



# **City of Saint Paul All- Hazard Mitigation Plan**

**Update-April 2012**

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## **Formal Adoption of Plan**

**NOTE: In addition to 2012 updates noted in this plan, the *City of Saint Paul All-Hazard Mitigation Plan* includes an overall reorganization of the 2007 plan; although the most current information has been used when available, significant details from the 2007 plan have been retained and irrelevant information has been omitted.**

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## **Executive Summary and Introduction**

### ***Mission Statement***

To create a proactive and specific plan of action for preventing loss of life and property in the City of Saint Paul by reducing risks posed by natural, man-made, technological and terrorist incidents.

### ***Purpose and Benefits***

The purpose of the plan is to identify hazards, risks, vulnerabilities, capability gaps, strategies, and measures that will prevent loss of life and damage to property while reducing future risks in the City of Saint Paul. Disasters can strike at any time in any place. In many cases, actions can be taken before disasters strike to reduce or eliminate the negative impacts. The benefits derived from comprehensive hazard mitigation planning and activities mirror the public safety priorities firmly established in City practices: saving lives and reducing injuries, preventing or reducing property damage, reducing economic losses, maintaining critical services to citizens, protecting infrastructure from damage, and protecting the environment.

Hazards are identified and examined for historical impact and potential effects on the City of Saint Paul. Capabilities are analyzed and local, state, and federal resources are identified. Shortfalls in the City's capability to handle various threats and impacts are identified. Finally, goals, strategies, and specific action plans are developed to correct those shortfalls, reduce potential threats and impacts, and to accomplish the objective of pre-disaster mitigation.

This plan will apply to all emergency response departments and agencies within the City of Saint Paul. In addition this plan complements and is consistent with mitigation plans for Ramsey County and the State of Minnesota.

Acceptance and approval of the plan does not incur direct costs. However, history has clearly shown the value of mitigation spending: every dollar spent on mitigation efforts saves not only lives, but saves thousands of dollars in reconstruction and recovery costs. A relatively small amount of money spent before a disaster can greatly reduce the economic loss to businesses and help ensure a stable, prosperous community after a disaster occurs.

### ***Legal Authorities and References***

This All Hazard Mitigation Plan has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act), 42 U.S.C. 5165, as amended by Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000). The regulations governing the mitigation planning requirements for local mitigation plans are published under the Code of Federal Regulations (CFR) Title 44, Section 201.6 (44 CFR §201.6).

Additionally, a DMA 2000 compliant plan that addresses flooding will also meet the minimum planning requirements for the Flood Mitigation Assistance program as provided for under 44 CFR §78. DMA 2000 provides requirements for local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning. DMA 2000 requires that local plans be updated every five years, with each plan cycle requiring a complete review, revision, and approval of the plan at both the state and Federal Emergency Management Agency (FEMA) levels.

Under 44 CFR §201.6, local governments must have a FEMA approved local mitigation plan in order to apply for and/or receive project grants under the following hazard mitigation assistance programs:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Severe Repetitive Loss (SRL)

When the Governor's Executive Order 11-03 (revised January 14, 2011) was approved it effectively rescinded the Governor's Executive Order 10-06. Through this process the new Executive Order assigned emergency responsibilities to designated state agencies. The Division of Homeland Security and Emergency Management (HSEM) is directed to conduct the following Recovery/Hazard Mitigation activities on behalf of the Minnesota Department of Public Safety:

- Each state agency that has a role in emergency management shall participate in the development of hazard mitigation strategies to reduce or eliminate the vulnerability of life and property to the effects of emergencies and disasters.
- Following a presidential declaration of a major disaster, state agencies shall be responsible for carrying out the hazard mitigation responsibility assignments contained in this Executive Order and elaborated upon in the State All-Hazard Mitigation Plan.
- State agencies shall, when requested by HSEM, provide appropriate personnel to assist with the damage assessment activities associated with the Public Assistance, Individual Assistance, and Hazard Mitigation programs. They shall also provide personnel to serve on an Interagency Hazard Mitigation Team or Hazard Mitigation Survey Team, when requested.
- State agencies shall, when requested by HSEM, provide appropriate personnel to serve on the Minnesota Recovers Task Force, and be prepared to commit and combine resources toward the long-term recovery/mitigation effort.

### ***Definitions***

FEMA maintains that mitigation plans form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. For this purpose mitigation involves:

- Structural hazard control or protection measures
- Retrofitting of facilities
- Acquisition and relocation of repetitive loss structures
- Development of mitigation standards, regulations, policies, and programs
- Public awareness and education programs
- Development or improvement of warning systems.

Mitigation lessens the financial impact on individuals, communities, and society as a whole. For example, a recent study by the Multi-hazard Mitigation Council shows that each dollar spent on mitigation saves society an average of four dollars.

The City of Saint Paul is subject to many natural and human caused disasters. These events could cause injury or loss of life, property damage, damage to the infrastructure, and impacts to response operations, the environment and the economic condition of the city that would affect the quality of life for its residents. Saint Paul Emergency Management has drafted this mitigation plan so that hazards are ranked by priority, strategies identified and linked to hazards, and goals set for reducing or eliminating the effects of a natural or human caused disaster.

Many related resources have been consulted to construct this mitigation plan and are incorporated into the plan and referenced throughout. Some of these sources include:

- U.S. Census Bureau data
- Watershed plans
- City Plans (2012 Update)
- Minnesota State Mitigation Plan (2012 Update)
- National Oceanographic and Atmospheric Administration (NOAA) (2012 Update)
- National Weather Service (2012 Update)
- U.S. Geological Survey (USGS) (2012 Update)
- The U.S. Army Corps of Engineers (USACE), (2012 Update)
- Saint Paul Campus Climatological Observatory (2012 Update)
- FEMA, EMAP regulations
- Infrastructure maps (sewer, water, etc)
- Utility maps
- Metropolitan Council data (2012 Update)
- Historical information (2012 Update)

These sources developed the plan's hazard, risk, and vulnerability assessment profiles that in return led to the development of meaningful mitigation actions.

Most of the maps used in this plan have been drafted from the City of Saint Paul Departments such as the Department of Licensing, Inspection (DSI), and Environmental Protection, the Parks and Recreation GIS Division, Planning and Economic Development (PED), and the State of Minnesota. Information included is: topographies, land use, soils, transportation systems, watershed and hydrology, and political subdivision boundaries.

Additions in data added for the 2012 plan update are noted, where appropriate. No significant data was deleted from the initial 2007 plan in the creation of this update.

### ***2012 Plan Update***

The 2012 Update of the City of Saint Paul Hazard Mitigation Plan has been significantly reorganized to provide a more logical progression of the information and data that supports the city's mitigation planning, projects, and to more closely align with current and future FEMA mitigation plan and review tools including Local Mitigation Plan Review Guide and crosswalk (July 2008 and October 1, 2011).

### ***City Profile:***



### ***Basic City Information***

The City of Saint Paul is located in Ramsey County which is geographically the smallest county by land area; however, it is also the most densely populated county in Minnesota. Using information collected from the 2010 Census, the City of Saint Paul estimates the population at 285,068. The city is contained in 56.2 square miles, of which 52.8 are land and 3.4 are water. Elevations vary within the City of Saint Paul from 692 feet to 1,107 feet above sea level.

### ***History***

The Dakota American Indians lived in the area along the Mississippi and Minnesota Rivers near current day Saint Paul long before European explorers arrived. They were well established in the culture of hunting and gathering and were skilled in horsemanship.

Father Lucien Galtier, who gave Saint Paul its name, arrived at Mendota in 1840. He was a French Missionary who was picked to help the settlers on the American Frontier. Galtier

built the Church of Saint Paul and prevented the name *Pigs Eye* from becoming the capitol's name.

