IV. Threat & Hazard Ranking and Probability

Hazard Evaluation Factors:

- Likelihood of Occurrence
- Speed of Onset
- Population Affected
- Potential for Causing Casualties
- Environmental Impact
- Adequacy of Warning
- Corollary Effects

Process

After a thorough review of the community profile, a county threat and hazard ranking and probability was completed. Several consideration factors were utilized including statistical data, public surveys, public official surveys, and governmental agency interviews. The selection of the evaluation factors was conducted by determining which aspects of the hazards were of greatest concern to the community. Seven evaluation factors (see below) were selected.

Hazard Evaluation Factors

The seven evaluation factors used to evaluate and rank each hazard facing the community are as follows:

1. **Likelihood of Occurrence:** Likelihood of occurrence measures the frequency with which a particular hazard occurs. The more frequently a hazard occurs, the more potential there is for damage and negative impact on a community.
2. **Speed of Onset:** Speed of onset measures how quickly a particular hazard can impact a community. The amount of time it takes for a hazard to begin affecting a particular community will impact mitigation efforts.
3. **Population Affected:** This aspect of the hazard determines how widespread the effects of a hazard will be by the amount of people impacted.
4. **Potential for Causing Casualties:** Potential for causing casualties refers to the number of potential fatalities that are likely if a particular hazard event occurs.
5. **Environmental Impact:** Environmental impacts include damage to hydrological systems, wildlife habitats, sensitive ecosystems, groundwater, and vegetation that can be incurred from a hazard event. Due to the interconnections of natural systems, negative environmental impacts can be direct or indirect.
6. **Adequacy of Warning:** This aspect of the hazard describes the scale and magnitude of the warning systems required to adequately notify affected populations of a hazard event.
7. **Corollary Effects:** Corollary effects describe a hazard's ability to cause other hazards. These effects are consequences of the hazard but often are considered an indirect effect. Corollary effects can include economic, environmental, or technological effects.

Table 4.1 Threat Ranking

Threat	1 Year	5 Year
Cyber Attack	Likely	Likely
Arson/Incendiary Attack	Not Likely	Somewhat Likely
Improvised Explosive Device (IED)	Not Likely	Somewhat Likely
Food/ Water Contamination	Not Likely	Somewhat Likely
Vehicle Borne Improvised Explosive Device	Not Likely	Somewhat Likely
Conventional Attack	Not Likely	Not Likely
Civil Unrest	Not Likely	Not Likely
Chemical Attack	Not Likely	Not Likely
Radiological Dispersion Device (RDD)	Not Likely	Not Likely
Maritime Attack	Not Likely	Not Likely
Biological (non - contagious)	Not Likely	Not Likely
Aircraft as a Weapon	Not Likely	Not Likely
Biological (Contagious)	Not Likely	Not Likely
Nuclear Device	Not Likely	Not Likely

Risk and Vulnerability Assessment

Based on the hazard ranking process, a composite of hazards and relative risk are presented below. This list, coupled with each hazard profile, was used as the foundation for developing hazard mitigation goals and strategies. For risk assessment, the following definitions apply:

- **High Risk:** Very likely to occur over the hazard mitigation planning horizon of 20 years.
- **Moderate Risk:** Somewhat likely to occur over the hazard mitigation planning horizon of 20 years.
- **Low Risk:** Not likely to occur over the hazard mitigation planning horizon of 20 years.

The vulnerability assessment looks at such points as population concentrations, age-specific populations, and development pressures, types of housing, presence of agriculture, sprawl, and other issues that may make St. Clair County more vulnerable to specific hazards. The vulnerability assessment relies heavily on the community profile of this Hazard Mitigation Plan, as it compares areas where hazards overlap with people and key public facilities. Vulnerability is defined as follows:

Risk v. Vulnerability

Risk is a probabilistic determination of the likelihood of the particular event occurring based on past experiences.

Vulnerability is a situational assessment of how the community will react to a hazardous event. Vulnerability is determined by criteria such as population concentrations, age-specific populations, and development pressures, types of housing, presence of agriculture, sprawl, and other issues.

- **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.
- **Moderate Vulnerability:** If an event occurred it would have confined impacts on the safety of residents and would have a financial impact on county residents and businesses.
- **Low Vulnerability:** If an event occurred it would have a very minimal impact on the safety of county residents and a minimal financial impact on county residents and businesses.

For the purposes of this Plan, it is critical to determine the vulnerability of the county's built environment. Such an assessment is useful in determining which communities are more vulnerable to certain hazard events based on their patterns of development. The following map depicts the vulnerability of the built environment in St. Clair County.

Members of the St. Clair County Hazardous Operations Team conducting an exercise. Source: St. Clair County Emergency Management.

Threats

Cyber Attack

Threat and Probability		
Threat	**1 Year**	**5 Year**
Cyber Attack	Likely	Likely

Source: www.dhs.gov/cyber-attacks

Cyber-attack is an attempt to damage, disrupt, or gain unauthorized access to a computer, computer system, or electronic communications network. The spectrum of cyber risks is limitless; threats, some more serious and sophisticated than others, can have a wide – ranging effects on the individual, community, organizational and national level. These risks include:

- Organized cybercrime, state-sponsored hackers, and cyber espionage can pose national security risks to our country.
- Transportation, power, and other services may be disrupted by large scale cyber incidents. The extent of the disruption is highly uncertain as it will be determined by many unknown factors such as the target and size of the incident.
- Vulnerability to data breach and loss increases if an organization's network is compromised. Information about a company, its own employees and its customers can be at risk.
- Individually-owned devices such as computers, tablets, mobile phones and gaming systems that connect to the internet are vulnerable to intrusion. Personal information may be at risk without proper security.

Arson/Incendiary Attack

Threat and Probability		
Threat	**1 Year**	**5 Year**
Arson/Incendiary Attack	Not Likely	Somewhat Likely

Incendiary is a word used to refer to a person who carries out arson attacks. It is also the name given to any weapon or substance containing chemicals that cause fire; describes missiles containing highly flammable substances that will cause a fire on impact. Arson is the act of intentionally or recklessly setting fire to another's property or to one's own property for some improper reason.

Improvised Explosive Device (IED)

Threat and Probability		
Threat	**1 Year**	**5 Year**
Improvised Explosive Device (IED)	Not Likely	Somewhat Likely

An IED attack is the use of a "homemade" bomb and/or destructive device to destroy, incapacitate, harass, or distract. IED's are used by criminals, vandals, terrorists, suicide bombers, and insurgents. Because they are improvised, IED's can come in many forms, ranging from a small pipe bomb to a sophisticated device capable of causing massive damage and loss of life. IED's can be carried or delivered in a vehicle; carried, placed, or thrown by a person; delivering in a package; or concealed on the roadside. Elements of an IED consist of a variety of components that include an initiator, switch, main charge, power source, and a container. IED's may be surrounded by or packaged with additional materials or "enhancements" such as nails, glass, or metal fragments designed to increase the amount of shrapnel propelled by the explosion. Enhancements may also include other elements such as hazardous materials. An IED can be initiated by a variety of methods depending on the intended target.

Food/Water Contamination

Threat and Probability		
Threat	**1 Year**	**5 Year**
Food/Water Contamination	Not Likely	Somewhat Likely

Source: www.lifetimefitnessnutrition.com/healthy-foods.html

Water contamination is the term used to describe hazardous materials of any kind that are polluting a source of water. This could include both biological and chemical substances, and the water source may be ponds, lakes, seas, oceans, or reservoirs used for drinking and bathing by humans. The most common types of water contamination are chemical runoff from homes and businesses and sometimes human or animal waste materials. Food contamination is when something makes the food inedible or can cause illness when consumed. Contamination can be biological (bacteria, parasites, viruses, etc.), chemical (cleaners, sanitizers, additives, etc.), or physical

(glass, metal, etc.). Contamination is not necessarily obvious or visible. Most microbes can be killed, and toxins deactivated, by cooking food and boiling water.

