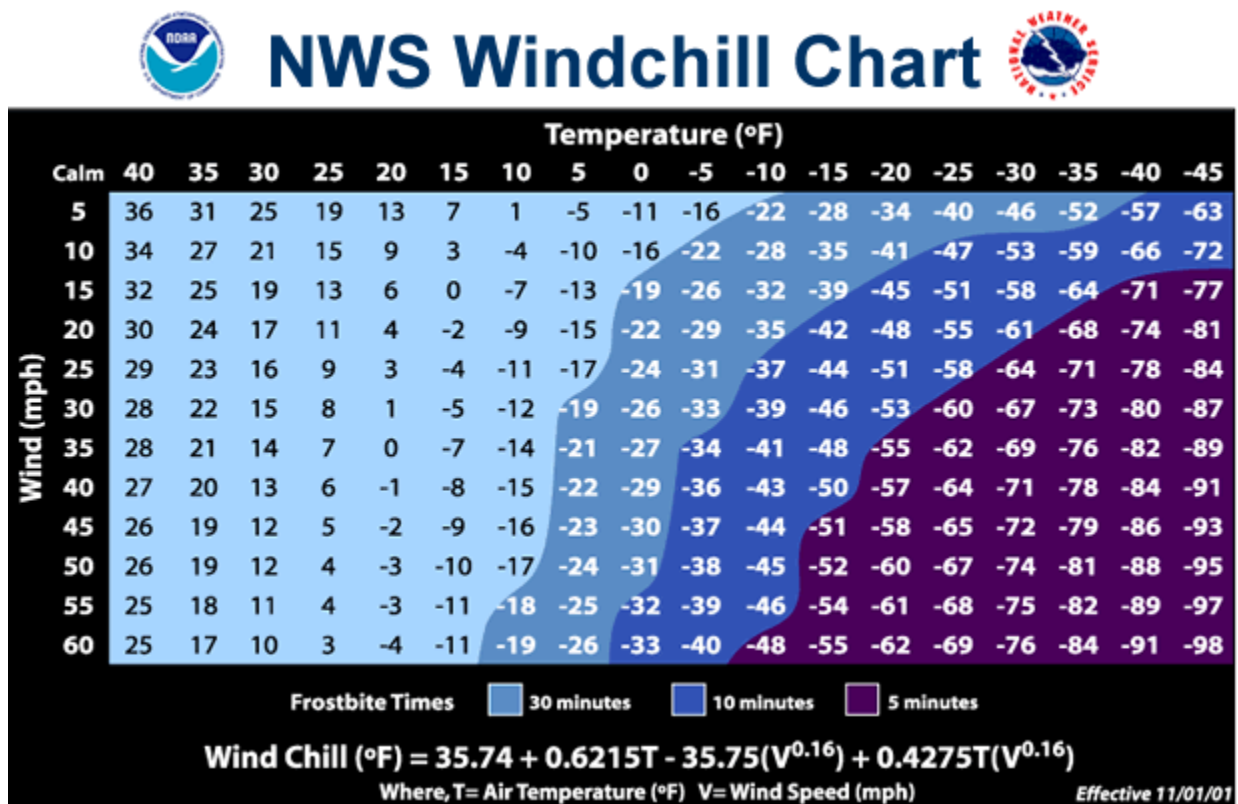


Figure 4.22 NWS Windchill Chart

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

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

(National Weather Service, 2005)

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

Hypothermia has often been called "the killer of the unprepared". It also claims the lives of many outdoor sports enthusiasts. This condition occurs when the body or "core temperature" is lowered. The blood is cooled, thereby reducing the amount of oxygen which is carried to the brain, thus dulling the senses. The victim becomes fatigued, delirious, and loses dexterity and

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control of arms and legs. If the body core temperature continues to drop and nears 85°F, the victim eventually slips into unconsciousness. If treatment is not started immediately, the result is arrest of the circulatory and respiratory systems and death.

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

Strong winds and ice or snow accumulations can take down utility lines. A long-term utility outage becomes more significant during extended cold periods as sheltering and cold weather exposure becomes more challenging. Accessing those in rural areas following heavy snow events to deliver supplies or provide emergency services can be difficult; the need for such services would be compounded by any long-term utility outage.

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

**Severe Summer Storms**

Severe summer storms can result in loss of life, injuries, and damage to property and crops. Although thunderstorms affect relatively small areas when compared to other hazards such as winter storms, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year than tornadoes. Heavy rain from thunderstorms can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with some thunderstorms. Of the estimated 100,000 thunderstorms that occur each year in the United States, only about 10 percent are classified as severe. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. The National Weather Service considers a thunderstorm severe if it produces hail at least ¾ inches diameter, winds of 58 mph or stronger, or a tornado. Thunderstorms are most likely to happen in the spring and summer months during the afternoon and evening hours, but they can occur year round and at all hours. Annually, the central and northern parts of North Dakota may have an average of 10 to 30 days with thunderstorm activity, while the southern part of the state averages between 30 to 50 days.

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

*The Cumulus Stage*

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*



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The mature stage is the strongest and most dangerous stage of a storm's life cycle. As the storm matures, the clouds have a black or dark green appearance. Hail, heavy rain, frequent lightning, strong winds, and tornadoes are most likely to occur during this phase, lasting an average of 10 to 20 minutes. At this stage, the storm contains both upward and downward moving air currents (updrafts and downdrafts) with precipitation in the downdraft area. These updrafts and downdrafts can reach velocities of 170 mph. When the cool downdraft hits the ground, it spreads out and forms a gust front, which may include damaging wind called a downburst. The updraft also causes the top of the storm to spread out.

*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.

*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.

*Wind*

Strong winds can form along the leading edge of a thunderstorm. Downburst winds occur when air is carried into a storm's updraft, cools rapidly, and comes rushing to the ground. Cold air is denser than warm air, and therefore, wants to fall to the surface. On warm summer days, when the cold air can no longer be supported up by the storm's updraft, or an exceptional downdraft develops, the air crashes to the ground in the form of strong winds. These winds are forced horizontally when they reach the ground and can cause significant damage. These types of strong winds can also be referred to as straight-line winds. Downbursts with a diameter of less than 2.5

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miles are called microbursts and those with a diameter of 2.5 miles or greater are called macrobursts. A derecho, or bow echo, is a series of downbursts associated with a line of thunderstorms. This type of phenomenon can extend for hundreds of miles and contain wind speeds in excess of 100 mph.

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

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

*Hail*

Hail is precipitation in the form of a lump of ice. Hail occurs when strong rising currents of air within a storm, called updrafts, carry water droplets to a height where freezing occurs. The ice particles grow in size, finally becoming too heavy to be supported by the updraft and fall to the ground. Hailstones are usually round but can be conical or irregular in shape. They can range from pea size to the size of grapefruit, and large hailstones can fall at speeds faster than 100 mph. Hail tends to fall in swaths that range from a few acres to an area ten miles wide and one hundred miles long. (National Severe Storms Laboratory, 2007) Most hail events affect only relatively small plots of land, while the latter case is rarer.

Hail causes considerable damage to crops and property in the United States, occasionally causing death to farm animals, but seldom causing loss of human life. The damaging aspects of hail falls include the hailstone sizes (average and maximum), number of hailstones per unit area, and associated winds; hail risk is a combination of these factors plus the frequency of hail at a point or over an area. Crop hail losses in recent years nationally are estimated at \$1.3 billion annually, representing between 1 and 2 percent of the annual crop value. Hail losses vary considerably regionally, representing, for example, 1 to 2 percent of the crop value in the Midwest, 5 to 6 percent of the crops produced in the High Plains, and much less elsewhere in the nation. Property hail losses have been increasing with time, now appearing to approximate crop-hail losses recently with crudely estimated annual losses of \$1 billion. (Changnon, 1997)

*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

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rotation may be two to six miles wide, extending through much of the storm. Most tornadoes form within this area of strong rotation when the rising air within the thunderstorm updraft tilts the rotating air from horizontal to vertical. Tornadoes may appear nearly transparent until the circulating wind in the funnel reaches the ground and picks up debris that eventually darkens the whole funnel.

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

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

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.

**4.23 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, 2007a.

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*Public Information and Warnings*

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

- **Hazardous Weather Outlook:** Hazardous weather outlooks alert the public to the possibility for severe weather in the area from one to seven days in advance.
- **Severe Thunderstorm Watch:** Severe thunderstorm watches are issued by the Storm Prediction Center when conditions for severe thunderstorms appear favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
- **Severe Thunderstorm Warning:** Severe thunderstorm warnings are issued when Doppler radar indicates or the public reports a thunderstorm with wind gusts of 58 mph or greater and/or hail  $\frac{3}{4}$  inch or larger in diameter. The warning is usually valid for 30-60 minutes.
- **Tornado Watch:** Tornado watches are issued by the Storm Prediction Center when conditions for tornadoes appear especially favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
- **Tornado Warning:** Tornado warnings are issued when Doppler radar indicates or the public reports a tornado. The warning is usually valid for 15-45 minutes.

(National Weather Service, 2005; Storm Prediction Center, 2007b)

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

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

(National Weather Service, 2005)

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

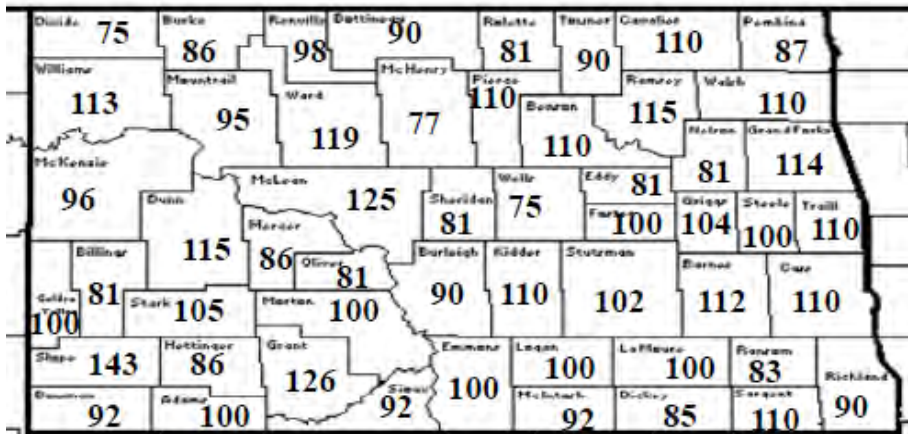
Most summer storms occur during the hot summer months and may be associated with other summer hazards. Lightning in thunderstorms may spark wildfires. When coupled with strong winds, these fires can quickly spread. Slow-moving thunderstorms often trigger flash floods due to the extended duration of the 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.

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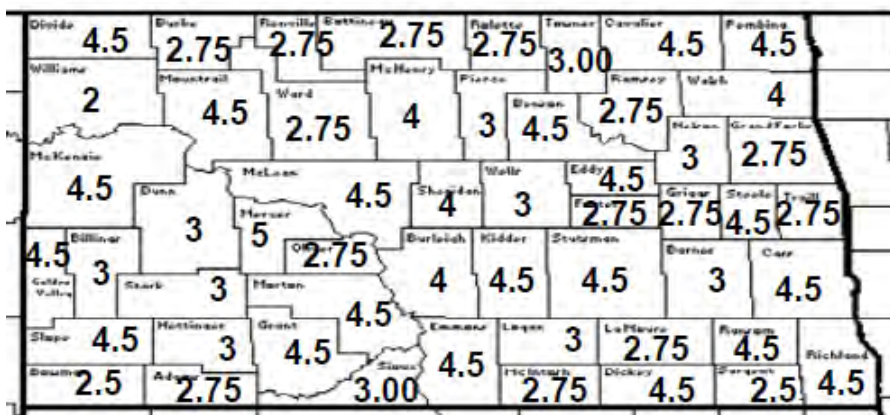
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4.24 Below are maps of North Dakota reported events. (Source: National Weather Service)

**Maximum wind speed reported 1950-2006  
(in mph, non-tornadic thunderstorm)**



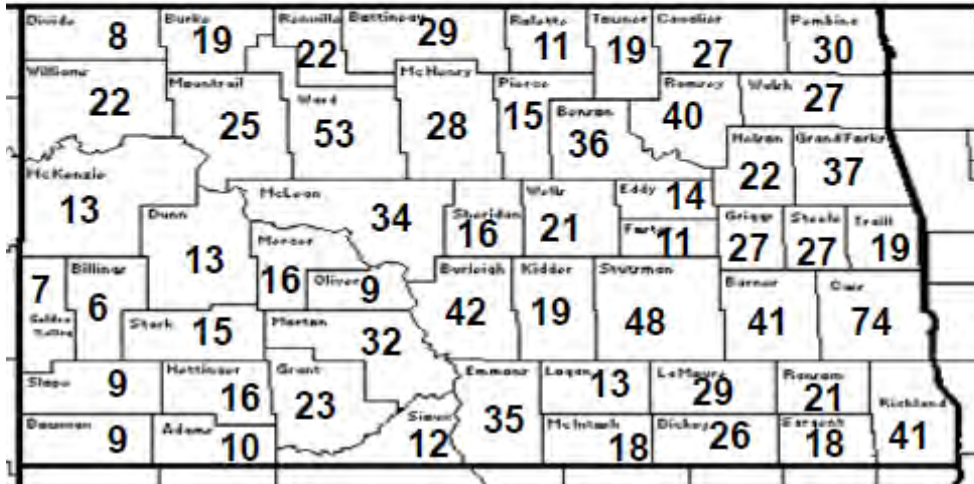
**Maximum hail size reported 1950-2006  
(in inches diameter)**



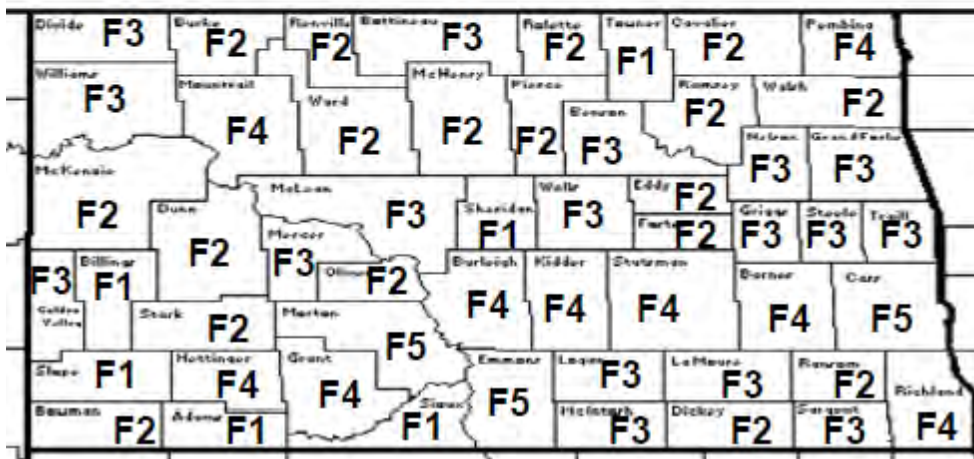
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Number of tornadoes reported 1950-2006



Strongest tornado reported 1950-2006  
 (Fujita scale)



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**History**

**Drought**

**05 Aug 2001, 11:00:00 AM CST**

Excessive Heat in Logan, LaMoure, Dickey, Foster, McIntosh, and Stutsman Counties was reported. No other information was reported.

According to SHELDUS, Logan County only had one significant drought event from 1950 to 2008.

**4.25 Drought Events**

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
6/1/1988	Drought - Heat	ND	Logan	0.00	0.00	94339.62	94339.62
Total				0.00	0.00	94339.62	94339.62

**Extreme Winter Weather**

According to SHELDUS, Logan County has had 10 significant snow and ice events from 1950 to 2008. The chart below shows the results of a winter weather query in SHELDUS.

**4.26 Winter Weather Events**

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
1/9/1997	Winter Weather	ND	Logan	1.25	0.06	1530555.56	0.00
4/4/1997	Winter Weather	ND	Logan	0.48	0.06	1354545.45	0.00
1/15/1997	Winter Weather	ND	Logan	1.43	2.00	900000.00	0.00
1/21/1997	Winter Weather	ND	Logan	1.43	0.00	900000.00	0.00
1/4/1997	Winter Weather	ND	Logan	0.38	0.00	250000.00	0.00
3/4/1983	Severe Storm/Thunder Storm - Winter Weather	ND	Logan	0.00	0.00	94339.62	0.00
12/16/1977	Wind - Winter Weather	ND	Logan	0.00	0.00	94339.62	0.00
3/2/1966	Winter Weather	ND	Logan	0.00	0.02	10204.08	0.00
4/29/1967	Winter Weather	ND	Logan	0.20	0.02	10000.00	0.00
11/7/1986	Winter Weather	ND	Logan	0.02	0.06	9433.96	0.00
Total				5.39	3.73	5186886.90	4129.13

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Some of the major winter storms in Logan County affected specific areas they include the following:

**November 22<sup>nd</sup>, 1993** – Heavy snow affected a large part of North Dakota. A slow moving and enormous storm over North America brought record single storm snowfall to much of North Dakota. Over two feet of snow fell over a large part of central and southeast North Dakota, and most of North Dakota had over a foot of snow from this storm. The greatest snowfall amount was reported at Oakes, in Dickey County in southeast North Dakota, 31 inches. At the National Weather Service office in Bismarck, 28.3 inches of snow was measured during the 108-hour snow event. This amount set a new single storm record for snow in Bismarck. The snow began the evening of the 22<sup>nd</sup> and did not end until the morning of the 27<sup>th</sup>. Except for about six hours during the day on the 26<sup>th</sup>, the snow was continuous through this period. The snowfall was intermittent over most of North Dakota during this lengthy event. Fortunately, the wind was only 10 to 25 MPH during this storm, so it was well below blizzard conditions and blowing and drifting of snow was not a problem. The storm occurred during the week of Thanksgiving, so many travelers were stranded. The prolonged snowfall kept snow removal crews working around the clock, and a few motorists crashed into the snowplows. Out in the rural areas, some farm buildings collapsed in the heavy snow. Property damage from this storm is estimated at \$500,000.

**April 25, 1994** – A late season winter storm came a few days after temperatures of 80 degrees. Parts of southern North Dakota received almost a foot of heavy wet snow. Some thunder occurred with the snowfall. Winds of 25 to 45 MPH caused blizzard conditions at times, and snow drifts three feet high. This late storm brought record seasonal snowfall to many parts of the state. Snowfall for the winter season topped 100 inches in some places. The storm closed schools and businesses, and shut down travel. Property damage from this storm is estimated at \$50,000.

**November 17, 1994** – An intense low pressure system tracked northeast out of Colorado and dumped 6 to 12 inches of snow extending from south central to northeast North Dakota. Along with the heavy snows came strong winds gusting to 50 MPH in the central part of the state. Schools were closed and travel was very difficult. One death, a 47 yr. old man in Ramsey County, occurred due to exposure during the storm.

**January 16, 1995** – A low pressure system moved northeast out of the central Rockies and through northern Minnesota. The low was responsible for areas of freezing rain and drizzle, heavy snow and gusty winds. Freezing drizzle and rain preceded the heavy snow and coated roads and power lines with ice. Logan and LaMoure Counties had power outages due to the ice. Six to twelve inches of snow fell over the area with a maximum of 14 inches in Underwood in McLean County. The freezing drizzle and rain, heavy snow, and winds gusting to 35 MPH made travel hazardous. Several schools were closed and no travel was advised in McHenry, Griggs, Stutsman, Ward, and Dickey Counties.

**February 9<sup>th</sup> and 10<sup>th</sup>, 1995** - strong northerly winds combined with recently fallen snow created near zero visibility in northwest, central, and eastern North Dakota. Along with the



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blowing snow were wind chills 40-60 below zero. Several counties advised no travel, many schools were cancelled and parts of I-29 and I-94 were closed for the second time in as many days. Among the many problems caused by the weather was a serious accident 15 miles west of Mandan on I-94. Zero visibility caused several vehicles to slow or stop on the interstate. Other cars, 23 in all, continued travel causing a chain reaction of accidents resulting in 1 death and 13 injuries. In addition to the injuries from the accident, several rescue workers suffered frostbite in their rescue efforts.

**March 26, 1995** – Several hours of light rain and drizzle preceded the snow. Six to eight inches of wet snow was common with Edgeley receiving a total of 14 inches. Grand Forks and Steele Counties advised no travel.

**April 11, 1995** – Heavy snow fell in parts of south central and southeastern North Dakota. Six to eight inches were common in those areas with a maximum of 16 inches in Wishek.

**February 1, 1996** – Dangerously cold weather once again hit North Dakota. The town of Rolette (Rolette County) in north central North Dakota reported a morning low of 53 below. Many places reported lows from 35 to 45 below. Fargo tied its record low of 39 below. The temperatures at Fargo remained at or below zero for 11 straight days (1/23/96 to 2/3/96). This ties the second longest subzero period, previously set in 1899. Daytime highs fared no better, as Bismarck reached a high of 26 below. Northwest winds up to 30 MPH created wind chills to 100 below. Electric companies reported peak loads, while natural gas companies had trouble keeping gas flowing through pipelines. Numerous schools closed and many water main breaks occurred. There were also shortages of #1 diesel fuel.

**February 10, 1996** – The same storm system that brought the blizzard conditions to north central and northeastern North Dakota also brought winds to the southwest and south central parts of the state. Dickinson (Stark County) and Bismarck (Burleigh County) both reported peak gusts of 62 MPH. Jamestown (Stutsman County) had peak gusts of 68 MPH. New construction projects in Jamestown had walls blown down. In McClusky (Sheridan County) the large plate glass window in the newspaper building was blown in.

**March 23, 1996** – An early spring snow storm moved up out of the 4 corners region of the country to bring another round of severe winter weather to the northern plains. Snow fall totals from the area include Minot AFB at 7 inches, Dickinson and Jamestown at 7.5 inches, Williston at 8 inches, Glen Ullin with 12 inches and Bismarck with 13 inches. I-94 in Morton County was reported to have 6 foot snow drifts blocking lanes and I-94 was closed from Saturday morning to Monday morning. Many travelers ended up being stranded for the weekend in North Dakota. Due to the warm weather received a few days before roadways were warm. When the storm began strong northeast to east winds blew the snow across the road leaving the roadway wet. When the temperature began to fall, roadways became extremely icy. There were numerous reports of vehicles in the ditch, and a few roll-overs were also reported. Many schools across western and central North Dakota had Monday March 25<sup>th</sup> off due to the slow progress of the snow removal. Winds during the weekend averaged between 20 and 30 MPH with higher gusts at times.

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**November 5, 1996** – A storm system that developed over north central Nebraska moved northeast into northwestern Minnesota. Although at first the storm appeared to be warm enough to only produce rain, once snow began to fall on the morning of the 5<sup>th</sup>, dynamic cooling led to an all snow event across south central and east central North Dakota. Luckily, no wind accompanied the storm system and there were no major interruptions in day to day activities. Snowfall totals include 5 inches at Carrington and 6 inches at Bismarck.

**November 19, 1996** – Another winter storm hit North Dakota bringing more unwanted snow to the state. Although there wasn't enough wind associated with the storm system to qualify the storm as a blizzard, the 10 to 20 MPH winds were enough to create some blowing and drifting snow in open areas. Many school districts cancelled their rural bus routes after busses got stuck or slid into the ditch. Some of the snow amounts recorded with this storm include Jamestown at 11 inches, Crosby with 8.5 inches, Garrison, New Town and Rugby with 8 inches, and Minot, Berthold and Bismarck from 6-8 inches.

**December 16<sup>th</sup>, 17<sup>th</sup>, and 18<sup>th</sup>, 1996** - a strong low-pressure center moved southeast out of Canada into the northern plains bringing with it blizzard conditions. The blizzard lasted for 3 days in North Dakota. The blizzard began in the western part of the state. This was the first 3-day blizzard since the winter of 1980-81. Snowfall amounts varied from 2 inches in Dickinson, 3-4 inches in Williston and Bismarck, and 6-8 inches in Jamestown. The light snow combined with north winds gusting to 50 mph produced massive blowing and drifting of snow. Temperatures also plummeted to 20 below creating wind chills from 40-60 below. Visibility was so poor that the North Dakota Highway Department pulled the plows off roads the evening of the 16<sup>th</sup> and did not allow them to return to the roads until the afternoon of the 18<sup>th</sup>. Snowdrifts as high as 10 feet were common. All of I-29 in North Dakota and I-94 from Bismarck to Fargo were closed, stranding hundreds of travelers. There were numerous reports of people stranded in their vehicles after going into the ditch or getting stuck in snowdrifts. Many school districts cancelled school Monday through Wednesday. With the closed roads, mail was delayed up to 3 days in many communities. Strong winds made the drifted snow so hard that many plows just road up and over the drift instead of knocking it down. There were also reports of snowplow blades being broken off by the hard compacted snow. The Game and Fish Department estimates that 12,000-16,000 pheasants may have died during the blizzard from cold, lack of food, or suffocation. Power lines were also knocked down in parts of southwestern North Dakota, leaving people without electricity for up to 31 hours. Many ranchers faced the possibility of losing part of their cattle herd due to the cold and being unable to get food to them.

**January 4<sup>th</sup> and 5<sup>th</sup>, 1997** - the first blizzard of 1997 hit east central North Dakota. The blizzard was preceded by freezing rain that lasted most of the day before switching over to snow. The snow became so heavy that the Highway Department pulled the plows off the roads the evening of the 4<sup>th</sup> and all day on the 5<sup>th</sup>. Northwest winds of 25-35 mph were common. Some of the higher snow amounts include 14 inches at Ellendale (Dickey County) and Linton (Emmons County), 11 inches at Hague (Emmons County), and 18 inches at Oakes (Dickey County). The roof collapsed at the Lull Plant in Oakes from the weight of the snow. Although the snow was not as heavy in the western part of North Dakota, the freezing rain made travel very hazardous. A Greyhound Bus slid into the ditch on I-94 near New Salem. This would turn out to be the first

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of 4 major snow events that would hit western and central North Dakota during January. Estimated property damages were \$6.5 million and 10 people were injured.

**January 9<sup>th</sup>, 10<sup>th</sup>, and 11<sup>th</sup>, 1997** - the second blizzard in less than 1 week brought North Dakota to a virtual standstill. This blizzard did not bring as much snow as the first storm, but the winds gusted from the northwest as high as 40 mph and lasted for 3 days. Snowfall amounts from this storm varied from 1-2 inches in the southwest to 2-4 inches in the central. Strong winds combined with this snow as well as the snow from a few days earlier, created widespread whiteout conditions lasting for 3 days. There were numerous communities that halted mail delivery and cancelled school. In Emmons County, every road was blocked by drifts, some as high as 18 feet. In McLean County there was a drift at the intersections of highways 83 and 37 that was 12 feet high and 150 yards long. It took snowplow operators, working from both directions, 10 hours to open. The Standing Rock Indian Reservation had severe hardship with snowdrifts taller than buses blocking all of the entrance roads. Most of the people on the reservation ran out of propane to heat their homes, and food shortages were widespread. Again, almost every major road in North Dakota was closed and plows pulled off. In Foster County, the county road department had to abandon some roads because they no longer had money or equipment to reopen them. When plows were running, the operators were putting in 12-14 hour days. The drifts were so big that 2 coal trains got stranded in the blizzard and an Amtrack train was stranded in Stanley. Many buildings were beginning to fail from the weight of the snow of this storm and the previous one. There were reports of people getting stranded in vehicles for up to 40 hours. Those that stayed with their vehicles survived, but those that did not, either perished or suffered second to third degree burns over 70-90 percent of their body. A 41-year-old Carrington man died from exposure when he tried to walk from his stranded car to his parent's farmhouse ½ mile away. A 66-year-old Dunseith man died from hypothermia when he fell off his porch when the railing gave way and he could not get back up. As the storm was winding down, bitter cold air moved in and wind chills plummeted to 85-90 below with actual air temperatures of 20-30 below. In Elgin (Grant County), the water tower froze and broke open due to the cold temperatures. With the amount of suffering and hardship going on, Governor Schafer declared the state a disaster area. This was followed on the 12<sup>th</sup> with President Clinton approving the first ever request to declare a major statewide disaster. The National Guard was called in to help with snow removal as many communities had already spent their snow removal money before the storm. Estimated damages were \$55.1 million. Two people died and 45 injured.

The state of North Dakota was hit by 4 major blizzards **January 4<sup>th</sup> – 22<sup>nd</sup>, 1997**. The economic impact these 4 blizzards had on North Dakota (all of which included Logan County) it is estimated that on the agricultural side alone, over \$6 million was lost for buildings and machinery, \$4.7 million in livestock deaths, \$21.7 million for extra feed consumption, and \$50,000 worth of dumped milk when transporters could not get to the farms. In addition, it is estimated that \$600,000 was spent by the Game and Fish Department to help farmer's battle deer that were eating their hay reserves. Also, it is estimated that the National Guard spent \$800,000 in January to help with snow removal. Many communities spent up to 10 times their snow removal budget in January alone, with the state itself spending an estimated additional \$125,000 in salaries and operating expenses.

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**April 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup>, and 7<sup>th</sup>, 1997** - warm weather the first 3 days of April led much of North Dakota to believe that spring had arrived with temperatures in the 60's and 70's. Mother Nature had other plans. A very strong area of low pressure moved out of the Colorado area into the northern plains. Warm moist air ahead of the low collided with cold air coming down from Canada. The result was the worst blizzard of the season for North Dakota, bringing much of the state to a complete halt. The precipitation began to fall as rain in the east and freezing rain or sleet in the west. Eventually the freezing rain and sleet had changed over to all snow in the west. Snow accumulations were on average 1.5 to 2 inches an hour with winds of 50-60 mph as well. The additional snow at Bismarck brought the season snowfall total to 101.4 inches, which set an all time record period. The old record was 91.8 inches. In Jamestown, they received 1.62 inches of rain before changing over to snow. After the devastating January blizzards, this was the storm that may have broken the back of many of the state's ranchers. An estimated 100,000 head of cattle (10 percent of the state's herd) was lost, with a large percentage of that being calves and yearlings. The estimated dollar loss was well over \$5 million. An estimated \$21.5 million worth of damage was done to farm buildings that collapsed under the weight of the heavy snow. Because of the closed roads, an estimated 200,000 pounds of milk had to be dumped when the trucks could not make it to pick up the milk. The dairy company that was supposed to pick up the milk also suffered damages. A roof collapsed under the heavy load, killing 40 dairy cows and injuring 45 others. Many power poles fell from the weight of the ice and snow combined with strong winds. It is estimated that over 300 wooden poles had to be replaced, with one Power Company reporting about 100 steel towers damaged or destroyed with over 200 miles of transmission line down. An estimated 75,000 homes were without power for some time over the weekend, with a few houses having to wait 4-5 days before power was fully restored. The state's electrical grid was in such patchwork condition that the governor requested that people conserve as much energy as possible for fear of overtaxing the system and creating a widespread brownout. National Guard helicopters were used to help power companies assess the damage done to power poles and lines. With the widespread power outages, many people had to resort to burning wood or running gas powered generators to keep their homes warm. This led to a few reports of carbon monoxide poisoning. Numerous vehicles and people were stranded in and out of towns. I-94, I-29, and all other major highways in the state were closed for the weekend. On the 7<sup>th</sup>, President Clinton declared North Dakota a disaster area for the 2<sup>nd</sup> time this winter, freeing up grants and making low interest loans possible. The effects of the 1997 blizzard will be felt for some time to come. The fear was that as the snow melted revealing the cattle that perished during the storm, ground water contamination would be possible due to cattle decaying in the spring sun. Ranchers also feared that the storm would weaken the surviving cattle and calves to the point that disease would take over and kill off part of the herd. Estimated damages were \$44.7 million. Two people died and 16 injured.