The City of Saint Paul began as a regional hub for the lumber industry and fur trade due to its proximity along the Mississippi River. In 1847, Saint Paul became the capitol of the Minnesota territory and when Minnesota was admitted into the union on May 4, 1858, Saint Paul was designated as the capitol.

Many famous and influential people have called Saint Paul home including former President of the United States, Zachary Taylor, Archbishop John Ireland, founder of the Saint Paul Cathedral, Henry Hastings Sibley, Civil War hero and first Governor of Minnesota, author F. Scott Fitzgerald, and Alexander Ramsey, Governor of Minnesota, U.S. Senator, and Secretary of War.

As Saint Paul settles into the 21<sup>st</sup> century, we have evolved into a regional hub for numerous businesses, a city known for its character and history, and a destination that has embraced diversity.

### ***Geography***

The City of Saint Paul is located along the Mississippi River, which runs along the City's southern and western borders. Saint Paul has 26 miles of linear riverfront along the Mississippi, the most of any city along the entire river. Industrial areas and railroad yards sit along the Mississippi River. Most of the city's residential areas are on higher ground, some distance from the river.

A vibrant downtown and the state capitol area are the anchors of the City of Saint Paul. In addition, Saint Paul is a city of strong, well-known neighborhoods; including Summit, Payne-Phalen, and Como, each contain its own character and community organizations.

Individual characteristics such as the numerous bluffs running along the Mississippi River, lakes, and parks add to the dynamic geographical nature of the City of Saint Paul. The City is dotted with a number of caves and tunnels, which unfortunately have become extremely dangerous in recent years.

[Link to Interactive Map of Saint Paul](#)

### ***Hydrology***

The source water from the Mississippi River is pumped through a chain of natural lakes north of Saint Paul. When the lakes are at optimum elevations, the available water supply is approximately 3.6 billion gallons of water.

The distribution system in the City of Saint Paul is divided into two main service areas: The low-service area embraces downtown, the low-lying regions south and southwest of downtown and the suburban areas south of the Mississippi River. Each service area has a



reservoir system for storage. Saint Paul is often referred to as “the city of seven hills”. This topography requires that a substantial amount of water in the distribution system be re-pumped through the utility's booster stations to provide sufficient pressure in the high-lying areas.

A map of the Superficial Hydrology of the Saint Paul area may be found in the map section of this plan, or by clicking the link below on the electronic version of the plan:

[Link to Surficial Hydrogeology Map](#)

**Saint Paul is part of two separate watersheds: Ramsey-Washington Metro Watershed District and Capitol Region Watershed District.**

Capitol Region Watershed District (CRWD) covers 40 square miles and includes portions of the cities of Falcon Heights, Lauderdale, Maplewood, Roseville and Saint Paul. The watershed is located within Ramsey County; CRWD has a population of 245,000 people. CRWD drains to the Mississippi River, its primary water resource. The lakes in CRWD include Como Lake, Crosby Lake, and Loeb Lake in Saint Paul and Lake McCarrons in Roseville.

The Ramsey-Washington Metro Watershed District (RWMWD) is a special purpose governmental unit responsible for protecting the water resources of the watershed, located in the eastern portion of Ramsey County and the western edge of Washington County, Minnesota. The watershed includes six actual small watersheds that each drain to the Mississippi River; the Phalen Chain of Lakes, Beaver Lake, Beltline Interceptor, Battle Creek, Fish Creek, and the Bluff lands area. There are 5 major creeks, 11 lakes and thousands of wetlands within the RWMWD.

The RWMWD also includes and services all or part of 10 cities in Ramsey and Washington Counties: These cities include Saint Paul, Woodbury, Oakdale, Landfall, North Saint Paul, Maplewood, Little Canada, White Bear Lake, Vadnais Heights and Gem Lake.

[Link to Capitol Region Watershed District Map](#)

[Link to Ramsey-Washington Metro Watershed District Map](#)

## ***Geology***

The City of Saint Paul community is diverse in its geologic characteristics. Its location along a major waterway, along with its bedrock geology and sand aquifer are but a few characteristics necessarily taken into consideration.

Native Americans have always referred to Carver's Cave as *Wakan Tibi*, the Dwelling of the Great Spirit. Jonathan Carver (1710–1780) visited what he called the “Great Cave” in 1766 and again in 1767, and it became the earliest Minnesota cave in the published

literature when the first edition of Carver's bestselling *Travels Through the Interior of North America* appeared in 1778.

[Link to Article on Carver's Cave](#)

Map of the Superficial and Bedrock Geology of the Saint Paul area may be found in the map section of this plan, or by clicking the links below on the electronic version of the plan:

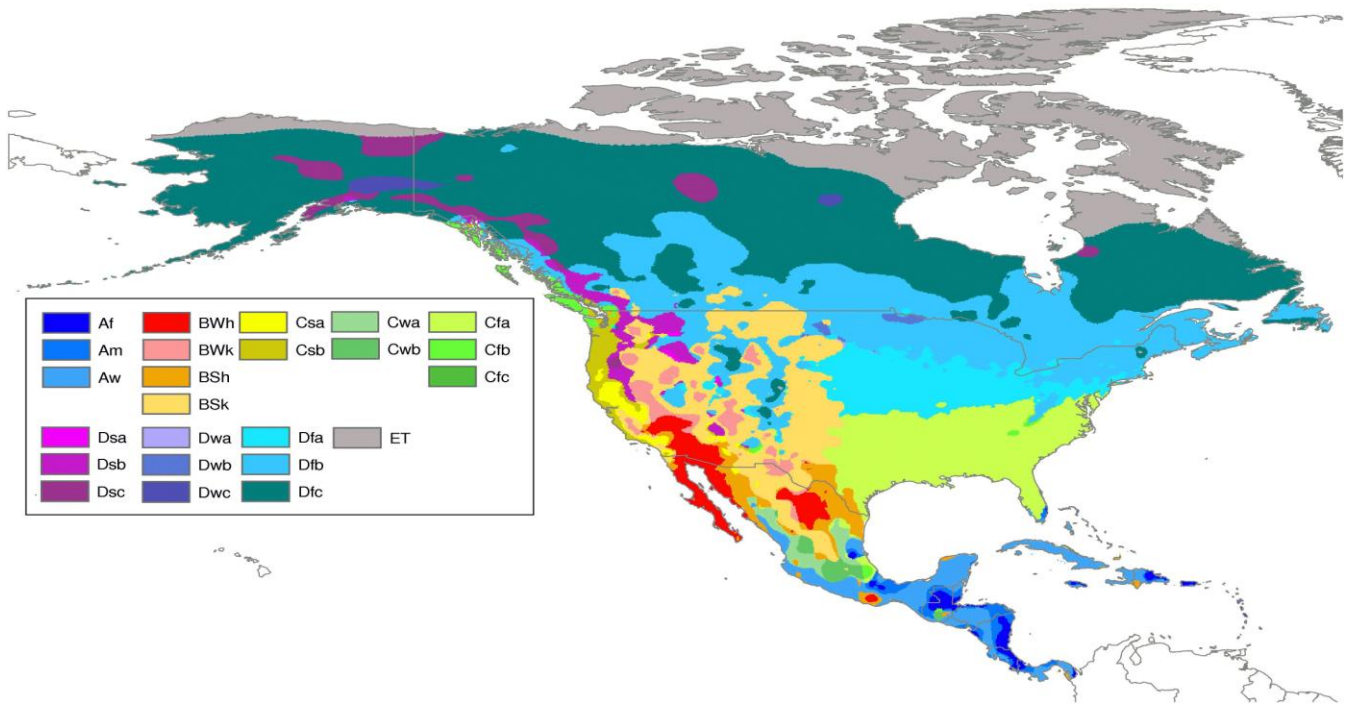
[Link to Bedrock Geology Map](#)

### *Climate*

On the widely used Köppen System, Saint Paul is located near the transition of the hot (Dfa) and warm (Dfb) within the humid continental climate zone. The continental climate refers to the large amounts of land mass and absence of large body of water that surrounds the region. The humid portion derives from the humid air masses that routinely flow northwards towards the region from the Gulf of Mexico. A feature of the humid continental climate in the United States is that weather can be unpredictable with extremes occurring in many phases of measurements. (2012 Update).

