4. RISK ASSESSMENT

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

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

Source: Federal Emergency Management Agency, 2001.

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

4.1 Risk Assessment Methodology

A comprehensive risk assessment for disaster mitigation includes an evaluation of the state's assets and values, future development potential, the nature of the hazards threatening the state, and the level of assets and values that could be lost in a disaster.

The *identified hazards* listed in the March 2005 Multi-Hazard Mitigation Plan were reviewed at the June 2007 Workshop. Two new hazards were added and four hazards were renamed to broaden the scope or clarify the scope of the hazard profile.

The *statewide inventory* includes elements such as state-owned buildings and property, critical facilities and infrastructure, population, housing units, economic values, ecologic values, historic values, social values, current land uses, and future development potential. This inventory was collected from a variety of sources across the state. See Section 4.3 for more details on sources.

Each hazard or group of related hazards has its own *hazard profile*. A stand-alone hazard profile allows for the comprehensive analysis of each hazard from many different aspects. Each hazard profile contains the *characteristics* of the hazard containing information from specific hazard experts and a record of the hazard *history* compiled from a wide variety of databases and sources.

Using the historical occurrence, or more specific documentation if available, a *probability* is determined. In most cases, the number of years recorded is divided by the number of occurrences, resulting in a simple past-determined recurrence interval. If the hazard lacks a historical record, the probability is assessed qualitatively based on possible scenarios and related assumptions or other contributing factors.

The *magnitude* or extent of the hazard is based on a realistic approximation of the worst case scenario. This qualitative approximation is based on past occurrences in the state. If the past occurrence is not an accurate representation, general knowledge of the hazard is used to approximate the type of impacts that could be expected from a low-frequency, high magnitude event of that hazard.

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

Vulnerabilities of state-owned buildings and property were assessed using insurance data for "state agencies" from the North Dakota State Tornado and Fire Fund. In some cases, past claims were analyzed to show the historic losses from a particular hazard. In cases where such data was not available or useful, a descriptive analysis of the exposure of state-owned buildings and property was conducted. The categories of losses the North Dakota State Fire and Tornado Fund use for claims and the hazard profile in which that data can be found are shown in Table 4.1A.

Table 4.1A Insurance Claim Data/Hazard Profile Crosswalk

Loss Cause Category	Related Hazard Profile
Fire	Urban Fire or Structure Collapse
Lightning	Summer Storm
Wind	Summer Storm
Hail	Summer Storm
Explosion	Hazardous Material Release
Smoke	Urban Fire or Structure Collapse
Vandalism	Homeland Security Incident
Vehicle Damage	Not Used
Theft	Homeland Security Incident
Water Damage	Not Used
Other	Not Used
Falling Objects	Not Used
Flood	Flood
Collapse	Urban Fire or Structure Collapse

Vulnerabilities of critical facilities and infrastructure were similarly assessed using insurance data from the North Dakota State Fire and Tornado Fund. The entity types provided by the fund used in the critical facilities and infrastructure analyses included local government (city, county, township, fire district, park,

other, fair association, and water district categories), school districts (limitation: not all districts in the state are insured through the fund), universities (limitation: only includes North Dakota University System schools), adjutant general, and airports. In cases where claims data was available, that data was listed for the mentioned categories as shown in Table 4.1A. In some cases, past claims were analyzed to show the historic losses from a particular hazard as a basis to approximate potential future losses. Given the nature of critical facilities and infrastructure, the functional losses and alternate arrangements needed typically extend beyond the structure and contents losses. These types of losses can be inferred based on the use and function of the facility. Qualitative methods were used to describe the potential losses to facilities and infrastructure not covered by the State Fire and Tornado Fund.

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

The methodology of assessing risk to jurisdictions in this plan revision is quite different than that found in the 2005 version. The assessment conducted by North Dakota State University in 2003 estimated losses by taking county-level data for building exposure, etc. and applied a standard loss ratio to all counties. This methodology may be fairly accurate for certain hazards, but for other hazards, such as flood, additional factors such as extent of hazard areas must be considered. Therefore, changes to the loss estimates due to changes in development in recent years are not easily comparable to those figures developed in 2005. Essentially, any mitigation activities, such as the acquisitions in flood-prone areas of the Red River Valley and Devils Lake Basin, reduce the vulnerability of the jurisdiction from the associated hazard. The overall impact, if other factors such as new development do not change the vulnerability, is that the overall risk to the community is directly reduced by those activities.

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

In addition to the statewide assessment of the counties and reservations using statewide data for each hazard, each of the counties that completed local mitigation plans conducted their own assessments. A similar approach was used for most areas; each hazard was assigned a "risk class". The classes were based on the following criteria shown in Tables 4.1B and 4.1C.

Table 4.1B Local Risk Analysis Criteria

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

Table 4.1C Local Risk Analysis Classifications

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

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

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

The assessment on the *vulnerabilities to future development* is based on the mechanisms currently in place to limit or regulate development in hazardous areas. Some hazards can be mitigated during development, others cannot. The impacts were assessed through a narrative on how future development could be impacted by the hazard given current regulations.

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

At the end of the risk assessment, the *summary* brings together data from each of the hazards to show comparisons and ultimately rank the hazards statewide. The county ratings were brought together to show the areas of the state that are most vulnerable to all hazards. The prioritization of hazards into high, moderate, and low categories is based on the classification of hazards by the individual jurisdictions in their local plans.

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