**April 3<sup>rd</sup>, 1999** – Strong low pressure over the central Rockies moved into the northern plains on the morning of the 3<sup>rd</sup>. The storm brought an area of heavy snow over western and central North Dakota. Snowfall ranged from 4 to 8 inches. The heaviest snow fell over the north central area. The city of Towner (McHenry County) reported 8 inches.

**February 26, 2000**- Low pressure developed over eastern Colorado on the 24<sup>th</sup> then moved east northeast into Nebraska and intensified before moving into the northern plains during the early

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morning hours of the 25<sup>th</sup>. The storm moved quickly northeast to southern Manitoba Canada by the early morning hours on the 27<sup>th</sup>. The storm system maintained abundant amounts of moisture which began as rain. As colder air spilled on the back side of the storm system the rain turned to wet snow. A wide band of heavy wet snow fell from south central North Dakota through portions of extreme north central North Dakota along the Canadian border. Scattered areas of 8 to 12 inches of wet snow fell over this area with numerous reports of 3 to 6 inches within this band. The maximum snowfall reported was 12 inches along the Grant County and Morton County line in central North Dakota. The eastern edge of the heavy snow band extended from Lemmon, South Dakota to Devils Lake (Ramsey County) and the western edge extended from Dickinson (Stark County) to Bottineau (Bottineau County). Winds with this storm generally ranged between 30 to 45 MPH which caused some blowing and drifting snow.

**March 8, 2000** – A strong low pressure system over Colorado moved into Nebraska on the 7<sup>th</sup> of March then tracked east northeast to southern Minnesota on the 8<sup>th</sup>. An abundant amount of moisture accompanied this storm system which brought rain and scattered thunderstorms across southern North Dakota before turning to wet snow. Snow amounts ranged between 3 to 6 inches with the heaviest falling over south central North Dakota. Winds during the storm ranged between 40 to 50 MPH which created dangerous winter conditions. Major roads were closed in and around the Jamestown area in Stutsman County. In McIntosh County, residents in the city of Ashley were out of power for 30 hours during the height of the storm. Winds and ice downed numerous power lines. The county was without power for an additional 5 hours when repairs were made to the poles at the end of the month.

**November 7, 2000** – A strong low pressure system along the Kansas/Missouri border moved northward to western Minnesota. An abundant amount of moisture was drawn northward with this system and wrapped around much colder air to the west and north of the low pressure center. Heavy snow fell across western and central North Dakota with accumulations of 6 to 18 inches reported. Up to 18 inches fell in the city of Alexander in McKenzie County causing widespread power outages due to 40 power lines downed. In Divide County at Crosby, reports of two dozen sheep were buried alive in four foot snow drifts. The sheep were rescued with no loss of livestock. Other areas received an average of 4 to 8 inches. The snow was accompanied by gusty northwest winds up to 40 MPH causing widespread reduced visibility less than a half mile and wind chills to 30 below.

**December 17, 2002, 2:52 PM CST – December 19, 2002, 4:00 PM CST**

A low pressure system developed over southwestern South Dakota, intensified and moved northeast to northwestern Minnesota. A band of heavy snow fell across north central and parts of east central North Dakota. An upper level system dropped south out of Canada bringing bands of snow from north central to east central North Dakota. In addition to the snow, winds of 25 to 40 mph caused considerable blowing and drifting. Areas of freezing rain preceded the snowfall. The heaviest snowfall occurred over north central North Dakota where 12 to 19 inches accumulated and drifts over 6 feet reported in some areas.

**January 4, 2004, 6:00 PM CST – January 5, 2004, 12:00 PM CST**

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A strong arctic high pressure system over British Columbia Canada moved southeast into the northern plains Sunday, the 4th of January and brought extremely cold temperatures and gusty winds to western and central North Dakota. Temperatures reached 20 to 30 below zero Sunday night and remained between 10 and 20 below zero on Monday. West winds of 10 to 25 mph combined with the subzero temperatures created wind chills ranging from 45 to 58 below zero over western and central North Dakota. The winds also created low visibility of blowing snow in many areas of the region. Some roads were closed due to the blowing and drifting snow over parts of northern North Dakota. The frigid temperatures lead to power outages and water line breaks in several areas.

**January 24, 2004, 8:00 AM CST – January 25, 2004, 4:00 PM CST**

Low pressure over the central Rockies intensified into a major winter storm impacting North Dakota on the weekend of January 24th and 25th. A persistent snow event produced 6 to 12 inches of snow over most of western and central North Dakota. The heaviest band of snow fell from the northwest through central North Dakota where snowfall amounts ranged from 9 to 12 inches. The storm began as freezing rain and sleet over north central North Dakota before turning over to all snow. Gusty winds of 15 to 25 mph accompanied the storm resulting in considerable blowing and drifting snow and wind chills to 30 below zero. Travel throughout the region was impacted due to reduced visibilities and blocked roads. Numerous vehicle accidents were reported with some minor injuries but no details on the injured.

**January 27, 2004, 6:00 PM CST – January 28, 2004, 11:30 AM CST**

An approaching arctic high pressure system over southern Canada and exiting low pressure system over the northern plains brought extremely cold temperatures and bitter wind chills to western and central North Dakota. Ambient temperatures ranging 20 to 35 below zero combined with northwest winds to 30 mph resulted in widespread wind chill factors of 40 to 65 below zero. In southwest North Dakota, in Adams County, icy roads and reduced visibilities in blowing snow resulted in a fatality (indirect) when a 35 year old male lost control of his vehicle and rolled several times. The driver was ejected from the vehicle. The arctic high pressure system settled over the region late Wednesday morning on the 28th of January and brought diminishing winds to the area.

**February 10, 2004, 2:49 PM CST – February 11, 2004, 12:00 PM CST**

The winter storm warning for western and central North Dakota was upgraded to a blizzard warning in the afternoon of the 10th. Strong winds of 50 mph combined with snow had reduced visibilities to zero at times by the late afternoon hours and remained at or near zero through the night. A gradual improvement began in the morning of the 11th. Snow drifts to 20 feet were reported in the northwestern areas of the state. Local and county snow removal equipment was not sufficient to move the snow and local and county governments requested state assistance. Many roads and parts of Interstate 94 were closed stranding numerous motorists and bringing travel to a standstill. The railroad systems in the northern part of the state were also halted due to the large snow drifts. An Amtrak train became stuck near Epping North Dakota and had to backup to Williston North Dakota, about 15 miles to the southwest. Numerous vehicles went into ditches, stalled out or became stuck in the heavy snowdrifts. Only minor injuries (indirect) were reported. Snowfall from the storm only amounted to around an inch; however snowpack from

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previous snow events combined with the strong winds created blizzard conditions throughout western and central North Dakota. Conditions rapidly improved by the late morning on the 11th as the storm system exited the region. A strong low pressure system over Alberta Canada moved rapidly southeast into eastern North Dakota resulting in strong northwest winds and snow over western and central North Dakota. Wind gust to 50 mph were reported over various locations of the region. Conditions deteriorated rapidly in the early afternoon hours on the 10th when visibilities lowered to less than a quarter mile (>1/4) producing "white out" conditions. The winter storm warning was upgraded to a blizzard warning by mid afternoon on the 10th.

**January 13, 2005, 2:58 PM CST – January 15, 2005, 12:00 PM CST**

An arctic high pressure system dropped southeast out of central Canada on the evening of the 13th of January. The system brought bitter cold temperatures to western and central North Dakota the night of the 13th. The air temperatures overnight dropped to 20 to 35 below zero with daytime temperatures ranging 10 to 20 below zero. The subzero temperatures lasted through the morning of the 15th. Northwest winds up to 20 mph accompanied the cold air producing extreme wind chills of 40 to 60 below zero across the region. Many schools and outdoor activities were cancelled due to the bitter cold.

**November 28, 2005, 5:00 AM CST – November 28, 2005, 6:00 PM CST**

Light freezing rain iced area roads before changing to snow during the day as colder air rushed in. Three inches of snow fell at Edmunds, Stutsman County, with as much as 5 inches in Gackle, Logan County. The wind gusted to 35 mph in Ashley, McIntosh County, and as high as 40 mph at Gackle. This caused reduced visibility in blowing snow. No travel was advised in Stutsman County and Interstate 94 was closed from Jamestown to the Minnesota line. Although snowfall was not significant, the combination of freezing rain, snow, and blowing snow resulted in a major disruption to transportation.

**December 29, 2005, 10:00 PM CST – December 30, 2005, 4:00 AM CST**

Freezing rain began falling over most of the area by early afternoon on the 29th with rain along the South Dakota border. Most areas had a coating of ice before precipitation changed to heavy wet snow. Snow on top of the ice resulted in no travel advised in Emmons and Kidder counties. Snow amounts reported were 6 inches near Hazelton and at Streeter, 8 inches at Ellendale, and 12 inches at LaMoure. The LaMoure County Sheriff advised no travel as even snow plows were having a tough time clearing roads of the heavy wet snow.

**February 16, 2006, 6:00 PM CST – February 18, 2006, 12:00 PM CST**

Temperatures were in the 15 to 25 degree below zero range with wind speeds of 15 to 25 mph resulting in wind chills mainly in the 40s below. The lowest wind chills were -55 in Rolette County and -50 in Foster, Kidder, and Mountrail counties. Wind chill warnings were posted a full day in advance, on the 15th.

**December 30, 2006, 5:00 AM CST – December 30, 2006, 11:00 PM CST**

Eleven inches of snow fell at Kulm. Snow plows were pulled off the highways. A unique meteorological condition led to very significant heavy snow over central and eastern North Dakota on December 30, 2006. An upper level low cut off over the southwest part of the United

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States and transported Gulf of Mexico moisture northward. At the same time a second upper level low cut off along the Montana and North Dakota border and acted to pull this moisture into North Dakota. The event was a heavy snow event as the surface low and pressure gradient were relatively weak and did not cause gusty wind or blowing snow. The highest snow totals, in excess of 10 inches, were from Bismarck, to Hazelton, Wishek, and Ashley, and through parts of Stutsman and Foster counties. These were the most significant snow amounts in these areas, from a single storm, in about seven winter seasons. The sheriff in several counties advised no travel. Snow plows were pulled off the highways from Wishek and Gackle, through Medina, Jamestown, and Carrington, to Rolla, due to the low visibility in heavy falling snow. There were many accidents and vehicles in ditches, at least 41 in the Bismarck area and more than 50 in the Jamestown area alone. A church in Jamestown was used as a shelter for 86 stranded people.

**February 28, 2007, 3:00 AM CST – February 28, 2007, 11:59 PM CST**

Seven to nine inches of snow was reported over Lamoure County. A low pressure system ejecting out of the Northern Rockies and into Wisconsin brought snow across western and central North Dakota from late Tuesday night February 27th into Wednesday night February 28th. The heaviest snow (9 to 12 inches) fell over far south central and southeastern North Dakota. Accumulating snow, along with freezing drizzle and blowing and drifting snow, continued over the eastern forecast area into Thursday morning of March 1st. (See Storm Data entries for March, 2007). In addition to the heavy snow, light freezing rain and sleet also fell Wednesday afternoon and night over the central and eastern counties of the Bismarck County Warning Area (CWA).

**March 1, 2007, 0:00 AM CST – March 1, 2007, 4:00 AM CST**

Six inches of total snow accumulation was reported across Renville County, along with light freezing rain and sleet. Precipitation continued from February 28. A low pressure system ejecting out of the Northern Rockies and into Wisconsin, continued to bring snow across portions of central North Dakota from late Tuesday night of February 27th through Thursday morning of March 1st. (See Storm Data entries for February). In addition to the heavy snow, light freezing rain and sleet also fell early Thursday morning over the eastern counties of the Bismarck County Warning Area (CWA).

**March 2, 2007, 6:00 AM CST – March 2, 2007, 9:00 PM CST**

Strong northwest winds sustained at 35 mph with gusts in excess of 40 mph, reduced visibilities in blowing snow to 1/4 mile or less at times, and created treacherous road conditions with ice and snow cover. State Highway 200A north of Washburn was closed. The winter storm system that brought heavy snow to West and Central North Dakota Wednesday February 28th (See Storm Data entries for February) through early Thursday March 1st, intensified as it moved towards and into Wisconsin later Thursday and Friday March 2nd. In addition to additional light snow accumulations (1 to 3 inches), strong northwest winds developed early Friday morning, and continued into Friday evening. Winds of 30 to 45 mph were recorded across central North Dakota for much of Friday. These winds, in combination with recent snowfall of 5 to 12 inches, created widespread areas of significant blowing and drifting snow with near zero visibilities. Conditions were much worse in the open country than they were within urban areas, as numerous rural roadways became impassable due to large snow drifts. As a result, no travel was advised for



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much of central North Dakota, along with several highways being closed including Interstate 94 from Bismarck to Fargo.

**January 29, 2008, 1:00 AM CST – January 30, 2008, 8:00 AM CST**

Wind chills of 40 to 55 below zero with wind speeds of 30 to 50 mph persisted for over 30 hours. The lowest wind chill recorded was 52 below zero at Gackle. Bitter cold arctic air with temperatures of 10 to 25 below zero, and winds of 30 to 40 mph with gusts up to 55 mph, resulted in wind chills of 40 to 60 below zero. These conditions began across west and central North Dakota Monday night the 28th and continued into Wednesday afternoon the 30th.

**February 9, 2008, 9:00 PM CST – February 10, 2008, 10:00 AM CST**

Wind chills of 40 to 50 below zero with wind speeds of 15 to 35 mph persisted for over 12 hours. The lowest wind chill recorded was 47 below zero. Bitter cold arctic air with temperatures of 15 to 30 below zero, and winds of 15 to 35 mph and gusts up to 45 mph, resulted in wind chills of 40 to near 60 below zero. These conditions developed over west and central North Dakota Saturday the ninth, and continued into the morning and early afternoon hours of Sunday the tenth. These conditions followed blizzard or near blizzard conditions on the eighth and ninth.

**Summer Storm**

According to SHELDUS, Logan County has had 10 severe summer storm events from 1950 to 2008.

**4.27 Summer Weather Events**

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
7/1/1994	Severe Storm/ThunderStorm	ND	Logan	0.00	0.00	2083333.33	208333.33
7/1/1993	Severe Storm/ThunderStorm	ND	Logan	0.00	0.00	943396.23	943396.23
7/16/1993	Severe Storm/ThunderStorm	ND	Logan	0.00	0.00	227272.73	227272.73
6/25/1999	Severe Storm/ThunderStorm - Wind	ND	Logan	0.00	0.00	200000.00	0.00
3/4/1983	Severe Storm/Thunder Storm - Winter Weather	ND	Logan	0.00	0.00	94339.62	0.00
6/19/1979	Severe Storm/ThunderStorm	ND	Logan	0.00	0.00	50000.00	0.00
7/4/1977	Hail - Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	50000.00	0.00
6/12/2001	Severe Storm/Thunder	ND	Logan	0.00	0.00	45000.00	0.00

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	Storm - Wind						
10/11/1997	Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	30000.00	0.00
8/29/1997	Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	10000.00	0.00
<b>Total</b>				<b>2.00</b>	<b>0.00</b>	<b>3744878.81</b>	<b>1392573.72</b>

Some of the major thunder storms in Logan County affected specific areas they include the following:

**July 8, 1995-** Thunderstorm winds were reported in Lehr. The wind speed is unknown. A pole barn was destroyed.

**July 9, 1995** – Thunderstorm winds (55 knots) were reported in Napoleon. Numerous tree branches and power lines were knocked down.

**August 29, 1997** – Thunderstorm winds (65 knots) were reported in Napoleon. The winds blew down a chain link fence around the school. Also numerous trees fell in town with some falling across houses or automobiles. Property damage is estimated at \$10,000.

**October 11, 1997-** Thunderstorm winds (75 knots) were reported ten miles southwest of Napoleon. Pole barns were toppled along damage path, as well as a few out buildings. Roofs were also partially ripped off a few barns. A few of the buildings just finished receiving repairs from the July storms. Property damage is estimated at \$30,000.

**August 18, 1998-** Thunderstorm winds (50 knots) were reported in Gackle. There were reports of branches down.

**June 25, 1999** – Thunderstorm winds (61 knots) were reported in Napoleon. Property damage is estimated at \$200,000.

**July 22, 1999** - Thunderstorm winds (50 knots) were reported in Gackle.

**November 1, 1999** – An intense low pressure system over southern Saskatchewan, Canada trailed a strong cold front into eastern Montana on the 31<sup>st</sup> of October. The strong cold front entered western North Dakota Sunday evening on the 31<sup>st</sup> moving into central North Dakota before midnight then across east central North Dakota during the early morning hours of November 1<sup>st</sup>. The system brought widespread winds in excess of 65 MPH to the region. The high winds combined with very dry conditions caused numerous wild fires burning thousands of acres of land and a few buildings. Numerous homes and businesses reported wind damage to roofs and windows.

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**April 5, 2000** – A low pressure system over Alberta, Canada moved southeast and intensified along the Canadian/North Dakota border. A very tight pressure gradient resulted in very high winds causing injuries and property damages throughout western and central North Dakota. Wind gusts of 55 to 70 MPH were common. The injuries were mainly in Burleigh County in the city of Bismarck where 9 people were taken to area hospitals injured from flying debris. One person suffered a broken wrist from falling. Damage was widespread. There were widespread power outages. Homes, automobiles, trees, power lines, and businesses suffered during the wind storm. Several grass fires erupted across the region.

**June 9, 2001, 6:53 PM CST – June 9, 2001, 7:40 PM CST**

Hail was reported .75 inches in Napoleon that lasted approximately 25 minutes. Cooperative observer reported a roof was blown off a business and mature trees uprooted with wind of 87 mph in Napoleon. Winds of 65 mph in Lehr caused large uprooted trees and damage to several homes in the city. Campers were overturned and 1 cabin was completely destroyed at Beaver Lake State Park with 1 camper blown into Beaver Lake. A number of power lines were downed and a business had a basement collapse.

**June 12, 2001, 10:00 PM CST – June 12, 2001, 10:00 PM CST**

Winds of 70 kts caused damage to pole barns and farm house 4 miles west northwest of Napoleon resulting in 45K of property damage.

**July 22, 2001, 4:50 AM CST – July 22, 2001, 4:50 AM CST**

Numerous tree branches were down in the city of Gackle with winds of 52 kts.

**July 31, 2001, 12:15 AM CST – July 31, 2001, 12:15 AM CST**

A grain bin was destroyed with winds of 57 kts 6 miles north northwest of Fredonia.

**June 28, 2002, 7:58 PM CST – June 28, 2002, 8:40 PM CST**

Two persons were injured when a large tree was toppled by winds of 55 kts onto their tent at the campground in Beaver State Park. Numerous trees were uprooted with several homes receiving minor wind damage. Winds of 57 kts were reported in Gackle.

**July 24, 2002, 9:50 PM CST – July 24, 2002, 9:50 PM CST**

Winds were reported of 52 kts in Napoleon.

**August 8, 2002, 9:00 PM CST – August 8, 2002, 9:00 PM CST**

Winds of 57 kts were reported 3 miles northwest of Lehr.

**July 3, 2003, 8:25 PM CST – July 3, 2003, 9:00 PM CST**

Wind damage to nearly all farmsteads between Napoleon and Fredonia with one family home destroyed with winds of 70 kts. Power outage occurred for several hours in the city of Napoleon along with numerous trees uprooted and one home receiving major roof damage. On the outskirts of Napoleon 30-4,000 pound thresher machines tipped on their sides. A 75,000 and two 25,000 bushel grain bins destroyed along with a well/drilling and repair shop destroyed in the city of Fredonia.

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**June 7, 2005, 8:45 PM CST – June 7, 2005, 9:16 PM CST**

USDA reported 60 percent loss of small grain, 40 percent loss of corn, sunflowers, soybeans and alfalfa, and 30 percent loss of mixed forage caused from high winds and hail. 0.75 inch hail accompanied the storm. Winds reported in Burnstad at 57 knots and Napoleon at 52 knots. Hail reported 5 miles southeast of Burnstad at .75 inches and heavy rainfall of 2.40 inches accompanied the storm. One mile north of Lehr hail was reported at .88 inches.

**August 22, 2006, 7:55 PM CST – August 22, 2006, 8:25 PM CST**

Hail swath 2 miles wide from 2 miles SW Napoleon to 10 miles E Napoleon. Hail was piled a foot deep in places. Major damage was reported to windows and roofs. Hail was being reported in real time by trained spotters. Hail path and swath was determined from newspaper articles. Crop damage included 250 acres of corn. Property damage estimated at \$150K and crop damage at \$40K. Winds reported 6 miles east, southeast of Burnstad at 52 knots.

**June 17, 2007, 8:00 PM CST – June 17, 8:13 PM CST**

In the late afternoon of Sunday, June 17th, Tornado Watch 412 was issued in anticipation of severe thunderstorms and possible tornadoes developing ahead of a strong surface cold front and low pressure center approaching. Numerous severe thunderstorm warnings and several tornado warnings were issued. Many reports of large hail and severe thunderstorm wind gusts, along with 1 funnel cloud report, were received during the episode. Wind at 52 knots was reported 6 miles north, northwest of Lehr. Five large pines were blown over in the north city park of Gackle, wind was 56 knots.

**September 23, 2007, 7:00 PM CST – September 23, 2007, 7:11 PM CST**

Severe Thunderstorm Watch 685 was issued in anticipation of severe thunderstorms developing ahead of a surface cold front over western South Dakota, and ahead of an ejecting upper level trough over the Rockies. Several severe thunderstorm warnings were issued. Large hail and severe thunderstorm wind gust reports were received during the early and mid evening hours over McIntosh and Logan Counties. McIntosh County was hit hard by this event with a 27 mile long stretch of damage from southwest to northeast across the county. Winds at 50 knots reported 9 miles north of Lehr.

**Windstorms**

According to SHEL DUS, Logan County had 10 significant high wind events.

**4.28 Windstorm Events**

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
6/25/1999	Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	200000.00	0.00
12/16/1977	Wind - Winter Weather	ND	Logan	0.00	0.00	94339.62	0.00
7/4/1977	Hail - Severe	ND	Logan	0.00	0.00	50000.00	0.00

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	Storm/Thunder Storm - Wind						
6/12/2001	Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	45000.00	0.00
10/11/1997	Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	30000.00	0.00
9/6/1970	Hail - Wind	ND	Logan	0.00	0.00	25000.00	0.00
8/29/1997	Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	10000.00	0.00
6/17/2007	Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	9000.00	0.00
6/17/1971	Hail - Wind	ND	Logan	0.00	0.00	4545.45	45454.55
11/8/1977	Wind - Winter Weather	ND	Logan	0.00	0.00	3571.43	0.00
<b>Total</b>				<b>2.02</b>	<b>0.06</b>	<b>478986.26</b>	<b>59025.98</b>

Most counties have experienced straight-line or downburst wind damage caused by winds in excess of 100 mph. Because there are few wind speed recording devices and these devices are spread quite far apart, there are likely fewer reported extreme wind events than occur. In recent years there has been an increase in the density of the wind reports and improved estimates of extreme wind speed. Each county is likely to experience one or more extreme wind event per year, and each event may affect tens to hundreds of square miles. Downburst winds cause much more overall damage than tornadoes each year since they cover so much more area. However, tornadoes tend to be more deadly within their narrow paths.

Some of the major high wind events in Logan County affected specific areas they include the following:

**November 1, 1001, 4:00 AM CST – November 1, 2001, 6:00 PM CST**

A strong low pressure system across southern Saskatchewan and Manitoba Canada swept a fast moving cold front through western and central North Dakota producing strong westerly winds of 30 to 45 mph. Occasional gust over 55 mph were observed. Logan County reported winds of 50 mph.

**November 29, 2002, 8:00 AM CST – November 29, 2002, 7:15 PM CST**

After record high temperatures, a strong Canadian cold front moved rapidly south through the state producing strong northwest winds of 40 to 70 mph over western and central North Dakota. The cold front brought colder air and a few snow showers to the region. Logan County reported winds of 61 kts.

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**March 10, 2004, 11:00 AM CST – March 10, 2004, 9:00 PM CST**

A fast moving cold front brought strong to high winds to western and central North Dakota in the late morning hours and continued through the early evening hours. Sustained winds of 40 mph with gust to 60 mph were common over western and central North Dakota. The winds subsided late in the evening of the 10th. Winds reported in Logan County were at 54 knots.

**December 11, 2004, 2:57 PM – December 12, 2004, 12:00 PM CST**

A strong cold front brought high winds to western and central North Dakota causing one minor injury and minor damage across the region. The frontal system also brought scattered snow showers with areas of blowing snow reducing visibilities in several locations. No travel was advised in the southwest due to the high winds. Sustain winds of 40 to 50 mph existed over the region with gust of 50 to 65 mph. The highest gust reported was 76 mph 5 miles east of Richardton in Stark County. Damage was confined to a new construction being built at the Fort Berthold Community College in Mountrail County. A male carrying his luggage from the Bismarck Airport to his vehicle was blown over by the high winds causing minor injuries to his leg. Logan County reported wind at 66 knots. Damage with this storm was estimated at \$30.0K.

**March 9, 2005, 10:00 PM CST – March 10, 2005, 11:00 AM CST**

A strong cold front moved rapidly through the northern plains resulting in strong winds over western and central North Dakota. Sustained speeds were generally 30 to 40 mph. The highest gusts were 68 mph at Selfridge and 73 mph just south of New Salem. Snow showers accompanied the winds causing reduced visibilities in some locales in the eastern part of central North Dakota. Logan County reported winds at 64 knots.

**May 1, 2008, 6:00 PM CST – May 1, 2008, 8:00 PM CST**

Sustained winds were measured at 40 mph with gusts to 68 mph at St. Anthony. A low pressure system pushed east across North Dakota and resulted in high winds over the south central part of the state for a few hours during the early evening of Thursday, May first. Winds were sustained around 40 mph with gusts as high as 68 mph measured at St. Anthony in Morton County. Logan County reported winds at 59 knots.

**Hail**

Most of the sizes reported in this graphic have occurred in just the last few years. Hail size reporting may also be skewed by population density since hail that occurs in less populated areas is less likely to be found or checked for size before it has begun to melt. Often, the hail melts before it can be measured and only the damage is left for record.

According to SHELDUS, Logan County had 10 significant hail events from 1950 to 2008.

**4.29 Hail Events**

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
8/19/1974	Hail - Tornado	ND	Logan	5.00	0.00	250000.00	250000.00
8/26/2007	Hail	ND	Logan	0.00	0.00	250000.00	500000.00

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8/22/2006	Hail	ND	Logan	0.00	0.00	150000.00	40000.00
7/28/1996	Hail	ND	Logan	0.00	0.00	80000.00	150000.00
8/10/2007	Hail	ND	Logan	0.00	0.00	60000.00	0.00
8/13/1989	Hail	ND	Logan	0.00	0.00	50000.00	50000.00
7/4/1977	Hail - Severe Storm/Thunder Storm - Wind	ND	Logan	0.00	0.00	50000.00	0.00
9/6/1970	Hail - Wind	ND	Logan	0.00	0.00	25000.00	0.00
6/24/1998	Hail	ND	Logan	1.00	0.00	20000.00	0.00
6/17/1971	Hail - Wind	ND	Logan	0.00	0.00	4545.45	45454.55
<b>Total</b>				<b>6.00</b>	<b>0.00</b>	<b>941002.59</b>	<b>1074025.98</b>

Some of the major hail events in Logan County affected specific areas reported by the National Climatic Data Center include the following:

**May 21, 1994** – 0.75 inch hail was reported two miles south of Napoleon. Property damage is estimated at \$5,000.

**July 18, 1994**- 1 inch hail was reported six miles south of Streeter.

**July 28, 1994**- 0.75 inch hail was reported 12 miles south of Napoleon. Wheat crops that were ready for harvest were completely devastated from the strong winds and hail. Overnight, farmers that were looking at a great harvest were now trying to determine if they would get a harvest at all. Crop damage is estimated at \$150,000.

**August 18, 1996** – 0.75 inch hail was reported in Napoleon.

**June 24, 1998**- 3 inch hail was reported in Gackle. One person was hit on the head while trying to get horses into the barn. Other damage occurred to neon signs, skylights, cars, and windows. Property damage is estimated at \$20,000.

**June 21, 1999** – 1 inch hail was reported in Burnstad. 1.25 inch hail was reported five miles south of Napoleon. 0.75 inch hail was reported ten miles southwest of Napoleon.

**June 29, 1999**- 0.75 inch hail was reported in Napoleon.

**July 22, 1999** – 2.75 inch hail was reported fifteen miles south of Gackle.

**June 10, 2000** – 0.75 inch hail was reported three miles northwest of Lehr.

**July 4, 2000** – 0.88 inch hail was reported in Gackle.

**July 11, 2000** – 1.50 inch hail was reported fourteen miles southwest of Gackle.

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**June 9, 2001, 6:53 PM CST – June 9, 2001, 7:40 PM CST**

Hail was reported .75 inches in Napoleon that lasted approximately 25 minutes.

Cooperative observer reported a roof was blown off a business and mature trees uprooted with wind of 87 mph in Napoleon. Winds of 65 mph in Lehr caused large uprooted trees and damage to several homes in the city. Campers were overturned and 1 cabin was completely destroyed at Beaver Lake State Park with 1 camper blown into Beaver Lake. A number of power lines were downed and a business had a basement collapse.

**June 20, 2001, 3:34 PM CST – June 20, 2001, 3:34 PM CST**

Hail was reported .75 inches in Napoleon.

**July 18, 2001, 7:25 PM CST – July 18, 2001, 7:25 PM CST**

Hail was reported 1.75 inches 2 miles northwest of Lehr.

**August 11, 2002, 3:25 PM CST – August 11, 2002, 3:25 PM CST**

Hail was reported .88 inches in Napoleon.

**June 11, 2003, 6:17 PM CST – June 11, 2003, 6:17 PM CST**

Hail was reported .75 inches in Burnstad.

**March 27, 2004, 6:00 AM CST – March 27, 2004, 6:00 AM CST**

Hail reported .88 inches 3 Miles northwest of Lehr.

**July 18, 2004, 6:45 PM CST – July 18, 2004, 6:45 PM CST**

Hail reported 1.75 inches 17 miles southeast of Napoleon.

**July 20, 2004, 7:20 PM CST – July 20, 2004, 7:23 PM CST**

Hail reported 1.75 inches 6 miles southeast of Burnstad.

**June 7, 2005, 8:45 PM CST – June 7, 2005, 9:16 PM CST**

USDA reported 60 percent loss of small grain, 40 percent loss of corn, sunflowers, soybeans and alfalfa, and 30 percent loss of mixed forage caused from high winds and hail. 0.75 inch hail accompanied the storm. Winds reported in Burnstad at 57 knots and Napoleon at 52 knots. Hail reported 5 miles southeast of Burnstad at .75 inches and heavy rainfall of 2.40 inches accompanied the storm. One mile north of Lehr hail was reported at .88 inches.