Minnesota is known for its extreme temperatures as winter days can sometimes get no warmer than -10 degrees and summer days can reach 100 degrees. The highest recorded temperature (all time daily high) was 108 degrees on July 14, 1936. The lowest recorded temperature (all time daily low) was minus 60 degrees on February 2, 1996.

The growing season, or average number of days between freezes, is 157 days. The maximum seasonal snowfall was 98.6 inches in the winter of 1983-84. The maximum seasonal rainfall was 40.15 inches in 1911, and the maximum rainfall in 24 hours was 10 inches on July 23-24, 1987. (2012 update). **Map 1:** Koppen Scale:



[Link to Koppen scale map from Melbourne University \(2007\)](#)

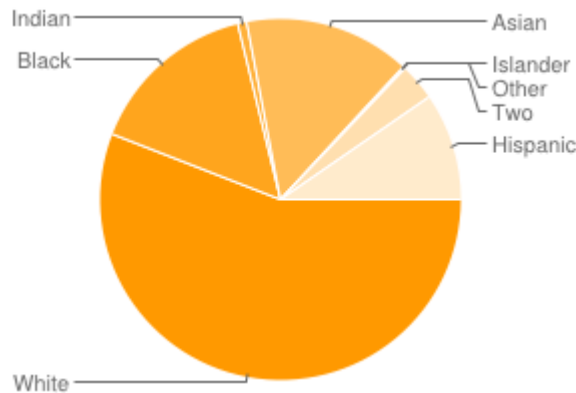
### ***Population Growth and Demographics***

The population of Saint Paul has varied over the years, from over 300,000 in the 1970s down to 285,068 in 2010. The diversity of Saint Paul and Ramsey County has been fluctuating as well in recent years. The chart and graph below shows current trends in population by race and ethnicity.

**Table 1:** Race and Origin

Race & Origin		%
Non-Hispanic		
	White	55.9
	Black	15.3
	Indian	0.8

	Asian	14.9
	Islander	0.0
	Other	0.2
	Two	3.3
Hispanic		9.6



The population of Saint Paul is quite diverse in age and ethnicity, and grew at a modest rate of 5.5% throughout the 1990's, and then leveled out after 2000. Between the censuses of 2000 and 2010 the population of Saint Paul decreased by 0.7%. Details of demographics, demographic trends, ethnicity, housing and housing costs, education, jobs, and income levels can be obtained from the Wilder Research Center from 2004. A succinct report from that organization can be viewed by clicking the link below:

[Link to Wilder Research Center: City of Saint Paul \(2004\)](#)

There is still projection of future estimated increase in population by the Metropolitan Council, particularly with ethnic and aging populations, which means the City of Saint Paul faces great planning challenges in housing, development, public safety, and transportation. The Metropolitan Council projects an increase in population to 331,000 by 2030. This projection would exceed the population in the 1970s by tens of thousands and needs to be considered in future planning.

[Link to Metropolitan Council - Current and Future Projections](#)

[Link to 2010 Saint Paul Census Data](#)

## ***Industry***

Saint Paul is a thriving commercial center and is home to three Fortune 500 companies (3M, Ecolab, and Jude Medical), large regional enterprises and countless small businesses, professional firms, and governmental offices. As large-scale, visionary developments like the Central Corridor continue to unfold the growth potential in Saint Paul will expand along with the changes.

The City of Saint Paul's Department of Planning and Economic Development (PED) offers a variety of services to assist new or expanding businesses; services include small business financing and loan guarantees/direct loans. Saint Paul has a number of large business interests that are located in Saint Paul. In addition, many national and multinational corporations have regional offices in Saint Paul that generate a number of jobs and contribute significantly to the city's economy. Below is a list of companies that contribute to the viability of the City of Saint Paul.

**Table 2:** List of Large Employers in Saint Paul

Large Employers in Saint Paul	
Name of Business	Type of Business
State of Minnesota	State Government
United States Government	Federal Government
Delta Airlines	Airline
University of Minnesota	Education
HealthEast Care System	Health Care
EcoLab	Manufacturer
Regions Hospital	Health Care
United Hospital	Health Care
Travelers Insurance	Insurance
Securian Financial Group	Financial Services
Wells Fargo Bank Minnesota, N.A.	Banking

## ***Land and Development***

Much of Saint Paul is comprised of single and two-family housing units, but there are a variety of multi-family housing units distributed throughout the city. There is also a healthy

mix of residential and commercial areas along main traffic arteries in all sections of the city. A large commercial area comprises the downtown core of the city. A detailed look at land development and zone is available by following the link below:

[Link to Interactive Map of Saint Paul Land use](#)

**Table 3: Saint Paul Land Use**

Saint Paul Land Use	2005		2010	
	Acres	Change	Acres	Change
<b>Residential Total</b>	<b>16,489</b>	<b>N/A</b>	<b>16,539</b>	<b>0.30%</b>
Single Family Detached	13,077	N/A	13,085	0.06%
Multifamily	3,412	N/A	3,454	1.23%
<b>Commercial Total</b>	<b>2,165</b>	<b>N/A</b>	<b>2,006</b>	<b>-7.34%</b>
Retail and Other Commercial	1,709	N/A	1,563	-8.54%
Office	456	N/A	443	-2.85%
<b>Industrial Total</b>	<b>3,487</b>	<b>N/A</b>	<b>3,459</b>	<b>-0.80%</b>
Industrial and Utility	2,693	N/A	2,628	-2.41%
Extractive	0	N/A	5	100%
Railway	794	N/A	826	4.03%
<b>Institutional Total</b>	<b>2,480</b>	<b>N/A</b>	<b>2,707</b>	<b>9.15%</b>
<b>Park and Recreational</b>	<b>5,133</b>	<b>N/A</b>	<b>5,252</b>	<b>2.32%</b>
Park, Recreational or Preserve	4,472	N/A	4,602	2.91%
Golf Course	661	N/A	650	-1.66%
<b>Mixed Use Total</b>	<b>306</b>	<b>N/A</b>	<b>438</b>	<b>43.14%</b>
Mixed Use Residential	74	N/A	155	109.46%
Mixed Use Industrial	115	N/A	144	25.22%
Mixed Use Commercial and Other	118	N/A	138	16.95%
<b>Major Roadways</b>	<b>1,319</b>	<b>N/A</b>	<b>1,261</b>	<b>-4.40%</b>
<b>Airport</b>	<b>541</b>	<b>N/A</b>	<b>539</b>	<b>-0.37%</b>
<b>Agricultural and Undeveloped Total</b>	<b>1,548</b>	<b>N/A</b>	<b>1,277</b>	<b>-17.51%</b>
Agriculture	1	N/A	1	0.00%
Undeveloped Land	1,547	N/A	1,275	-17.58%
<b>Open Water</b>	<b>2,356</b>	<b>N/A</b>	<b>2,349</b>	<b>-0.30%</b>
<b>Total</b>	<b>35,824</b>	<b>N/A</b>	<b>35,827</b>	<b>0.01%</b>

[Link to Metropolitan Council Community Profile](#)

Below is a Metropolitan Council projection on land use for the year 2020. The use of the land may be altered in the next few years, but not too drastically. The basic premise will still stand and that is to use the land in the best manner for the City of Saint Paul and its residents.