Vehicle Borne Improvised Explosive Device

Threat and Probability		
Threat	**1 Year**	**5 Year**
Vehicle Borne Improvised Explosive Device	Not Likely	Somewhat Likely

Vehicle borne improvised explosive device training. Source: www.navy.gov/training-pic

Vehicle borne IED's (VBIED) are devices that use a vehicle as the package or container of the device. These IED's come in all shapes, colors, and sizes which vary by the type of the vehicles available – small sedans to large cargo trucks. There have been instances of what appeared to be generators, donkey drawn carts, and ambulances used to attempt attacks on Coalition Forces and the New Iraqi Government. Larger vehicles enable larger amounts of explosive that can be used, resulting in a greater effect. Functioning of devices can vary within the same methods as the package types and can have the same common characteristics or indicators as other IEDs. VBIEDs have increasingly used larger amounts of explosives, and the explosive charge has ranged anywhere from 100lbs to well over 1000 pounds. The explosive charge has included items such as mortar rounds, rocket motors, rocket warheads, PE4 explosives, and artillery rounds. Functioning of devices can vary within the same methods as the package types and can have the same common characteristics or indicators as other IED's.

Conventional Attack

Threat and Probability		
Threat	**1 Year**	**5 Year**
Conventional Attack	Not Likely	Not Likely

Conventional attack is conducted by using conventional weapons and battlefield tactics between 2 or more states in open confrontation. Normally using conventional weapons, and not with chemical, biological, or nuclear weapons.

Civil Unrest

Threat and Probability		
Threat	**1 Year**	**5 Year**
Civil Unrest	Not Likely	Not Likely

Civil unrest in London, Source: www.tedkizak.com

Can also be known as civil disorder, or civil strife, is used to describe one or more forms of unrest caused by a group of people. Civil disturbance is typically a symptom of, and a form of protest against major socio–political problems; the severity of the action coincides with public expression(s) of displeasure. Examples include, but are not necessarily limited to: illegal parades; sit – in's and other forms of obstructions; riots; sabotage; and other forms of crime. It is intended to be a demonstration to the public and the government, but can escalate into general chaos.

Chemical Attack

Threat and Probability		
Threat	**1 Year**	**5 Year**
Chemical Attack	Not Likely	Not Likely

Chemical dumping in Pine River, Source: St. Clair County Emergency Management.

A chemical attack is the spreading of toxic chemicals with the intent to do harm. A wide variety of chemicals could be made, stolen, or otherwise acquired for use in an attack. Industrial chemical plants or the vehicles used to transport chemicals could also be sabotaged. Harmful chemicals that could be used in an attack include:

- Chemicals weapons (warfare agents) developed for military use.
- Toxic industrial and commercial chemicals that are produced, transported, and stored in the making of petroleum, textiles, plastics, fertilizers, paper, food, pesticides, household cleaners, and other products.
- Chemical toxins of biological origin such as ricin.

The toxicity of chemicals varies greatly. Some are acutely toxic (cause immediate symptoms); others are not very toxic at all. Chemicals in liquid or vapor form generally lead to greater exposure than chemicals in solid form. Potential delivery methods include:

- Ventilation systems of a building
- Misting, aerosolizing devices, or sprayers
- Passive release (container of chemical left open)
- Passive release (container of chemical left open)

- Bombs, mines, or other explosive devices that contain chemicals other than those used to create the explosion
- Improvised chemical devices that combine readily available chemicals to produce a dangerous chemical
- Sabotage of plants or vehicles containing chemicals
- Introduction of toxins in food and water supply

Radiological Dispersion Device (RDD)

Threat and Probability		
Threat	**1 Year**	**5 Year**
Radiological Dispersion Device	Not Likely	Not Likely

Source: www.ready.gov/radiological-dispersion-device-rdd

Terrorist use of an RDD – often called "dirty nuke" or "dirty bomb" – is considered far more likely than use of a nuclear explosive device. An RDD combines a conventional explosive device – such as a bomb – with radioactive material. It is designed to scatter dangerous and sub – lethal amounts of radioactive material over a general area. Such RDD's appeal to terrorists because they require limited technical knowledge to build and deploy compared to a nuclear device. Also, the radioactive materials in RDD's are widely used in medicine, agriculture, industry and research, and are easier to obtain than weapons grade uranium or plutonium. RDD's could also include other means of dispersal such as placing a container of radioactive material in a public place, or using an airplane to disperse powdered or aerosolized forms of radioactive material. It is very difficult to design an RDD that would deliver radiation doses high enough to cause immediate health effects or fatalities in a large number of people. Therefore, experts generally agree that an RDD would most likely be used to:

- Contaminate facilities or places where people live and work, disrupting lives and livelihoods.
- Cause anxiety in those who think they are being, or have been exposed.

Maritime Attack

Threat and Probability		
Threat	**1 Year**	**5 Year**
Maritime Attack	Not Likely	Not Likely

Cities in and around ports hold a greater risk for a maritime attack, most of the world's goods travel through these ports. Source: St. Clair County Emergency Management

Maritime targets are relatively scarcer than land targets; Surveillance at sea offers less cover and concealment than surveillance on land. Maritime terror operations may require skills that are not quickly or easily acquired; such as special training in navigation, coastal piloting and ship handling. Maritime attacks could have very significant consequences, in the form of mass casualties, severe property damage, and attendant disruption of commerce. Terrorist risk factors from shipping:

Cargo

- Using cargo to smuggle people and/or weapons.
- Using cargo to transport conventional nuclear, chemical or biological weapons.

Vessels

- Using the vessel as a weapon.
- Using the vessel to launch an attack.
- Sinking the vessel to disrupt infrastructure.

External Impacts

- Loss of life and damage to property
- Disruption to trade flows.
- Additional cost of transport due to additional security measures.

People

- Attacking the ship to provoke human casualties.
- Using the cover of seafarer identities to insert terrorist operatives.

Money

- Using revenue from shipping to fund terrorist activities.
- Using ships to launder illicit funds for terrorist organizations.

Biological (Non – Contagious and Contagious)

Threat and Probability		
Threat	1 Year	5 Year
Biological Non - Contagious and Contagious	Not Likely	Not Likely

Bacteria disease, Source: www.ready.gov

A biological attack is the intentional release of a pathogen (disease – causing agent) or bio toxin (poisonous substance produced by a living organism) against humans, plants, or animals. An attack against people could be used to cause illness, death, fear, societal disruption, and economic damage. An attack on agricultural plants and animals would primarily cause economic damage, loss of confidence in the food supply, and possible loss of life. It is useful to distinguish between two kinds of biological agents:

1. Transmissible agents that spread from person to person (e.g. smallpox, Ebola) or animal to animal (e.g. foot and mouth disease).
2. Agents that may cause adverse effects in exposed individuals by that do not make those individuals contagious to others (e.g. anthrax, botulinum toxins).

Biological agents are organisms or toxins that can kill or incapacitate people, livestock and crops. A biological attack is the deliberate release of germs or other biological substances that can make you sick. The three basic groups of biological agents that would likely be used as weapons are bacteria, viruses and toxins. Most biological agents are difficult to grow and maintain. Many break down quickly when exposed to sunlight and other environmental factors, while others, such as anthrax spores, are very long lived. Biological agents can be dispersed by spraying them into the air, by infecting animals that carry the disease to humans and by contaminating food and water. Delivery methods include:

- **Aerosols –** biological agents are dispersed into the air, forming a fine mist that may drift for miles. Inhaling the agent may cause disease in people or animals.
- **Animals –** some diseases are spread by insects and animals, such as fleas, mice, flies, mosquitoes and livestock.
- **Food and Water Contamination –** some pathogenic organisms and toxins may persist in food and water supplies. Most microbes can be killed, and toxins deactivated, by cooking food and boiling water. Most microbes are killed by boiling water for one minute, but some require longer.
- **Person–to–Person** – spread of a few infectious agents is also possible. Humans have been the source of infection for smallpox, plague, and the Lassa viruses.