**June 20, 2005, 5:51 AM CST – June 20, 2005, 5:58 PM CST**

Hail reported 10 miles east southeast of Napoleon at .75 inches.

**August 17, 2005, 3:05 PM CST – August 17, 2005, 5:47 PM CST**

Hail reported 5 miles southwest of Gackle at .75 inches. Flash flooding south and east of Gackle. There was two feet of water over some county roads. Water washed into the basement of a farm house. Four inches of rain reported. Property damage estimated at \$10.0K. Tornado briefly touched down in open country in a farm field 2 miles east, southeast of Fredonia. No damage.



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**May 26, 2006, 7:10 PM CST – May 26, 2006, 7:12 PM CST**

Hail reported 6 miles northwest of Napoleon at 1.00 inches.

**May 29, 2006, 1:20 AM CST – May 29, 2006, 1:26 AM CST**

Hail reported 10 miles southwest of Gackle at 1.75 inches that broke out house windows. Property damage was estimated at \$1.0 K.

**June 14, 2006, 2:30 AM CST – June 14, 2006,**

Hail reported in Burnstad of 1.50 inches and .75 inch hail 15 miles northeast of Napoleon.

**June 15, 2006, 8:19 PM CST – June 15, 2006,**

Hail reported 8 miles southwest of Napoleon ranging from .88 to 1.00 inches, Gackle reported .88 inches.

**June 23, 2006, 4:18 PM CST – June 23, 2006, 4:28 PM CST**

Hail reported 6 miles west northwest of Gackle at 1.75 inches.

**June 30, 2006, 8:00 PM CST – June 30, 2006, 8:10 PM CST**

Hail reported 12 miles east southeast of Burnstad at .75 inches.

**August 9, 2006, 6:50 PM CST – August 9, 2006, 6:55 PM CST**

Hail reported 11 miles southwest of Gackle at .88 inches.

**August 16, 2006, 4:27 PM CST – August 16, 2006, 5:22 PM CST**

Hail reported in Gackle at .88 inches and 10 miles southwest of Gackle at 1.75 inches.

**August 20, 2006, 4:01 PM CST – August 20, 2006, 4:06 PM CST**

Heavy rain accompanied the hail with 1.45 inches reported in Gackle.

**August 22, 2006, 7:55 PM CST – August 22, 2006, 8:25 PM CST**

Hail swath 2 miles wide from 2 miles SW Napoleon to 10 miles E Napoleon. Hail was piled a foot deep in places. Major damage was reported to windows and roofs. Hail was being reported in real time by trained spotters. Hail path and swath was determined from newspaper articles. Crop damage included 250 acres of corn. Property damage estimated at \$150K and crop damage at \$40K. Winds reported 6 miles east, southeast of Burnstad at 52 knots.

**May 28, 2007, 11:55 PM CST – May 28, 2007, 11:58 PM CST**

In the late afternoon of Monday May 28th, Severe Thunderstorm Watch 302 was issued in anticipation of severe thunderstorms developing during the evening along and behind a surface front situated across south central North Dakota. Several severe thunderstorm warnings were issued. Two reports of large hail were received. Hail reported in Gackle was 1.00 inches.

**August 10, 2007, 5:45 PM CST – August 10, 2007, 5:55 PM CST**

Windows were broken on cars and there was other property damage. A complex and lengthy severe weather event occurred over west and central North Dakota starting in the morning of

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Friday, August 10th, and lasting into the early morning hours of Saturday, August 11th. Scattered severe thunderstorms continuously redeveloped over the area along a surface trough that was oriented from southwest to northeast, from around Dickinson, to near Grand Forks. Convection was also supported by a favorable overrunning situation when the southerly low level jet intensified and persisted. Numerous warnings were issued, and numerous severe weather reports were received. Severe Thunderstorm Watch 582 was issued due to ongoing convection and in anticipation of future development/intensification across south central North Dakota. Late in the afternoon on Friday, Severe Thunderstorm Watch 584 was issued for all of western and much of central North Dakota. Storms were expected to reintensify during the evening and spread east as large scale upper level support and a cold front approached. Napoleon reported hail size at 2.50 inches.

**August 26, 2007, 6:45 PM CST – August 26, 2007, 8:08 PM CST**

There were multiple reports from various sources of large hail over north central and northeast Logan County, including in the city of Napoleon. Most of the hail was 1.50 to 2.50 inches in diameter. The largest stones were 3.50 inches diameter from 4 miles northeast of Napoleon to 8 miles northeast of Napoleon, and in the area 17 miles east of Napoleon. The swath of hail damage to crops was a few miles wide in spots. Reports came from law enforcement, newspapers, emergency management, weather spotters, and the public. The same super cell storm produced two tornadoes in Logan County. In the late afternoon of Sunday, August 26th, Tornado Watch 653 was issued in anticipation of severe thunderstorms developing ahead of a cold front situated across western North Dakota. Strong low level wind shear ahead of the front and MLCAPE values near 3500 j/kg increased the potential for tornado super cells. Logan County was hit especially hard. Hail property damage was estimated at \$250K and crop damage at \$500K. Public reported tornado touched down four times along this path. Tornado lifted to a funnel cloud and then touched down repeatedly. NWS storm damage survey also indicated this as the evidence was sporadic along the path, indicating the tornado was not on the ground the entire time / length. No structures impacted but crop damage 5 to 6 miles north northwest of Napoleon at \$5K. Three miles north northeast of Napoleon reported F0 with \$10K crop damage. There was damage to trees and hay and straw bales 5 to 6 miles northeast of Napoleon. Hail reported 12 miles southwest of Gackle at .88 inches.

**August 27, 2007, 11:30 AM CST – August 27, 2007, 11:40 AM CST**

Scattered elevated thunderstorms developed across south central North Dakota in an area of strong mid level convergence at the 850mb level. Hail reported 5 miles northwest of Napoleon at 1.00 inches.

**Tornadoes**

Since 1997, the state has been under a much more uniform Doppler radar coverage, and has an increased NWS presence. This has led to a marked increase in the detection of these storms, while improved SkyWarn training has led to increased levels of reporting.

The strongest tornado has been determined in each case by a review of the damage caused by one or more distinct tornadoes. Since most tornadoes in North Dakota occur over largely open country it is rare that they will cause sufficient damage to be rated at F4 or F5 intensity (Fujita

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scale). However, there have been several occurrences of F4 and F5 damage caused by tornadoes, and each county is susceptible to these devastating events in any given year.

According to SHELDUS, Logan County had 4 significant tornado events from 1950 to 2008.

**4.30 Tornado Events**

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
8/19/1974	Hail - Tornado	ND	Logan	5.00	0.00	250000.00	250000.00
7/16/1990	Tornado	ND	Logan	2.00	0.00	50000.00	50000.00
8/26/2007	Tornado	ND	Logan	0.00	0.00	0.00	10000.00
8/26/2007	Tornado	ND	Logan	0.00	0.00	0.00	5000.00
Total				7.00	0.00	300000.00	315000.00

Some of the major tornado events in Logan County affected specific areas they include the following:

**June 10, 1998** – A F0 (65-85) tornado touched down fifteen miles northeast of Napoleon. The width of the path was 33 yards. The tornado remained in rural areas and caused no damage. The ground was white with pea size hail after the storm lifted.

**August 15, 1999** – A F1 (86-110) tornado touched down in an open field twelve miles northeast of Napoleon. The length of the path was nine miles and the width was 100 yards.

**August 17, 2005, 3:05 PM CST – August 17, 2005, 5:47 PM CST**

Hail reported 5 miles southwest of Gackle at .75 inches. Flash flooding south and east of Gackle. There was two feet of water over some county roads. Water washed into the basement of a farm house. Four inches of rain reported. Property damage estimated at \$10.0K. Tornado briefly touched down in open country in a farm field 2 miles east, southeast of Fredonia. No damage.

**August 26, 2007, 6:45 PM CST – August 26, 2007, 8:08 PM CST**

There were multiple reports from various sources of large hail over north central and northeast Logan County, including in the city of Napoleon. Most of the hail was 1.50 to 2.50 inches in diameter. The largest stones were 3.50 inches diameter from 4 miles northeast of Napoleon to 8 miles northeast of Napoleon, and in the area 17 miles east of Napoleon. The swath of hail damage to crops was a few miles wide in spots. Reports came from law enforcement, newspapers, emergency management, weather spotters, and the public. The same super cell storm produced two tornadoes in Logan County. In the late afternoon of Sunday, August 26th, Tornado Watch 653 was issued in anticipation of severe thunderstorms developing ahead of a cold front situated across western North Dakota. Strong low level wind shear ahead of the front and MLCAPE values near 3500 j/kg increased the potential for tornado super cells. Logan County was hit especially hard. Hail property damage was estimated at \$250K and crop damage

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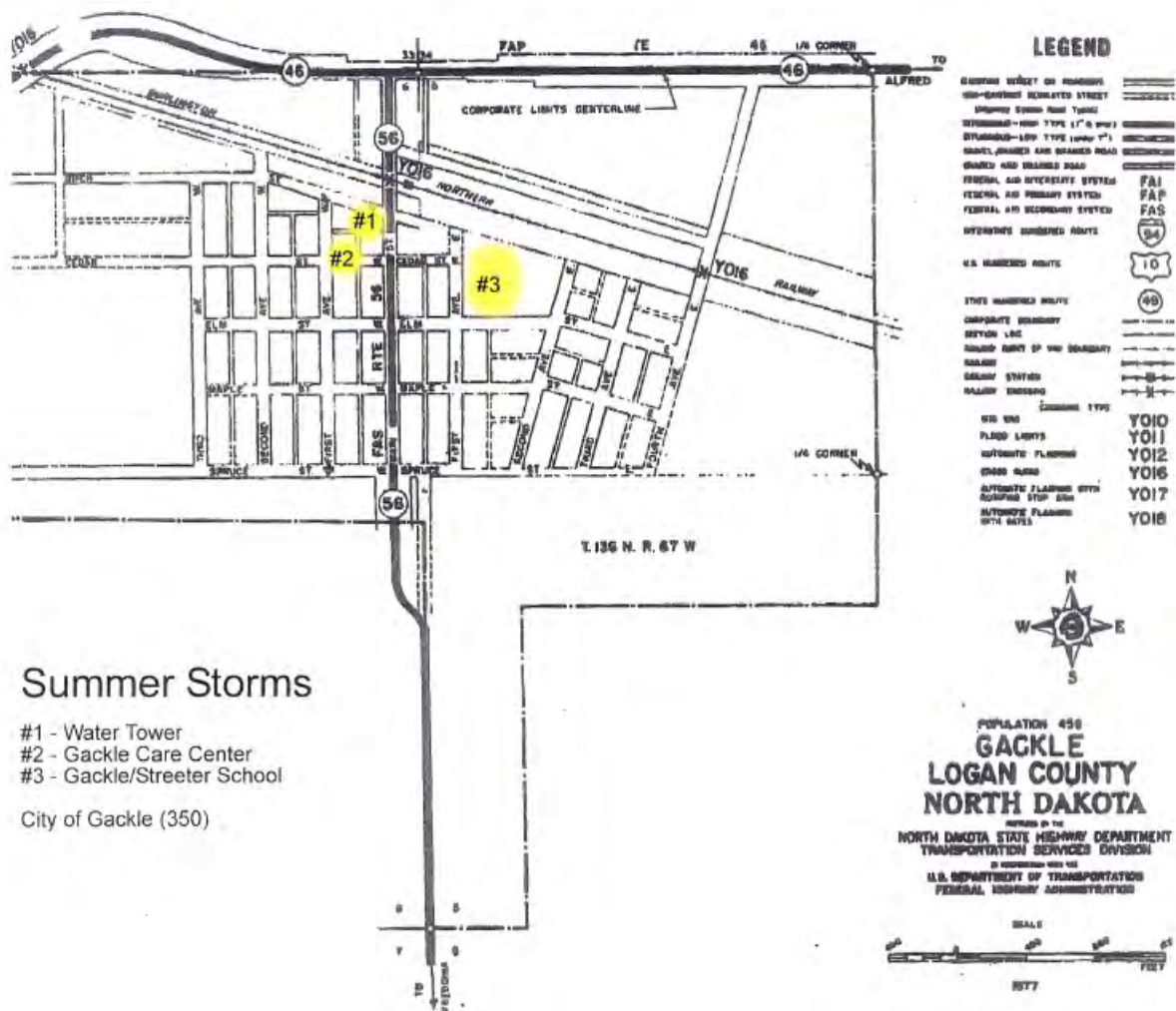
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at \$500K. Public reported tornado touched down four times along this path. Tornado lifted to a funnel cloud and then touched down repeatedly. NWS storm damage survey also indicated this as the evidence was sporadic along the path, indicating the tornado was not on the ground the entire time / length. No structures impacted but crop damage 5 to 6 miles north northwest of Napoleon at \$5K. Three miles north northeast of Napoleon reported F0 with \$10K crop damage. There was damage to trees and hay and straw bales 5 to 6 miles northeast of Napoleon. Hail reported 12 miles southwest of Gackle at .88 inches.

\*\*Source: National Climatic Data Center, US Department of Commerce [www.ncdc.noaa.gov/oa/ncdc.html](http://www.ncdc.noaa.gov/oa/ncdc.html)

NOAA Satellite and Information Service, National Environmental Satellite, Data, and Information Service (NESDIS) – Research & Monitoring, US Storm Events Database

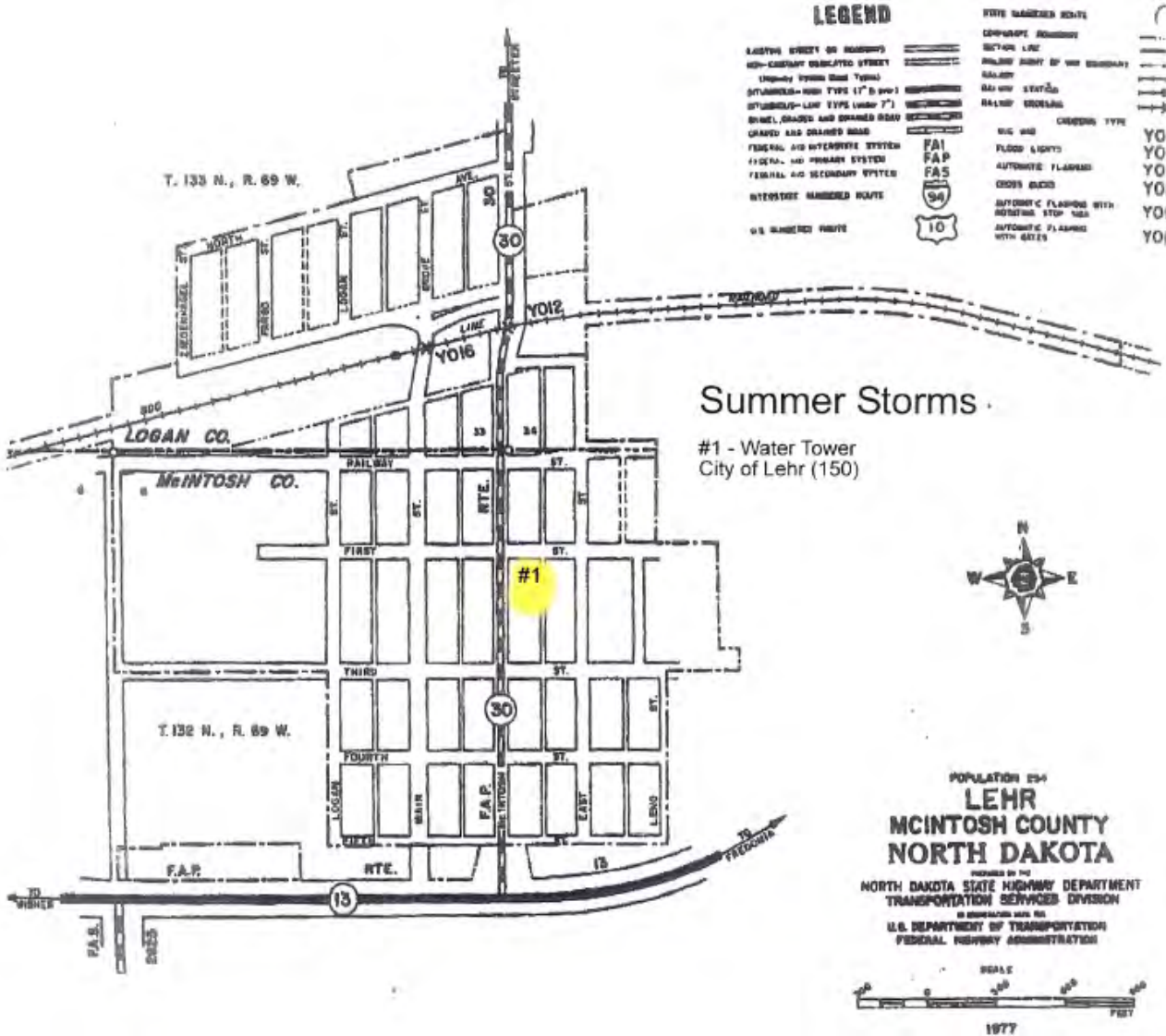
**4.31 Map of Gackle Summer Storm Hazard**



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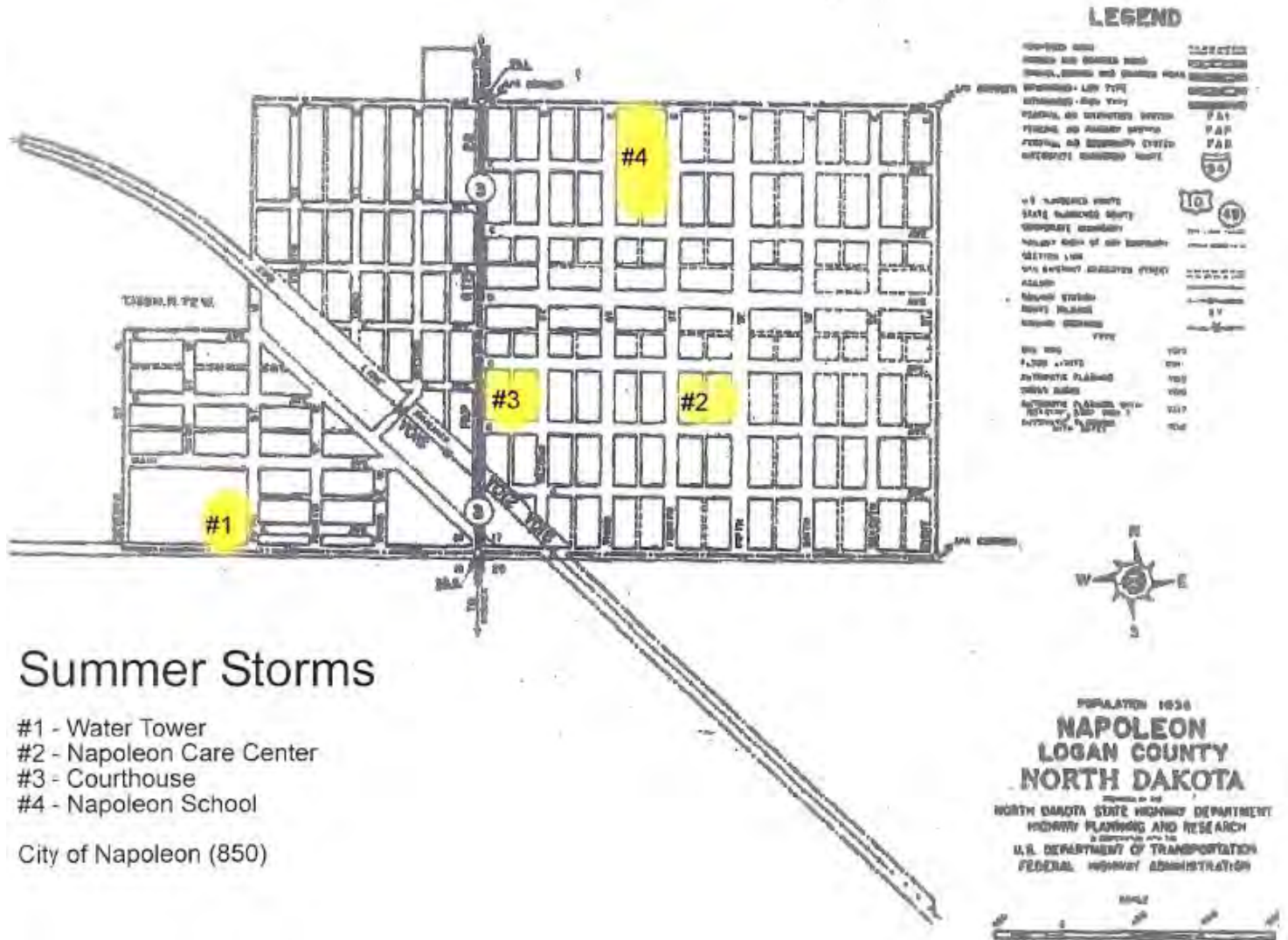
**4.32 Map of Lehr Summer Storm Hazard**



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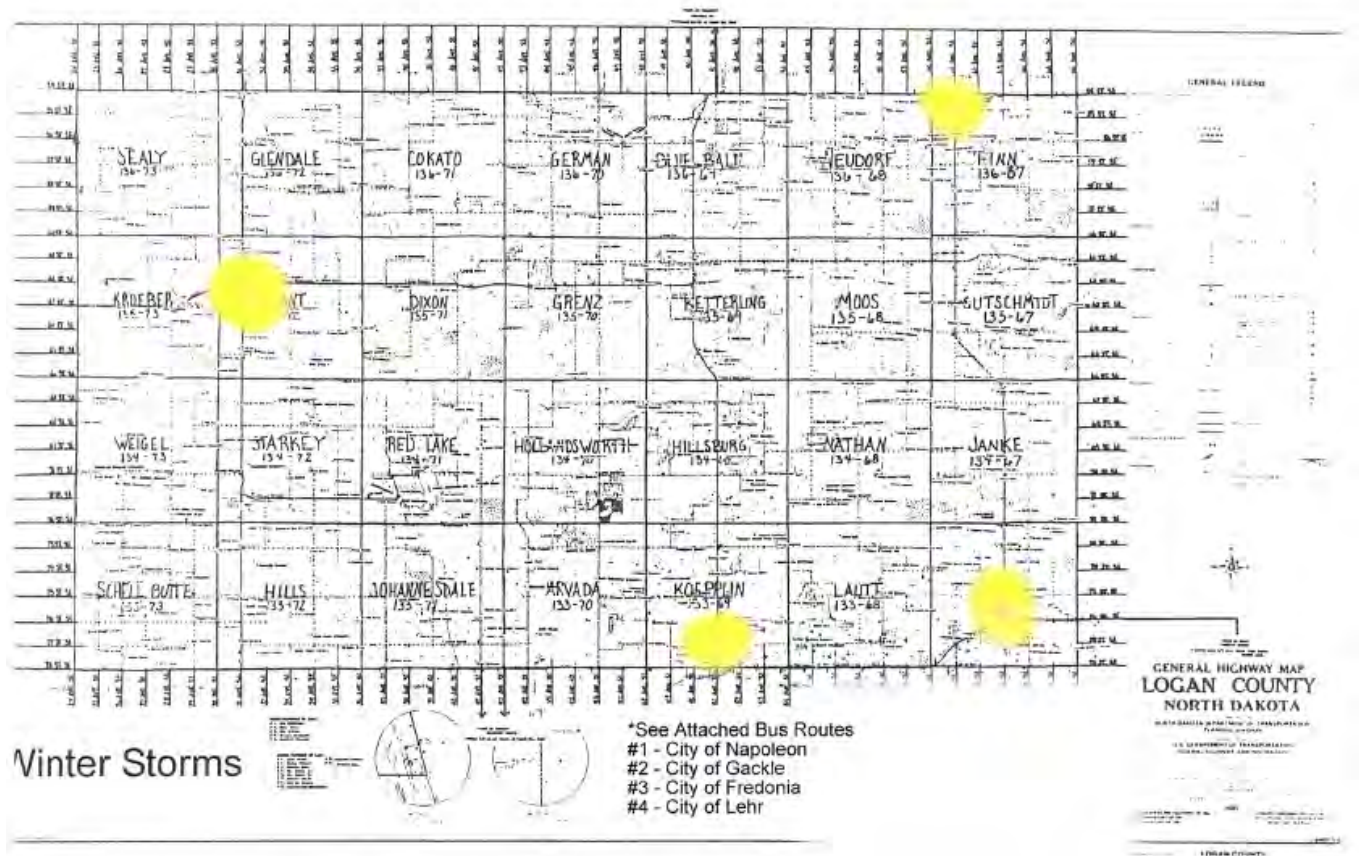
**4.33 Map of Napoleon Summer Storm Hazard**



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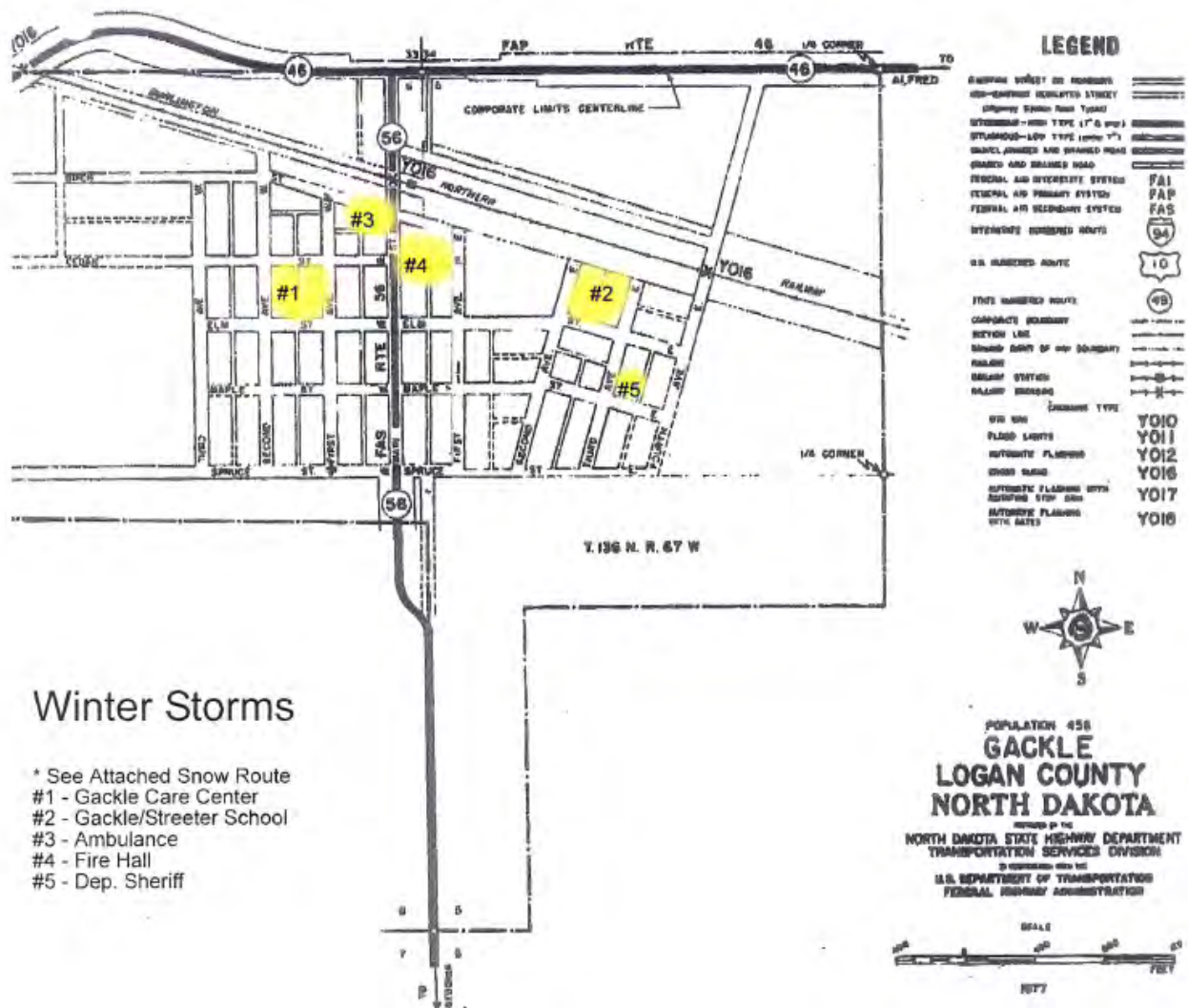
**4.34 Map of Logan County Winter Storm Hazard**



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**4.35 Map of Gackle Winter Storm Hazard**