**Table 4:** Land Use for Saint Paul 2020

### Land Use Saint Paul for 2020

Planned Land Use	Year	
	2020	
	Acres	% of Total
Airport	593	1.65%
Commercial	1,343	3.75%
Industrial	2,432	6.79%
Institutional	2,790	7.79%
Mixed Use	280	0.78%
Multifamily Residential	3,125	8.72%
Multi-Optional Development	1,296	3.62%
Open Space or Restrictive Use	1,264	3.53%
Park and Recreation	3,885	10.85%
Railway (inc. LRT)	1,035	2.89%
Rights-of-Way (i.e., Roads)	1,440	4.02%
Single Family Residential	13,763	38.42%
Vacant or No Data	222	0.62%
Water	2,358	6.58%
<b>Total</b>	<b>35,826</b>	<b>100.00%</b>

### *Housing and Community Development*

Housing and community development is an important priority for the City of Saint Paul. Housing and residential information is presented below through a series of tables and links.

**Table 5: Housing Status City of Saint Paul**

	SAINT PAUL	RAMSEY COUNTY	MINNESOTA
<b>HOUSING STATUS</b>			
(In units except population occupied, as noted)			
<b>Total</b>	120,795	217,197	2,347,201
Occupied	111,001	202,691	2,087,227
Owner-occupied	56,993	123,448	1,523,859
Population in owner-occupied	149,177	314,023	3,950,160
( number of individuals )			
Renter-occupied	54,008	79,243	563,368
Population in renter-occupied	124,453	176,233	1,218,370
( number of individuals )			
Households with individuals under 18	30,744	54,374	615,770
Vacant	9,794	14,506	259,974
Vacant: for rent	4,197	6,348	48,091
Vacant: for sale	1,569	2,522	30,726
Vacant: for seasonal/recreational/occasional use	486	987	130,471

**Table 6: Homeowner rate City of Saint Paul**

Homeownership rate, 2005-2009	56.30%
Housing units in multi-unit structures, percent, 2005-2009	44.40%
Median value of owner-occupied housing units, 2005-2009	\$206,200
Households, 2005-2009	110,705
Persons per household, 2005-2009	2.42
Per capita money income in past 12 months (2009 dollars) 2005-2009	\$25,587
Median household income 2005-2009	\$46,026
People of all ages in poverty - percent, 2005-2009	19.80%
Persons per square mile, 2010	5,484.30



**Table 7: Housing Purchase Average**

	Single Family Detached Housing		Duplex & Triplex Properties		Multifamily ownership (Townhomes and Condos)	
Year	Volume of sales	Median Price	Volume of sales	Median Price	Volume of sales	Median Price
2005	3856	\$ 191,842.00	608	\$ 219,000.00	901	\$ 205,500.00
2006	3070	\$ 194,570.00	432	\$ 224,000.00	693	\$ 209,900.00
2007	2377	\$ 187,000.00	330	\$ 181,825.00	441	\$ 196,900.00
2008	2055	\$ 155,000.00	300	\$ 62,500.00	315	\$ 183,000.00
2009	2493	\$ 119,000.00	425	\$ 50,000.00	291	\$ 147,000.00
5- Year Average	2770	\$ 169,482.00	419	\$ 147,465.00	528	\$ 188,460.00
5- Year Change	-35%	-38%	-30%	-77%	-68%	-28%

[Link to 2010 Saint Paul Census Data](#)

[Link to Saint Paul Zoning Districts](#)

### ***Environment***

The City of Saint Paul has a rich and varied environment which the City and its residents are committed to preserving. Examples of past and present projects in environmentally sensitive areas include:

- Revitalization along the downtown Mississippi River corridor
- Numerous urban renewal projects for the downtown area
- Como Lake and Phalen Lake Shoreline Restoration
- Westside Bluff Management Initiative
- Central Corridor Rail Line

Pollution can have a significant effect on the environment. As of January 1, 2012, the City of Saint Paul has no active sites on the National Priorities List of Superfund sites. Completed and successful mitigation actions on the Kopper's Coke site has resulted in removing the site from the aforementioned list. Kopper's Coke continues to be monitored for the long run. Information about this site (Kopper's Coke) can be found at the following link:

[Link to EPA Narrative for Koppers Coke](#)

## ***Transportation***

The history of transportation in the City of Saint Paul has its origins in the Mississippi River. It began with canoes of cedar wood and birch bark used by Native Americans. In 1819 the first keelboats came up the Mississippi followed by the first steamboat in 1823. Barge traffic continues today to be an essential link in the transportation chain as nearly 10 million tons of barged material moves through the Saint Paul Harbor.

Land transportation developed as people from the eastern states and Europe settled the area. In the early 1800s, Red River ox carts made the trip from what is now the Twin Cities to Pembina, Alberta in Canada in 75 days. Today, the automobile is the most heavily used mode of personal transportation by volume in Saint Paul, with mass transit following in second place. The City is served by several major interstate highways (I-35 and I-94), as well as several US and State highways, and many Ramsey County roads. The City has the capability and the resources to maintain designated roads and highways.

Metro Transit, the main mass transit provider in Saint Paul, has increased users by around 20 percent between the years 2007-2011. The Hiawatha Light Rail line runs from downtown Minneapolis to the Mall of America and the Minneapolis-Saint Paul International Airport. The Hiawatha Light Rail will be enhanced with the Central Corridor Light Rail when it is completed in 2014. The Central Corridor Light Rail line is 11 miles long and will connect downtown Minneapolis with Downtown Saint Paul via Washington Avenue and University Avenue.

The Union Depot, one of America's great rail stations of the early 20th century, is considered a project of regional and national significance by the federal government. When restoration is complete, the 290,000 square foot Union Depot building and its 33-acre site will be filled with activity that complements transit and embraces the Depot's location on the Mississippi River and in Saint Paul's distinctive Lowertown neighborhood.

The Union Depot is a multi-modal transit center that will be completed the end of 2012. Amtrak's Empire Builder service, currently located at a station in the Midway area of Saint Paul, will relocate to the remodeled building. The Union Depot will be a destination for riders of the Central Corridor light rail transit as well as Metro Transit bus routes; Jefferson Lines and Greyhound intercity and regional bus lines; bicyclists and pedestrians. The Depot will be a hub for future regional transit ways including the Rush Line, Red Rock, Gateway, Robert Street and Riverview corridors. Future high-speed rail service to Chicago will also stop at the Depot.

## ***Special Planning Considerations***

The City of Saint Paul has several special areas of concern regarding mitigation planning:

- Large recreational venues, including the Xcel Energy Center (professional hockey arena), River Centre Convention Center, and Harriet Island – the site of many major events each year.
- The Minnesota State Fairgrounds, which for 10 days each August enjoys a population surge of over 100,000 daily.
- The State Capitol and great number of state office buildings along with a number of religious, cultural, medical institutions, and private sector facilities are located in the City of Saint Paul.
- The Mississippi River commercial industries centered along Childs Road, and cutting through the southeast portion of the City and into the heart of the downtown area
- The University of Minnesota agricultural campus, located in the northwest corner of the City. It's a major center of agricultural research, genetic engineering research, and a population center for much of the year.
- The Central Corridor Light Rail System that connects Downtown Saint Paul and Minneapolis through a new light rail system that will be operational in the year 2014. This includes the Union Depot which will be a multi-modal transit center for the Twin Cities. (2012 Update).