Aircraft as Weapon

Threat and Probability		
Threat	1 Year	5 Year
Aircraft as a Weapon	Not Likely	Not Likely

September 11, 2001 airplane attack on the world trade centers the most known terrorist attack using an aircraft as a weapon. Source: www.google/images.com

Past attacks and disrupted plots demonstrate terrorists' interests in using aviation as an attack method. To lower the overall risk from this attack method, Federal Government has placed high emphasis on preventing aircraft from being commandeered. Aircraft as a weapon presents unique challenges for security at the facility level. Vulnerability to this attack method is high across most infrastructure sectors, since it is extremely difficult to provide adequate countermeasures at the critical infrastructure/key resources (CIKRs) sites. Successful attacks could cause severe consequences.

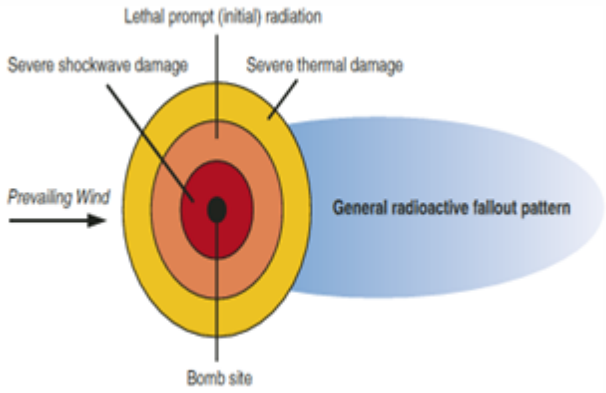
The attack method, aircraft as a weapon, is the terrorists' use of control of an aircraft as a means to attack infrastructure targets directly. The aircraft could be cargo aircraft, gliders, helicopters, large or small commercial passenger aircraft, privately owned aircraft of any size, or unconventional airborne vehicles, such as lighter – than – air vehicles.

The September 11, 2011 attacks demonstrated the destructiveness, lethality and potential catastrophic consequences of terrorists' use of aircraft as a weapon. Enhanced security measures and heightened passenger sensitivity regarding aviation security make it more difficult for terrorists to conduct a September 11, 2001 – style attacks, but terrorists likely will continue to seek innovative ways to conduct large – scale attacks using aircraft.

For terrorists to conduct an attack on infrastructure using an aircraft, they must be able to accomplish the following: evade or overcome internal and external security measures, gain control of the aircraft on the ground or in flight, fly or dictate the flight of the aircraft, and maintain control of the aircraft to the intended target.

Nuclear Device

Threat and Probability		
Threat	1 Year	5 Year
Nuclear Device	Not Likely	Not Likely



Representation of the general patterns of damage from a 10 – kT nuclear explosion on the ground. Source: www.dhs.gov

Unlike a "dirty bomb" which disperses radioactive material using conventional explosives, a nuclear attack is the use of a device that produces a nuclear explosion. A nuclear explosion is caused by an uncontrolled chain reaction that splits atomic nuclei (fission) to produce an intense wave of heat, light, air pressure, and radiation, followed by the production and release of radioactive particles. For ground blasts, these radioactive particles are drawn up into a "mushroom cloud" with dust and debris, producing fallout that can expose people at great distances to radiation.

Traditional cold – war concerns were focused on the possible use of military nuclear weapons. A nuclear terrorist attack might be carried out with an improvised nuclear device (IND), which is a crude nuclear device built from the components of a stolen weapon or from scratch using nuclear material (plutonium or highly enriched uranium).

A nuclear attack could cause substantial fatalities, injuries, and infrastructure damage from the heat and blast of the explosion, and significant radiological consequences from both the initial nuclear radiation and the radioactive fallout that settles after the initial event. An electromagnetic pulse from the explosion could also disrupt telecommunications and power distribution. The energy released by a nuclear explosion is distributed roughly as 50% shockwave; 35% heat; 5% initial nuclear radiation; and 10% fallout radiation. This distribution varies depending on the design of the weapon and the altitude of the explosion.

Characteristics of a Nuclear Explosion:

- **Fireball –** roughly spherical in shape, is created from the energy of the initial explosion. It can reach tens of millions of degrees.
- **Shockwave –** races away from the explosion and can cause great damage to structures and injuries to humans.
- **Mushroom Cloud –** typically forms as everything inside of the fireball vaporizes and is carried upwards. Radioactive material from the nuclear device mixes with the vaporized material in the mushroom cloud.
- **Fallout –** results when the vaporized radioactive material in the mushroom cloud cools, condenses to form solid particles, and falls back to the earth. Fallout can be carried long distances on wind currents as a plume and contaminate surfaces miles from the explosion, including food and water supplies.

Hazards

Hazards	1 Year
Thunderstorms (winds over 70 mph)	80%
Winter Storms (12 inches or higher)	75%
Hazardous Materials	32%
Extreme Heat	20%
Flood (5 foot or higher)	15%
Tornado (F2 or higher)	12%
Utility Failure	6%
Pandemic Influenza	3%
Earthquake	0.01%

Thunderstorm (80%)

Thunderstorms are one of the most common and most noticeable weather products of our atmosphere. They develop in warm, moist air in advance of eastward-moving cold fronts and affect small areas. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. People are in danger of lightning if they can hear thunder. Strong winds can hurl heavy objects through the air. Hail of all sizes can be harmful to people, as well as pets and livestock.

Winter Storm (75%)

A winter storm is described as a period of rapid accumulation of snow, ice or other similar precipitation. Often winter storms are accompanied by high winds, cold temperatures, and low visibility. Blizzards are the most dramatic and perilous of all winter storms, characterized by low temperatures and strong winds bearing enormous amounts of snow. Impacts due to snow storms or blizzards are far-reaching: traffic accident deaths and injuries; structural fires due to snow melt seeping into electrical meter boxes; roofs collapsing under the weight of snow; school closings; loss of electricity; and impassable streets causing many stranded people needing shelter.

Hazardous Materials (32%)

Hazardous material incidents refer to uncontrollable releases of hazardous materials. Incidents may have a deleterious impact to land, water, air quality or transportation. Examples of hazardous materials include corrosives, explosives, flammable materials, radioactive materials, poisons, oxidizers, and dangerous gases. Hazardous materials are highly regulated by the government to reduce risk to the general public, property and the environment. Despite precautions taken to ensure careful handling during the manufacture, transport storage, use and disposal of these materials, accidental releases are bound to occur.

Extreme Heat (20%)

When temperatures reach excessive highs, they are primarily effecting the most sensitive populations such as the elderly, children, impoverished individuals, and people in poor health. The major threats of extreme heat are heatstroke, which is a major medical emergency, and heat exhaustion. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Other settings that can stimulate heat-related illnesses include dormant atmospheric conditions and poor air quality. Extreme heat can be fatal when it pushes the human body beyond its limits. Under normal conditions, the body's internal thermostat generates perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must exert more effort to sustain a normal temperature.

