Chapter 7 – Risk and Vulnerability Assessment

Hazard Ranking Methodology

After a thorough review of the community profile, a county hazard ranking was completed using a three step process. The first step was the selection of evaluation criteria, the second step was assigning relative weights to each of the rating criteria and the third step was assigning point values in each of the selected criteria for each of the hazards.

The selection of the evaluation criteria was done by determining what aspects of the hazards were of most concern to the community. This process was completed by assigning level of importance ranging from "Always Important" to "Not Worth Considering" to each hazard aspect. **Table 7-1** shows the complete lists of all the aspects considered and the level of importance assigned by the committee.

Each of the evaluation criteria was then assigned a "weight" to express the level of importance each of the criteria will have in ranking hazards. The sum of the weights of all of the evaluation criteria must equal 100%. Each of the individual criteria was assigned a percentage value based on the relative importance that specific criteria would have in ranking the various hazards. Point values of 1-10 were assigned using the scoring parameters as outlined in the Evaluation Measure Benchmark Factors shown on page 7-2. Using a spread sheet, values were input and calculated to provide a hazard ranking as shown in **Table 7-2.**

Hazard Analysis Evaluation Measures

The following is a list of six evaluation measures and corresponding benchmark factors that were used to evaluate each hazard facing the community. Those measures are: 1) likelihood of occurrence; 2) capacity to cause physical damage; 3) population impact (casualties); 4) ability to mitigate; 5) availability of warning systems; 6) economic impacts. Based on each individual factor's relative severity and negative impacts a corresponding benchmark factor has been assigned (10, 7, 4 or 1 point).

<u>Likelihood of Occurrence</u>
Likelihood of occurrence measures the frequency with which a particular hazard occurs. The more frequently a hazard event occurs, the more potential there is for damage and negative impact on a community.

<u>Potential for Physical Damages</u>
The capacity to cause physical damages refers to the destructive capacity of the hazard. While the destructive capacity of some hazard events, such as floods and tornadoes, is often immediate and readily apparent, some hazards may have significant destructive capacity that is less obvious as it may occur over a extended period of time such as extreme temperatures or drought.

<u>Potential for Causing Casualties</u>
Potential for causing casualties refers to the number of casualties (deaths and injuries) that can be expected if a particular hazard event occurs.

Ability to Mitigate
Ability to mitigate refers to the relative ease with which a particular hazard event can be mitigated through the application of structural or non-structural (or both) mitigation measures. Generally, the easier a hazard event is to mitigate against, the less of a future threat it may pose to a community in terms of loss of life and property.

Availability of Warning Systems
Availability of warnings indicates the ease with which the public can be warned of a hazard. This measure does not address the availability of warning systems in a community, per se. Rather, it looks at the overall availability of warning in general for a particular hazard event. For example, a community might receive warning that a flood will occur within 24 hours, but receive no warning when a large structural fire occurs. Generally, hazards that have little or no availability of warning tend to be more problematic for a community from a population protection and response standpoint.

Economic Impacts
Economic effects are the monetary damages incurred from a hazard event, and include both public and private damage. Direct physical damage costs, as well as indirect impact costs such as lost business and tax revenue, are included as part of the total monetary damages.

Evaluation Measure Benchmark Factors

Likelihood of Occurrence	
Excessive Occurrence	10 pts
High Occurrence	7 pts
Medium Occurrence	4 pts
Low Occurrence	1 pt

Potential For Damage	
Significant Potential	10 pts
High Potential	7 pts
Medium Potential	4 pts
Low Potential	1 pt

Economic Impacts	
Significant Impacts	10 pts
Medium Impacts	7 pts
Low Impacts	4 pts
Minimal Impacts	1 pt

Potential for Casualities	
Significant Potential	10 pts
High Potential	7 pts
Medium Potential	4 pts
Low Potential	1 pt

Ability to Mitigate	
Impossible to Mitigate	10 pts
Difficult to Mitigate	7 pts
Possible to Mitigate	4 pts
Easy to Mitigate	1 pt