**NOTE: In addition to 2012 updates noted in this plan, the *City of Saint Paul All-Hazard Mitigation Plan* includes an overall reorganization of the 2007 plan; although the most current information has been used when available, significant details from the 2007 plan have been retained and irrelevant information has been omitted.**

## Planning Process

**2012 Update:** This section of the 2007 plan was reviewed by members of the Project Team and evaluated for consistency based on guidelines contained in “Local-Multi-Hazard Mitigation Planning Guidance” (July 1, 2008 and October 1, 2011) published by FEMA. In addition, consideration was given to relevant planning standards noted in the Emergency Management Standards by EMAP®, and changes were made and noted, where applicable, to be consistent with the Standards. Significant changes were made in the plan format to ensure that all criteria were addressed.

### *Overview*

The mitigation planning process includes a number of steps to prepare a plan that is not only compliant with the current regulations, but an appropriate fit for the City of Saint Paul. The following five steps describe the general methodology for mitigation planning:

1. Identify and analyze natural and human-caused hazards that could impact the community.
2. Assess the community’s vulnerability to natural and human-caused hazards.
3. Assess the community’s capability to respond to a disaster.
4. Assess the community’s current policies and ordinances that affect hazard mitigation.
5. Develop hazard mitigation strategies that can be implemented to reduce future vulnerability. (Source: Natural Hazard Center, Pennsylvania State University)

The initial Saint Paul All-Hazards Mitigation Plan was primarily developed between 2001 and 2004 and approved by FEMA in March of 2007. At that time, the planning process was undertaken by the City of Saint Paul Department of Emergency Management, a division within the Department of Fire and Safety Services. The Emergency Management Department called together a steering committee with broad representation from the stakeholder group and held a series of planning meetings beginning as early as 2001. Representatives from the following entities participated in the development of the initial multi-hazard jurisdictional plan in 2007:

- Representatives from each City department involved in emergency response and planning
- Representatives from County Government
- State Government Partners
- Private Industry
- Government-operated and public utilities
- Business owners and managers
- Organizations active in disaster response
- Private Citizens

Meetings consisted of the full Steering Group as well as numerous small group discussions. The first draft plan was completed in late 2004 and presented to the Steering Committee for

review and refinement. The public reviewed the final draft of the plan prior to submission for approval and final adoption. The plan was submitted to Minnesota Homeland Security and Emergency Management in December 2005, was approved by FEMA in March 2007, and was adopted by resolution of the City of Saint Paul on February 28, 2007.

**2012 Update:** The planning process used for the 2012 plan update was based on the accepted planning principles and guidance used in 2007 and the plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000; however the updated FEMA Local Multi-Hazard Mitigation Planning Guidance (October 2011) was also considered, and elements of this guidance were compared with the 2008 Local Multi-Hazard Mitigation Planning Guidance crosswalk to ensure that all required elements of the 2008 Guidance would be addressed in the revised plan, along with new criteria provided in the 2011 Guidance. In addition, the City of Saint Paul Emergency Management agency intends to address criteria outlined in the Emergency Management Accreditation Program (EMAP)© standards through the update of this plan and all future updates. Therefore, information was added or reformatted where applicable to meet EMAP hazard identification and risk assessment and hazard mitigation standards.

The City of Saint Paul received a 2010 Mitigation Planning Grant from the State of Minnesota to update and establish a FEMA compliant Hazard Mitigation Plan for the jurisdiction.

The following timeline provides a summary of key activities for the 2012 update:

#### **Timeline of Key Activities**

2/2011	Stakeholders agree to participate in City planning
3/2011	Survey and schedule created
4/2011	Stakeholder Survey Online
8/2011	Survey completed and analyzed
12/2011	Preparation for update is conducted, meetings with Ramsey County and stakeholders throughout the month.
1/2012	Involved in Ramsey County Public Meeting
2/2012	Consultant involved in update
3/16/12	Kick-Off meeting for Stakeholder group
3/2012	Update in process of completion
3/2012	Survey made public until 3-31-2012
3/16/2012	Meeting with stakeholders
4/13/12	Public Meetings held
4/2012	Survey Data compiled and Stakeholder group meets
5/2012	Submission of Plan to State of Minnesota

In fall 2011 and early spring 2012, Saint Paul EM staff members developed a scope of work and obtained proposals from consultants to potentially serve as a subject matter expert for the plan update project. Once a vendor was selected and the contract approved,

the Project Team was formed and work began in late February 2012. Tom Miller, Emergency Management Planning Coordinator, served as Project Coordinator, and coordinated SWG activities; and Heather Winkleblack, Emergency Management Planning Specialist, was the primary plan developer for the update. Nancy Freeman, Emergency Management Consultant, was contracted to coordinate the plan revision schedule, update formats and information for compliance requirements, and provide technical assistance to staff members during the planning, review, approval and adoption process.

### ***Stakeholder Participation***

Stakeholder participation throughout the 2012 update process occurred on many different levels. The process started with a survey conducted in April of 2011, which provided not only a baseline for the process, but also an element for the City's Strategic Plan. The stakeholders involved were both city employees and public/private sector partners who conduct business in the City of Saint Paul.

Because many of those involved in the 2007 planning process were no longer with the jurisdiction, or were in different positions, a new stakeholder group was designated for the 2012 update. An existing Stakeholder Group, the Emergency Management Council (having key representation from City departments, agencies and organizations) was tasked with the oversight of the 2012 update. The group had previous involvement in the comprehensive strategic planning initiative, and members were already familiar with the scope of hazards, risks, and mitigation opportunities and projects in the City of Saint Paul. Members of this group were invited to participate in the stakeholder survey between April and August 2011 that established a baseline on which to build the 2012 plan update process.

The City of Saint Paul Emergency Management (Saint Paul EM) is the responsible agency for coordinating, drafting and monitoring this plan. Saint Paul EM facilitated the planning process with the Emergency Management Council (EM Council), as the Stakeholder Work Group (SWG) with participation from:

- Saint Paul Mayor's Office
- Saint Paul Animal Control
- Saint Paul District Councils
- Saint Paul Fire and Safety Services
- Saint Paul GIS
- Saint Paul Park and Recreation
- Saint Paul Police Department
- Saint Paul Public Works
- Saint Paul/Ramsey County Department of Public Health
- Saint Paul Risk Management
- Saint Paul Safety and Inspections
- Saint Paul Port Authority
- Saint Paul Public Schools

- Ramsey County Emergency Management
- Anoka County Emergency Management
- Metro Transit
- Metro Wastewater Treatment Plant
- Upper River Services
- Capitol Security
- Minnesota Department of Homeland Security and Emergency Management
- Minnesota National Guard
- Minnesota VOAD
- United State Coast Guard
- American Red Cross
- Salvation Army
- Saint Paul Chamber of Commerce
- Saint Paul Downtown Airport
- Business Owners and Managers Association
- Ever-Green Energy
- Qwest
- U.S. Bank
- Xcel Energy
- Xcel River Centre
- Allina and United Hospitals
- St. Joseph's Hospital
- Bethesda Long Term Care Hospital
- Colleges and Universities (Security)
- Minnesota Emergency Managers Association (MEMA)

(A full listing of EM Council/SWG members is included as **Appendix 1.**)

### ***Stakeholder Meetings and Coordination***

For the 2012 update, mitigation planning with stakeholders was coordinated through various methods. SWG meetings allowed face-to-face presentations and discussion-based input into the planning process and content. Email updates kept SWG members advised on progress and any issues that needed input.

The Stakeholder Working Group was invited through email to a kick-off meeting in March 2012 which included a presentation on the plan update project, planning process, and timeline. Periodic emails to stakeholders were utilized to request data updates and confirm information.

In April 2012, a second Stakeholder Group meeting was held to provide an update on the project, present draft sections of the plan and solicit input. Input showed a clear interest in what the department is doing for mitigation and feedback was positive.