Flooding (15%)

When rainfall runoff collects in rivers, creeks, and streams and exceeds the capacity of channels, floodwaters overflow onto adjacent lands. Floods result from rain events, whether short and intense or long and gentle. Possible loss of life would be primarily from drowning incidents. Other potential health-related problems could be from sewer back-ups and increased pollutant concentrations. Floods may leave people stranded in their homes for several days without power or heat, or they may be unable to reach their homes at all. There is the potential for safety issues if a shoreline bank were to collapse unexpectedly or a storm surge caused flooding of a structure with inhabitants.

Tornado (12%)

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. Tornadoes in the winter and early spring are often associated with strong, frontal systems that form in the central states and move east. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be excess of one mile wide and 50 miles long. A tornado would affect an entire population in the tornado path. While all types of buildings can potentially be damaged in a tornado, three types of structures are more susceptible to extreme damage: 1) Mobile homes, 2) buildings with large spans, such as airplane hangars, gymnasiums, and 3) Homes on crawl spaces. The most vulnerable population would be residents living in mobile home parks. There are 32 mobile home parks in St. Clair County.

Utility Failure (6%)

Utility failures are defined as loss of public or private utility infrastructure that causes temporary cessation of essential functions and/or services. Although severe weather plays a vital role in causing electrical power and communication failures on a regular basis throughout the county, these failures are usually short in duration and limited to a specific area. Many types of utility failure can lead to disastrous public health and safety consequences if immediate actions are not taken. Typically, it is the most vulnerable members of society, such as; the elderly, very young, impoverished, and people in poor health that are the most heavily impacted by a utility failure. The availability of clean drinking water is crucial to the health and safety of the public. Water service interruptions can cause untreated or poorly treated drinking water to enter the water supply, resulting in boil water advisories. Power outages can be particularly dangerous during times of extreme heat or cold, especially since people rely on electricity to cool or heat homes.

Pandemic Influenza (3%)

A pandemic is a disease outbreak. It is determined by how the disease spreads not how many deaths it causes. When a new influenza virus emerges, a flu pandemic can occur. Because the virus is new, the population has little to no immunity against it. The virus spreads quickly from person-to-person. An influenza pandemic can occur when a non-human (novel) influenza virus gains the ability for efficient and sustained human-to-human transmission and then spreads throughout a region. Flu symptoms include; a fever of one degrees or higher, a cough and/or sore throat, a runny or stuffy nose, headaches and/or body aches, chills, fatigue, nausea, vomiting and/or diarrhea. Children are at higher risk for the flu because their immune systems are not fully developed. Most healthy adults may be able to infect other people beginning 1 day before symptoms develop and up to 5 to 7 days after becoming sick. Children may pass the virus for longer than 7 days. Symptoms start 1 to 4 days after the virus enters the body. That means that you may be able to pass on the flu to someone else before you know you are sick, as well as while you are sick**.** Some people can be infected with the flu virus but have no symptoms. During this time, those persons may still spread the virus to others.

Earthquake (0.01%)

An earthquake is a series of vibrations induced in the earth's crust by the abrupt rupture and rebound of rocks in which elastic strain has been slowly accumulating. St. Clair County has a comparatively low risk of experiencing damaging ground movements. Fortunately, St. Clair County is not located in an area subject to major earthquake activity. Although there are faults in the bedrock throughout the state, they are now considered relatively stable. However, these faults are poorly mapped. The greatest impact on the state would probably come from damage to natural gas and petroleum pipelines. If an earthquake were to occur in the winter, many areas of the state could be severely impacted by fuel shortages. Damage would probably be negligible in well-designed and constructed buildings. However, poorly designed and constructed buildings could suffer considerable damage under the right circumstances.

Financial Risk Determination for Select Hazards

Risk determinations are assessments for potential hazards for St. Clair County. The goal is to quantitatively measure the experienced by St. Clair County communities. The risk assessment attempts to annualize the fiscal impacts of hazards, thus enabling a dollar-for-dollar comparison of the most likely disaster events to affect the County. Please consider the following as you review the risk assessment process:

The purpose is to produce reasonable information that measures the costs of an **average disaster event, not the most extreme scenario.**

The intent is **not precision, but reason and consistency.** There is no single methodology for determining the costs of each hazard. The Michigan State Police, Emergency Management Division suggests that each community creatively explore the costs they expect to incur from a disaster event. Consistency is produced when the same costs are applied to each hazard determination (see Table 6, Costs). A risk assessment is not comparable to the hazard ranking table.

The risk assessment results allow for both the consequences of hazards and mitigation strategies to be compared relatively with an equal unit of measurement. Incidents can vary widely and the methodology for determining cost is cautiously subjective.

Probability

Probability is determined by reviewing the frequency of past occurrences of a particular event. Data related to weather events was provided by the National Oceanic and Atmospheric Administration (NOAA). Other relevant data was provided by members of the Steering Committee.

Vulnerability

Vulnerability is determined by incorporating the characteristics of the land uses found in the St. Clair County Master Plan Districts. The different circumstances are translated into the costs that are incurred both individually and by the population as a whole. “Severity Factors” are incorporated to express the differences in low, moderate, and high impact events.

Identification of Consequences

Each hazard has factors that affect the final cost of impact and recovery. For example, tornado costs vary according to the severity of tornado, the area impacted, the type of land involved.

Identification of Costs

Costs are identified based on historic data or researched values. Table 4.6 shows the cost schedule, including sources.

Table 4.2: Cost Schedule for Financial Risk Determination

	Factor Considered	Cost	Unit	Source
Loss of Function Costs	Economic activity loss per employee	$87	/Day	DHSES
	Electric power loss per Household	$110	/Day	DHSES
	Potable water service loss per resident	$103	/Day	DHSES
	Delayed Vehicles	$32	/Mile /Hour	DHSES
Casualties	Temporary Shelter, lodging	$500	/Day	Red Cross
	Death	$1,500,000	/Person	FEMA
	Major Injury	$15,000	/Person	FEMA
	Minor Injury	$1,500	/Person	FEMA
Response and Cleanup	Removal of Tree	$17.00	/3" diameter	SCCES
	Removal /disposal of pest infected tree	$700	/Tree	SCCES
	Activation of Emergency Operations Center	$25,000	/Event	SCCEMHSD
	Activation of Hazardous Materials Team	$25,000	/Event	SCCEMHSD
Loss of Property	Overhead transmission line repair (75-150k people)	$390,000	/Mile	DTE
	Culvert replacement	$150,000	/Location	SCCMPC
	Local bridge replacement & moderate superstructure repair	$550,000	/Location	SCCMPC
	Grade separation replacement	$2,500,000	/Location	SCCMPC
	Crops ($2.50 per bushel, 103 bushels per acre, 640 acres per square mile)	$160,000	/Sq. Mile	Michigan Farm Crops
	Livestock	$1,500	/Head	SCC City Data
	Farmstead	$150,000	/Location	SCC City Data
	Commercial Structure	$218,665	/Location	SCCMPC
	Employees		69,706	MiDLEG
	Households		64,083	US Census
	Businesses		1,203	US Census
	Housing Units	$79,700	/Location	US Census
	Vehicles	$16,523	/Passenger Vehicle	SCCRC

Calculation of the Total Estimated Annual Cost for Select Hazards

The following worksheets show how the annualized costs are calculated.