Availability of Warnings	
Warnings Unavailable	10 pts
Generally Not Avail.	7 pts
Sometimes Available	4 pts
Warnings Available	1 pt

Table 7-1 Alcona Hazard Evaluation Criteria

Hazard Aspect	Always Very Important	Usually Important	Sometimes Important	Rarely of Importance	Not worth Considering
Likelihood of Occurrence	**X**				
Potential for Damage	**X**				
Size of Affected Area		**X**			
Speed of Onset			**X**		
Percent of Population Affected					
Potential for casualties	**X**				
Potential for Negative Economic effects		**X**			
Duration of Threat		**X**			
Seasonal Risk Pattern			**X**		
Environmental Impact			**X**		
Predictability of Hazard		**X**			
Ability to Mitigate	**X**				
Availability of Warning System	**X**				
Public Awareness			**X**		
Corollary Effects			**X**		

Table 7-2
ALCONA COUNTY HAZARD RATINGS

Evaluation Criteria								
	Likelihood of Occurrence	Potential for Damage	Potential for Casualties	Ability to Mitigate	Warning System	Economic Impact	Total Weight Must = 100%	
WEIGHT =========>	20%	20%	20%	20%	10%	10%	100%	
Hazard							**Score**	**Rank**
Wildfire	8	7	4	7	5	7	6.40	1
Shoreline Flooding	10	9	1	7	2	7	6.30	2
Riverine Flooding	10	8	1	5	5	8	6.10	3
Severe Winds	10	5	2	4	3	2	4.70	4
Winter Weather Hazard	10	3	1	2	4	4	4.00	5
Tornados	10	2	2	3	2	2	3.80	6
Transportation Hazmat	7	2	1	5	5	2	3.70	7
Extreme Temperature	5	5	1	5	1	4	3.70	7
Infrastructure Failure	2	5	1	5	8	3	3.70	7
Drought	5	5	1	4	1	5	3.60	8
Public Health	2	1	8	4	3	3	3.50	9
Lightning	8	2	1	5	2	1	3.50	9
Terrorism/Sabotage/WMD	2	2	5	5	5	2	3.50	9
Hail	5	5	1	3	2	2	3.20	10
Nuclear Attack	1	2	5	4	1	5	3.00	11
Structural Fire	10	1	1	5	3	2	2.90	11
Dam Failure	3	2	1	2	2	10	2.80	12
Transportation Accident	5	1	1	3	5	2	2.70	13
Pipeline Accident	2	2	1	6	2	1	2.50	14
Fixed Site Hazmat	1	1	1	8	1	1	2.40	15
Scrap Tire Fire	1	1	1	6	1	1	2.00	16
Oil/Gas Well Incident	2	2	1	2	2	1	1.70	17
Earthquake	1	2	1	3	1	1	1.60	18
Subsidence	1	1	1	3	1	1	1.40	19
Civil Disturbance	1	1	1	1	1	1	1.00	20

Table 7-3
Alcona County Hazard Ranking Summary

HAZARD	HISTORY OF OCCURRENCE	CHANCE OF OCCURRENCE	LOCAL CAPABILITY	POPULATION/ PROPERTY AFFECTED	ECONOMIC IMPACT	HAZARD RANKING
WILDFIRES	5	5	2	3	4	19
INFRASTRUCTURE FAILURES	4	4	1	5	3	17
FLOODING	3	3	4	2	4	16
THUNDERSTORM HAZARDS	4	4	2	3	3	16
SEVERE WINTER STORM HAZARDS	4	4	1	5	2	16
EXTREME TEMPERATURES	3	3	2	5	2	15
PUBLIC HEALTH EMERGENCIES	1	2	4	5	3	15
NUCLEAR ATTACK	0	0	4	5	5	14
HAZARDOUS MATERIALS – TRANSPORTATION	4	2	4	1	2	13
DROUGHT	2	2	2	5	2	13
DAM FAILURES	1	1	3	1	3	9
STRUCTURAL FIRES	1	1	2	1	4	9
OIL & NATURAL GAS WELL ACCIDENTS	3	3	2	0	1	9
HAZARDOUS MATERIALS – FIXED SITE	0	1	5	0	2	8
TRANSPORTATION ACCIDENTS	0	2	4	0	1	7
CIVIL DISTURBANCES	0	1	3	1	2	7
SABOTAGE – TERRORISM	0	1	3	1	1	6
PETROLEUM & NATURAL GAS PIPELINE ACCIDENTS	0	2	2	0	1	5
SCRAP TIRE FIRES	0	2	1	0	1	4
SUBSISTENCE	0	0	3	0	1	4