For the purpose of the 2012 plan update, the Stakeholder Group's role and responsibilities included:

- Provide oversight for the broad scope of hazards and mitigation strategies and opportunities in the jurisdiction
- Review and update the current projects list
- Provide available data related to hazards, disasters, risks or vulnerabilities, and projects, including but not limited to policies, plans, procedures, studies, reports and maps
- Review and provide input for the mitigation plan draft
- Accept assignment for their agency as responsible entity to implement action steps/projects

Final SWG was held on April 27, 2012. Prior to the meeting a draft version of the plan was sent to each department or partner. Each department or partner was also given a list of previously identified projects to look over and determine what projects have been completed, are in process, or need to be removed. At this time additional projects and ideas were shared and integrated in the goals, strategies and priorities.

### ***Public Participation and Meetings:***

Citizen participation in mitigation planning efforts can bring to light significant local issues that are unknown to planners or have been lost during transition in City leadership and personnel. For the 2012 plan update, private citizen input was attained by:

- Having representation on the Stakeholder Work Group throughout development of the plan
- Through the use of a community survey developed by and distributed by Saint Paul Emergency Management during the planning update cycle;
- Through a publicly-noticed meeting to present mitigation planning information; and
- Through the opportunity to review the final draft plan online.

Analysis of the 2011 surveys completed by members of the Stakeholder Group and the 2012 public survey was completed in April 2012. The complete summary is available in **Appendix 4.11**. Feedback from the public surveys indicated that while citizens are very familiar with the hazards that produce the highest risk and vulnerabilities, they have generally taken no action to reduce the impact of hazards. This critical finding indicates the need to enhance mitigation education and information to the public, which is addressed as an action step in this plan. Specifically, the following findings were noted:

- Damaging winds, tornadoes, floods and criminal or terrorist events were judged to be of the most concern



- 81.3% viewed Hazard Mitigation planning, procedures, and implementation as either *Vitally Important* or *Very Important*. An additional 12.5% viewed them as *Important*
- Almost 60% of survey respondents admitted they had taken no action, such as preparing a family or home fire and/or emergency plan, to prepare for emergencies

Participation during plan development for the 2012 update included the two legally-noticed meetings, representation on the SWG, the online survey, and advertised access to the final draft of the updated plan. The public meetings were scheduled during the planning process to:

- Inform the public about Pre-Disaster Mitigation Planning
- Discuss steps currently being taken through hazard mitigation planning to protect the community
- Gather valuable information from the community regarding past disasters within the community
- Gain a community perspective regarding steps to be taken in the area of Pre-Disaster Hazard Mitigation
- Present some of the key goals and strategies discovered during the draft development of this plan

(Documentation of public participation (survey, emails, sign-in sheets, website page) is included in the **Appendix 3**.)

### ***Review of Plans, Studies and Reports***

A review of existing policies, plans, reports, studies, and information was conducted during the initial phase of creating the 2007 Saint Paul All Hazard Mitigation Plan. The primary purpose for review of the information in 2012 was to substantiate previously-identified hazards, assess the need to consider new hazards, assess and quantify risks and vulnerabilities, and develop hierarchies of predominant hazards based on vulnerability for each hazard.

First, the 2007 plan was reviewed with the assistance of individuals from multiple departments in the City of Saint Paul, with the previous plan as a starting point. Then, Saint Paul EM staff identified additional data and information that could be added to the 2012 plan update, including historical data, maps, charts and other graphical products. Tables were also developed for impact, consequence, probability, risk, and vulnerability to create hazard hierarchies that were used as the foundation to identify and define capabilities, and to further develop strategies, objectives and initiatives.

### ***Incorporation of Existing Documents into the Mitigation Plan***

After the review of existing documents and data, the information related to specific hazards has been incorporated into the 2012 plan update to ensure that the information in this plan is both current and relevant. New information incorporated and used to write the 2012 update includes:

- *Changes in development patterns and trends* – Each trend was defined and analyzed for potential impact on hazard impacts, consequences, and/or vulnerabilities.
- *State of Minnesota All Hazard Mitigation Plan*, this was in order to align the concepts.
- *Ramsey County All Hazard Mitigation Plan*, this was to insure that Saint Paul and Ramsey County are working together towards mitigation goals.
- Each individual plan for the City, including but not limited to the Saint Paul Comprehensive Plan, Central Corridor Plan, Mississippi Corridor Plan, Housing Plan, and Neighborhood Plan.
- City of Saint Paul Emergency Management Department Plans such as: Emergency Operations Plan (EOP), the Continuity of Operations Plan (COOP), and the Strategic Plan for the City.

### ***Public Participation for Future Plan Updates***

The process in 2012 for reviewing and revising the All Hazards Mitigation plan included public participation on several levels throughout the update cycle. The strategies used for the 2012 update included: public survey, notices to the public during the process, coordination with City neighborhood planning councils (through the SWG), and two public meetings. These strategies will be maintained during future update cycles and enhanced with additional activities that may be identified in the future, including, but not limited to information releases for neighborhood newsletters, and public information campaigns and/or media events related to proposed and completed mitigation projects.

In addition to public information provided during update cycles, a publicly-noticed meeting will be held following any declared disaster to present mitigation strategies, objectives and potential mitigation projects related to the hazard that caused the disaster, and to ensure that opportunities for comment and input are available to the public.

### ***Monitoring, Evaluation and Updating***

Per federal requirements stated in *44 CFR 201*, all local hazard mitigation plans are required to go through a FEMA update review cycle every 5 years to remain eligible for hazard mitigation grants.

The Saint Paul Hazard Mitigation Plan (SPHMP) will be monitored, evaluated, and updated annually (on a schedule determined by Saint Paul EM and the Mitigation Coordinator and documented in the implementing procedures for the SPHMP as well as

after any disaster declaration in the City of Saint Paul. Saint Paul EM staff will initiate the evaluation, review and update process with input from the SWG. (See also, Section V for additional details related to plan review and evaluation.)

## **Threat and Hazard Identification and Risk Assessment**

### **Introduction**

This section of the plan presents the hazard overview and detailed descriptions of natural, technological and man-made hazards that are known to impact the City of Saint Paul or are considered to be a threat to the people, property, infrastructure, environment, economic conditions and/or disaster operations of the City. The hazard descriptions are based on historical reports and information, predictive models, and other verified data collected from a broad range of sources to support the comprehensive risk and vulnerability assessment and consequence analysis. Hazard data and information provided in this plan should be used in the development and update of other City plans to provide a consistent foundation for all policies, plans and programs that potentially address the reduction of the risk, impacts, consequences and costs of disasters.

The City of Saint Paul categorizes hazards into two categories. One being natural as a stand alone category and the other category combining technical and man made hazards under one type. Each hazard will be discussed in detail with information such as the location and extent of hazard impact, history and probability of occurrence, impacts and consequences, repetitive losses associated with the hazard, capabilities related to mitigation of the hazards, and overall analysis of vulnerability.

*(2012 Update)* Hazard Reorganization: The category “Infrastructure Failure” has been created in order to encompass nine hazards that were previously identified as individual hazards. They are hazards that need to be recognized, but either involves actions that the City can do little to mitigate against, or is more of a cascade effect from other hazards that don’t impact the City by themselves, but could potentially cause serious impact or consequences to the City infrastructure. The “Terrorist and Criminal Acts” hazard category encompasses both Large Scale Threats of Violence (Criminal Acts) and Terrorism and CBRNE (Terrorism).

The only other reconfiguration made to the threat/hazard list in the 2012 update is that “Failure of a Dam/Levee” was moved to the natural hazard section due to the flooding impact that results from the dam/levee failure. This alteration is consistent with the change made in the 2011 State of Minnesota Mitigation Plan Update.