Infrastructure Failure: Utility

Table 4.3: Calculated Annual Utility Failure Event Risk

A. Itemized Cost for Utility Failure			
	Quantity	$$$/unit	Calculated
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (100% of Employees)	69,706	$87/Day	$6,064,422
Loss of Electric Service (100% Households)	64,083	$110/Day	$7,049,130
Temporary Shelter, Lodging (Two Weeks per Households)	2,000	$500/Day	$1,000,000
Minor Injuries	4	$1,500/Person	$6,000
		District Total	$14,144,552
Rural Residential District (One Residence per 5 Acres)			
Clean Up Trees and Debris	40	$500/Household	$20,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (3% of Employees)	2,091	$87/Day	$181,917
Loss of Electric Service (7% of Households)	4,485	$110/Day	$493,350
Temporary Shelter, Lodging (Two weeks per Household)	2,000	$500/Day	$1,000,000
Minor Injuries	8	$1,500/Person	$12,000
		District Total	$1,732,267
Urban and General Services District (25 unit Multi-Family or Manufactures Homes and 1 Residence per Acre)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (5% of Employees)	3,485	$87/Day	$303,195
Loss of Electric Service (10% of Households)	6,408	$110/Day	$704,880
Temporary Shelter, Lodging (Two weeks per household)	2000	$500/Day	$1,000,000
Minor Injuries	16	$1,500/Person	$24,000
		District Total	$2,057,075

B. Total Expected Annual Damage (Utility Failure)

Annual Probability	Severity Probability		Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
6%	Low	60%	1	Rural and Agriculture Conservation District	57%	$14,144,552	$96,748.74
				Rural Residential District	18%	$1,732,267	$37,416.97
				Urban and General Services District	25%	$2,057,075	$61,712.25
	Moderate	30%	2	Rural and Agriculture Conservation District	57%	$14,144,552	$96,748.74
				Rural Residential District	18%	$1,732,267	$37,416.98
				Urban and General Services District	25%	$2,057,075	$61,712.26
	High	10%	4	Rural and Agriculture Conservation District	57%	$14,144,552	$644,499.16
				Rural Residential District	18%	$1,732,267	$24,944.64
				Urban and General Services District	25%	$2,057,075	$29,621.88

C. Annualized Risk per Master Plan District

Rural and Agriculture Conservation District	$837,996.64
Rural Residential District	$99,778.59
Urban and General Services District	$153,046.39
Total	$1,090,791.62

The St. Clair County HazMat Team working to clean up a chemical barrel dumped in a field. Source: St. Clair County Emergency Management

Hazardous Materials Transportation Incident

Table 4.4: Calculated Annual Hazardous Materials on Freeways Event Risk

A. Itemized Costs for Hazardous Materials on Freeway Event

	Quantity	$$$/Unit	Calculated Value
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Activation of Hazardous Materials Team	1	$25,000	$25,000
Delayed vehicles	144	$32/Car	$4,608
Minor Injuries	10	$1,500	$15,000
Major Injuries	3	$15,000	$45,000
Deaths	1	$1,500,000	$1,500,000
		District Total	$1,614,608
Rural Residential District (One Residence per 5 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Activation of Hazardous Materials Team	1	$25,000	$25,000
Delayed vehicles	144	$32/Car	$4,608
Minor Injuries	10	$1,500	$15,000
Major Injuries	3	$15,000	$45,000
Deaths	1	$1,500,000	$1,500,000
		District Total	$1,614,608
Urban and General Services District (25 Unit Multi-Family or Manufactures Homes and 1 Residence per Acre)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Activation of Hazardous Materials Team	1	$25,000	$25,000
Delayed vehicles	144	$32/Car	$4,608
Minor Injuries	10	$1,500	$15,000
Major Injuries	3	$15,000	$45,000
Deaths	1	$1,500,000	$1,500,000

B. Total Expected Annual Damage (Hazardous Material Transportation Incident)

Annual Probability	Severity Probability		Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
32%	Low	60%	1	Rural and Agriculture Conservation District	57%	$1,614,608	$392,059.12
				Rural Residential District	18%	$1,614,608	$61,904.07
				Urban and General Services District	25%	$1,614,608	$171,955.75
	Moderate	30%	2	Rural and Agriculture Conservation District	57%	$1,614,608	$392,059.11
				Rural Residential District	18%	$1,614,608	$123,808.14
				Urban and General Services District	25%	$1,614,608	$171,955.75
	High	10%	4	Rural and Agriculture Conservation District	57%	$1,614,608	$261,372.74
				Rural Residential District	18%	$1,614,608	$82,538.76
				Urban and General Services District	25%	$1,614,608	$114,637.16
						District Total	$1,614,608

C. Annualized Risk per Master Plan District	
Rural and Agriculture Conservation District	$1,045,490.97
Rural Residential District	$268,250.97
Urban and General Services District	$458,548.66
Total	$1,772,290.60

St. Clair County has numerous freight trucks and cargo shipments passing through its borders every day, especially along 1-94 and I-69. Source: www.media2.wxyz.com

Hazardous Materials Facility Incident

Table 4.5: Calculated Annual Hazardous Materials Facility Incident Risk

A. Itemized Costs for Hazardous Materials Facility Incident			
	Quantity	$$$/Unit	Calculated Value
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Activation of Hazardous Materials Team	1	$25,000	$25,000
Economic Loss (100 Employees)	100	$87/Day	$8,700
Damage to Businesses (Clean up)	4	$250,000	$1,000,000
Minor Injuries	10	$1,500	$15,000
Major Injuries	3	$15,000	$45,000
Deaths	1	$1,500,000	$1,500,000
		District Total	$2,618,700
Rural Residential District (One Residence per 5 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Activation of Hazardous Materials Team	1	$25,000	$25,000
Economic Loss (100 Employees)	100	$87/Day	$8,700
Damage to Businesses (Clean Up)	4	$250,000	$1,000,000
Temporary Shelter, Lodging (Two Weeks per Household)	25	$500/Day	$12,500

Minor Injuries	10	$1,500	$15,000
Major Injuries	3	$15,000	$45,000
Deaths	1	$1,500,000	$1,500,000
		District Total	$2,631,200
Urban and General Services District (25 Unit Multi- Family or Manufactures Homes and 1 Residence per Acre)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Activation of Hazardous Materials Team	1	$25,000	$25,000
Economic Loss (100 Employees)	100	$87/Day	$8,700
Damage to Businesses (Clean up)	4	$250,000	$1,000,000
Temporary Shelter, Lodging (Two Weeks per Household)	125	$500/Day	$62,500
Minor Injuries	10	$1,500	$15,000
Major Injuries	3	$15,000	$45,000
Deaths	1	$1,500,000	$1,500,000
		District Total	$2,681,200

B. Total Expected Annual Damage (Hazardous Material Fixed Sites)

Annual Probability	Severity Probability	Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
32%	60%	1	Rural and Agriculture Conservation District	57%	$2,618,700	$7,424,485.86
			Rural Residential District	18%	$2,631,200	$2,355,765.98
			Urban and General Services District	25%	$2,681,200	$3,334,072.20
	30%	2	Rural and Agriculture Conservation District	57%	$2,618,700	$7,424,485.86
			Rural Residential District	18%	$2,631,200	$2,355,765.98
			Urban and General Services District	25%	$2,681,200	$3,334,072.20
	10%	4	Rural and Agriculture Conservation District	57%	$2,618,700	$4,949,657.24
			Rural Residential District	18%	$2,631,200	$1,570,510.65
			Urban and General Services District	25%	$2,681,200	$2,222,714.80

C. Annualized Risk per Master Plan District

Rural and Agriculture Conservation District		$19,798,628.96
Rural Residential District		$6,282,042.61
Urban and General Services District		$8,890,859.20
	Total	$34,971,530.77

The county's HazMat Team participates in numerous training exercises every year. Source: St. Clair County Emergency Management