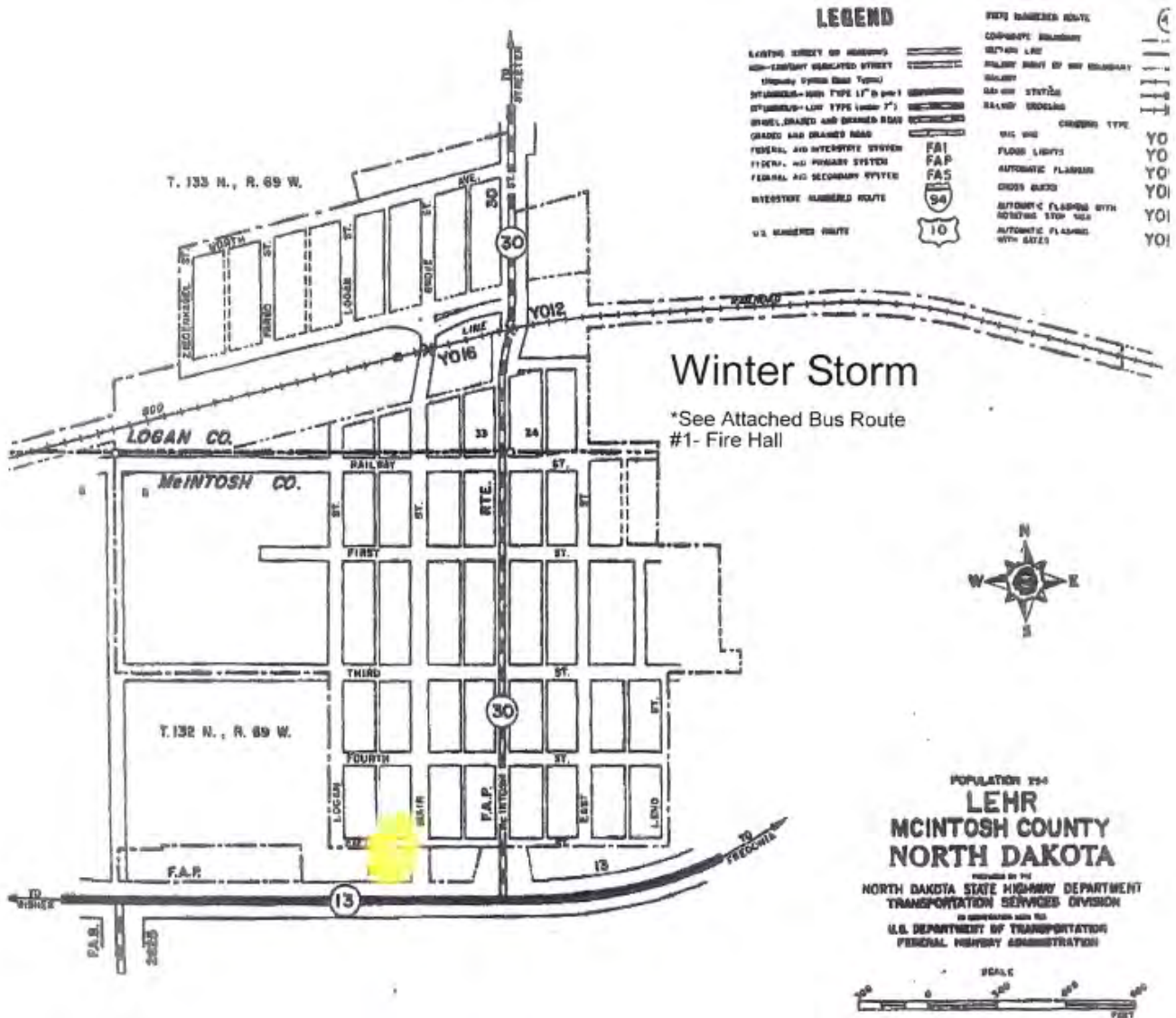




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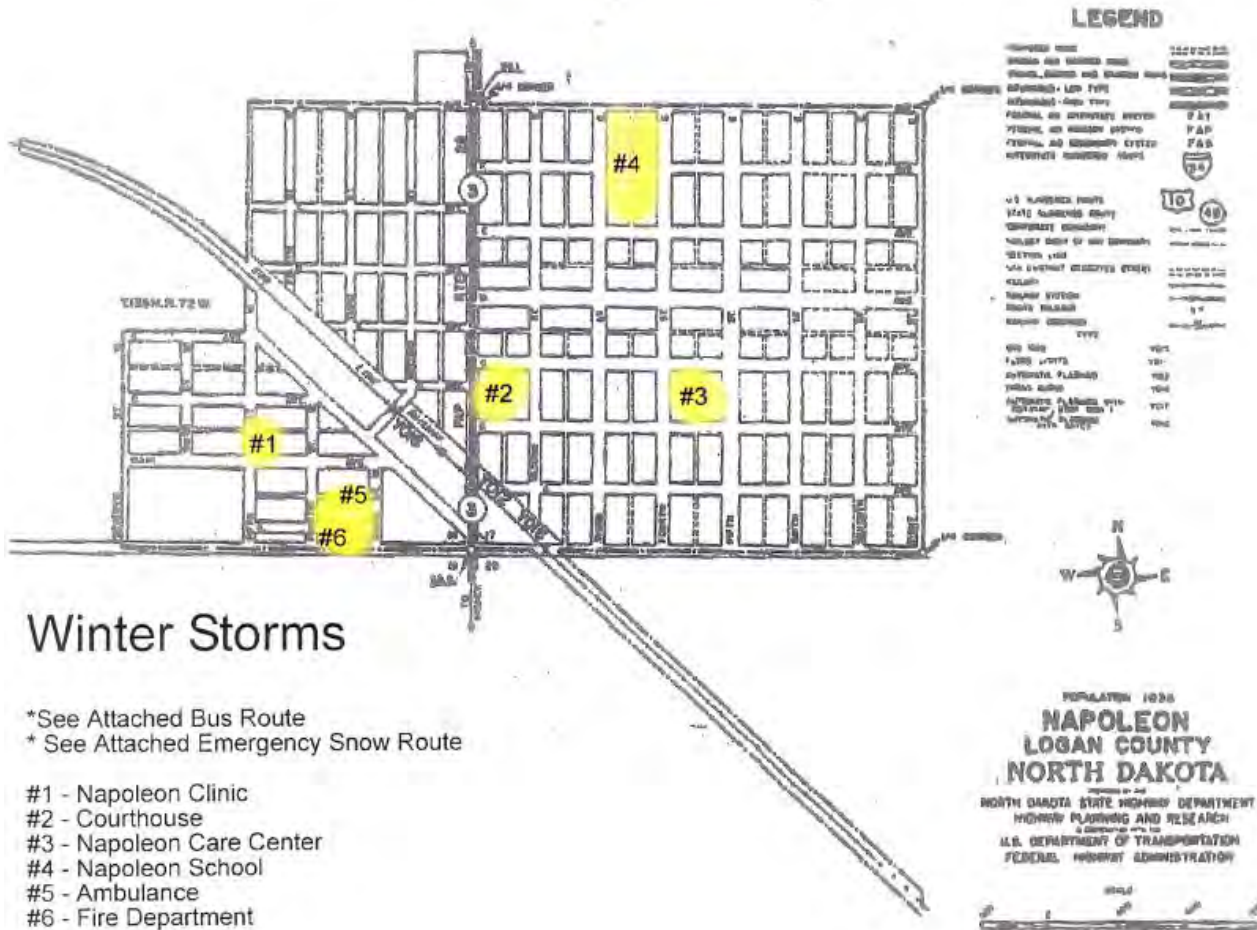
**4.36 Map of Lehr Winter Storm Hazard**



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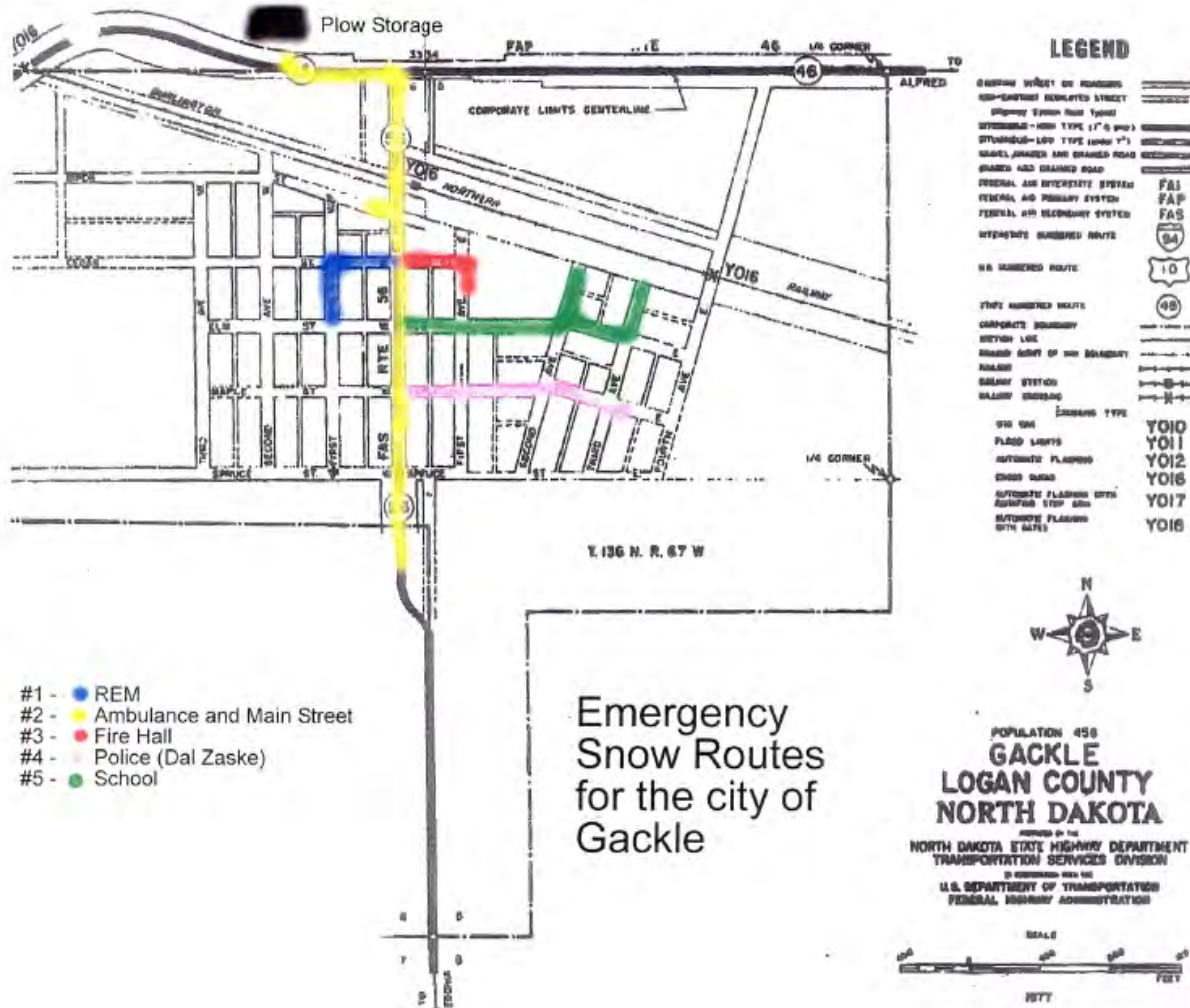
**4.37 Map of Napoleon Winter Storm Hazard**



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**4.38 Map of Gackle Emergency Snow Routes**

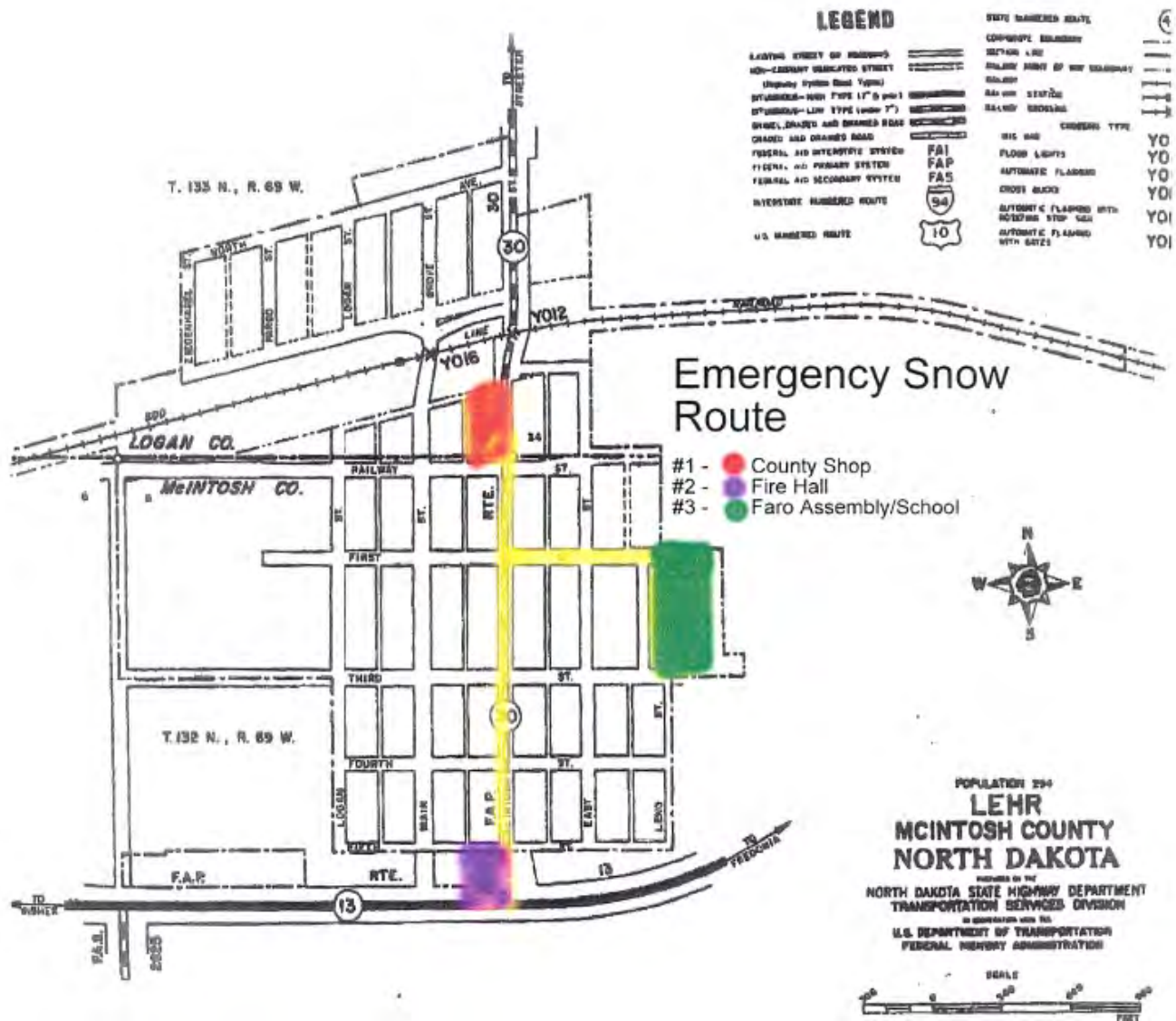


- #1 - REM
- #2 - Ambulance and Main Street
- #3 - Fire Hall
- #4 - Police (Dal Zaske)
- #5 - School

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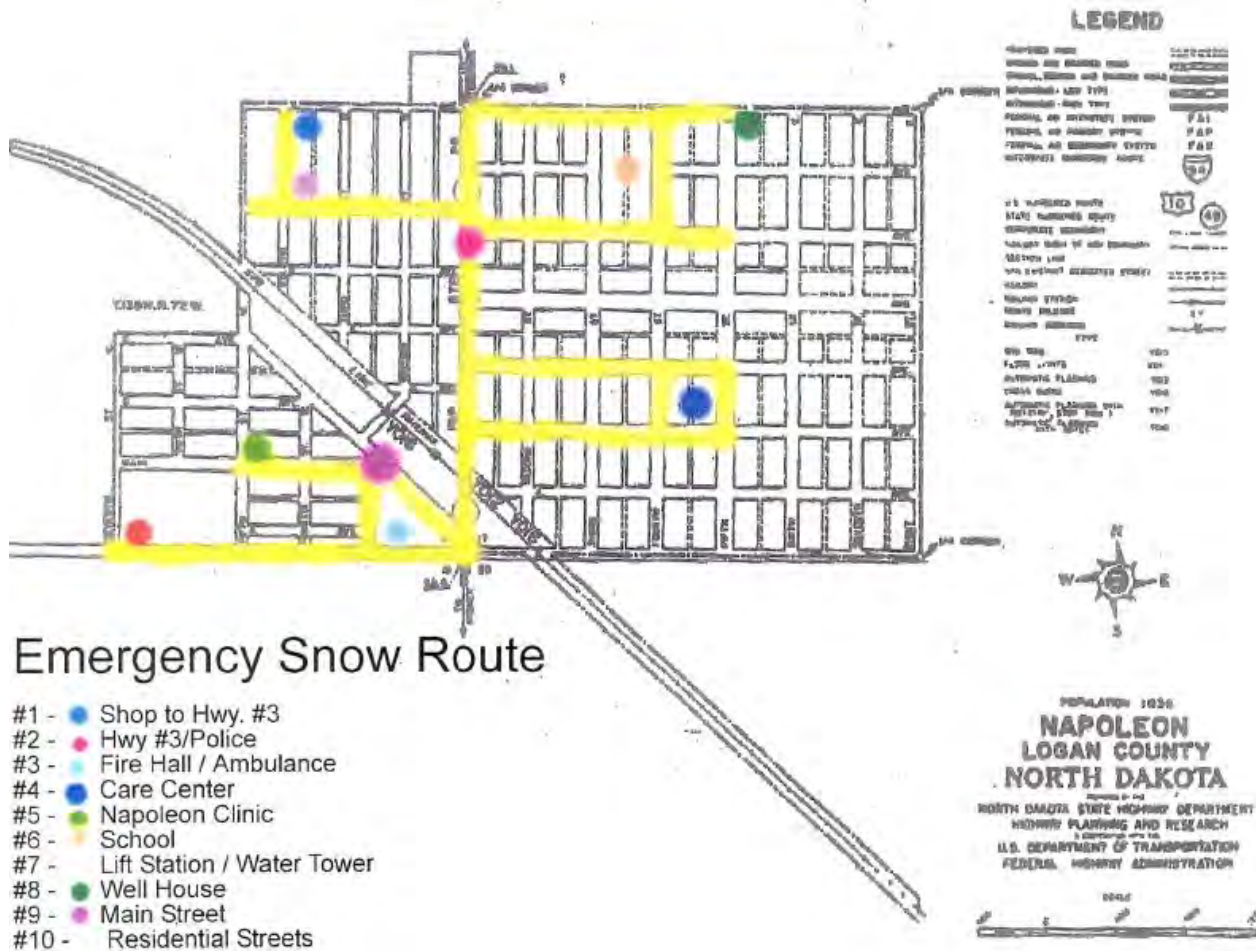
4.39 Map of Lehr Emergency Snow Routes



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**4.40 Map of Napoleon Emergency Snow Routes**



**Drought Identified Risks**

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

**Winter Weather Identified Risks**

- Blocked Roads
- Building Collapse
- Business Interruptions

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

**Summer Weather Identified Risks**

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

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**Hazard: Dam Failure**

<b>Probability: Low</b>	<b>Severity: Low</b>
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**Hazard Definition**

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

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

A majority of these dams are earth fill embankments. The remaining dams can be categorized as follows: three gravity concrete dams, three variable radius concrete arch dams, two rock embankment dams, and one hydraulic fill dam. These dams function in a variety of service capacities for the County, including irrigation, recreation, stock watering, power production, and municipal water supply. The following table depicts the dams under State jurisdiction in Logan County. These are the largest dams within the county, there are only 20 dams listed with the State Water Commission and no dams are high hazard dams.

**4.41 Dams Under State Jurisdiction in Logan County**

<b>DAM</b>	<b>Max Pool Volume</b>	<b>Federal Hazard Class</b>
Beaver Dam	5319	Low
Hildenbrand Dam	100	Low
Markus Wold	85	Low

\*Source: State of North Dakota Water Commission, Dams within the Jurisdiction of the State of North Dakota

There are approximately no “significant” or “high hazard” dams in the county. If a high hazard dam fails, there is a potential for the loss of many lives. All federal dams in the state are required to have emergency action plans. In addition, emergency action plans (EAP) are required for the nonfederal dams greater than 1,000 acre-feet of storage in North Dakota. The State Water Commission does not recognize Beaver Dam as high hazard.

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**Status:** At this time, no other emergency action plans are on file at the State Water Commission, nor are they being developed by the respective dam owners, until further funding can be acquired. Logan County Commissioners will work with dam owners to encourage developing Emergency Action Plans for the dams.

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

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

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

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

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

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

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



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- 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.

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

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

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

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

**Medium Hazard:** Dams located in predominantly rural or agricultural areas where failure may damage isolated homes, main highways, railroads or cause interruption of minor public utilities. The potential for the loss of a few lives may be expected if the dam fails.

**High Hazard:** Dams located upstream of developed and urban areas where failure may cause serious damage to homes, industrial and commercial buildings, and major public utilities. There is a potential for the loss of more than a few lives if the dam fails.

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

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

## History

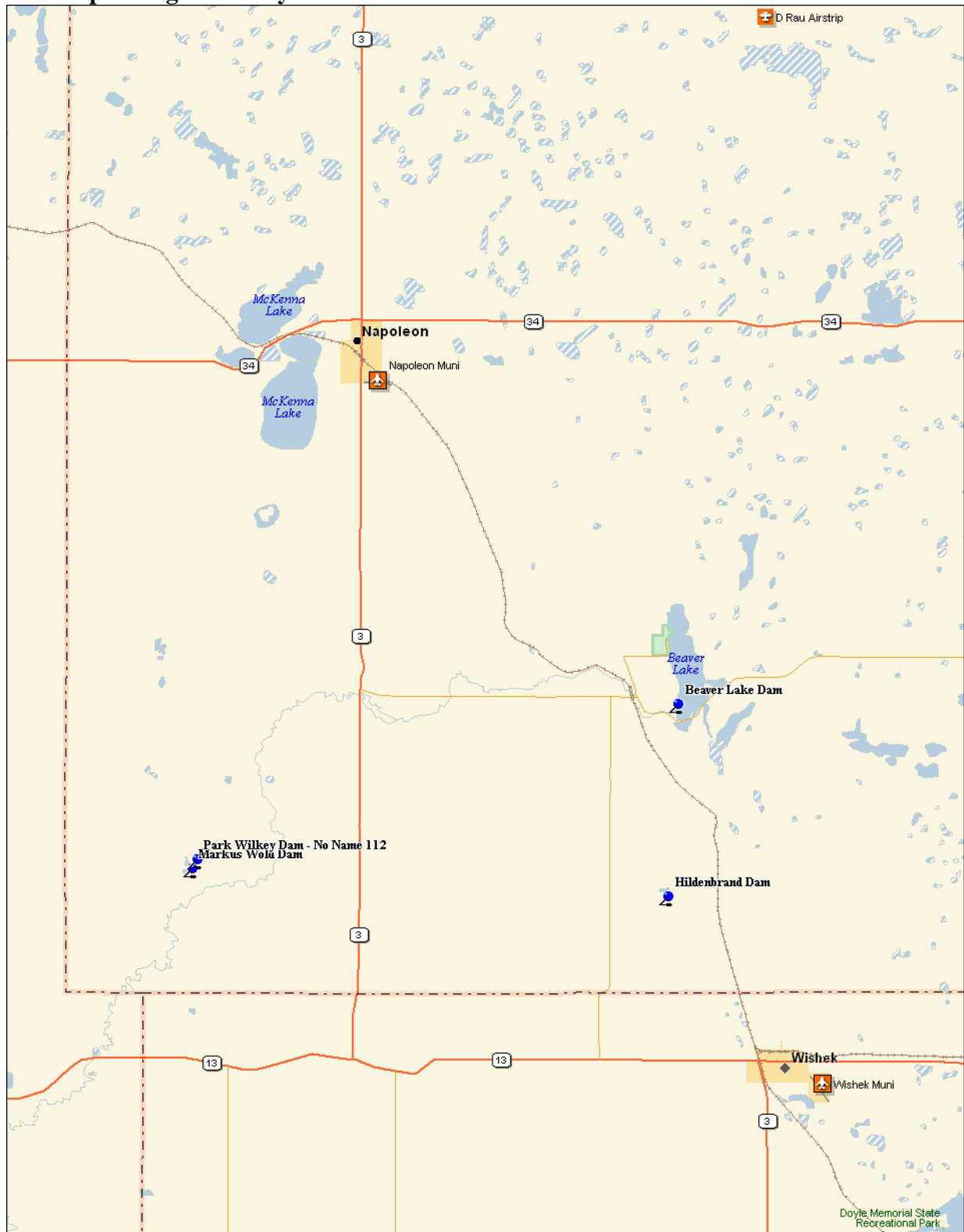
There is no history of dam failure in Logan County. According to NCDC and SHELDUS dating back to 1950 no information was found.

The map below shows the distance of the dams from the jurisdictions involved in the plan.

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**4.42 Map of Logan County Dams**



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**Identified Risks**

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

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**Hazard: Hazardous Materials Incidents**

<b>Probability: High</b>	<b>Severity: Medium</b>
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**Hazard Definition**

Hazardous materials (Hazmat) consist of substances that by their nature, lack of containment, and reactivity, have the capability for inflicting harm. Hazmat poses a threat to health and the environment when improperly managed. Hazmat can be toxic, corrosive, flammable, explosive, reactive, an irritant, or a strong sensitizer. Hazmat substances also include certain infectious agents, radiological materials, oxidizers, oil, used oil, petroleum products, and industrial solid waste substances.

Hazardous materials can pose a threat where they are manufactured, stored, transported or used. They are used in almost every manufacturing operation and by retailers, service industries, and homeowners.

Hazardous material incidents are one of the most common technological threats to public health and the environment. Incidents may occur as the result of natural disasters, human error, and/or accident.

Hazmat incidents typically take three forms:

Fixed facility incidents

- It is reasonably possible to identify and prepare for a fixed site incident, because laws require those facilities to notify state and local authorities about what is being used or produced there.

Transportation incidents

- Transportation incidents are more difficult to prepare for because it is impossible to know what material(s) could be involved until an accident actually happens.

Pipeline incidents

- Pipelines carry natural gas and petroleum. Breakages in pipelines carry differing amounts of danger, depending on where and how the break occurs, and what is in the pipe.

In the event of hazardous material release, the National Weather Service has the ability to issue a variety of warnings or statements. For example, a Hazardous Materials Warning, a warning of the release of a non-radioactive hazardous material that may recommend evacuation or shelter in place, may be issued using information reported by state or local officials. Other warnings and statements for civil danger, civil emergency, evacuation immediate, local area emergency, radiological hazard, and shelter in place are also available to state and local emergency officials if needed. (National Weather Service, 2005)

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**History**

The county is exposed to and is at risk from accidents and/or incidents involving hazardous materials. The economy is based upon agriculture, manufacturing, and industry. All of these rely on the production, use, storage, transportation, etc. of hazardous materials. Explosives, flammable liquids, flammable solids, gases, poisons, pesticides, oxidizing substances, miscellaneous dangerous substances, and radioactive materials are either used in or transported through the county. Over the years Logan County has had few hazardous materials incidents.

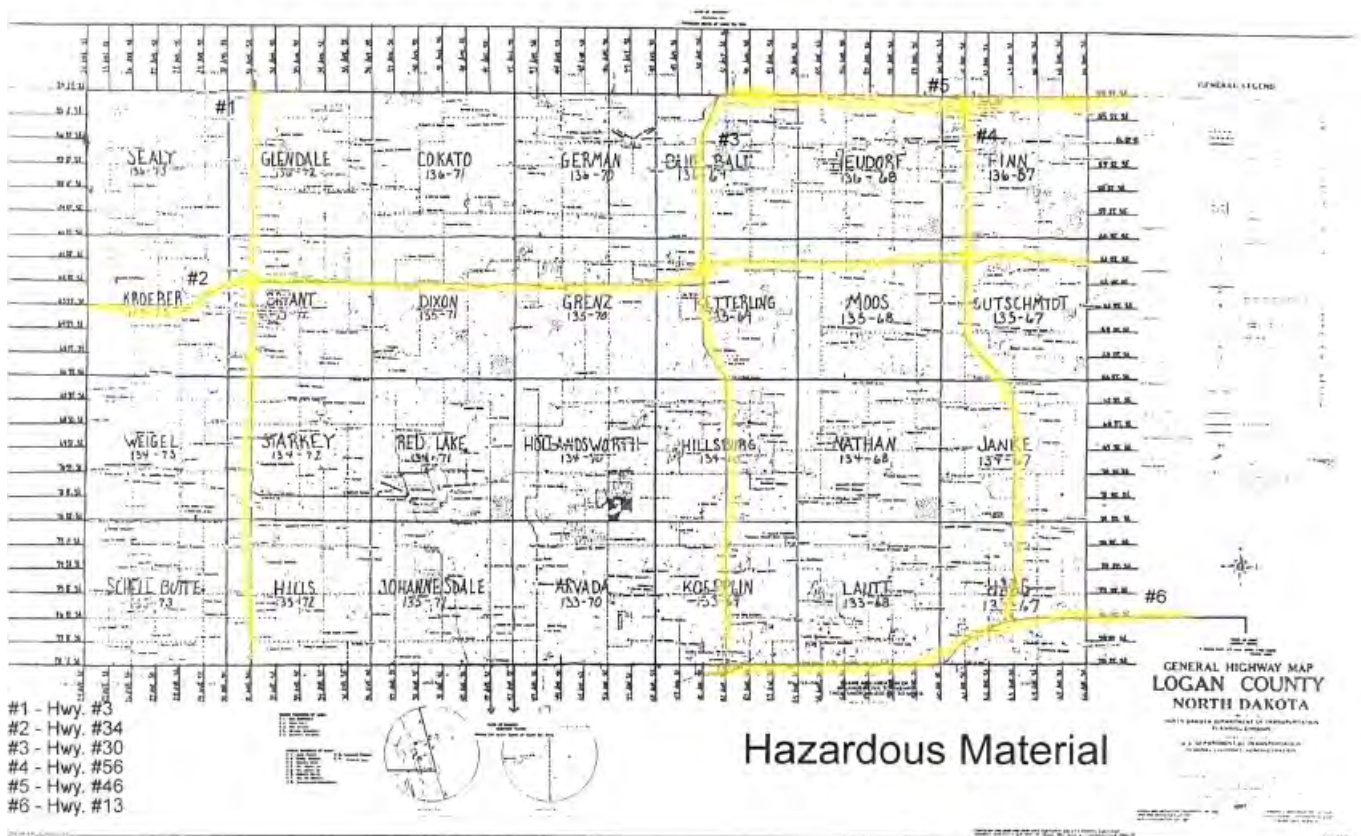
**4.43 Hazardous Materials Release Report from North Dakota Department of Health  
Division of Waste Management (Scott Radig)**

Incident Date	Location Description	Incident Type	Contaminant	Cause of Spill	Risk Evaluation	Fatalities	Injuries	Action Taken
4/30/2008	4 miles north, 1 mile west, 1 mile north of Kintyre	tank leak	anhydrous	anhydrous tank came loose from the back of an air seader being pulled by a tractor	None	0	0	None reported

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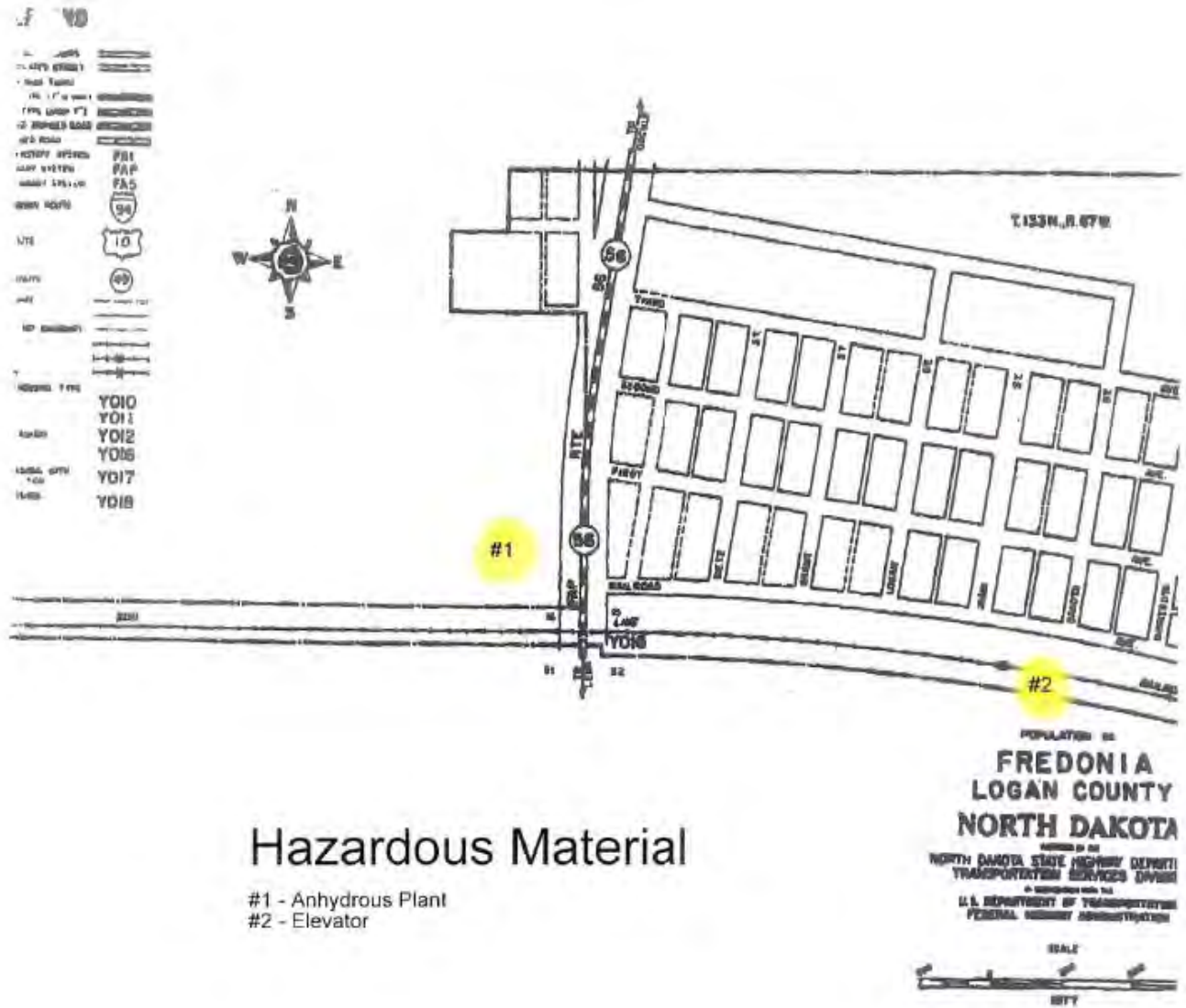
## 4.44 Map of Logan County Hazardous Materials