### **Natural Hazards List**

- Tornado
- Damaging Winds/Thunderstorms

- Flood
- Blizzard/Ice Storm
- Extreme Heat/Cold
- Natural or Urban Fire
- Drought
- Karst, Tunnels and Caves
- Earthquake
- Failure of a Dam/Levee
- Infectious Disease (Human or Animal)
- Invasive Species

**Natural Hazard Risk Assessment Summary Ranking Table (from Table 81):**

<b>NATURAL HAZARDS</b>	<b>VULNERABILITY ( I + C)= V</b>	<b>PROBABILITY</b>	<b>RISK V+P=R</b>
Damaging Winds/Thunderstorms	6.34	5	11.34
Tornado	6.2	5	11
Blizzard/Ice Storm	5.31	5	10.31
Flood	5.25	5	10.25
Infectious Disease	6.74	2	8.74
Extreme Heat/Cold	4.29	4	8.29
Dam/Levee Failure	5.25	2	7.25
Natural Fire	4.77	2	6.77
Karst, Tunnels and Caves	3.86	2	5.86
Drought	3.46	2	5.46
Invasive Species	3.03	2	5.03
Earthquake	2	1	3

### **Technological and Man Made Hazard List**

- Infrastructure Failure ( large scale fuel shortage, computer virus/hacker
- water supply contamination, natural gas leak, chemical leak/spill, hazardous material event, explosion, communication failure, and labor strikes)
- Animal Escape
- Major Community Events
- Large Scale Threats of Violence (labor strikes)
- Terrorism CBRNE

### **Threat and Hazard Identification and Risk Assessment Methodology**

The Threat/Hazard Identification and Risk Assessment (THIRA) process implemented in the 2012 update was developed to meet multiple hazard mitigation planning criteria which included FEMA *natural* hazard planning requirements under 44 CFR Part 201, and the *all-hazard (natural, man-made and technological)* planning requirements defined by the Emergency Management Accreditation Program (EMAP) Standard, Chapter 4.3, Hazard Identification, Risk Assessment and Consequence Analysis. The EMAP Standard provides specific guidance to the THIRA process in two applicable standards:

- 4.3.1 – The Emergency Management Program *shall identify the natural and human-caused hazards* that potentially impact the jurisdiction using a broad range of sources. The Emergency Management Program *shall assess the risk and vulnerability* of people, property, the environment, and its own operations from these hazards.
- 4.3.2 – The Emergency Management Program *shall conduct a consequence analysis* for the hazards identified in 4.3.1 to consider the impact on the public; responders; continuity of operations including continued delivery of services; property, facilities, and infrastructure; the environment; the economic condition of the jurisdiction, and public confidence in the jurisdiction’s governance.

Using these standards as a guide, this plan was updated to ensure that all hazards – natural, man-made and technologic were included. The hazards identified in the 2012 update are the same as those presented in the 2007 edition; however, in some cases the categories were reorganized or redefined and some hazards are presented in an overarching category, such as “infrastructure failure”. The impact and consequence analysis conducted for each hazard in this section is new to this update.

**NOTE: It is implied that the use of the word “hazard” is inclusive to all threats as well as hazards (natural, man-made and technological) when used in the general context of the process of identifying and analyzing impacts, consequences, and risks.**

Each hazard described in this section of the plan includes two parts that address the impacts, consequences and risks:

- Part E: includes a narrative description of each impact and consequence element that could potentially occur in relation to the hazard.
- Part H: provides a measured rating and summary of each impact and consequence element as well as overall vulnerability and risk related to the hazard in a matrix format.

## **Vulnerability and Risk Summary**

The step-by-step quantitative analysis of risk is accomplished through scored ranking of each impact and consequence element to attain a “vulnerability score”, and then adding the impact vulnerability score, consequence vulnerability score, and probability score together to get a hazard risk rating. The risk rating process allows the jurisdiction to establish a list of hazards that can be ranked in order of highest priority to develop projects based on the greatest opportunity for overall loss and risk reduction.

The following steps describe the process followed in the THIRA analysis.

### Step 1:

- Each hazard was considered against each impact element in the matrix based on the appropriate scoring tables and a numerical score was selected.

Example: Scoring Table:

Human	
Risk of injuries and deaths from the hazard	
1	Death very unlikely, injuries are unlikely
2	Death unlikely, injuries are minimal
3	Death unlikely, injuries may be substantial
4	Death possible, injuries may be substantial
5	Deaths probable, injuries will likely be substantial

- Impact scores for each element were totaled, averaged, and resulted in the “Impact Vulnerability Score”.

Example: Impact Summary Table with Scores:

HAZARD	IMPACTS					VULNERABILITY H+R+B+E+P=#; #/5=V
	Human	Residential Property	Business Losses	Environment	Program Operations	
Tornado	4	4	4	2	2	3.2

### Rating Scale Summary

The following rating scale was used for each impact and consequence element, and was also used to determine the Vulnerability and Hazard Risk Levels:

Scale	
Low	2 - 3.6
Moderate	3.7 - 5.2
Medium	5.3 - 6.8
High	6.9 - 8.4

Severe	8.5 - 10
--------	----------

**Step 2:**

- Consequence scores were assigned and calculated by the same process (using the same or similar Scoring Tables) to determine the “Consequence Vulnerability Score”.

Example: Consequence Summary Table with Scores:

HAZARD	CONSEQUENCES							VULNERABILITY P+R+C+P+En+Ec+Go =#; #/7=V
	Public	Responders	Continuity - Operations and Services	Property, Facilities and Infrastructure	Environment	Economic Condition	Public Confidence in Governance	
Tornado	5	2	2	5	2	3	2	3.0

**Step 3:**

- The Vulnerability Scores resulting from the Impact and Consequence tables were added with a numerical probability factor to determine the Hazard Risk Level.
- The probability ranking table was developed to relate frequency of occurrence to hazard impacts and consequences in order to determine the final hazard risk level.

Probability Ranking Table:

Probability/Frequency	
Frequency of Hazard occurrence based on historical occurrences or scientific data.	
1	No previous occurrences or losses documented
2	Somewhat probable, based on previous occurrences or losses
3	Moderately probable, based on previous occurrences or losses
4	Likely to occur, based on previous occurrences or losses
5	Very frequent occurrences, based on previous occurrences or losses

Example: Hazard Risk Summary Table with Score:

HAZARD	VULNERABILITY	PROBABILITY	RISK V+P=R
Tornado	6.2	5	11 - High

**Summary of Methodology:**

This process provided a method by which the jurisdiction can quickly identify priority hazards and risk levels. In addition, the detailed analysis of specific impact and consequence factors provides guidance for preparedness, response, recovery and mitigation plans and actions when a hazard occurs.

### ***Natural Hazards***

Natural disasters are examined on a local and statewide basis in order to determine what hazards have and could occur in the City of Saint Paul, as well as in the State of Minnesota or other jurisdictions that might impact the City. Natural disasters can be caused by climatological, geological, hydrological, or seismic events. These events are known to threaten lives, property and the environment.

2012 Update: No natural hazards have been added or eliminated from the jurisdiction's plan update. Information on each type of disaster has been reviewed and updated from the previous mitigation plan (2007).

## **TORNADO**

### **a. General Description**

Tornadoes are the most violent of summer storms. Although tornadoes may occur in many parts of the world, they are most common in the United States. In an average year in the United States, almost 800 tornadoes are reported. These result in an average of almost 90 deaths, over 1,500 injuries, and over \$436 million in damage. While tornadoes can occur in the City of Saint Paul any time of the year, most occur during the months of April through September. The month with the most activity in the past 53 years is July. Tornadoes can occur at any time of day but are mostly likely to form between the hours of 2 p.m. and 9 p.m.