I. HISTORY OF OCCURRENCE
5 = Has occurred within 1 year
4 = Has occurred within 5 years
3 = Has occurred within 10 years
2 = Has occurred within 20 years
1 = Has occurred within 100 years
0 = No record of occurrence

II. PROBABILITY OF OCCURRENCE
5 =Will occur within 1 year
4 = Will occur within 5 years
3 = Will occur within 10 years
2 = Will occur within 20 years
1 = Will occur within 100 years
0 = No data available

III. LOCAL CAPABILITY
5 = No capability
4 = Minimum capability
3 = Some capability
2 = Good capability
1 = Excellent capability
0 = Fully capable

IV. POPULATION/PROPERTY AFFECTED
5 = 80% to 100%
4 = 60% to 80%
3 = 40% to 60%
2 = 20% to 40%
1 = 1% to 20%
0 = Under 1%

V. ECONOMIC IMPACT
5 = Extreme
4 = Significant
3 = Sizeable
2 = Some
1 = Minimum
0 = None

ALCONA COUNTY HAZARD RANKING SUMMARY (CONT)

NOTES: 1) FOR PURPOSES OF THIS ANALYSIS, SHORELINE AND RIVERINE FLOODING ARE COMBINED AS ONE RANKING.

2) HAZARDS SUCH AS EARTHQUAKES, TSUNAMIS, HURRICANES (NOT CONSIDERED VIABLE HAZARDS IN ALCONA COUNTY) WERE PURPOSELY EXCLUDED FROM THIS ANALYSIS.

3) RANKINGS IN THIS ANALYSIS SHOULD NOT BE USED TO ASSUME THAT ANY ONE HAZARD WILL OCCUR PRIOR TO ANOTHER – OR IF A HAZARD DOES OCCUR – THAT IT WILL BE ANY MORE DEVASTATING OR COSTLY THAN ANOTHER. IN OTHER WORDS, ANY OF THESE HAZARDS CAN OCCUR AT ALMOST ANY TIME. THIS ANALYSIS IS TO BE USED FOR PLANNING PURPOSES ONLY.

Risk Assessment and Vulnerability Assessment Summary

Risk Assessment

Based on the weighted hazard ranking process recommended in the Michigan Hazard Analysis workbook and the 2002 Alcona County Hazard Analysis, a composite of hazards and their relative risk are presented below. This list will be used as the foundation for developing hazard mitigation goals and strategies in subsequent chapters.

Vulnerability Assessment

This step looks at such points as population concentrations, age-specific populations, development pressures, types of housing (older homes, mobile homes), presence of agriculture, sprawl (spreading resources too thin), and other issues that may make Alcona County more vulnerable to specific hazards. Basic criteria are listed below.

High Vulnerability: If an event occurred it would have severe impacts over large geographic areas or more densely populated areas and have a serious financial impact on County residents and businesses.

Medium Vulnerability: If an event occurred it would have confined impacts on the safety of residents but would have a financial impact on County residents and businesses.

Low Vulnerability: If an event occurred it would have very minimal impact on the safety of County residents and minimal financial impact on County residents and businesses.