Tornado

Table 4.6: Calculated Annual Risk for Tornado Event

A. Itemized Costs for Tornado Event			
	Quantity	$$$/Unit	Calculated Value
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Clean Up Trees and Debris	20	$600	$12,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (1% of Employees)	697	$87/Day	$60,639
Loss of Electric Service (5% of Households)	3,204	$110/Day	$352,440
Overhead Transmission Line Repair (75-150K People)	1	$390,000	$390,000
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
Loss of Livestock	20	$1,500/Head	$30,000
Damage to Farmstead	1	$150,000	$150,000
Damage to Homes	5	$79,700	$398,500
Damage to Businesses	1	$250,000	$250,000
Temporary Shelter, Lodging (Two Weeks per Households)	5	$500/Day	$350,000
Minor Injuries	4	$1,500	$6,000
Major Injuries	1	$15,000	$15,000
		District Total	$2,199,579
Rural Residential District (One Residence per 5 Acres)			
Clean Up Trees and Debris	40	$600	$24,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (3% of Employees)	2,091	$87/Day	$181,917
Loss of Electric Service (7% of Households)	4,485	$110/Day	$493,350
Overhead Transmission Line Repair (75-150k People)	1	$390,000	$390,000
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
Loss of Livestock	3	$1,500/Head	$4,500

Damage to Homes	10	$79,700	$797,000
Damage to Businesses	3	$250,000	$750,000
Temporary Shelter, Lodging (Two Weeks per Household)	10	$500/Day	$70,000
Minor Injuries	8	$1,500	$120,000
Major Injuries	2	$15,000	$30,000
		District Total	$3,045,767
Urban and General Services District (25 Unit Multi-Family or Manufactures Homes and 1 Residence per Acre)			
Clean Up Trees and Debris	80	$600	$48,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (5% of Employees)	3,485	$87/Day	$303,195
Loss of Electric Service (10% of Households)	6,408	$110/Day	$704,880
Overhead Transmission Line Repair (75-150k People)	1	$390,000	$390,000
Damage to Homes	20	$79,700	$1,594,000
Damage to Businesses	5	$250,000	$1,250,000
Temporary Shelter, Lodging (Two Weeks per Households)	20	$500/Day	$140,000
Minor Injuries	16	$1,500	$24,000
Major Injuries	4	$15,000	$60,000
Deaths	1	$1,500,000	$1,500,000
		District Total	$6,039,075

B. Total Expected Annual Damage for Tornado Event

Annual Probability	Severity Probability		Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
12%	F0	11%	1	Rural and Agriculture Conservation District	57%	$2,199,579	$48,269.76
				Rural Residential District	18%	$3,045,767	$130,480.66
				Urban and General Services District	25%	$6,039,075	$58,126.10
	F1, F2	68%	2	Rural and Agriculture Conservation District	57%	$2,199,579	$596,789.77
				Rural Residential District	18%	$3,045,767	$260,961.31
				Urban and General Services District	25%	$6,039,075	$718,649.92
	F3, F4	21%	4	Rural and Agriculture Conservation District	57%	$2,199,579	$368,605.44
				Rural Residential District	18%	$3,045,767	$161,181.99
				Urban and General Services District	25%	$6,039,075	$443,872.01

C. Annualized Risk per District

Rural and Agriculture Conservation District	$1,013,664.97
Rural Residential District	$552,623.96
Urban and General Services District	$1,220,648.03
Total	$2,786,936.96

Damage from a tornado that went through Fort Trodd Campground. Source: www.media2.wxyz.com

Extreme Temperatures

Table 4.7: Calculated Annual Extreme Temperature Risk

A. Itemized Costs for an Extreme Temperature Event			
	Quantity	$$$/Unit	Calculated Value
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Loss of Livestock	40	$1,500/Head	$60,000
Temporary Shelter, Lodging (Two Weeks per Household)	20	$500/Day	$140,000
Minor Injuries	4	$1,500	$6,000
Major Injuries	1	$15,000	$15,000
		District Total	$246,000
Rural Residential District (One Residence per 5 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Loss of Livestock	6	$1,500/Head	$9,000
Temporary Shelter (Two Weeks per Household)	40	$500/Day	$280,000
Minor Injuries	8	$1,500	$12,000
Major Injuries	2	$15,000	$30,000
		District Total	$356,000
Urban and General Services District (25 Unit Multi-Family or Manufactures Homes and 1 Residence per Acre)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Temporary Shelter, Lodging (Two Weeks per Household)	80	$500/Day	$560,000
Minor Injuries	16	$1,500	$24,000
Major Injuries	4	$15,000	$60,000

Deaths	1	$1,500,000	$1,500,000
		District Total	$21,690,000

B. Total Expected Annual Damage for Extreme Temperature Event

Annual Probability	Severity Probability		Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
20%	Low	60%	1	Rural and Agriculture Conservation District	57%	$246,000	$14,302.44
				Rural Residential District	18%	$356,000	$6,645.10
				Urban and General Services District	25%	$21,690,000	$553,095
	Moderate	30%	2	Rural and Agriculture Conservation District	57%	$246,000	$14,302.44
				Rural Residential District	18%	$356,000	$6,536.16
				Urban and General Services District	25%	$21,690,000	$553,095
	High	10%	4	Rural and Agriculture Conservation District	57%	$246,000	$9,534.96
				Rural Residential District	18%	$356,000	$6,052
				Urban and General Services District	25%	$21,690,000	$368,730

C. Annualized Risk per Master Plan District

Rural and Agriculture Conservation District	$38,139.84
Rural Residential District	$19,233.26
Urban and General Services District	$1,474,920
Total	$1,532,293.10

Flooding

Table 4.8: Calculated Annual Flooding Event Risk

A. Itemized Costs for Flood Event

	Quantity	$$$/Unit	Calculated Value
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Clean Up Trees and Debris	80	$600	$48,000
Culvert Replacement	5	$150,000	$750,000
Local Bridge Replacement & Moderate Superstructure Repair	2	$550,000	$1,100,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (1% of Employees)	697	$87	$60,639
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
Loss of Livestock	20	$1,500/Head	$30,000
Damage to Farmstead	3	$150,000	$450,000
Damage to Homes	20	$79,700	$15,940,000
Damage to Businesses	5	$250,000	$1,250,000
Minor Injuries	4	$1,500	$6,000
Major Injuries	1	$15,000	$15,000

Deaths	1	$150,000	$150,000
		District Total	$19,984,639
Rural Residential District (One Residence per 5 Acres)			
Clean Up Trees and Debris	40	$600	$24,000
Culvert Replacement	3	$150,000	$450,000
Local Bridge Replacement & Moderate Super Structure Repair	2	$550,000	$1,100,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (1% of Employees)	697	$87/Day	$60,639
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
Loss of Livestock	3	$1,500/Head	$4,500
Damage to Homes	20	$79,700	$15,940,000
Damage to Businesses	5	$250,000	$1,250,000
Minor Injuries	8	$1,500	$12,000
Major Injuries	2	$15,000	$30,000
		District Total	$19,056,139
Urban and General Services District (25 Unit Multi-Family or Manufactures Homes and 1Residence per Acre)			
Clean Up Trees and Debris	10	$600	$6,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (1% of Employees)	697	$87/Day	$60,639
Damage to Homes	20	$79,700	$15,940,000
		District Total	$16,031,639

B. Total Expected Annual Damage for Flood Event

Annual Probability	Severity Probability		Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
15%	Low	60%	1	Rural and Agriculture Conservation District	57%	$19,984,639	$478,432.56
				Rural Residential District	18%	$19,056,139	$144,064.41
				Urban and General Services District	25%	$16,031,639	$168,332.21
	Moderate	30%	2	Rural and Agriculture Conservation District	57%	$19,984,639	$478,432.56
				Rural Residential District	18%	$19,056,139	$144,064.41
				Urban and General Services District	25%	$16,031,639	$168,332.21
	High	10%	4	Rural and Agriculture Conservation District	57%	$19,984,639	$318,954.84
				Rural Residential District	18%	$19,056,139	$96,042.94
				Urban and General Services District	25%	$16,031,639	$112,221.47