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**4.45 Map of Fredonia Hazardous Materials**



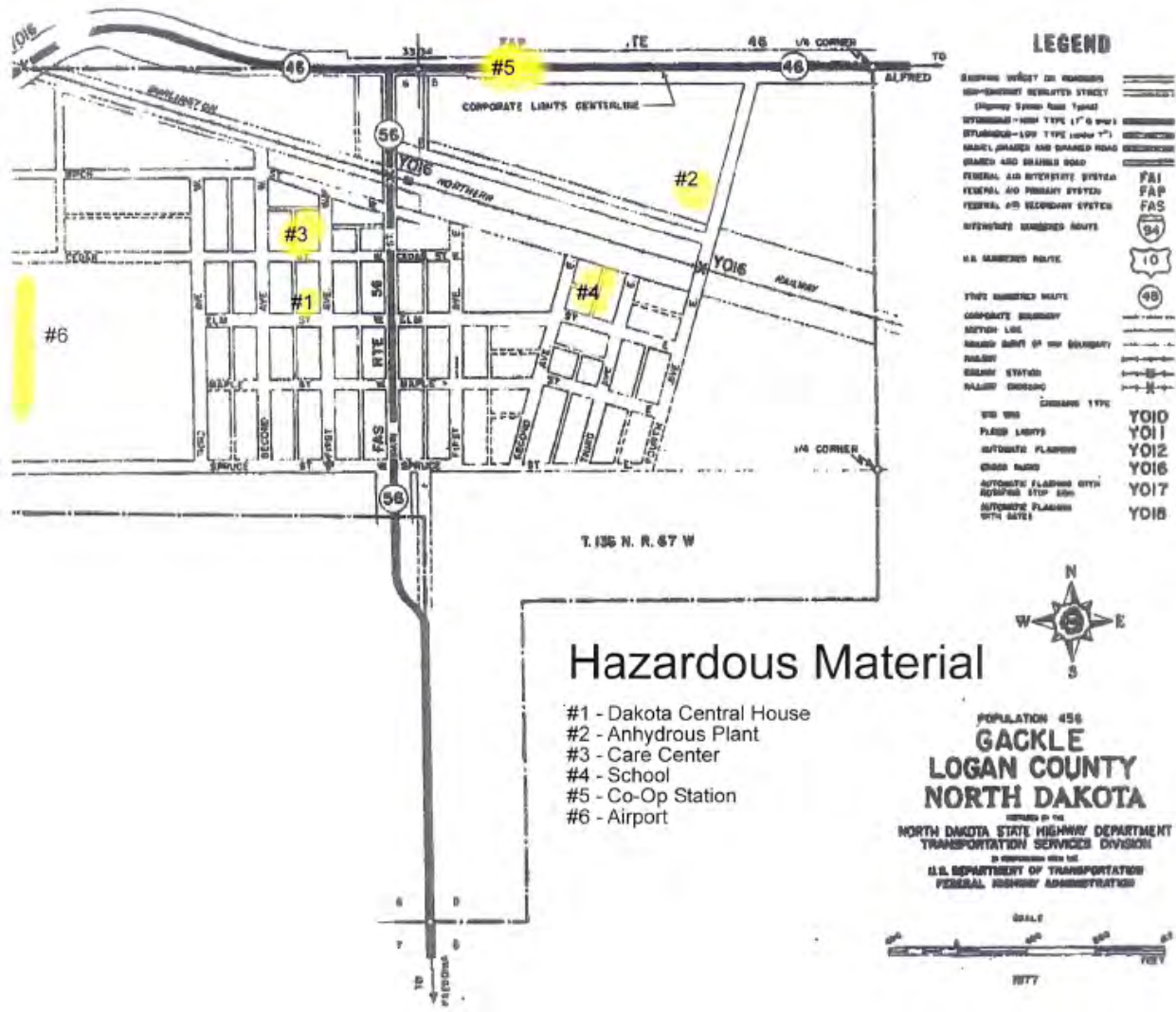
**Hazardous Material**

- #1 - Anhydrous Plant
- #2 - Elevator

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**4.46 Map of Gackle Hazardous Materials**

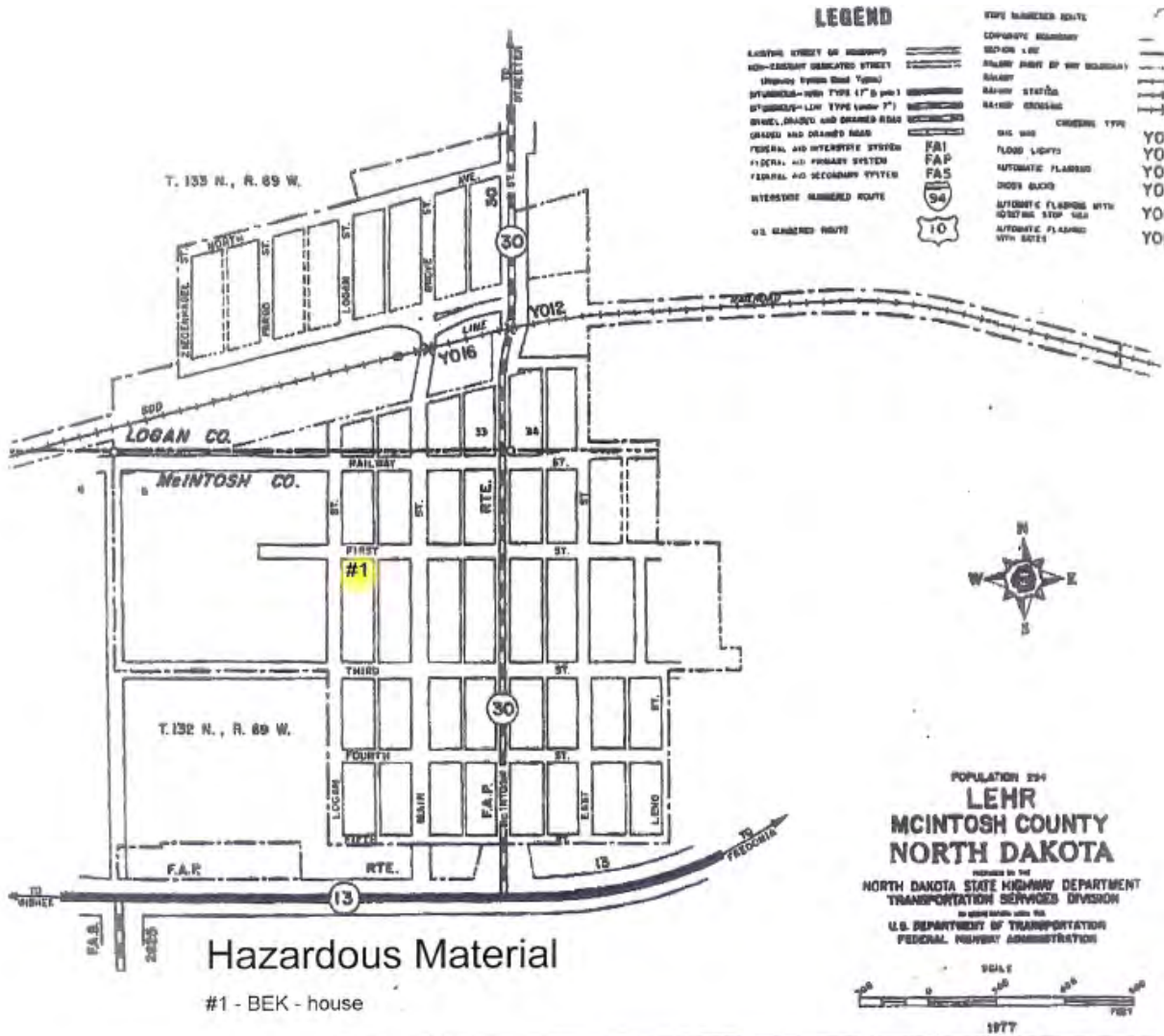




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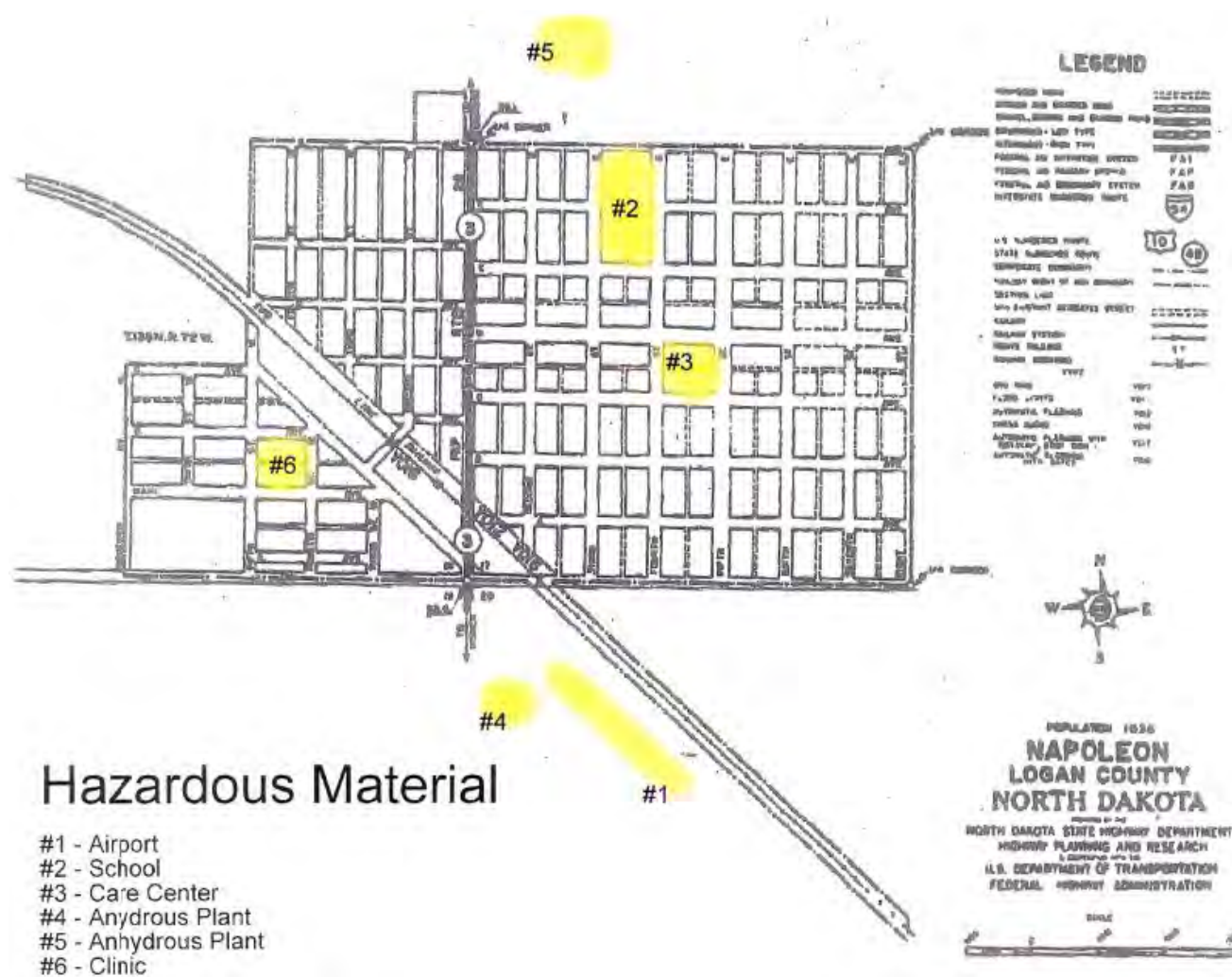
4.47 Map of Lehr Hazardous Materials



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4.48 Map of Napoleon Hazardous Material



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**Identified Risks**

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

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**Hazard: Communicable Disease (Including animal, plant, and human diseases)**

<b>Probability: Low</b>	<b>Severity: Low</b>
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**Hazard Definition**

**Insect Infestation**

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

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

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

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

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

**History**

The second leading industry in Logan County is agriculture, which provides a very significant base to the County's economy. Logan County's gross income of agricultural production for 2002 totaled \$7,985 per farm compared to \$4,928 in 1997.

\*\*Source: <http://www.agcensus.usda.gov/Publications/2002/index.asp> Census of Agriculture 2002

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**North Dakota Crop Profile (Source: US Department of Agriculture)**

**Sunflowers:** Insect damage to sunflowers may cause substantial loss and economic hardships come harvest time. Insect populations may be influenced by the previous year's populations, winter conditions, and the current year's conditions in the Northern Plains. Without season long monitoring, damaging population levels may go unnoticed in sunflowers. Most insect damage often goes unnoticed due to small injury areas within the field or is often mistaken for disease or other problems.

Scouting to estimate insect population levels should occur weekly. Scouting should be done during peak activity times of major pest insects to determine if control is needed.

Insecticide use was reported on 40.1% of sunflowers in 1996 (Zollinger, et al, 1998). In 1997, 91.7% of the respondent's acres were treated once; with 8.3 percent of the acres were treated twice (Lamey, et al., 1999). Aerial application was used on 68.9% of acres, with 31.1% of application being done by ground rigs.

In 1997, survey respondents from North Dakota reported that the sunflower beetle was the worst insect on 58.4% of their total acres. The sunflower midge was reported to be the second worst pest on 13.1%. The stem weevil and seed weevil were in third and fourth on 6.7% and 5.5%, respectively. Grasshoppers were fifth on 3.2%; with the banded sunflower moth and cutworm coming in sixth and seventh on 1.5% and 0.5%, respectively.

Insecticides used most commonly in 1997 on respondents, acres were: Asana XL on 40.8%, Warrior on 14.9%, and Lindane/Maneb, a seed treatment, on 1.6% of the total acres.

The most recent pesticide use surveys for North Dakota indicate a major shift in insecticide use by sunflower growers in the state. The pyrethroid insecticides have been more widely used in the region than any other class of insecticide. This shift is largely due to a change in occurrence of economic insect pests during the mid-90's. Pyrethroids have been very effective at controlling the foliage feeding insects which have been most prevalent. In previous years, head infesting insects have been the most important insect pests. The organophosphate insecticides, parathion and methyl parathion, generally provide better control of head feeding insects. Chemical properties of these insecticides increase their movement to the insects' hiding sites among the bracts and florets of the sunflower head. The parathions were still the most widely used insecticides in Kansas where the Sunflower head moth, *Homoeosoma electellum*, was the most often targeted insect pest, (Lamey et al., 1999).

Non-chemical control practices used in 1997 by producers in North Dakota were: crop rotations on 58.5% of total respondents' acres, tillage used on 30.1% of acres, and hybrid selection used on 9.9% of the total acres.

There are approximately 15 species of insects in the Dakotas, Minnesota, and Manitoba, but only 7 species may warrant control yearly. Cutworms, Sunflower Beetles, Spotted Sunflower Stem

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Weevil, Banded Sunflower Moth (*Cochylis hospes*), Red Sunflower Seed Weevil (*Smicronyx fulvus*), Sunflower Midge, and Grasshoppers.

**HRS and Durum Wheat**

Insecticides were applied on 4% of the wheat acreage in 1996. Starting in 1996 the wheat midge had a significant influence on insecticide usage. Approximately 500,000 acres were treated with chlorpyrifos, the only registered insecticide for wheat midge. Other products used were lambda cyhalothrin, carbofuran, carbaryl, and ethyl parathion. The most frequent target pests for these products included grasshoppers and cereal aphids. A total of 541,500 acres were treated with insecticides. The producer applied 22% with ground equipment and the remaining 78% of treatments were aerial applied.

Aphids: Greenbug (*Schizaphis graminum*), English grain aphid (*Sitobion avenae*), Bird cherry oat aphid (*Rhopalosiphum padi*), and Russian wheat aphid (*Diuraphis noxia*).

Orange Wheat blossom Midge: *Sitodiplosis mosellana*

Wheat midge populations have been partially held in check by a parasitic wasp called *Macroglenes penetrans* (Kirby). This wasp can control up to 50% of the overwintering midge population each year. Rotating wheat with other non susceptible crops aids in reducing wheat midge numbers. Crops such as oilseeds, barley, and oats can be grown with little or no risk of damage. By selecting early maturing varieties and planting early, the wheat crop will head and flower before the peak of the wheat midge emergence.

Current treatment recommendations are when one or more midge are observed for every four to five wheat heads. Treat only when 75% of wheat heads have emerged from the boot. Treatment after 50% of the wheat heads have flowered is not recommended because of reduced efficacy and for the protection of the parasitic wasps.

Grasshoppers: Clearwinged grasshopper (*Camnula pellucida*), Two-striped grasshopper (*Melanoplus bivittatus*), Migratory grasshopper (*Melanoplus sanguinipes*), differential grasshopper (*Melanoplus differentialis*), and Redlegged grasshopper (*Melanoplus femurrubrum*).

Grasshoppers are sporadic pests in North Dakota, especially in regions that receive little rainfall. Weather is one of the main factors affecting grasshopper populations. Outbreaks are usually preceded by several years of hot, dry summers and warm falls, allowing populations to increase. Damage to wheat is usually concentrated near field margins. Individual plants can be damaged by leaf stripping, awn loss, head clipping, and damaged kernels.

Natural enemies include parasites, predators, and diseases. Some type of natural enemy attacks all grasshopper stages. Early seeding establishes vigorously growing plants that are more tolerant to grasshopper injury. Early seeded crops will mature earlier and reduce the risk of late season

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migrations of adult grasshoppers. Crop rotation, tillage, trap strips, and harvesting crops early are other cultural control practices used to reduce grasshopper damage. Grasshoppers are more easily controlled in the nymphal stage. Treatment is advised when 50 or more nymphs per square yard are found in field margins or 30 or more nymphs per square yard are found within the field.

Armyworms: *Pseudaletia unipuncta*

Cutworms: several species (Lepidoptera: Noctuidae)

Wireworms: (Coleoptera: Elateridae)

There are multiple minor insect pests present in the region. These include: wheat stem sawfly, *Cephus cinctus*, wheat stem maggot, *Meromyza americana*, and Hessian fly, *Mayetiola destructor*. These insects are managed most effectively through cultural practices. Insecticidal control has not proven adequate for these pests.

### **Dry Edible Beans**

In North Dakota, populations of potential insect pests of Dry Edible Beans (DEB) are usually small and require only infrequent management with insecticides (Glogoza 2000). Insects causing moderate defoliation early in the season have little effect on DEB. Insect feeding during the reproductive stages are more likely to cause yield and quality losses.

Grasshoppers and potato leaf hoppers are the two primary insect problems in the region. The seed corn maggot can be a serious pest of DEB when temperatures are unfavorable for germination and emergence of DEB. Spring hatching cutworms can cause problems during stand establishment. Aphids, bean leaf beetles, armyworms, green cloverworm, cabbage looper, velvetbean caterpillar, and thistle caterpillar are all potential pests in the region but seldom require management. European corn borer can be found in dry bean fields, but information on field scouting and possible treatment guidelines have not been determined for the region.

Grasshoppers Clearwinged grasshopper (*Camnula pellucida*), Two-striped grasshopper (*Melanoplus bivittatus*), Migratory grasshopper (*Melanoplus sanguinipes*), differential grasshopper (*Melanoplus differentialis*), and Redlegged grasshopper (*Melanoplus femurrubrum*)

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

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per square yard are occurring in the crop.

**Potato Leafhoppers** *Empoasca fabae*

Potato leafhoppers do not overwinter in North Dakota. Migrations of potato leafhoppers can occur from May through August, moving with weather fronts originating over southern states. The extent of seasonal problems is influenced by the time of migration and the numbers of leafhoppers that are transported into the region. Leafhopper adults are wedge shaped and pale green. Adults are very active and jump or fly when disturbed. Adults are very mobile and move readily within and between fields. Nymphs are wingless, run backwards or sideways, feed on the underside of the leaf, and complete their growth on the leaves near their hatching site. Hopper-burn is the term used to describe leafhopper damage.

Leaves become dwarfed and curled, and small triangular brown areas appear on leaf tips. Feeding damage reduces plant vigor and yield. The recommended treatment threshold is one leafhopper per trifoliolate leaf. Insecticides used to manage leafhoppers are very effective. It is not uncommon for growers to use reduced rates of certain insecticides to control early leafhopper migrants while DEB are still small and before the plant canopy has closed.

**Seedcorn maggot** *Delia platura*

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

**Cutworms**

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

**Bean Leaf Beetle** *Cerotoma trifurcate*



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

**Dairy**

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

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

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

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

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

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

Calves are stunted in their growth, and become susceptible to secondary infections such as pneumonia.

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

### **Barley**

Foliar insecticides were applied to 0.8 %, 20,000 acres, of the ND barley acres in 1996. Insecticides used were carbofuran and encapsulated methyl parathion targeted at barley thrips, grasshoppers, or cereal aphids. The seed treatment insecticide, lindane, was used on 4 % of the barley acreage for wireworm protection in 1996.

Barley Thrips (*Limothrips denticornis*): Barley thrips are small dark brown to black insects that can cause economic yield losses in barley. Occasionally there are reports of thrips in durum. Thrips emerge from overwintering sites in late May and early June. Early seeded barley is the preferred host for thrips.

Aphids Greenbug (*Schizaphis graminum*), English grain aphid (*Sitobion avenae*), Bird cherry oat aphid (*Rhopalosiphum padi*), and Russian wheat aphid (*Diuraphis noxia*).

The English grain aphid, bird cherry oat aphid, and the greenbug are the most common aphid pests of small grains in North Dakota. The Russian wheat aphid has only been a minor pest in the state. The greenbug and the Russian wheat aphid are considered to be the most injurious of the aphids. During feeding these aphids inject saliva which is toxic to the plant causing yellowing and death of leaf tissue. Large populations of bird cherry oat aphid are associated with high infection levels of Barley yellow dwarf virus.

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Problems with cereal aphids are dependent on when they migrate into the region, weather conditions when they arrive, and growth stage of barley when populations increase. Aphids are present in barley fields each season. Aphids are usually the most troublesome during periods of cool, wet weather. Late seeded crops are likely to be most severely infested. Growers are discouraged from applying excess nitrogen, since excessive plant growth will promote aphid infestations. Most infestations are minor and are kept in check by natural enemies such as syrphid fly larvae, aphid lions, ladybird beetles, several parasitic wasps, and parasitic fungi. When natural enemies are present in large numbers, farmers are discouraged from applying insecticides.

Grasshoppers Clearwinged grasshopper (*Camnula pellucida*), Two-striped grasshopper (*Melanoplus bivittatus*), Migratory grasshopper (*Melanoplus sanguinipes*), differential grasshopper (*Melanoplus differentialis*), and Redlegged grasshopper (*Melanoplus femurrubrum*).

Grasshoppers are sporadic pests in North Dakota, especially in regions that receive little rainfall. Weather is one of the main factors affecting grasshopper populations. Outbreaks are usually preceded by several years of hot, dry summers and warm falls, allowing populations to increase. Damage to barley is usually concentrated near field margins. Individual plants can be damaged by leaf stripping, awn loss, head clipping, and damaged kernels.

Natural enemies include parasites, predators, and diseases. Some type of natural enemy attacks all grasshopper stages. Early seeding establishes vigorously growing plants that are more tolerant to grasshopper injury. Early seeded crops will mature earlier and reduce the risk of late season migrations of adult grasshoppers. Crop rotation, tillage, trap strips, and harvesting crops early are

other cultural control practices used to reduce grasshopper damage. Grasshoppers are more easily controlled in the nymphal stage.

Treatment is advised when 50 or more nymphs per square yard are found in field margins or 30 or more nymphs per square yard are found within the field.

Armyworms *Pseudaletia unipuncta* Outbreaks in North Dakota occur when large migrations of moths from the south occur in late spring and early summer. Armyworms feed at night on above ground vegetation, and hide under the foliage and in the soil during the day. In most years, populations are kept low by unfavorable weather conditions such as cool wet weather.

A number of diseases and parasites attack armyworms. Tachinid flies, parasitic wasps, and viruses are all natural controls of the armyworm. These natural enemies often do not destroy armyworm larvae until after severe crop damage has occurred. Their greatest impact is preventing excessive increases in the next generation.

Current treatment recommendations are when four to five or more worms per square foot are present.

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Wireworms (Coleoptera: Elateridae): Wireworms can affect barley in North Dakota. This early season, spotty pest is difficult to detect, which results in great uncertainty regarding the economic value of seed treatments which are the only labeled chemical control. Using seed treatment strictly as insurance against injury is discouraged.

**Potato**

There are many key pests of potato; fortunately relatively few occur in North Dakota and the Red River Valley. The Colorado potato beetle is the most serious pest found in North Dakota. Other potato pests occur sporadically. The aster leafhopper is of concern for producers who raise potatoes intended for chipping. A seed potato crop can be deemed unsuitable for seed potatoes because of the viruses transmitted by aphids. Wireworms potentially could be a problem for potatoes on light soils. Other insect pests would cause problems if it were not for the control measures being taken against the key pests. The major pests are discussed below. Insecticides used for controlling these pests and the estimated number of treated acres in 1996 are summarized in Table 1 (Zollinger, et al. 1998). Table 2 summarizes recent data for insecticide use obtained from a USDA-NASS survey on agricultural chemical use in fall potatoes (USDA-ARS, 2000).

Colorado Potato Beetle (*Leptinotarsa decemlineata*) The Colorado Potato Beetle (CPB) is a constant threat as a defoliator in potato fields. Both the adult and immature forms feed on the foliage of the potato. CPB overwinter as adults and emerge in the spring with the developing potatoes. Overwintered adults feed, and lay eggs for the first generation. First generation larvae feed from early June to mid-July. Larvae develop into adults around mid-July. In North Dakota and the Red River Valley there is a second generation of adults that usually emerge towards the end of August. Insecticide control measures target the small larvae. They are the most susceptible to the insecticides, reducing the number of small larvae before they become large larvae. The larger larvae cause the greatest amount of defoliation. Resistance to chemicals is of concern to the producers of North Dakota.

There are documented cases of CPB being resistant to the pyrethroid (Asana and others) and carbamate (Furadan) insecticides in North Dakota. When used, these classes of insecticides should be limited to once per season to reduce the possibility of a resistant population. Cultural control practices for CPB control are to distance potato fields from fields of the previous year by crop rotation. Current biological control practices that are commercially viable are the use of genetic engineered plants that contain Bt (*Bacillus thuringiensis*).

*Leaf Hoppers*

Potato Leafhopper (*Empoasca fabae*)  
Aster leafhopper (*Macrosteles fascifrons*)

There are two leafhoppers commonly associated with potato fields in North Dakota, the potato leaf hopper and the aster leafhopper. The leaf hoppers overwinter in southern United States and are carried to the northern states by upper level winds. Aster leafhopper also overwinters in the egg stage, producing a local population. They build up their populations in alfalfa or grain fields

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before the potatoes have emerged in the spring. The potato leafhoppers can cause significant yield loss by feeding on potato sap. Most years they arrive late enough not to be of concern; other years, such as 1990 and 1999, they arrived early and needed to be managed with insecticides. Unlike the potato leafhopper, only the aster leafhopper adults are found on the potato. The aster leafhopper does not reproduce on the potato. The aster leafhopper is a vector of the potato purple top which affects chipping potato and is why it is a species of concern for many producers. Biological control has not been a viable option to control these insects. Because these insects cause damage in different ways it is important to make the correct identification of the species.

*Aphids*

Green peach aphid (*Myzus persicae*)  
Potato aphid (*Macrosiphum cuphurbiae*)  
Buckthorn aphid (*Aphis nasturtii*)

Aphids are a major pest of seed potatoes. These aphids are the primary vectors of viruses which can lead to the rejection of the seed lot. For this reason, seed producers must keep aphid numbers much lower than what can be tolerated in table stock potatoes. Control measures are targeted specifically against aphids in an effort to keep virus spread to a minimum in seed production fields. Control is seldom necessary in normal commercial production, though even this may be changing in recent production years. The treatment threshold for aphids in seed stock is 10 aphids per 100 leaves; the threshold to prevent yield loss in table stock is 30 aphids per 100 leaves. The two most important viruses transmitted are the potato leaf roll virus (PLRV) and potato virus Y (PVY or mosaic). Although there are several species of aphids on potatoes, the green peach aphid is the most common and the most efficient vector for PLRV. The potato aphid and buckthorn aphid can transmit PLRV. Green peach aphid is an efficient PVY vector, but there are many other aphids that act as a vector for PVY.

Potato Flea Beetle (*Epitrix cucumeris*)

The potato flea beetle is often the first pest to attack the potatoes during spring. The overwintering adults can cause economic damage to the newly emerging potato plants. The damage is identifiable by small shot holes in the leaves. There are usually two generations of this beetle in North Dakota. Mid-season damage is uncommon because the plants are larger and are often treated for other insect pests. Fortunately, the tuber beetle, *Epitrix tuberis* a much more destructive pest, does not occur in North Dakota.

*Other Damaging Insects*

Grasshoppers, especially redlegged grasshopper, *Melanoplus femurrubrum*; black blister beetle, *Epicauta pennsylvanica*; and numerous other defoliators occur on potatoes and occasionally cause conspicuous injury. The economic consequence of these pests seldom justifies treatment. Potatoes are relatively tolerant of some defoliation especially if the attack is not sustained. Cabbage looper and other caterpillars are probably never of economic importance on potatoes.

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The soil insects, wireworm and white grub, are occasional pests of potato in the region. Soil insecticides have provided some protection from damage when populations are small. Unfortunately, infestations may go undetected until tuber damage is found at harvest.

**Identified Risk**

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

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

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

**Plans and Programs**

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

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

**Human Disease Hazard**

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

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

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meningoencephalitis refers to inflammation of the brain and the membrane surrounding it.

**Avian Influenza (Bird Flu) and Avian Influenza A (H5N1) Virus** is an infection by avian (bird) influenza (flu) viruses. These influenza viruses occur naturally among birds. Wild birds worldwide carry the viruses in their intestines, but usually do not get sick from them. However, avian influenza is very contagious among birds and can make some domesticated birds, including chickens, ducks, and turkeys, very sick and kill them.