Wildfire Hazard

According to the 1978 Michigan Resource Information System Land Cover/use Inventory, over 73 percent of the County is forested. Forest fires have been identified as the number one natural hazard in the Alcona County Hazard Analysis Plan. Aspen-birch, red oak-white oak and jack-red-white pine are the most common forest types. Under dry spring conditions forest fires can occur in any forests type. However some forest types have higher risks. Jack and red pine forests have a high risk for wildfires. Oak and white pine forests have a moderate risk for wildfires. According to the MIRIS Land Cover/Use Inventory, jack pine and red pine forest types cover approximately 14 percent of the forestland. Oak and white pine forests account for another 20 percent. Draughty, low fertility sandy soils, found in outwash plains and channels, supported pre-settlement pine forests that for thousands of years were perpetuated by wildfires. Today, residential development has occurred within the same wildfire prone areas. There is a concentration of pine forest types in Mikado, Curtis and Mitchell Townships. The Alcona County Hazards Map (**Figure 6.3**) shows areas of highest wildfire risk, pine forests are red, oak-pine forest are orange and aspen-birch forests are yellow. Though wildfires can occur in all cover types, even grasses, these three forest types have the highest risk.

As part of a nationwide effort to identify communities at high risk the following federal agencies developed a list of urban wildland interface communities in the vicinity of Federal lands that are at high risk from wildfire: Forest Service, Department of Agriculture; Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service, Department of the Interior. This was published in the **Federal Register** / Vol. 66, No. 160 / Friday, August 17, 2001; Urban Wildland Interface Communities within the Vicinity of Federal Lands that are at High Risk from Wildfire. Below is a list of communities identified in the document. State of Michigan, along with many other states, felt the urban wildland interface is not limited to communities in the vicinity of Federal land and developed a comprehensive state list of communities at risk.

Alcona County Communities at High Risk from Wildfires, Federal Register

Alcona Township
Curtis Township
Glennie
Mikado
Mikado Township
Millen Township

Community centers and dispersed rural residential development interfaces with these high risk forest types of pine, oak and aspen. Based on an examination of forest cover type maps of Alcona County, other communities with a high risk include Gustin, Hawes, Caledonia, and Mitchell. Given the extensive forest areas, the entire county could be considered highly vulnerable to wildfire hazards. According to the 2000 US Census, there are 7,416 housing units in the eight identified communities that could potentially be at risk from wildfires. The median house value in Alcona County is $83,700. It is impossible to accurately predict potential loss of property if a wildfire were to occur in Alcona County. Historical regional data shows in May of 1980, a wildfire in Oscoda County (known as the Mack Lake fire) destroyed 44 homes and buildings, forced the evacuation of 1,500 people, and killed one firefighter. A total of 24,000 acres were burned, resulting in a total property and timber loss of $2 million. In May 1990, a wildfire near Grayling in Crawford County (known as the Stephan Bridge Road fire) burned 76 homes and 125 other structures, 37 vehicles and boats, and over 5,900 acres of forestland, resulting in property losses of $5.5 million. The timber losses totaled another $700,000. The last twenty years have seen an increase in the number of second homes/cabins in the rural, forested parts of the county. As a result, a higher of structures are considered vulnerable to

wildfires. At the same time, local communities and state and federal agencies have improved their capacity to fight wildfires.

Summer Weather Hazard

Summer weather hazards include: thunderstorms, tornados, lightening, and hail. Strong winds and thunderstorm winds are a common severe weather that affects Alcona County. Annually, thunderstorms will occur on an average of 24 days per year and on average one or two thunderstorms per year will have severe winds. Since 1962 there have been 37 severe wind events recorded in the County. Strong winds are most likely to be associated with thunderstorms that occur in the summer, but can occur any time of year. One of the most powerful windstorms ever recorded in the Great Lakes region occurred on November 10, 1998. Wind speeds from this powerful storm reached 82 knots. Over the past 49 years, 9 tornados touched down in Alcona County, causing over $3 million in property damage.. Of the 9 tornados that have struck Alcona County, two were F3, one was an F2, five were an F1 and one was an F0.