C. Annualized Risk per Master Plan District	
Rural and Agriculture Conservation District	$1,275,819.96
Rural Residential District	$384,171.76
Urban and General District	$448,885.89
Total	$210,887.61

Belle River Flood, April 2011. Source: St. Clair County Emergency Management

Thunderstorms, Severe Winds, Hail, Lightning Events

Table 4.9: Calculated Annual Severe Weather Event Risk

A. Itemized Costs for Severe Weather Event			
	Quantity	$$$/Unit	Calculated Value
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Clean Up Trees and Debris	10	$600	$6,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Loss of Electric Service (10% of Households)	6,408	$110/Day	$704,880
Overhead Transmission Line Repair (75-150K People)	1	$390,000	$390,000
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
Loss of Livestock	10	$1,500	$15,000
Damage to Farmstead	1	$150,000	$150,000
Damage to Homes	10	$79,700	$797,000
Damage to Businesses	2	$250,000	$500,000
Minor Injuries	1	$1,500	$1,500
	District Total		$2,749,380
Rural Residential District (One Residence per 5 Acres)			
Clean Up Trees and Debris	20	$600	$12,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Loss of Electric Service (15% of Households)	9,612	$110/Day	$1,057,320

Overhead Transmission Line Repair (75-150k)	1	$390,000	$390,000
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
Loss of Livestock	1	$1,500	$1,500
Damage to Homes	20	$79,700	$1,594,000
Damage to Businesses	6	$250,000	$1,500,000
Minor Injuries	4	$1,500	$6,000
Major Injuries	1	$15,000	$15,000
	District Total		$4,760,820
Urban and General Services District (25 Unit Multi-Family or Manufactures Homes and 1 Residence per Acre)			
Clean Up Trees and Debris	40	$600	$24,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Loss of Electric Service (20% of Households)	12,816	$110/Day	$1,409,760
Overhead Transmission Line Repair (75-150k People)	1	$390,000	$390,000
Damage to Homes	40	$79,700	$3,188,000
Damage to Businesses	10	$250,000	$2,500,000
Minor Injuries	8	$1,500	$12,000
Major Injuries	2	$15,000	$30,000
	District Total		$7,578,760

B. Total Expected Annual Damage for Severe Weather Event

Annual Probability	Severity	Probability	Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
80%	Low	60%	1	Rural and Agriculture Conservation District	57%	$2,749,380	$2,736,237.96
				Rural Residential District	18%	$4,760,820	$1,496,230.51
				Urban and General Services District	25%	$7,578,760	$3,308,128.74
	Moderate	30%	2	Rural and Agriculture Conservation District	57%	$2,749,380	$2,736,237.96
				Rural Residential District	18%	$4,760,820	$1,496,230.51
				Urban and General Services District	25%	$7,578,760	$3,308,128.74
	High	10%	4	Rural and Agriculture Conservation District	57%	$2,749,380	$1,824,158.64
				Rural Residential District	18%	$4,760,820	$997,487.01
				Urban and General Services District	25%	$7,578,760	$2,205,419.16

C. Annualized Risk per Master Plan District	
Rural and Agriculture Conservation District	$4,834,020.56
Rural Residential District	$3,989,948.03
Urban and General Services District	$8,821,676.64
Total	$17,645,645.23

Lightning over Blue Water Bridge. Source: WeatherUnderground.com, uploaded by user cadamia1111

Drought

Table 4.10: Calculated Annual Drought Event Risk

A. Itemized Costs for Drought Event			
	Quantity	$$$/Unit	Calculated Value
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (1% of Employees)	697	$87/Day	$60,639
Overhead Transmission Line Repair (75-150k People)	1	$390,000	$390,000
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
		District Total	$635,639
Rural Residential District (One Residence per 5 Acres)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (1% of Employees)	697	$87/Day	$60,639
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
		District Total	$245,639
Urban and General Services District (25 Unit Multi-Family or Manufactures Homes and 1 Residence per Acre)			
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (1% of Employees)	697	$87/Day	$60,639
		District Total	$85,639

B. Total Expected Annual Damage for Drought Event

Annual Probability	Severity Probability		Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
20%	Low	60%	1	Rural and Agriculture Conservation District	57%	$635,639	$54,347.13
				Rural Residential District	18%	$245,639	$6,632.25
				Urban and General Services District	25%	$85,639	$3,211.46
	Moderate	30%	2	Rural and Agriculture Conservation District	57%	$635,639	$54,347.13
				Rural Residential District	18%	$245,639	$6,632.25
				Urban and General Services District	25%	$85,639	$3,211.46
	High	10%	4	Rural and Agriculture Conservation District	57%	$635,639	$36,231.42
				Rural Residential District	18%	$245,639	$4,421.50
				Urban and General Services District	25%	$85,639	$2,140.98

C. Annualized Risk per Master Plan District

Rural and Agriculture Conservation District	$144,925.68
Rural Residential District	$17,686.00
Urban and General Services District	$8,563.90
Total	$171,175.58

In July of 2013 the federal government declared most of Michigan a disaster area because of damage to fruit and crops from adverse spring weather. Source: Washington Post

Snow and Ice Storms

Table 4.11: Calculated Annual Snow and Ice Event Risk

A. Itemized Costs for Snow and Ice Event			
	Quantity	$$$/Unit	Calculated Value
Rural and Agriculture Conservation District (One Residence per 40 Acres)			
Clean Up Trees and Debris	20	$600	$12,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (15% of productivity)	10,455	$87/Day	$909,585
Loss of Electric Service (15% of Households)	9,612	$110/Day	$1,057,320
Overhead Transmission Line Repair (75-150k)	1	$390,000	$390,000
Delayed Vehicles	10	$32/Car	$320
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
Loss of Livestock	20	$1,500	$30,000
Damage to Farmstead	1	$150,000	$150,000
Damage to Homes	5	$79,700	$398,500
Damage to Businesses	1	$250,000	$250,000
Temporary Shelter (2 weeks per Household)	5	$500/Day	$35,000
Minor Injuries	4	$1,500	$6,000
Major Injuries	1	$15,000	$15,000
		District Total	$3,438,725
Rural Residential District (One Residence per 5 Acres)			
Clean Up Trees and Debris	40	$600	$24,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (15% of productivity)	10,455	$87/Day	$909,585
Loss of Electric Service (15% of Households)	9,612	$110/Day	$1,057,320
Overhead Transmission Line Repair (75-150k)	1	$390,000	$390,000
Delayed Vehicles	10	$32/Car	$320
Loss of Crops (640 acre per square mile)	103/acre	$2.50/Bushel	$160,000
Loss of Livestock	3	$1,500	$4,500
Damage to Homes	10	$79,700	$797,000
Damage to Businesses	3	$250,000	$750,000
Temporary Shelter (2 weeks per Household)	10	$500/Day	$70,000
Minor Injuries	8	$1,500	$12,000
Major Injuries	2	$15,000	$30,000
		District Total	$4,229,725
Urban and General Services District (25 Unit Multi-Family or Manufactures Homes and 1 Residence per Acre)			
Clean Up Trees and Debris	80	$600	$48,000
Activation of Emergency Operations Center	1	$25,000	$25,000
Economic Loss (5% of Employees)	3,485	$87/Day	$303,195
Loss of Electric Service (15% of Households)	9,612	$110/Day	$1,057,320
Overhead Transmission Line Repair (75-150k)	1	$390,000	$390,000
Delayed vehicles	10	$32/Car	$320
Damage to Homes	20	$79,700	$1,594,000
Damage to Businesses	5	$250,000	$1,250,000
Temporary Shelter (2 weeks per Household)	20	$500/Day	$140,000
Minor Injuries	16	$1,500	$24,000
Major Injuries	4	$15,000	$60,000
Deaths	1	$1,500,000	$1,500,000
		District Total	$6,391,835