Infected birds shed influenza virus in their saliva, nasal secretions, and feces. Susceptible birds become infected when they have contact with contaminated secretions or excretions or with surfaces that are contaminated with secretions or excretions from infected birds. Domesticated birds may become infected with avian influenza virus through direct contact with infected waterfowl or other infected poultry, or through contact with surfaces (such as dirt or cages) or materials (such as water or feed) that have been contaminated with the virus.

Infection with avian influenza viruses in domestic poultry causes two main forms of disease that are distinguished by low and high extremes of virulence. The low pathogenic form may go undetected and usually causes only mild symptoms (such as ruffled feathers and a drop in egg production). However, the highly pathogenic form spreads more rapidly through flocks of poultry. This form may cause disease that affects multiple internal organs and has a mortality rate that can reach 90-100% often within 48 hours.

Usually, avian influenza virus refers to influenza A viruses found chiefly in birds, but infections with these viruses can occur in humans. The risk from avian influenza is generally low to most people, because the viruses do not usually infect humans. However, confirmed cases of human infection from several subtypes of avian influenza infection have been reported since 1997. Most cases of avian influenza infection in humans have resulted from contact with infected poultry or surfaces contaminated with secretion/excretions from infected birds. The spread of avian influenza viruses from one ill person to another has been reported very rarely, and transmission has not been observed to continue beyond one person.

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

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

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viruses and bacteria.

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

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

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

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

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

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

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



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**Exotic Newcastle Disease** (END) is a contagious viral disease affecting many species of birds including poultry and wild birds. This is probably one of the most infectious diseases of poultry in the world with a death rate of almost 100 percent in unvaccinated poultry flocks and so virulent that many birds die without showing any clinical signs. The disease can even infect and cause death in vaccinated poultry.

END is extremely contagious. The spread is primarily through direct contact between healthy birds and the bodily fluids of infected birds. It can be transmitted through infected bird droppings as well as secretions from the nose, mouth and eyes. It spreads rapidly among confined birds... like commercially raised chickens. The disease is also easily spread by virus-bearing material picked up on shoes and clothing and carried from an infected flock to a healthy one. END can also spread from poultry flocks to wildlife as wild birds come into contact with infected poultry, possibly when wild birds enter a pen to feed on spilled grain. Although experiments have documented that several wild species including ducks and pheasants can develop the disease, widespread illness and death has only been documented in double-crested cormorants in the United States and Canada. This disease affects the respiratory, nervous and digestive systems, with an incubation period ranging from two to 15 days. The available information suggests that Newcastle disease can affect people; however, it does not pose a significant health risk. In humans, the disease is usually limited to conjunctivitis, which is a mild inflammation of the tissues around the eyes and is seen in persons associated with infected birds or facilities where infected birds are housed. It should be noted that poultry products in the Arizona marketplace, including eggs and meat, continue to be safe to consume.

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

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

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

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transmitted in ready-to-eat foods that have been kept properly refrigerated.

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

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

**Norwalk virus** is a virus that attaches to the outside of cells lining the intestine. Once attached, it transfers its genetic material into that cell. There it reproduces, finally killing the human cell to release new copies of it that attach to more cells of the intestine's lining. Common names of the illness caused by the Norwalk and other small round structured or caliciviruses are viral gastroenteritis, acute nonbacterial gastroenteritis, food poisoning, and food borne infection. This illness occurs worldwide. Humans are the only known hosts. The viruses are passed in the stool of infected persons. Of viruses, only the common cold is reported more like viruses are increasingly being recognized as leading causes of food-borne disease in the United States. People most often get Norwalk virus infection by swallowing infected food or water. Outbreaks in the U.S. are often linked to eating raw shellfish, especially oysters and clams. Steaming does not kill the virus or prevent its transmission.

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

**Salmonella** is a type of bacteria that causes typhoid fever and many other infections of intestinal

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

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

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

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

## History

The first North Dakota recorded death from West Nile Virus in 2006 occurred in Barnes County. In 2005 there was the presence of West Nile Virus infecting 25 humans, 79 birds, 53 sentinel chickens and 7 horses. Outbreaks had been localized and controlled.

## Plans and Programs

### Public Health

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

The Public Health Laboratory System in North Dakota is a unique and diverse system of 39 autonomous County and City facilities, working in close cooperation with the North Dakota Department of Health state laboratories. The Logan County Public Health Laboratory provides

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extensive laboratory services to the people of North Dakota for diagnostic and epidemiological investigations. The Health Department Laboratories are staffed by Public Health Microbiologists. These professionals are certified by the State of North Dakota, health related degrees and have been trained in approved public health laboratories. Laboratories vary in size of how many certified Public Health Microbiologists there are depending on population and level of service provided. An approved Laboratory Director supervises each laboratory.

**Immediate Disease Control Measures**

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

**Notification of First Responders, Medical Community and Public Sector**

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

**4.49 Logan County Communicable Disease Report from N.D. Department of Health Division of Disease Control (Kirby Krueger)**

<b>Logan County</b>	2004	2005	2006	2007
West Nile	0	0	1	0
H5N1	0	0	0	0
Mad Cow (BSE)	0	0	0	0
Botulism	0	0	0	0
Campylobacter	0	3	1	2
Canine Distemper	Animal Illness - No data			
E. Coli	0	0	0	0
Exotic Newcastle Disease	Animal Illness - No data			
Hantavirus	0	0	0	0
Hepatitis A	0	0	0	0
Listeria Monocytogenes	0	0	0	0
Lyme disease	0	0	0	0
Monkey Pox	0	0	0	0
Norwalk Virus	Not reportable - outbreaks only - for more outbreak information visit:			

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	<a href="http://www.ndhealth.gov/disease/GI/Docs/Foodborne_Outbreaks_in_ND.pdf">www.ndhealth.gov/disease/GI/Docs/Foodborne_Outbreaks_in_ND.pdf</a>			
Plague	0	0	0	0
Salmonella	0	0	0	1
Shigella	0	0	0	0
Tularemia	0	0	0	0

**Hazard: Homeland Security Incident**

<b>Probability: Low</b>	<b>Severity: Low</b>
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**Hazard Definition**

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

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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 perfluroisobutylene cause pulmonary edema usually hours after exposure. Incapacitating agents produce reversible disturbances within the central nervous system and cognitive abilities and include the agent BZ. (Sidell, 1996)

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

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

Radiological/nuclear terrorism involves the use of radiological dispersal devices, nuclear weapons, or nuclear facilities to attack the population. Exposure to radiation can cause radiation sickness, long-term illness, and even death. Terrorism experts fear the use of explosive and radiological devices in the form of a “dirty bomb” to attack the population. A “dirty bomb” is a low-tech, easily assembled and transported device made up of simple explosives combined with a suitable radioactive agent. As with chemical and biological events, radiological incidents present contamination challenges for first responders. North Dakota is also home to United States intercontinental ballistic missiles located in silos around Minot Air Force Base. (Wikipedia, 2007b) 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 incidents typically occur on a smaller scale than terrorism when large groups, organizations, or distraught individuals take action with potentially disastrous or disruptive results. Civil unrest can result following a disaster that creates panic in the community. Violence can be small scale, such as domestic violence, or larger and require significant government response, as is profiled in this plan.

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

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- **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. (Southern Poverty Law Center, 2007)
- **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. (Southern Poverty Law Center, 2007)
- **Eco-Terrorists:** These environmentally-oriented, subnational groups use or threaten to use violence of a criminal nature against innocent victims or property for environmental-political reasons. They may also aim their attacks at an audience beyond the target, often of a symbolic nature. Organizations identified by the FBI as having terrorist cells include the Animal Liberation Front (ALF) and the Earth Liberation Front (ELF). Although supporting organizations generally advocate peaceful demonstrations, the FBI estimates that the ALF/ELF have committed more than 600 criminal acts in the United States from 1996-2001, resulting in damages in excess of \$43 million. The most destructive acts committed by the ALF/ELF involve arson. (Federal Bureau of Investigation, 2002)
- **General Hate:** These groups include anti-gay groups that go beyond mere disagreement with homosexuality by subjecting gays and lesbians to campaigns of personal vilification. Other general hate groups include Holocaust denial groups, racist music groups, radical traditionalist Catholic groups, and other groups espousing a variety of hateful doctrines. (Southern Poverty Law Center, 2007)
- **Ku Klux Klan:** This organization, with its mystique and long history of violence, is the most infamous, and oldest, American hate group. Although blacks have typically been the Klan's primary target, it has also attacked Jews, immigrants, homosexuals, and, until recently, Catholics. (Southern Poverty Law Center, 2007)
- **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. (Southern Poverty Law Center, 2007)
- **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. (Southern Poverty Law Center, 2007)
- **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. (Southern Poverty Law Center, 2007)
- **White Nationalist:** These groups espouse white supremacist or white separatist ideologies, often focusing on the alleged inferiority of non-whites. (Southern Poverty Law Center, 2007)

According to the Southern Poverty Law Center Intelligence Project, none of these groups have active cells in North Dakota. More specific to North Dakota, however, is the Little Shell Logan 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

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Logan 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 Logan 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)

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

- **Local Area Emergency Message:** This message defines an event that by itself does not pose a significant threat to public safety and/or property, but the event could escalate, contribute to other more serious events, or disrupt critical public safety services. Instructions, other than public protective actions, may be provided by authorized officials. Examples of when this message may be used include: utility disruptions, road closures, or a potential terrorist threat where the public is asked to remain alert.
- **Civil Emergency Message:** This message outlines a significant threat or threats to public safety and/or property that is imminent or in progress. The hazard is usually less specific or severe than those requiring a Civil Danger Warning.
- **Law Enforcement Warning:** This warning is issued for a bomb explosion, riot, or other criminal event. An authorized law enforcement agency may block roads, waterways, or facilities, evacuate or deny access to affected areas, and arrest violators or suspicious persons.
- **Radiological Hazard Warning:** This warning warns of the loss, discovery, or release of a radiological hazard such as the theft of a radiological isotope used for medical, or other purposes, discovery of radioactive materials, or a transportation accident involving nuclear weapons, nuclear fuel, or radioactive wastes. Authorized officials may recommend protective actions be taken if a radioactive hazard is discovered.
- **Civil Danger Warning:** This warning is issued when an event presents a danger to a significant civilian population. The message usually warns of a specific hazard and outlines specific protective actions such as evacuation or shelter in place.
- **Shelter In Place Warning:** This warning is issued when the public is recommended to shelter in place (go inside, close doors and windows, turn off air conditioning or heating systems, and turn on the radio or TV for more information). Examples include hazardous material releases or radioactive fallout.

(National Weather Service, 2005)

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.



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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, 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 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 gaspowered 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 pleaded 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 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 firefighter said the blazes were started with cans of gasoline thrown through glass doors into the entryways of

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the two buildings. The law enforcement center suffered minor damage and the prisoners had to be relocated. There apparently was a standoff 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 about at 10:45 p.m.

(North Dakota Department of Emergency Services, 2007d)

Within North Dakota, the Southern Poverty Law Center Intelligence Project Hatewatch, recorded one hate incident from 2003-2007 when a mosque was vandalized in Fargo in October 2004. 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 remains at-large. (National Memorial Institute for the Prevention of Terrorism, 2007)

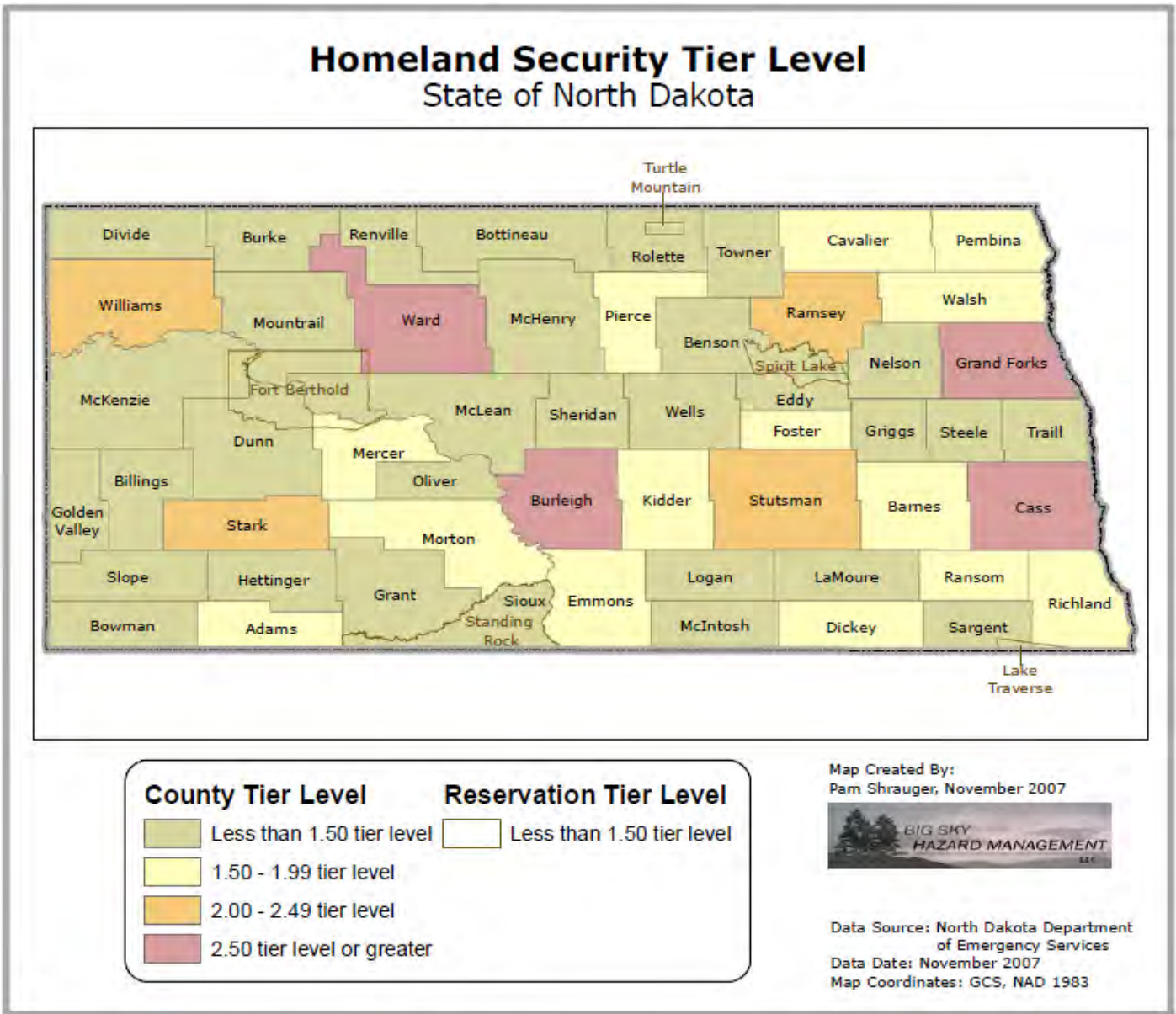
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**4.50 Homeland Security Tier Levels for North Dakota**

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\*Source: State of North Dakota Enhanced Hazard Mitigation Plan

**Risk Assessment**

Worldwide there were 457 incidents or planned acts during the period from 1980 to 1999. Of these, 135 were international and 322 domestic terrorism. The majority of these incidents (321) have been bombings. However, there is also a concern for the potential of Weapons of Mass Destruction (WMD) use in future terrorist events. The use of WMDs increases the potential for mass casualties and damage.

One of the special considerations in dealing with the terrorist threat is that it is difficult to predict. One must know the minds and capabilities of various terrorists and terrorist groups. These

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are characteristics terrorist organizations strive to conceal. Because all terrorists are not the same, the calculation is even more difficult. Two things are clear from the perspective of hazard mitigation. The most often used weapon of terrorists is bombs and the greatest potential for loss is from WMDs.

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

## **Threats**

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

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

## War

Worldwide, wars have claimed over 100 million lives during the first half of the 20<sup>th</sup> century. We have had 140 wars since World War II. We had 20 wars in 1988. There are 14,000 wars recorded in world history.

Each generation has striven to eliminate war, "World War I" was the war to end all wars, however, and none has succeeded.

## Nuclear Threat

Nuclear weapons have the potential for causing the most catastrophic National Security disaster imaginable.

In recent years superpowers have been seeking ways to reduce their nuclear arsenals, while maintaining a capability to use their nuclear strength as a deterrent to general war, however, at

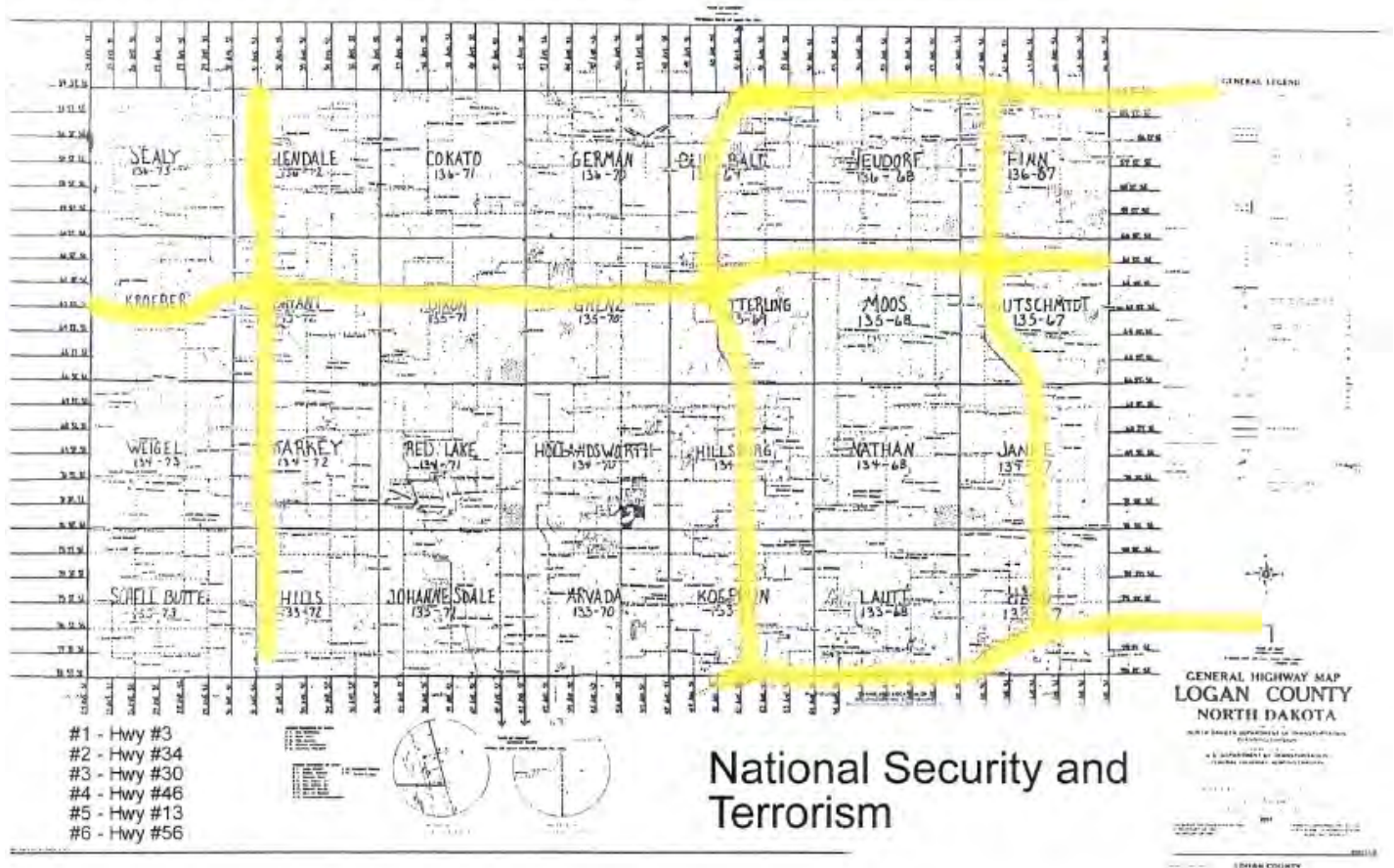
## **History**

There is no history of homeland security incidents within Logan County in the last five years. WWI, WWII, and September 11, 2001 and following months after terrorist attack to present.

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**4.51 Map of Logan County National Security Hazard**

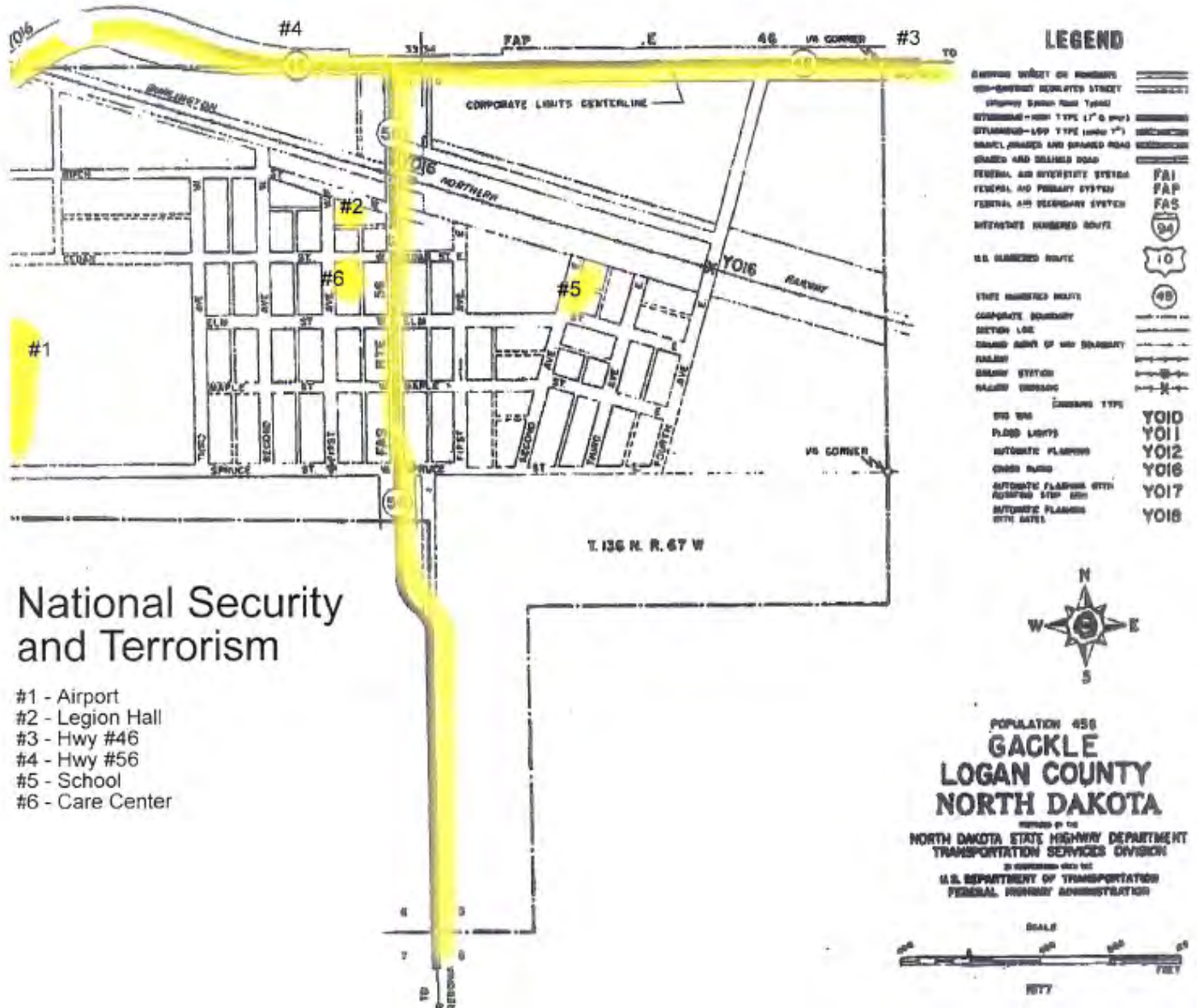


**4.52 Map of Fredonia National Security Hazard**



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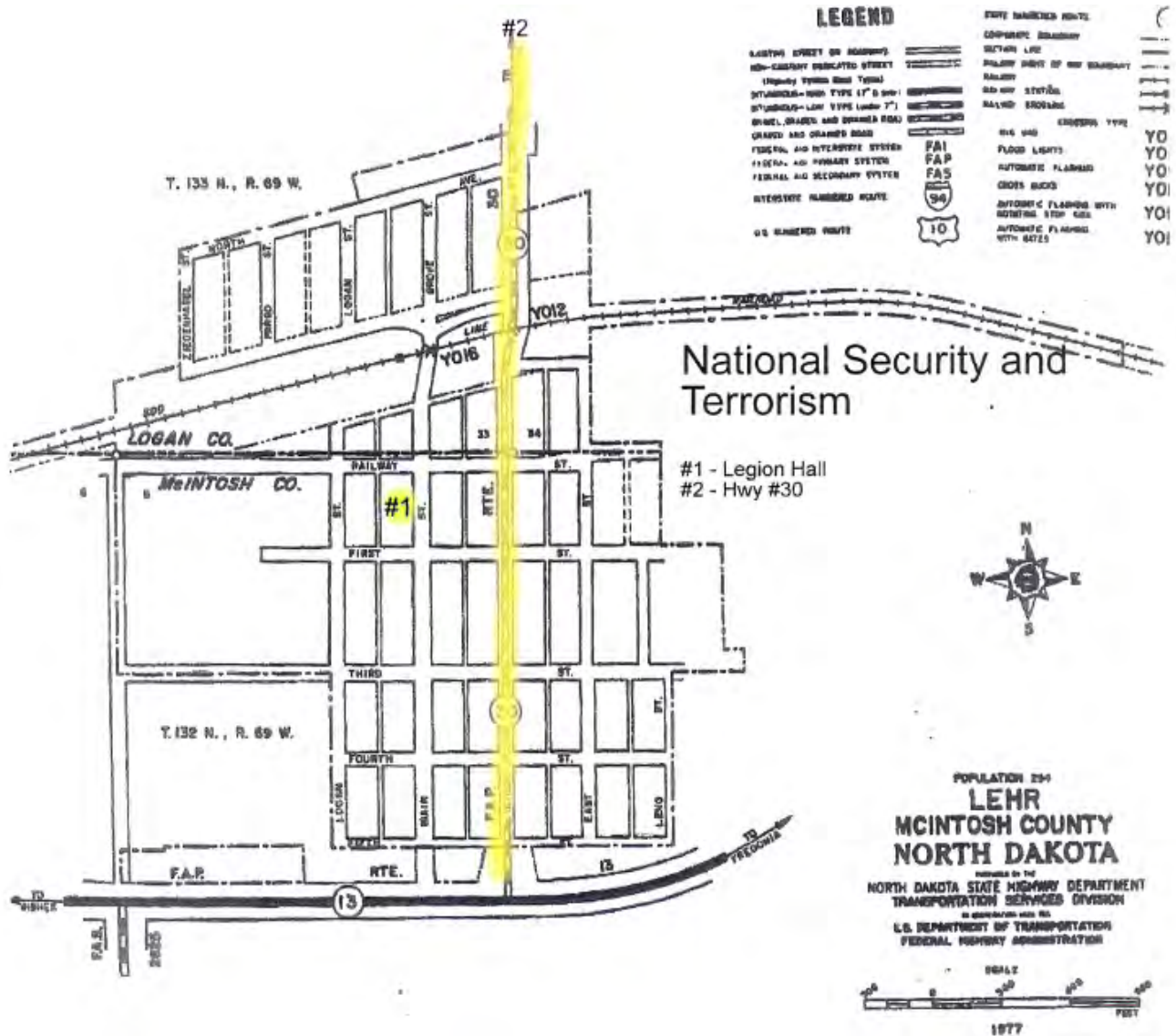


4.54 Map of Lehr National Security Hazard



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**Identified Risks**

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

**Hazard: Transportation Accidents**

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<b>Probability: Low</b>
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<b>Severity: Low</b>
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**Hazard Definition**

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

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

State Highways 13, 34, and 46 are the major east-west routes across the county. State Highways 3, 30, and 56 are major north-south routes. These state and federal highways along with the hard surfaced and graveled county and township roads provide a good transportation network.

Community airports: Gackle and Napoleon. The nearest major airline facilities are located in Burleigh County. The Dakota Missouri Valley and Western Railroad, and numerous motor transport carriers support freight needs.

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

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

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

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

**Threat**

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

**History**

There has been no history of transportation accidents within Logan County.

**Identified Risks**

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

Contagious Disease (either from bioterrorism or necrotoxins), Crowd control, both press and civilians, and Post-traumatic stress of workers

**Hazard: Shortage of Critical Materials**

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**Probability: Low**

**Severity: Low**

**Definition**

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 Logan County citizens.

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

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

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

Almost any hazard can cause a shortage or outage of critical materials or infrastructure, but disruptions can also occur due to human error, equipment failures, or low supplies. The most common hazards that interrupt electric services are heavy snow, ice, and wind. Water supplies may be threatened by drought. Sewer services can be disrupted by flood. Often these types of outages are short lived. Crews quickly respond and resolve the problem causing the outage. During a widespread or complicated outage, services may be down for days or even weeks. Most problems arise during these longer term outages. For example, electricity is needed to maintain water supplies and sewer systems, but also to run blowers for heating systems. Essentially,

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without electricity, most facilities are without heat, water, fuel, or other appliances during a long term outage. This problem becomes particularly significant during the cold winter months. Telephone services are important for day-to-day business, but are most important for 911 communications in an emergency. Without telephone service, emergency services can be severely delayed. In most cases, a long term utility outage would force many businesses to close until the services were restored. Gasoline shortages are also common during times of disaster.

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

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

(National Weather Service, 2005)

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.

### **History**

Logan County has not experienced any critical material shortages. However, North Dakota has experienced three separate major statewide incidents involving shortages of critical materials:

1970's 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.

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- 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.