According to the 2000 US Census, there were 10,584 housing units in Alcona County. Single family, detached housing account for 84.6 percent total number of housing units. Thirty-five percent of the structures were built prior to 1960. Some 48 percent or 5,067 housing units were listed as seasonal, recreational or occasional use homes. Therefore, it can be surmised that the County's resident population significantly increases during peak periods in the summer months. Furthermore, there were 1,385 mobile homes reported in the 2000 Census. Thirty-five percent of the housing stock is 40 or more years old. Mobile homes and older homes tend to sustain the greatest amount of damage from severe wind events. Overall, all structures across the county are vulnerable to severe summer storm events and therefore, the county is considered highly vulnerable to these hazards. According to the 2000 US Census, there are 10,584 housing units in the county that could potentially be at risk from summer storm hazards. The median house value in Alcona County is $83,700.

Other areas for concern are campgrounds and community events. Campgrounds are heavily used during prime summer months and on Memorial and Labor Day weekends. Campgrounds equate into large concentrations of transient populations staying in structures that are highly vulnerable to severe storm events. The Harrisville State Park, located in Harrisville Township adjacent to the City of Harrisville, has 229 sites. The campground is typically full during June, July and August. Assuming the average family size of 2.24 persons, there could be a population of over 500 persons on any given day. Therefore, the transient population at the Harrisville State Park is comparable to the population of the City of Harrisville. Curtis Township County operates a campground on Alcona Pond in Curtis Township. The 470 sites are rented by the season, so there isn't a constant turnover of campers. Still during the primary camping season, assuming the average household size of 2.24 persons, the campground results in an increase of 1,053 persons in the township. This campground nearly doubles the size of the Township's year round population.

Winter Weather Hazards

Winter weather hazards consisting of heavy snow, freezing rain and blizzards are the most prevalent seasonal hazards in Alcona County and can be expected to occur several times every year. Since 1993, 24 heavy snowstorms and 3 blizzards have been recorded in Alcona County. Over the past 10 years the county averaged 2.7 heavy snowstorms and/or blizzards each year, although the number and intensity of snowstorms can fluctuate dramatically from year to year. In 1993 heavy snowstorms, freezing rain and or blizzards occurred 8 times while in 1995 only one heavy snow storm was recorded.

According to the 2000 US Census, there are 10,584 housing units in the county that could potentially be at risk from winter storm hazards. While winter weather hazards are widespread and impact the entire county, elderly, disabled and homebound persons are most vulnerable. Of greatest concern are freezing rain events that can indirectly cause infrastructure failure through power outages from trees falling on power lines. Loss of power during cold weather will disable most furnaces. According to the US Census 28.3 percent of the housing units are heated with natural gas, a 47 percent increase from 1990. Some 45.8 percent heat with bottled, tank or LP gas and 12.3 percent heat with wood. Four percent or 222 homes use electricity and 9.2 percent use fuel oil. Other data show 0.7 percent of the structures lack complete plumbing and 0.4 percent lack complete kitchen facilities. Some 2.2 percent or 114 occupied units have no phone service. In conclusion, most of the residences and businesses are highly vulnerable to winter storm events.

Infrastructure Failure

The greatest concern for infrastructure failure is power outages. This can be caused by local events such as high winds, freezing rain and wildfires. Events far from the county can also cause power outages. As stated above, power outages during winter months are most critical. With the exception of the downtown business district of Mio, the electrical delivery system consists of above ground power transmission lines. The network traverses a heavily forested landscape and is very vulnerable to impacts from falling branches and trees. Other concerns are phone service, as much of the area is not covered by cell phone service. An event in 2004 resulted in temporary loss of phone service over a large area of northeast Michigan. The event was attributed to a beaver cutting through a fiber optic line. While there is no history of failure from the natural gas delivery system, such an event would severely impact 28 percent of the housing units that use natural gas as well as most businesses in in the county. According to the 2000 US Census, there are 10,584 housing units in the county that could potentially be at risk from infrastructure failure. The county is considered highly vulnerable to infrastructure failure.

Public Health

There is no hospital located in the county. For emergency medical services; people must travel to Alpena, Gaylord, West Branch, Tawas or Grayling to seek medical assistance. Elderly and low income populations are most vulnerable to public health emergencies. Twenty-five percent of the county population is 65 years and older. Nine percent of the families live below the poverty level while nearly 13 percent of the overall population lives below poverty level. Both of these figures are a few percentage points higher than Michigan as a whole. Given the lack of access to a hospital within the county and the above stated demographics, the county is highly vulnerable to public health emergencies.