B. Total Expected Annual Damage for Snow and Ice Events

Annual Probability	Severity Probability		Scale Factor	Impacted District	Amount of County Land	Cost	Calculated Annual Damage
75%	Low	60%	1	Rural and Agriculture Conservation District	57%	$3,438,725	$81,1470.33
				Rural Residential District	18%	$4,229,725	$437,776.54
				Urban and General Services District	25%	$6,391,835	$661,554.92
	Moderate	30%	2	Rural and Agriculture Conservation District	57%	$3,438,725	$811,470.33
				Rural Residential District	18%	$4,229,725	$315,199.11
				Urban and General Services District	25%	$6,391,835	$661,554.92
	High	10%	4	Rural and Agriculture Conservation District	57%	$3,438,725	$540,980.22
				Rural Residential District	18%	$4,229,725	$210,132.74
				Urban and General Services District	25%	$6,391,835	$441,036.62

C. Annualized Risk per Master Plan District	
Rural and Agriculture Conservation District	$2,163,920.88
Rural Residential District	$963,108.39
Urban and General Services District	$1,764,146.46
Total	$4,892,175.73

An early January 2014 snowstorm left a foot of snow or more on some parts of West Michigan. Sources say Michigan was experiencing one of the harshest winters in over 20 years. Source: Channel 8 Wood TV

Comparison of Calculated Risk

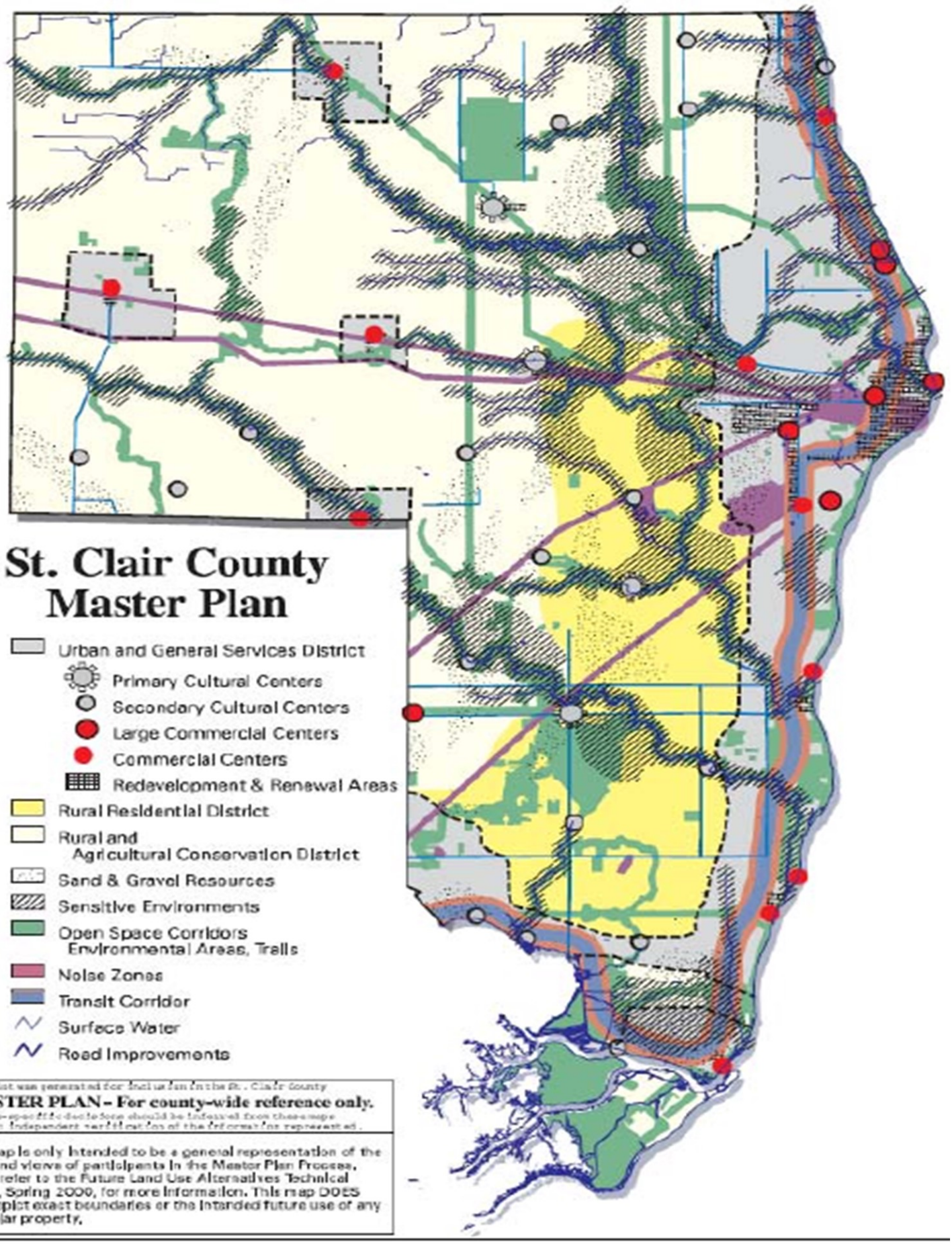
Table 4.12: Summary of Risk by Master Plan District

Event	Annual Probability	Rural and Agriculture Conservation	Rural Residential	Urban and General Services
Blackout	6%	$837,996.64	$99,778.59	$153,046.39
HazMat Facility	32%	$19,798,628.96	$6,282,042.61	$8,890,859.20
HazMat Transportation	32%	$1,045,490.97	$268,250.97	$458,548.66
Tornado	12%	$1,013,664.97	$552,623.96	$1,220,648.03
Severe Weather	80%	$4,834,020.56	$3,989,948.03	$8,821,676.64
Extreme Temperatures	20%	$38,139.84	$19,233.26	$1,474,920.00
Flooding	15%	$1,275,819.96	$384,171.76	$448,885.89
Drought	20%	$144,925.68	$17,686.00	$8,563.90
Snow and Ice Storms	75%	$2,163,920.88	$963,108.39	$1,764,146.46
Total Risk by District		$31,152,608.46	$12,576,843.57	$23,241,295.17

Benefit Cost Analysis

Benefit cost analysis is a calculated ratio that represents the dollars saved by the mitigation action (perhaps by injury reduction or preservation of property) divided by the dollars spent. This approach alone may favor the lowest cost projects which score a high ratio while a project that mitigates a high calculated risk may have a low ratio. It is best to optimize the mixture of projects and costs to achieve the best overall average.

The calculated risk analysis compares the event examples in like terms (dollar amounts). This analysis is particularly helpful in optimizing the prioritization of projects. Optimizing projects is performed by calculating the benefit-cost ratio of the mitigation strategy and arranging the projects to get the highest average benefit per cost. This approach is more economically feasible than prioritizing mitigation strategies by lowest cost or by addressing the greatest calculated risk.


St. Clair County
Master Plan
Urban and General Services District
Primary Cultural Centers
Secondary Cultural Centers
Large Commercial Centers
Commercial Centers
Redevelopment & Renewal Areas
Rural Residential District
Rural and
Agricultural Conservation District
Sand & Gravel Resources
Sensitive Environments
Open Space Corridors
Environmental Areas, Trails
Noise Zones
Transit Corridor
Surface Water
Road Improvements
MASTER PLAN – For county-wide reference only.
his map is only intended to be a general representation of the
leas and views of participants in the Master Plan Process.
lease refer to the Future Land Use Alternatives Technical
eport, Spring 2000, for more information. This map DOES
OT depict exact boundaries or the intended future use of any
articular property.