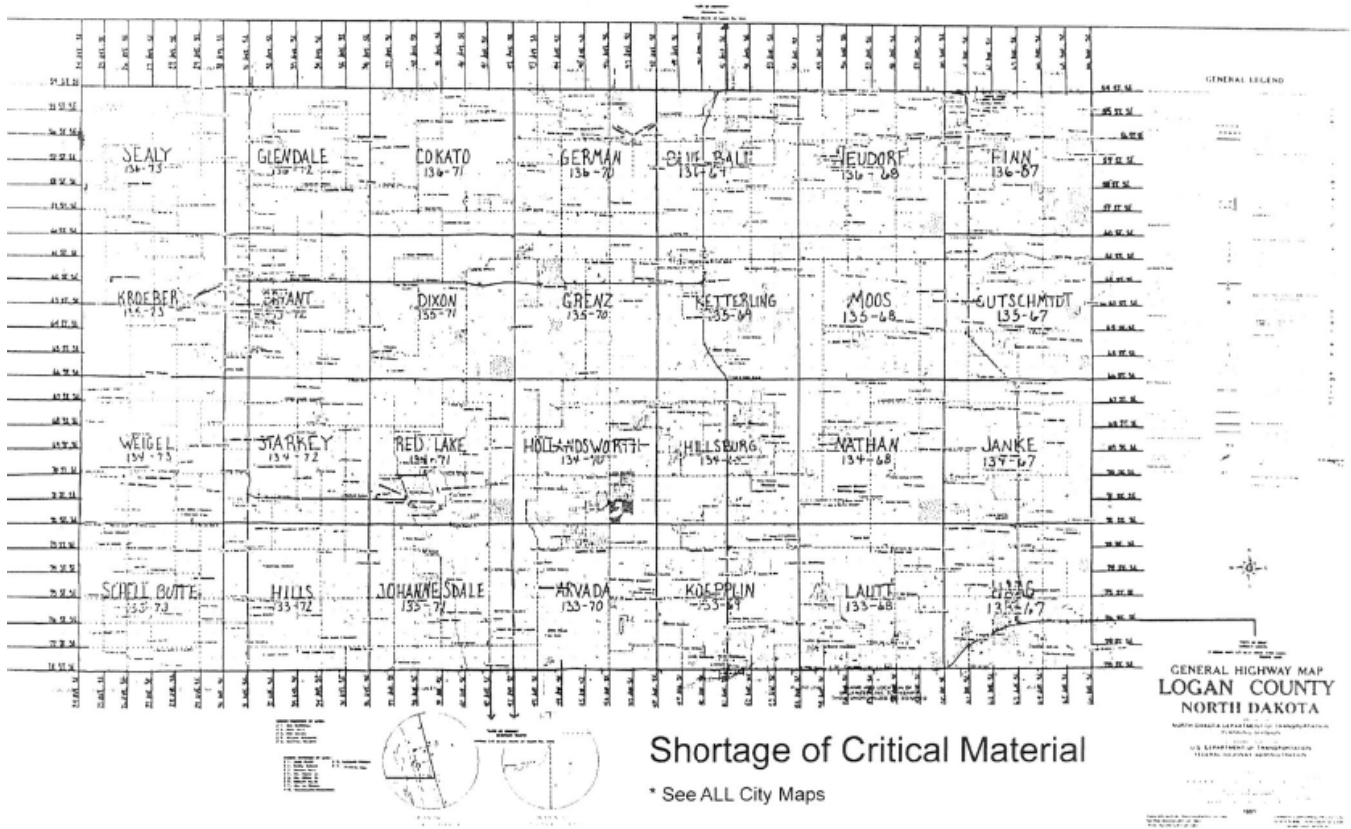
1970’s Anti-Freeze Shortage: The anti-freeze shortage occurred prior to and during the winter months when it is critical to protect cooling system liquids from freezing in automobile engines. Distributors were able to receive ample stocks, but state officials monitored the situation and prepared to activate 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.

1980’s 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.

**4.55 Map of Logan County Shortage of Critical Materials**

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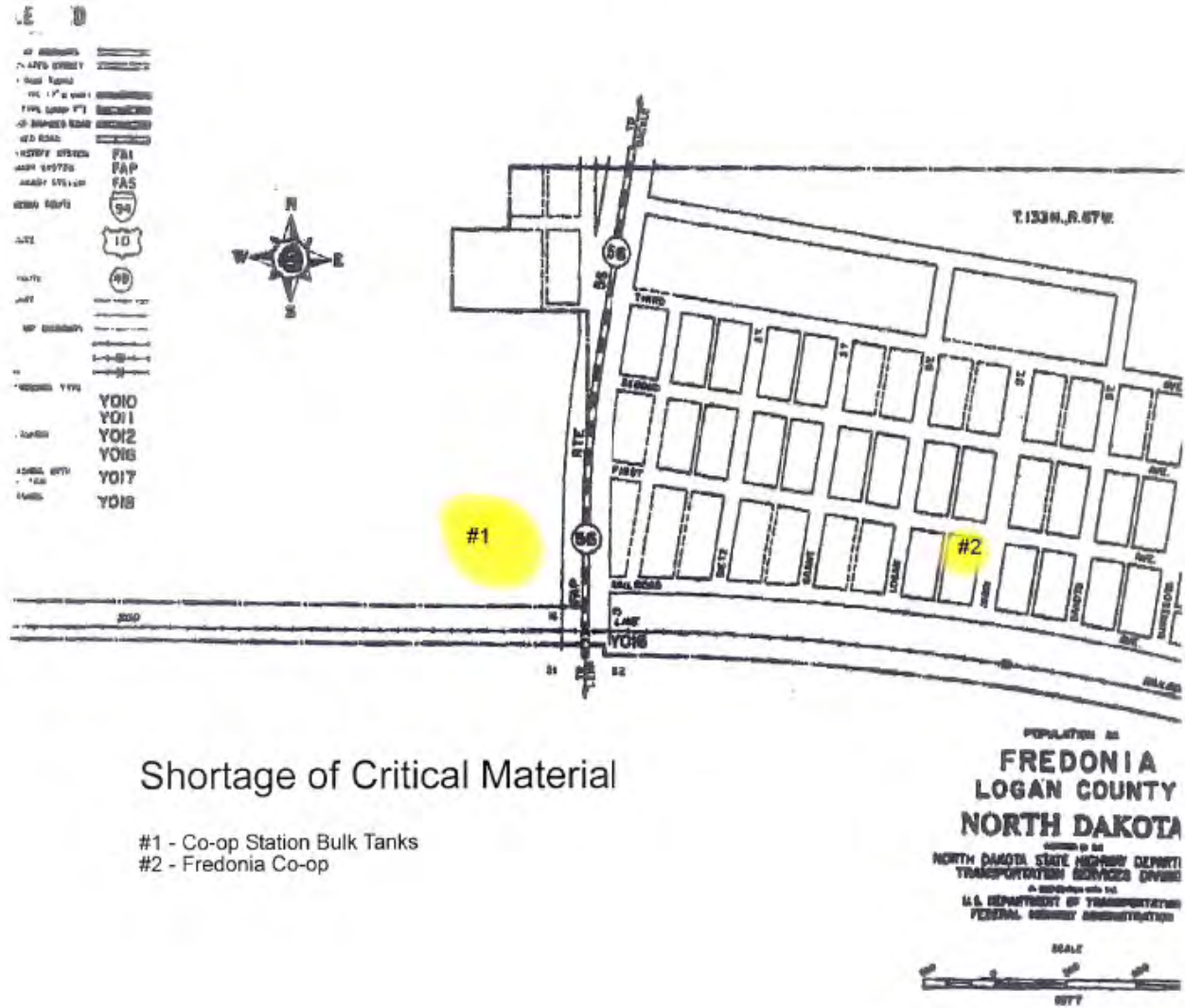


4.56 Map of Fredonia Shortage of Critical Materials



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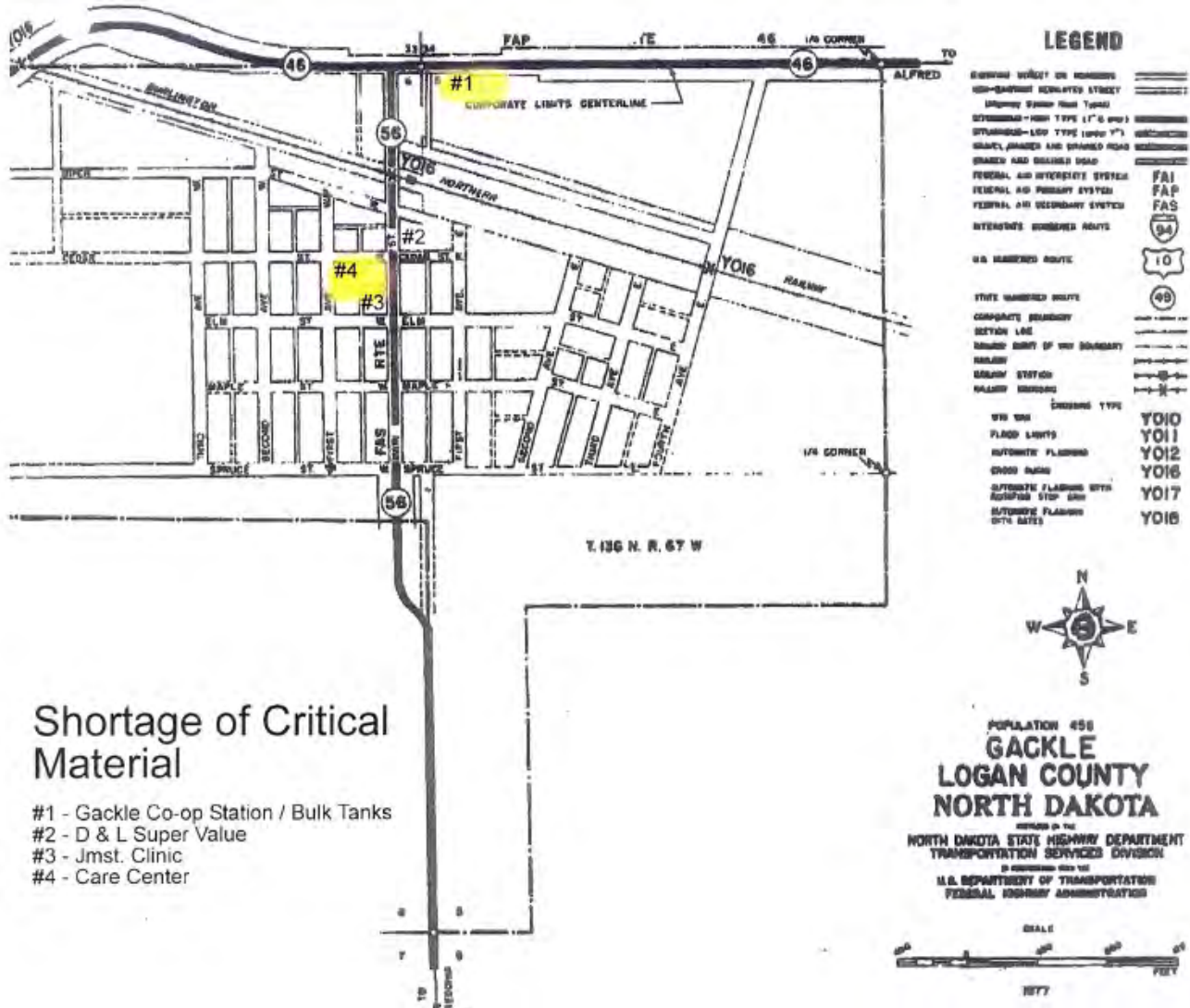
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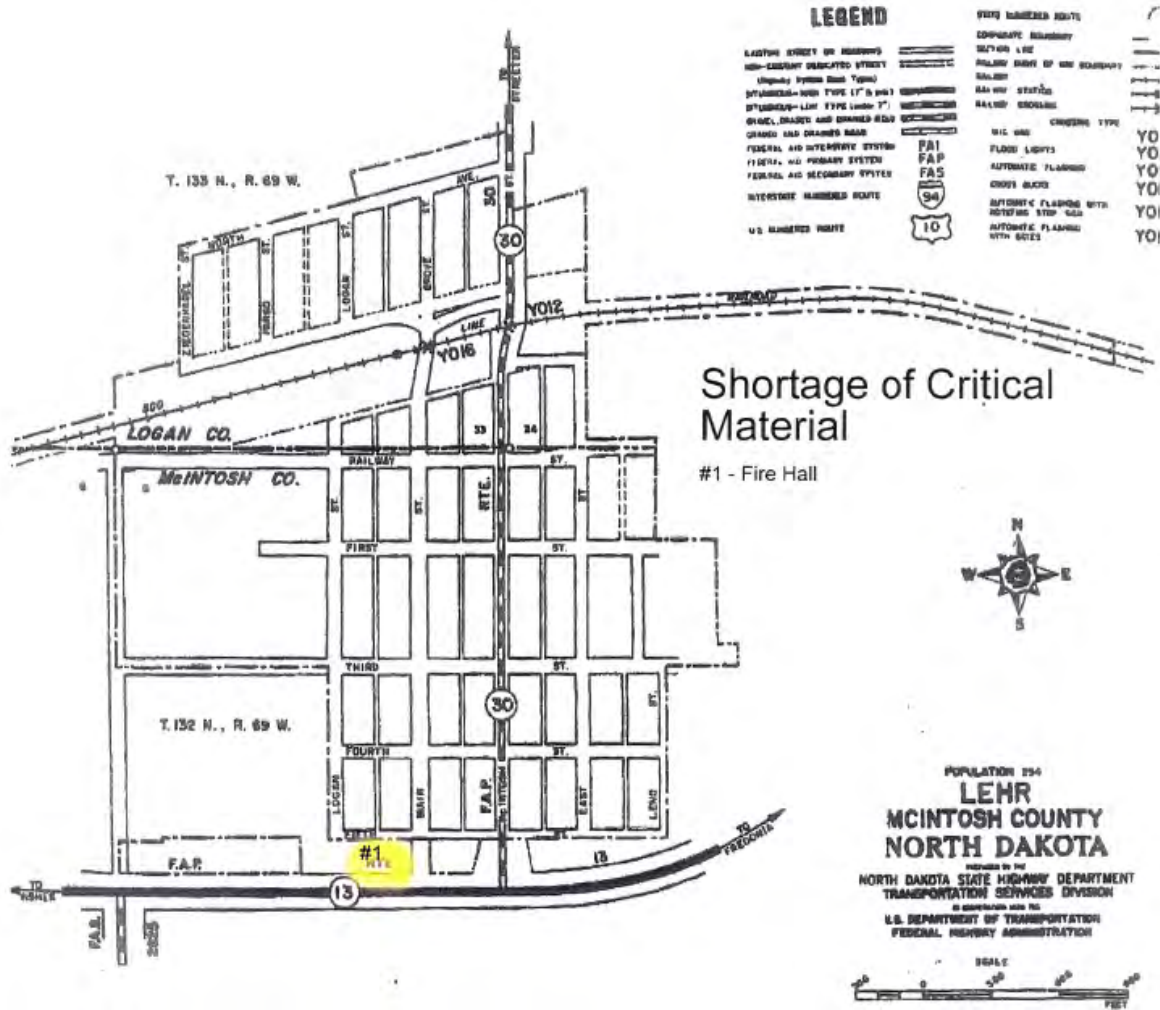
**4.57 Map of Gackle Shortage of Critical Materials**



**4.58 Map of Lehr Shortage of Critical Materials**

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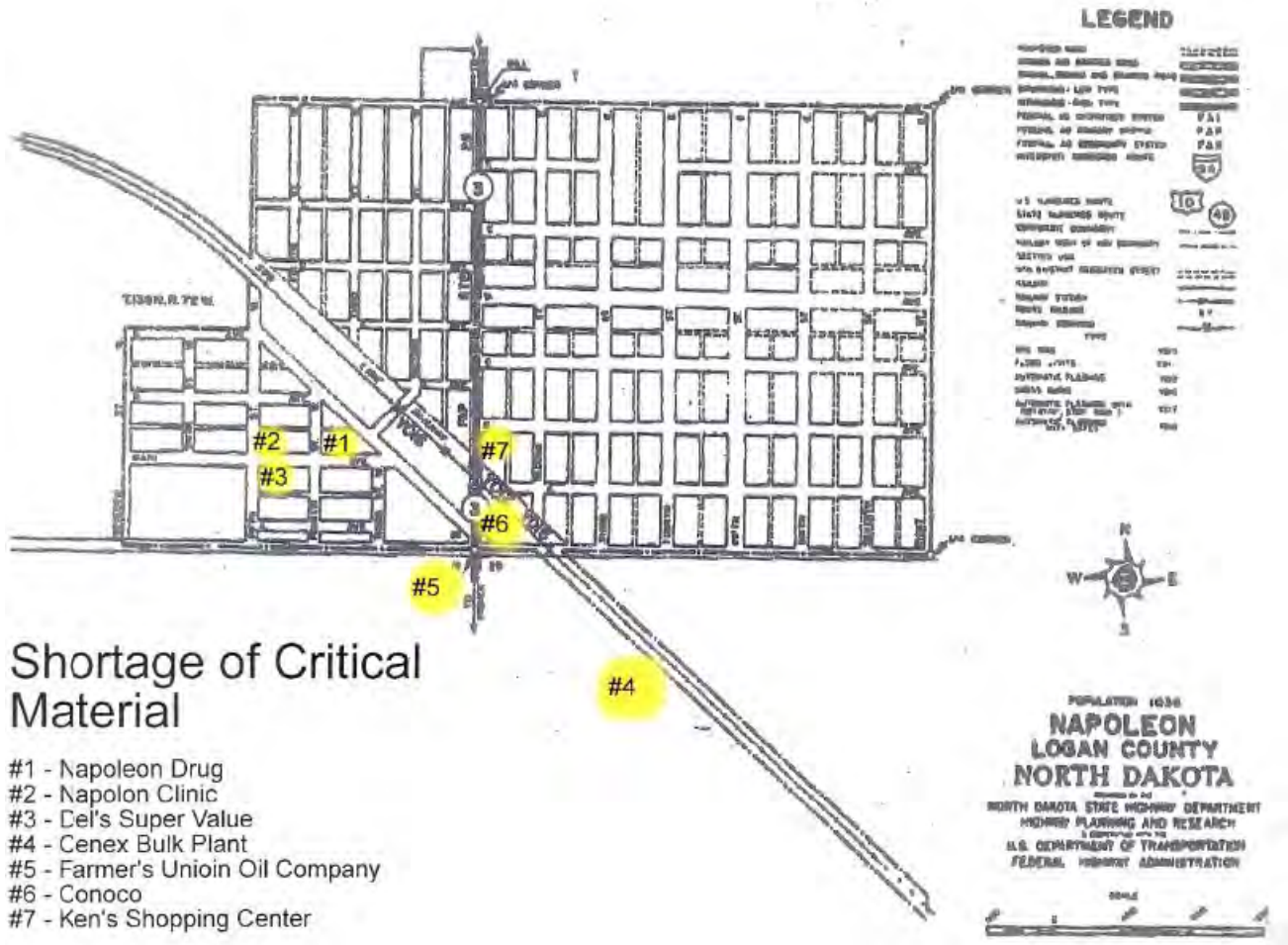
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**4.59 Map of Napoleon Shortage of Critical Materials**



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**Identified Risks**

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

This section was updated to include any changes regarding the risk assessment from the previous plan to address any vulnerability that may have not been addressed before. The planning team discussed the addition of tables to describe risk analysis criteria and local risk analysis classifications. The planning team agreed with the risk analysis summary with the new hazards identified. The planning agreed to changes that were made by majority vote at the

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**5. Risk Assessment Summary**

This risk assessment represents an approximate history and estimated vulnerabilities to Logan County and the incorporated jurisdictions 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.

The hazards are prioritized using the best possible information on risks and vulnerabilities to provide guidance when selecting mitigation strategies. Certain factors may be considered when prioritizing hazards:

- Probability or Frequency of event
- Magnitude or Severity of event
- Impact to Critical Facilities
- Impact to Critical Infrastructure
- Impact to Structures
- Impact to Population

**5.1 Critical Facilities and Vulnerable Populations**

*Critical Facilities:*

- Courthouse
- Radio Tower
- City Halls (3)
- Tower House
- Pump Houses (4)
- Lift Station
- Schools (2)
- Fire Halls (4)
- Water Towers (3)
- Fettig Day Care

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- Well House
- Water Tank
- BEK Communication
- CHS
- Dickey Rural Telephone
- Farmers Elevevator
- Farmers Elevevator NH3 Pant
- FUOC LP Plant
- FUOC Bulk Plant
- FUOC Station
- COOP Oil Co.
- Grain COOP.
- Ken's Shopping Center
- Care Centers (2)
- NDDOT
- St. Philip Neri Church
- Sub-Station
- Water Plant
- Napoleon Care Center
- Clinics (2)
- Police/Ambulance Station (2)
- Nursing Home
- Water Supply
- Lagoon
- Residential Homes (1112)
- Mobile Homes (81)

**5.2 Local Risk Analysis Criteria**

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

**5.3 Local Risk Analysis Classifications**

		SEVERITY			
		<i>Negligible</i>	<i>Limited</i>	<i>Critical</i>	<i>Catastrophic</i>
FREQUENCY	<i>Highly Likely</i>	<b>C</b>	<b>B</b>	<b>A</b>	<b>A</b>
	<i>Likely</i>	<b>C</b>	<b>C</b>	<b>B</b>	<b>A</b>
	<i>Possible</i>	<b>D</b>	<b>C</b>	<b>B</b>	<b>B</b>
	<i>Unlikely</i>	<b>D</b>	<b>D</b>	<b>C</b>	<b>C</b>

**5.4 RISK ANALYSIS SUMMARY 2008**



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<b>Risk Class:</b>	<b>pending</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>D</b>	<b>D</b>	<b>D</b>	<b>A</b>
<b>HAZARD:</b>	<b>Communicable Disease (Rare, once every 30 or 50 years)</b>	<b>Dam Failure</b>	<b>Drought</b>	<b>Flood</b>	<b>Hazardous Material Release</b>	<b>Homeland Security Incident</b>	<b>Shortage or of Critical Materials</b>	<b>Summer Storm</b>	<b>Transportation Accidents</b>	<b>Urban Fire or Structure Collapse</b>	<b>Wildland Fire</b>	<b>Winter Storm</b>
Blocked Roads		X		X	X	X		X	X	X	X	X
Building Collapse		X		X		X		X		X		X
Business Interruptions	X	X	X	X	X	X	X	X	X	X	X	X
Delayed Emergency Response		X		X	X	X		X	X			X
Downed Power Lines		X		X				X		X	X	X
Downed Trees		X		X				X			X	X
Evacuation (Full)		X		X	X							
Evacuation (Localized)		X		X	X	X		X	X	X	X	X
Explosion					X	X			X	X	X	
Flooding (Street)		X		X				X				
Flooding (Structure)		X		X				X				
HAZMAT Release (Anthrax)	X	X		X	X	X		X	X	X	X	X
Increased Fire Potential			X		X	X		X		X	X	X
Increased Public Safety Runs		X		X	X	X	X	X	X	X		X
Loss of Potable Water	X	X	X	X	X	X		X				X
Loss of Medical Facilities		X				X		X				X
Loss of Power		X		X		X		X		X	X	X
Mass Casualties	X	X			X	X		X	X	X		
Property Damage		X	X	X	X	X		X	X	X	X	X
School Closure	X	X		X	X	X	X	X		X		X
Sewer Backup		X		X				X				
Wind Chill												X
Livestock Injury/Death	X	X	X	X	X		X	X			X	X
Loss of Economy	X	X	X	X		X	X	X		X	X	X

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Additions to this section were the additional funding sources, and repetitive loss structures for the county. This section was gone over in detail to add new projects, review projects from previous plan and prioritize all projects and statuses of the projects. At the meeting on July 9<sup>th</sup>, 2009 the planning team participated in the prioritization and the completion of the mitigation action table in this section. Comments were in agreement to add all projects that were submitted to the Emergency Manager as a result of the last meeting that was held. The additional funding options were relayed to the planning team for the projects so they are aware of other sources for projects. The planning team agreed to modify the projects for the plan by accepting changes with a majority vote.

**6. Multi-Jurisdiction Goals, Objectives, and Mitigation Strategies**

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.

Hazard mitigation measures must be practical, cost-effective, and environmentally and politically acceptable. Actions taken to limit the vulnerability of society to hazards must not in themselves be more costly than the value of anticipated damages. If the cost of a flood control project exceeds the value of flooding damages that could be prevented, community warning, evacuation, and other operational procedures may be the only available means of limiting the adverse impacts of a hazard. Such plans and procedures are not generally considered mitigation actions because they do nothing to reduce or limit the actual vulnerability of a community to a hazard; however they may generate some savings in property losses or protect the population.

For some hazards, there are no economic means of avoiding the effects of future damages, especially when it is virtually impossible to predict with any certainty the location, frequency, or severity of a specific hazard. New infrastructure within Logan County includes a new drug store and café. The drug store had burned down in the fall of 2008 construction is currently taking place.

Logan County utilizes zoning ordinances, which can be used to restrict new development in high hazard areas, or building codes, which can ensure that new development of buildings, are able to withstand the impacts of hazards in the county. The NFIP (National Flood Insurance Program) requires communities to participate and adopt ordinances to control development and improvements in floodplain areas as to make flood insurance available in the county. There are certain jurisdictions that have participated with NFIP in the previous 2003 plan these jurisdictions have not changed, and will continue to comply with the NFIP, Lehr and Fredonia have not joined the NFIP efforts the County Commissioners are working to educate the benefits of the NFIP for all jurisdictions in the county.

The development of a pre-disaster mitigation strategy allows for the county and the incorporated jurisdictions to create a vision for preventing future disasters, establish a common set of

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mitigation goals, prioritize actions, and evaluate the success of such actions. The mitigation strategy is based on the results of risk assessment and recommendations by local officials, other stakeholders, and the public. The goals are broad, visionary, forward looking statements that outline in general terms what the county and incorporated jurisdictions 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.

All losses cannot be entirely mitigated, however, some actions can be taken, as funding and opportunities arise, that may reduce the impacts of disasters, thus, saving lives and property. Some mitigation projects were carried over from the last update of the plan and new projects were added based on community input received.

**Project Prioritization**

Each of the proposed projects have value, however, time and financial constraints do not permit all of the proposed actions to be implemented immediately. By prioritizing the actions, 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, some actions may be best achieved outside the priorities established.

To ensure that community goals and other factors are taken into account when prioritizing projects a prioritization model that uses the following factors has been developed: cost, staff time, feasibility, population benefit, property benefit, values benefit, maintenance, and hazard rating. *Cost* considers the direct expenses associated with the project such as material and contractor expenses. *Staff time* evaluates the amount of time needed by a local government employee 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 processes, and/or private business implementation. *Property benefit* estimates the reduction of property losses, including structures and infrastructure, from the hazard being mitigated. *Values benefit* considers the economic, ecologic, historic, and social benefits of the project. *Maintenance* rates the amount of work 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.

When evaluating projects for grant applications, established cost-benefit analysis requiring detailed project specific data should be used.

**6.1 Prioritization Criteria**

<b>Factor</b>	<b>Threshold</b>	<b>Rating</b>	<b>Score</b>
Cost <i>Range: 1-5</i>	Little to no direct expenses	Low	5
	Less than \$5,000	Low to Moderate	4
	\$5,000 to \$25,000	Moderate	3
	\$25,001 to \$100,000	Moderate to High	2

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	Greater than \$100,000	High	1
Staff Time <i>Range: 1-3</i>	Less than 10 hours of staff time	Low	3
	10-40 hours of staff time	Moderate	2
	Greater than 40 hours of staff time	High	1
Feasibility <i>Range: 1-3</i>	Positive support for the project	High	3
	Neutral support for the project	Moderate	2
	Negative support for the project	Low	1
Population Benefit <i>Range: 1-4</i>	Potential to reduce more than 20 casualties	Very High	4
	Potential to reduce 6-20 casualties	High	3
	Potential to reduce 1-5 casualties	Moderate	2
	No potential to reduce casualties	Low	1
Property Benefit <i>Range: 1-4</i>	Potential to reduce losses to 6-20 buildings or severe damages to infrastructure	Very High	4
	Potential to reduce losses to 6-20 buildings or substantial damages to infrastructure	High	3
	Potential to reduce losses to 1-5 buildings or slight damages to infrastructure	Moderate	2
	No potential to reduce property losses	Low	1
Values Benefit <i>Range: 1-3</i>	Provides significant benefits to economic, ecologic, historic, or social values	High	3
	Provides some benefits to economic, ecologic, historic, or social values	Moderate	2
	No or very little benefit to economic, ecologic, historic, or social values	Low	1
Maintenance <i>Range: 1-3</i>	Requires very little or no maintenance	Low	3
	Requires less than 10 hours per year	Moderate	2
	Requires more than 10 hours per year	High	1
Hazard Rating <i>Range: 1-5</i>	See Risk Assessment Summary	High	5
	See Risk Assessment Summary	Moderate	3
	See Risk Assessment Summary	Low	1

**Project Implementation**

A critical component of any mitigation program is the implementation of the mitigation projects. Maintaining this Multi-Hazard Mitigation Plan has been the responsibility of Logan County Emergency Management in coordination with other appropriate agencies. However, once a

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hazard has been identified for mitigation, Emergency Management generally steps back from the leadership role and assumes the role of team participant. The lead role in project development should then shift to the department or agency responsible for the project management.

**Funding Sources**

Funding for mitigation projects exists 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.

**6.2 Mitigation Funding Sources**

<b>Name</b>	<b>Description</b>	<b>Managing Agencies</b>
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 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
Flood Mitigation Assistance Program (FMA)	Provides pre-disaster flood mitigation funding (with priority for repetitive flood loss properties under the National Flood Insurance Program).	North Dakota State Water Commission and FEMA Region VIII
Hazard Mitigation Grant Program (HMGP)	Provides post-disaster mitigation funding.	North Dakota Department of Emergency Services and FEMA Region VIII
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

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Individual Assistance (IA)	Following a disaster, funds can mitigate hazards when repairing individual and family homes.	North Dakota Department of Emergency Services and FEMA Region VIII
Law Enforcement Support Office 1033 Program	Provides surplus military property to local law enforcement agencies.	North Dakota National Guard
Map Modernization Program	Provides funding to establish or update floodplain mapping.	North Dakota State Water Commission and FEMA Region VIII
National Fire Plan (NFP)	Provides funding for pre-disaster wildfire mitigation.	North Dakota Forest Service and US Forest Service
National Wildlife Wetland Refuge System	Provides funding for the acquisition of lands into the federal wildlife refuge system.	US Fish and Wildlife Service
North American Wetland Conservation Fund	Provides funding for wetland conservation projects.	US Fish and Wildlife Service
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 and Wildlife Service
Pre-Disaster Mitigation (PDM) Grants	Provides grants through a competitive process for specific mitigation projects, including planning.	North Dakota Department of Emergency Services and FEMA Region VIII
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 and FEMA Region VIII
Repetitive Flood Claims (RFC) Grant	Provides funding to reduce flood damages to insured properties that have had one or more claims to the NFIP.	North Dakota State Water Commission and FEMA Region VIII
Rural Fire Assistance (RFA) Grant	Funds for fire mitigation 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)
Severe Repetitive Loss (SRL) Grant	Provides funding to reduce flood damages to residential insured properties that have had at least four claims to the NFIP.	North Dakota State Water Commission and FEMA Region VIII
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. Many opportunities for mitigation funding exist both in the public and private sectors such as businesses, foundations, and philanthropic organizations.

The Emergency Manager Cindy Doll Contacted Ray Morrell at DES October 14, 2009 for repetitive loss properties for Logan County at this time there are no repetitive loss properties only the following sites below.