Transportation of Hazardous Materials

Although there is no record of a serious hazardous materials incident occurring on Alcona County transportation routes there have been incidents. There have been many minor petroleum and hazardous materials spills throughout the years on both the highways and the railroad system. All major highways within the County are primarily two lanes. These routes are heavily congested in the summer months and often icy or impassable in the winter.

Areas most at risk are within a 1-5 mile radius of a major transportation route along which hazardous material shipments move. All areas in Michigan are potentially vulnerable to a hazardous material transportation incident, although the heavily urbanized and industrialized areas in southern Michigan are particularly vulnerable due to the highly concentrated population. M-72, M-65 and US-23 traverse Alcona County. Hazardous materials are shipped through the county making communities like Harrisville vulnerable to hazardous materials incidents. It is certainly only a matter of time before a serious hazardous materials incident

occurs on a County roadway, railway, or waterway. Given the criteria for assessing vulnerability, the county has a medium vulnerability to hazards related to transportation.

Shoreline Flooding

In nearly every decade, high water levels on the Great Lakes have caused significant damage and impact to Michigan coastal communities. The most recent high water period began in 1997 and resulted in the Great Lakes being at or near record levels set in the mid-1980s'. In response to the threat of severe shoreline flooding and erosion, the U.S. Army Corps of Engineers (USACE), at the request of the Governor, implemented its Advance Measures Program to assist Michigan shoreline communities in their flood and erosion mitigation efforts. To date, over 20 Michigan jurisdictions have taken advantage of this program. Residences, businesses and facilities in the four coastal townships and City of Harrisville are impacted by periodic shoreline flooding. As new construction continues, problems related to fluctuating levels of Lake Huron are expected to continue and increase. Since flooding is confined to coastal areas but can have a negative impact on the local economy shoreline flooding and erosion is classified as medium vulnerability. The coastal areas of Alcona, Haynes, Harrisville and Greenbush Townships are high risk zones for shoreline flooding and erosion.

Riverine Flooding

Riverine flooding, though not a common occurrence in Alcona County, has caused damage to bridges and roadways. These events occurred when spring snowmelt coincided with heavy prolonged rains. Riverine Flooding is very likely to occur in Alcona County when Lake Huron is at or near its record level. The levels of the Great Lakes are cyclic, but impossible to predict at this point. The last high water level in 1998 washed out several roads and conduits. Alcona County was granted a Presidential Declaration of Disaster in 1985 for flood related events. Flooding tends to be localized, no major community was identified in flood prone areas. Vulnerability assessment identified this hazard as medium vulnerability. High risk communities for riverine flooding are Alcona, Greenbush, Gustin, Harrisville, Haynes, and Mikado.

Table 7.4
Alcona County Risk and Vulnerability Assessment Summary

Hazards in Alcona County	**Risk Assessment**	**Vulnerability Assessment**
Wildfire	High	High
Shoreline Flooding	High	Medium
Riverine Flooding	High	Medium
Summer Severe Storm Hazards Severe Winds, Tornados, Lightening & Hail	High	High
Winter Severe Storm Hazards	High	High
Transportation of Hazardous Materials	High	Medium
Extreme Temperatures	High	medium
Infrastructure Failure	High	High
Public Health	Medium	High
Terrorism/Sabotage/WMD	Medium	Medium
Dam Failures	Medium	Medium
Oil and Gas Wells Accidents	Medium	Low
Transportation Accidents	Medium	Low
Petroleum and Natural Gas Pipeline Accidents	Medium	Medium
Drought	Medium	Medium
Structural Fires	Low	Low
Nuclear Attack	Low	High
Civil Disturbance	Low	Low
Subsidence	Low	Low
Earthquakes	Low	Low
Scrap Tire Fire	Low	Low
Hazardous Materials Fixed Site	Low	Low