**6.3 Repetitive Loss Sites**

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2009 FEMA -DR-1829-ND				UPDATE 5-7-09
LOGAN COUNTY TOWNSHIP ROADS				
DISASTER PERIOD MARCH 13TH AND CONTINUING, 2009				
STATUS: V-VERIFIED BY COMMISSIONER/TOWNSHIP SUPERVISOR, R-REPORTED				
MAP SITE #	TOWNSHIP	SECTION	LOCATION INFO/ NUMBER OF DAMAGED AREAS, MISC INFO	STATUS
	133-67 HAAG-O	2-3	THREE SITES- TWO SITES WERE FEMA 2007 SITES, COMPLETED, HAD UNDERRUNS	VS
	133-67 HAAG-O	6 NORTH		VS
	133-67 HAAG-O	10-11	TWO SITES-THERE WAS A 2007 FEMA SITE, COMPLETED, UNDERRUN	VS
	133-67 HAAG-O	13-14	FY2007 FEMA SITE,EXTENSION, HAAG REQUESTED RIPRAP, P MAESNER, DES CALLED TO DISCUSS THIS. INCLUDE WITH NEW DISASTER	VS
	133-67 HAAG-O	14-15	TWO SITES	VS
	133-67 HAAG-O	14-23	WHOLE LENGTH NEEDS GRAVEL	VS
	133-68 LAUTT	7-18	TWO SITES	V
	133-68 LAUTT	22-23		V
	133-68 LAUTT	31-32	ROAD WAS UNDERWATER (TERRY STICKEL)	
	133-68 LAUTT	32-33		V
	133-68 LAUTT	34-35		V
	133-69 KOEPLIN	1 EAST	TWO SITES ON NORTH END	V
	133-69 KOEPLIN	31 SOUTH	THREE SITES	V
	133-70 ARVADA	1-12		V
	133-70 ARVADA	3-10		V
	133-70 ARVADA	5-6		V
	133-70 ARVADA	6		V

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	133-70 ARVADA	5-8		V
	133-70 ARVADA	13-24		V
	133-70 ARVADA	31-32	SOUTH END	V
	133-71 JOHANNESDALE	11-12		V
	133-71 JOHANNESDALE	21-22		V
	133-71 JOHANNESDALE	23-26	FARM ACCESS ROAD	V
	133-71 JOHANNESDALE	27-34	TWO SITES	V
	133-71 JOHANNESDALE	28-33		V
	133-71 JOHANNESDALE	29-32		V
	133-72 HILLS	2-3		V
	133-72 HILLS	2-11		V
	133-72 HILLS	3 NORTH		V
	133-72 HILLS	4 NORTH		
	133-72 HILLS	4-5	TWO SITES	V
	133-72 HILLS	5-8		V
	133-72 HILLS	6 NORTH		V
	133-72 HILLS	10-11		V
	133-72 HILLS	14-23		V
	133-72 HILLS	22-23,26-27	JUNCTION	V
	133-72 HILLS	28-33		
	133-72 HILLS	31 SOUTH		V
	133-72 HILLS	35-36		V
	133-73 SCHELL BUTTE	1-2	TWO SITES	VC
	133-73 SCHELL BUTTE	2 NORTH		VC



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	133-73 SCHELL BUTTE	2-3		VC
	133-73 SCHELL BUTTE	2-11		VC
	133-73 SCHELL BUTTE	3 NORTH	TWO SITES	VC
	133-73 SCHELL BUTTE	5-8		VC
	133-73 SCHELL BUTTE	9-16	TWO SITES	VC
	133-73 SCHELL BUTTE	10-15		VC
	133-73 SCHELL BUTTE	11-12,13-14	JUNCTION	VC
	133-73 SCHELL BUTTE	13-14		VC
	133-73 SCHELL BUTTE	17-20		VC
	133-73 SCHELL BUTTE	19-20		VC
	133-73 SCHELL BUTTE	21-28		VC
	133-73 SCHELL BUTTE	23-26		VC
	133-73 SCHELL BUTTE	25-26	TWO SITES	VC
	133-73 SCHELL BUTTE	27-28	TWO SITES	VC
	133-73 SCHELL BUTTE	27-34		VC
	133-73 SCHELL BUTTE	28-33	TWO SITES	VC
	133-73 SCHELL BUTTE	29-30		VC
	133-73 SCHELL BUTTE	29-32	TWO SITES	VC
	133-73 SCHELL BUTTE	35-36		VC
	133-73 SCHELL BUTTE	36 SOUTH		VC
	134-67 JANKE-O		10 SITES NOT ALL IDENTIFIED, CHECK 2007 FEMA SITES	
	134-67 JANKE-O		ACCESS TO EUELLA WOLF DAMAGE???	
	134-67 JANKE-O	26-27		
	134-67 JANKE-O	35 SOUTH	HOWARD SCHULZ ACCESS	R

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	134-68 NATHAN	7-8		V
	134-68 NATHAN	11-12	2007 FEMA SITE??	V
	134-68 NATHAN	14	PRIVATE DRIVE/NO RESIDENCE:RAY BURKLE	R
	134-68 NATHAN	17-18		V
	134-68 NATHAN	15-16	4 AREAS	V
	134-68 NATHAN	29-30	2007 FEMA SITE??	V
	134-68 NATHAN	30-31		V
	134-69 HILLSBURG	2-11		V
	134-69 HILLSBURG	3-10		V
	134-69 HILLSBURG	5-8		V
	134-69 HILLSBURG	11-12		V
	134-69 HILLSBURG	20-29	FARM TO MARKET ROAD	V
	134-69 HILLSBURG	32 SOUTH	DAVID LEHR FARMSTEAD-BUILDING HOUSE	V
	134-69 HILLSBURG	33 SOUTH	TWO SITES	V
	134-70 HOLLANDSWORTH	3 NORTH		V
	134-70 HOLLANDSWORTH	4 NORTH	TWO SITES	V
	134-70 HOLLANDSWORTH	4-5	TWO SITES	V
	134-70 HOLLANDSWORTH	17-18		V
	134-70 HOLLANDSWORTH	22-23		
	134-70 HOLLANDSWORTH	31		V
	134-71 RED LAKE-O	3-10		VS
	134-71 RED LAKE-O	5-6	TWO SITES	VS
	134-71 RED LAKE-O	6 NORTH	TWO SITES	VS
	134-71 RED LAKE-O	7-8	TWO SITES	VS

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	134-71 RED LAKE-O	7-18	THREE SITES	VS
	134-71 RED LAKE-O	8-17		VS
	134-71 RED LAKE-O	9-10		VS
	134-71 RED LAKE-O	12-13		VS
	134-71 RED LAKE-O	13-14		VS
	134-71 RED LAKE-O	19-30		VS
	134-71 RED LAKE-O	20-29		VS
	134-71 RED LAKE-O	20	THREE SITES	VS
	134-71 RED LAKE-O	22-23	TWO SITES	VS
	134-71 RED LAKE-O	23-24	TWO SITES	VS
	134-71 RED LAKE-O	25		VS
	134-71 RED LAKE-O	25-26		VS
	134-71 RED LAKE-O	26/27	TWO SITES	VSC
	134-71 RED LAKE-O	32	WIPPERLING ACCESS ROAD-TWO SITES	VSC
	134-71 RED LAKE-O	33	FARM TO MARKET ROAD BRIDGE AREA	VSC
	134-71 RED LAKE-O	33-34	FARM TO MARKET ROAD	VSC
	134-72 STARKEY	1 NORTH	HOLE	R
	134-72 STARKEY	2-3		R
	134-72 STARKEY	3-10	culvert collaspe	PS
	134-72 STARKEY	6 NORTH		
	134-72 STARKEY	6-7		
	134-72 STARKEY	9-16		
	134-72 STARKEY	11	TWO SITES	
	134-72 STARKEY	12-13	WASHED AREA, ABOUT 1/4 MILE	

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	134-72 STARKEY	19-30	TWO SITES	
	134-72 STARKEY	20	KAMBEITZ FARM ACCESS ROAD	R
	134-72 STARKEY	23-24	TWO SITES	
	134-72 STARKEY	25-26		USPS
	134-72 STARKEY	26-27	FARM ACCESS ROAD	R
	134-72 STARKEY	27-34	FARM TO MARKET	
	134-72 STARKEY	32-33		
	134-72 STARKEY	34-35		
	134-72 STARKEY	35-36	TWO SITES	
	134-73 WEIGEL	1-12	FARM TO MARKET ROAD	V
	134-73 WEIGEL	2-3		V
	134-73 WEIGEL	4-5		V
	134-73 WEIGEL	5-8	rejected by FEMA Project Officer	V
	134-73 WEIGEL	6 WEST		V
	134-73 WEIGEL	10-11		V
	134-73 WEIGEL	11-12		V
	134-73 WEIGEL	18 WEST	NEW ROAD BUILT 2008 / EMMONS CO LINE	V
	134-73 WEIGEL	20-21		V
	134-73 WEIGEL	22-27	TWO SITES	V
	134-73 WEIGEL	23-26		V
	134-73 WEIGEL	24-25		V
	134-73 WEIGEL	25-26		
	134-73 WEIGEL	28-29	added by FEMA PO	
	135-67 GUTSCHMIDT-O	13-24		VC

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	135-67 GUTSCHMIDT-O	14-15		VC
	135-67 GUTSCHMIDT-O	27-28		VC
	135-67 GUTSCHMIDT-O	31-32		VC
	135-67 GUTSCHMIDT-O	33-34		VC
	135-68 MOOS	7-8		VC
	135-68 MOOS	17-18		VC
	135-68 MOOS	19-20	TWO SITES	VC
	135-68 MOOS	20-29	THREE SITES	VC
	135-68 MOOS	21-28	TWO SITES	VC
	135-68 MOOS	22	LARRY KNECHT ACCESS, ANOTHER CULVERT	VC
	135-69 KETTERLING	6-7		VC
	135-69 KETTERLING	16-21		
	135-70 GRENZ	1-12		VC
	135-70 GRENZ	2-11		VC
	135-70 GRENZ	8-9	REBUILT LAST FALL, UNDER WATER	VC
	135-70 GRENZ	15-16	TWO SITES	VC
	135-70 GRENZ	17-18		R
	135-70 GRENZ	26-27		VC
	135-70 GRENZ	27-28		VC
	135-70 GRENZ	33-34		VC
	135-71 DIXON	7-8		VC
	135-71 DIXON	9-10		VC
	135-71 DIXON	24 EAST		VC
	135-72 BRYANT-O(DIS)	6 NORTH	REPORTED UNDER GLENDALE	V

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	135-72 BRYANT-O(DIS)	8-9		V
	135-72 BRYANT-O(DIS)	13-14		V
	135-72 BRYANT-O(DIS)	16-21		V
	135-72 BRYANT-O(DIS)	20-21		V
	135-72 BRYANT-O(DIS)	21-22	TWO SITES	V
	135-72 BRYANT-O(DIS)	22-27		
	135-72 BRYANT-O(DIS)	23-24		V
	135-72 BRYANT-O(DIS)	25 EAST		V
	135-72 BRYANT-O(DIS)	27-28	TWO SITES	V
	135-72 BRYANT-O(DIS)	28-33	4 SITES	R
	135-72 BRYANT-O(DIS)	29-32	moved to 38-33 by FEMA po	R
	135-72 BRYANT-O(DIS)	30-31		V
	135-72 BRYANT-O(DIS)	31 WEST	TWO SITES	V
	135-72 BRYANT-O(DIS)	31 SOUTH	rejected by FEMA Project Officer	V
	135-72 BRYANT-O(DIS)	33-34		V
	135-72 BRYANT-O(DIS)	34-35	TWO SITES	V
	135-73 KROEBER	2 NORTH		V
	135-73 KROEBER	3-4		V
	135-73 KROEBER	4 NORTH	SWITCHED FROM SEALY LIST	
	135-73 KROEBER	5-6		
	135-73 KROEBER	7-8		V
	135-73 KROEBER	9-10	TWO SITES	V
	135-73 KROEBER	17-18		V
	135-73 KROEBER	19 WEST		V

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	135-73 KROEBER	21-22	TWO SITES	V
	135-73 KROEBER	22-23		V
	135-73 KROEBER	28-29		V
	135-73 KROEBER	31 WEST		V
	135-73 KROEBER	34-35	TWO SITES	V
	135-73 KROEBER	36 SOUTH	rejected by FEMA Project Officer	R
	136-67 FINN-O	3-4		VC
	136-67 FINN-O	6	GACKLE LAGOON & AIRPORT ACCESS RD	V
	136-67 FINN-O	7	TWO SITES	VC
	136-67 FINN-O	15-16	TWO SITES	VC
	136-67 FINN-O	18-19		VC
	136-68 NEUDORF	4-5 / 8-9	ALL ONE SITE	VC
	136-68 NEUDORF	5-6		VC
	136-68 NEUDORF	10-15	2 SITES	VC
	136-68 NEUDORF	14-23		VC
	136-68 NEUDORF	16-17		VC
	136-69 BLUE BALL	7 WEST		VC
	136-69 BLUE BALL	7-18	FARM TO MARKET ROAD	VC
	136-69 BLUE BALL	14-15	TWO SITES	VC
	136-69 BLUE BALL	19 WEST		VC
	136-69 BLUE BALL	22-23		VC
	136-69 BLUE BALL	22-27		VC
	136-69 BLUE BALL	30 WEST	TWO SITES	VC
	136-69 BLUE BALL	30-31		VC

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	136-69 BLUE BALL	34-35		VC
	136-70 GERMAN	2 NORTH		VC
	136-70 GERMAN	4-5		VC
	136-70 GERMAN	5-6		VC
	136-70 GERMAN	7 WEST		VC
	136-70 GERMAN	8-9	TWO AREAS REPORTED 5-1-09	PS
	136-70 GERMAN	10-11		VC
	136-70 GERMAN	10-15	FARM TO MARKET ROAD	VC
	136-70 GERMAN	16-17		VC
	136-70 GERMAN	18 WEST	FARM TO MARKET ROAD	VC
	136-70 GERMAN	19 WEST	FARM TO MARKET ROAD	VC
	136-70 GERMAN	25-36	TWO SITES	VC
	136-70 GERMAN	27-34		VC
	136-70 GERMAN	28-29	THREE SITES	VC
	136-70 GERMAN	34-35		USPS
	136-71 COKATO	1-12		USPS
	136-72 GLENDALE-O	1 EAST	TWO SITES	VS
	136-72 GLENDALE-O	2-11		VS
	136-72 GLENDALE-O	3-10		VS
	136-72 GLENDALE-O	8-9		VS
	136-72 GLENDALE-O	8-17		VS
	136-72 GLENDALE-O	18-19	THREE SITES	VS
	136-72 GLENDALE-O	22-23		VS
	136-72 GLENDALE-O	22-27	FARM TO MARKET ROAD	VS



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	136-72 GLENDALE-O	23-26	FARM TO MARKET ROAD	VS
	136-72 GLENDALE-O	31 SOUTH		VS
	136-72 GLENDALE-O	36 SO EAST		VS
	136-73 SEALY-O	3-4		
	136-73 SEALY-O	4 NORTH		
	136-73 SEALY-O	5 NORTH		
	136-73 SEALY-O	5-6		
	136-73 SEALY-O	9-10		
	136-73 SEALY-O	11-12		
	136-73 SEALY-O	13-24		
	136-73 SEALY-O	14-23		
	136-73 SEALY-O	15-16	TWO SITES	
	136-73 SEALY-O	16-21		
	136-73 SEALY-O	17-18		
	136-73 SEALY-O	18-19		
	136-73 SEALY-O	19-20		
	136-73 SEALY-O	19-30		
	136-73 SEALY-O	20-21	TWO SITES	
	136-73 SEALY-O	21-22		
	136-73 SEALY-O	27-28		
	136-73 SEALY-O	30-31		
	136-73 SEALY-O	31-32	4 SITES	

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**6.4 Loss Estimation:**

- Floods: \$5,171,687.68
- Wildfires: \$1,463,529.06
- Severe Summer Storms – Tornado: \$14,2169,283.28
- Severe Summer Storms – Hail: \$2,626,973.80
- Severe Winter Storms: \$2,626,973.80
- Drought: \$49,484.29

The loss estimation information was provided by Wayne Hokenson at DES for the assessment completed in 2004 by the group at NDSU the information provided was not completed by NDSU. Nelson County may want to contract for a future assessment for the county the Emergency Manager will look into a possible updated assessment. Janna Charrier also provided the methodology for the 3% increase of the loss estimates that was provided to her by FEMA to estimate losses for planning purposes.

The projects in the table below were prioritized by the planning team using table 6.1 Prioritization Criteria and cost benefit analysis. The members of the community were met with individually and as a team to present possible mitigation projects. After all projects were submitted the planning team met to prioritize the projects from the worksheets and then added to the project table. Project worksheets are only utilized as a tool for the county to submit projects then attached as documentation.

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. In order to ensure a consistent approach in determining the cost effectiveness of all mitigation projects, the county uses the FEMA benefit cost analysis (BCA) module and process consistent with OMB Circular A-94.

The BCA is an assessment of the mitigation project 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. With limited project data and streamlined benefit-cost methods, a cost effectiveness determination can usually be made relatively quickly and accurately.

**6.5 In Progress/On-Going/Completed mitigation Projects**

City or County	Project	Purpose	Cost / Responsible Party – Funding Source	Category	Status / Timeframe	Priority
Napoleon	Replace curbs and gutters approximately 30 x 20 ft on 4 <sup>th</sup> street to the east and south corner by Wanglers and on the north and	Prevent flooding in homes	\$8,250 / City of Napoleon	Flooding	Deferred due to funding	Low

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	east corner approximately 10 x 10 ft by Flemmer.					
North Lake north side of Highway 34, also north of and connecting to Lake McKenna which is the lake next to Napoleon	Natural Outlet	Prevent washout of roads and culverts	\$30,000 / Logan County	Flooding	Completed 1997 / DOT Funding (Northern Improvement)	
Napoleon	Replace curbs and gutter from Ave B to C on 4 <sup>th</sup> St. E	Water sets doesn't drain	\$7,000 / Napoleon	Flooding	Deferred due to funding	Low
Napoleon	Replace curb and gutter on Ave B between 3 <sup>rd</sup> and 4 <sup>th</sup> St. E approximately 50 ft	Water sets doesn't drain	\$2,500 / Napoleon	Flooding	Deferred due to funding	Low
Logan County Bryant Township	Repair sinkholes with 8" of fill for a distance of 1000 ft. Raise roadbed 6" for a distance of 2,640 ft	Access road for emergency personnel to city	\$45,000 / Funded by Logan County	Flooding and Winter Weather	Completed November 2005	
Logan County Bryant Township	Remove knoll on adjacent property	Eliminate snow barrier and moving material to raise roadway below rim of hill, cut down edge of hill and right of way on roadway creating greater visibility to traffic	\$20,000 / Logan County	Winter Weather	Deferred due to funding	Medium
Logan County Bryant Township	Cut away rims and right of way roadway dropoff using material to raise lower areas	Reduce risk of visibility and snow problems	\$40,000 / Logan County	Flooding and Winter Weather	Deferred due to funding	Medium
Logan County Finn Township	Raise road and rip rap sides of road	Reduce risk of high water on roads	\$2,500 / Funded by Finn Township	Flooding	Completed 2004	
Logan County Finn Township Sec 6	Raise road and rip rap sides of road	Reduce risk of high water on roads	\$3,000 / Finn Township	Flooding	On-going	Low
Fredonia	Install new culverts	Prevent spring and seasonal flooding	\$4,000 / City Council	Flooding	Estimated completion would take 7 days - deferred	Low
Logan County Janke Township	Raise roads in township	Reduce risk of flooded roads	\$75.00 per mile / Janke Township	Flooding	Completed 2007	
Logan County Red Lake Township	Replace Culverts on Fettig Road	Flooding of low creek area	\$6,580 / Red Lake Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Logan County	Add culverts on	Reduce risk of	\$5,000 / Red Lake	Flooding	Deferred due to	Low

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Red Lake Township	Ibach Road	flooded roads	Township		funding – Repetitive Loss	
Logan County Red Lake Township	Add fill embankment on both sides of Hoberg Road	High Water risk	\$4,466.32 / Red Lake Township	Flooding	Completed 2003	
Logan County Red Lake Township	Add fill embankment on both sides of Haegele Road	High Water risk	\$2,742.00 / Red lake Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Logan County Red Lake Township	Add cement wings, both on north and south sides of Gene Horner Road	Reduce risk of wash out	\$2,500 / Red Lake Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Logan County Red Lake Township	Add fill east side of Auch Road	Reduce risk of wash out	\$1,182 / Rad Lake Township	Flooding	Completed 2003	
Logan County Red Lake Township	Replace culvert on Feist Road old one has crushed end	Reduce risk of flooding	\$771.20 / Red Lake Township	Flooding	Completed 2009	
Logan County Sealy Township	Build up road with gravel project 21/22	Reduce risk of road flooding	\$20,000 / Sealy Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Logan County Sealy Township	Build up road with gravel project 30/31	Reduce risk of road flooding	\$5,000 / Sealy Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Logan County Sealy Township	Build up road with gravel project 16/21	Reduce risk of road flooding	\$5,000 / Sealy Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Logan County Sealy Township	Build up road with gravel project 4/35	Reduce risk of road flooding	\$1,000 / Sealy Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Logan County Sealy Township	Build up road with gravel project 17/18	Reduce risk of road flooding	\$1,000 / Sealy Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Logan County Sealy Township	Build up road with gravel project 3 / 4	Reduce risk of road flooding	\$1,000 / Sealy Township	Flooding	Deferred due to funding – Repetitive Loss	Low
Napoleon	Storm drainage management	Reduce risk of flooding	\$75,000 / City of Napoleon	Flooding	Estimated time of completion 1 year	High
Gackle	Construct new lagoon cell	Cells 1 and 2 of Lagoon are flooding and not repairable, prevent backup into homes and businesses	\$674,371.50 / City of Gackle	Flooding, Winter and Summer Storms, Communicable Disease	On going	High
Logan County Gutschmidt Township Sec. 13-24	Construct road with culvert	Make road accessible	\$10,000 / Gutschmidt Township	Flooding, Winter and Summer Storms	Approximate time to complete is one week– Repetitive Loss	Medium
Lehr	Replace pipes for water supply provide water for fire departments and	Increase water flow for hydrants	\$200,000 / City of Lehr	Urban Fire, Transportation Accidents, Hazardous Materials,	Estimated timeframe 2 years	Medium

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	residents			Drought		
Lehr	Sirens warning systems	Siren system out of date cannot reach residents	\$12,000 / City of Lehr	Winter Storms, Summer Storms, Flooding	Estimated timeframe 1 year	Medium
Fredonia	Storm drainage management	Reduce risk of flooding	\$10,000 / City of Fredonia	Flooding	Estimated time of completion 6 months	Low
Logan County Haag Township Sec. 2 and 3 and Sec. 10 and 11 133-67 Site 2	Install 2 - 36" culverts and 1 - 30" culvert and lower ditches in 2 places to move water along west side of road, also gravel several spots	Allow access for emergency personnel	\$3,506 plus labor / Haag Township	Flooding, Winter Storms, Summer Storms	Would take approximately 2 days to complete	Low
Logan County Haag Township Sec. 2 and 3 and Sec. 10 and 11 133-67 Site 3	Install 18 x 30 culvert	Allow access for emergency personnel	\$691.00 / Haag Township	Flooding, Winter Storms, Summer Storms	Estimated time of completion 2 days	Low
Logan County Haag Township Sec. 2 and 3 and Sec. 10 and 11 133-67 Site 4	Add gravel ¾ mile road	Allow access for emergency personnel	\$3,000 / Haag Township	Flooding and Winter Weather	Estimated time of completion 2 days	Low
Logan County Haag Township Sec. 13-14-133-67	Rip rap both sides of road about 500 ft	Allow road to be used	\$5,000 / Haag Township	Flooding and Winter Weather	Approximate time to complete is 3 to 4 days	Low
Logan County Haag Township Sec. 14 and 23 - 133-67 south side of city limits	Repair and gravel portion of road going beside city limits, gravel 1 ½ miles of road east of town	Allow road to be used	\$5,000 / Haag Township	Flooding, Winter and Summer Storms	Approximate time to complete is 7 days	Low
Logan County Haag Township Sec. 14 and 23 - 133-67 Site 6	Replace culvert 18 x 25	Reduce risk of washout	\$532.00 / Haag Township	Flooding, Winter and Summer Storms	Approximate time to complete is 3 to 4 days	Low
Logan County Haag Township Sec. 14 and 23 - 133-67 Site 7	Add two loads of gravel to road	Reduce risk of washout	\$350.00 / Haag Township	Flooding, Winter and Summer Storms	Approximate time to complete is 3 to 4 days	Low
Fredonia	Install culverts at multiple locations in city, repair locations where roads are destroyed, gravel and repair roads	Prevent future street and road damage from water	\$10,000 / City of Fredonia	Flooding, Winter and Summer Storms	Estimated timeframe 1 year	Low
Gackle Neudorf Township Sec. 5-6	Rip rap and Fill dirt	Make road accessible	\$10,000 / Neudorf Township	Flooding, Winter and Summer Storms	Approximate time to complete is 7 days – Repetitive Loss	Low

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Gackle Neudorf Township Sec. 10-15	Build up road and rip rap	Make road accessible	\$1,000 / Neudorf Township	Flooding, Winter and Summer Storms	Approximate time to complete is one month– Repetitive Loss	Low
Napoleon German Township Sec. 7	Build up road and rip rap	Make road accessible	\$3,000 / German Township	Flooding, Winter and Summer Storms	Approximate time to complete is three months– Repetitive Loss	Low
Napoleon Grenz Township Sec. 8-9	Build up road and rip rap	Make road accessible	\$30,000 / Grenz Township	Flooding, Winter and Summer Storms	Approximate time to complete is four months– Repetitive Loss	Medium
Napoleon Grenz Township Sec. 17-18	Install culvert and fill washout	Prevent road washout	\$1,000 / Logan County	Flooding, Winter and Summer Storms	Completed 2009	
Gackle Moos Township Sec. 21-28	Install culvert and fill washout	Prevent road washout	\$3,000 / Moos Township	Flooding, Winter and Summer Storms	Completed 2009	
Logan County Ketterling Township Sec. 6-7	Build up road and rip rap	Make road accessible	\$8,000 / Ketterling Township	Flooding, Winter and Summer Storms	Approximate time to complete is three months– Repetitive Loss	Low
Logan County Blueball Township Sec. 14-15	Install new culverts and build up road and rip rap	Make road accessible	\$10,000 / Blueball Township	Flooding, Winter and Summer Storms	Approximate time to complete is two months– Repetitive Loss	Low
Logan County Blueball Township Sec. 34-35	Build up road and rip rap	Make road accessible	\$5,000 / Blueball Township	Flooding, Winter and Summer Storms	Approximate time to complete is two months– Repetitive Loss	Low
Logan County Finn Township Sec. 3-4	Build up road and rip rap	Make road accessible	\$10,000 / Finn Township	Flooding, Winter and Summer Storms	Approximate time to – Repetitive Loss - deferred complete is one month	Low
Logan County Finn Township Sec. 7	Fill with dirt, add culvert and rip rap	Make road accessible	\$10,000 / Finn Township	Flooding, Winter and Summer Storms	Approximate time to complete is two months– Repetitive Loss	Low
Napoleon	Educate Contractors on new café and drug store to utilize NFIP, and zoning ordinances	Comply with building codes, NFIP regulation, and zoning ordinances	\$200.00/ Napoleon	Flooding	On-going	Low
Logan County	Education and outreach of the NFIP program to insurance agents, building permit office, and realtors in the county	Public Awareness	Unknown / Logan County Emergency Management	Flooding	On-going	High

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Logan County	Use of media, workshops, exercises, and literature to inform the public of the hazards of a winter storm.	To make the public aware of the hazards of a winter storm	Staff time / Logan County Emergency Management	Winter Storms	On-going	Medium
Logan County	Inform the public through media, exercises, and literature of the proper tornado drill procedures.	Inform the public of the importance of adopting plans and procedures for tornado drills.	Staff time / Logan County Emergency Management	Summer Storms	On-going	Medium
Logan County	Provide annual workshops and training sessions	Implement training programs for public	Staff time / Logan County Emergency Management	All Hazards	On-going	Medium
Logan County	Use of media, workshops, exercises, and literature to inform the public of the hazards of a summer storm.	To make the public aware of the hazards of a summer storm	Staff time / Logan County Emergency Management	Summer Storms	On-going	Medium
Logan County	Provide informational meetings and brochures	Encourage dealers to inform employees and customers of dangers and safety procedures that must be followed	Staff time / Logan County Emergency Management	All Hazards	On-going	Medium
Logan County	Use of media and literature to inform the public of the hazards of a grass fire and how to prevent them	Implement public awareness campaigns	Staff time / Logan County Emergency Management	Rural Fire and Urban Fires	On-going	Medium
Logan County	The measure must be implemented immediately and is to be continued indefinitely. Local officials must initiate and take the lead role in this measure in regard to public awareness	Complacency of the people in the United States is a problem in urban fire public awareness	Staff time / Logan County Emergency Management and County Commissioners	Rural Fire and Urban Fires	On-going	Medium
Logan County	Inform the public of federal	Public Awareness campaign	Hourly staff time / Logan	Dam Failure	On-Going	Low

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	assistance programs. Conduct public meetings and publish news releases.		County Emergency Management			
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\* Gray shaded projects are new projects collected



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This section is an addition to the plan to comply with the update process. Logan County will be reviewing the plan with yearly reviews of the plan and understand they need to update the plan every five years. The planning team commented that they would be interested in the possibility of being included in a regional plan in the next five years. They agreed to the process of the updates and maintenance of the plan as stated in this section. The date of the yearly updates will be decided once the plan receives an approval date. The planning team decided that two years prior to the update that they will apply for funding for the 2014 update. The planning team will continue to review the plan prior to the update they understand that it may take up to two years to complete a new update for submittal in 2014. The planning team voted and by a majority they agreed to accept the additions to this section.

## **7. Plan Maintenance**

An important aspect of any useable plan is the maintenance and upkeep of the document. To facilitate and ensure the plan will remain viable for Logan County and the incorporated jurisdictions for years, the plan maintenance responsibilities lie with the Logan County Emergency Management Office. In general, the Emergency Management Office is responsible for coordinating emergency planning issues for the county and communities. Given the broad interaction emergency management has with a variety of agencies, this office maximizes the involvement of others in mitigation planning and maintenance.

### **Plan Monitoring**

The initial evaluation of the plan will be conducted by the Logan County Emergency Management Office as needed throughout the five year plan update cycle. If needed, contact with the jurisdictions and other stakeholders will be made during the evaluation process to solicit additional input. The methods of implementing and maintaining the plan will be evaluated for successes and improvements. Changes to the implementation schedule or plan maintenance will be made as needed to ensure hazard mitigation activities continue. The evaluation will consider the effectiveness of the programs, changes in land development, and other programs that may affect mitigation priorities. New stakeholders and interested parties will be identified and invited to participate in the implementation process. Should a hazard event have occurred during the previous year in which a mitigation project was a factor, will be written and included in the projects identified.

### **Plan Updates**

As disasters occur, projects are completed, and hazard information is improved, the Logan County Multi-Hazard Mitigation Plan will need to be updated. To remain an active and approved plan, an updated plan must be submitted to the North Dakota Department of Emergency Services and the Federal Emergency Management Agency every five years. The next formal submission is required in October 2014. To facilitate the update process, annual updates to the plan are recommended. Updates to the Multi-Hazard Mitigation Plan will be added to the yearly work plan of the County Emergency Manager, planning team meetings will be held starting one year after the approval of the update. All disaster or emergency incidents will be evaluated for

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general/specific mitigation recommendations to be added to the plan. Logan County two years prior to the expiration date will apply for funding for the update. The plan may take up to two years to complete before the expiration date of October 2014, with this in mind Logan County may hire a contractor to complete the planning process. All disaster or emergency incidents will be evaluated for general/specific mitigation recommendations to be added to the plan.

**Public Involvement**

Logan County and the incorporated jurisdictions involve the public directly in the review and updated of the Multi-Hazard Mitigation Plan. A copy of the Multi-Hazard Mitigation Plan will be available for review at the Logan County Emergency Management Office. The public is also invited to attend public meetings and hearings related to the mitigation plan to provide input and feedback. Public notices are provided prior to the meetings and encourage the public to attend and provide comments.