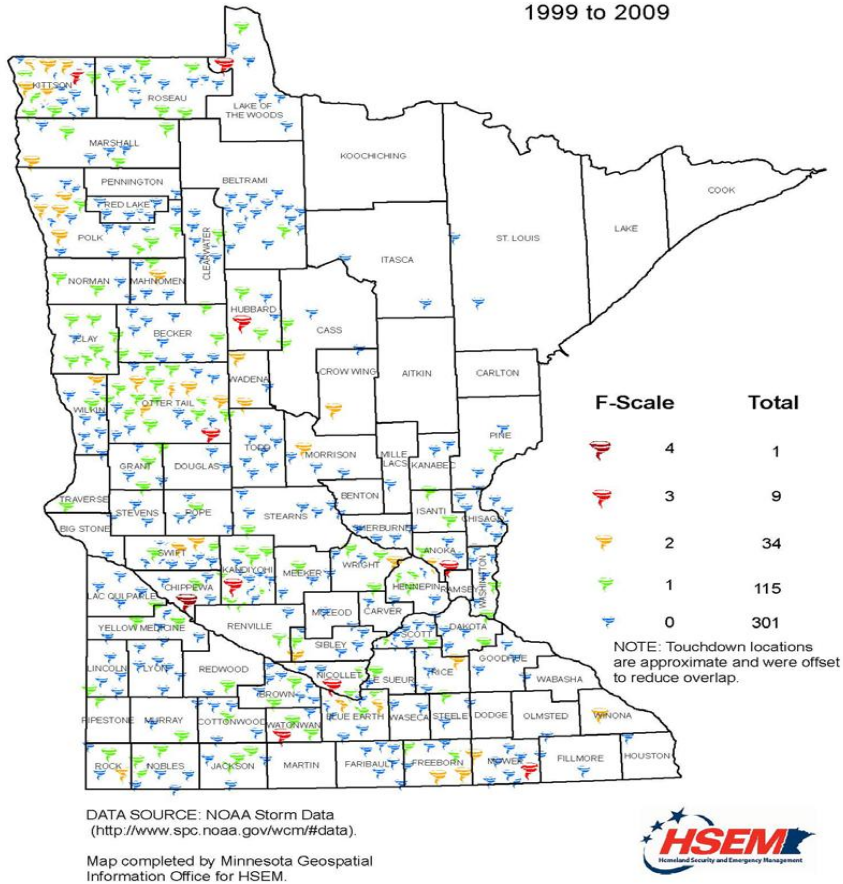
The following table provides a general assessment of tornado activities and preparedness indicators.



<p><b>TORNADO</b></p> <p><b>Assessment:</b> <b>High Risk Hazard</b></p>	<p><b>Location</b> – Citywide  <b>Extent</b> – The results would be devastating towards human, property, business, environment and the Emergency Management in partial cases as well as possibly all above mention areas.  <b>Probability</b>--Moderate  <b>Duration</b> – Less than a day  <b>Seasonal pattern</b> – Spring/Summer/Fall  <b>Speed of Onset</b> - Rapid  <b>Warning time</b> – Minimal (minutes) for actual tornado, hours/days for accompanying storm pattern  <b>Repetitive Loss</b>- N/A</p>	<p><b>CASCADING EFFECTS</b></p> <ul style="list-style-type: none"> <li>• Power/utility outages</li> <li>• Traffic/roadway damage</li> <li>• Visitor/staff safety</li> <li>• Medical attention for visitors/staff</li> <li>• Animal escape (Como Zoo)</li> <li>• Vehicle fleet could be unusable</li> <li>• Communication breakdown</li> </ul>
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**Map 2:** Tornado Touchdown below illustrates the number of tornadoes in the State of Minnesota from 1999-2009.

## Tornado Touchdowns 1999 to 2009



Source: National Oceanographic and Atmospheric Administration and City of Saint Paul Office of Homeland Security and Emergency Management

A tornado is a rapidly rotating vortex or funnel of air extending from a cumulonimbus cloud to the ground. It is usually spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Often, vortices remain suspended in the atmosphere as funnel clouds. When the lower tip of a vortex touches the ground, it becomes a tornado and a force of destruction. Damage from a tornado is caused by high wind velocity and wind-blown debris. Environmental clues of a developing tornado include a dark, “greenish” sky, a wall cloud, large hail, and/or a loud roar that is compared to the sound of a freight train.

The Enhanced Fujita Tornado Scale measures tornado-damage severity. The Enhanced Fujita Scale assigns a numerical value based on wind speeds and categorizes tornadoes from EF0 to EF5. Scale values above EF5 are not used because wind speeds above 318 mph are unlikely. The Enhanced Fujita Scale was updated in 2007. (2012 Update)

The Enhanced F-scale is a set of wind estimates (not measurements) based on damage. It uses three-second gusts estimated at the point of damage based on a judgment of eight levels of damage to the 28 indicators listed in **Table 8** below. These estimates vary with height and exposure.

**Table 8:** THE ENHANCED F-Scale (adopted February 1, 2007):

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

*Source: Storm Prediction Center, National Weather Service*

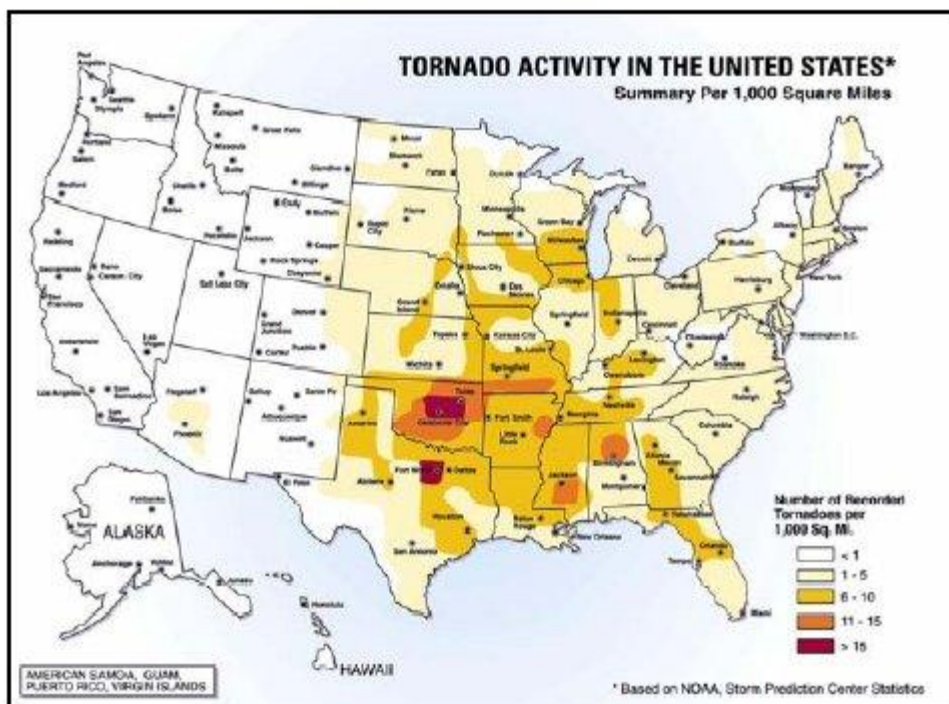
#### **b. Location**

The City of Saint Paul has had 1-5 F3, F4, and F5 tornadoes per 1,000 square miles (see **Map 3**, below).

While Minnesota tornadoes can occur with greatest frequency during the late spring and early summer months and at all hours of the day or night, they typically occur during late afternoon and early evening hours. In the City of Saint Paul, most wind damage in the past ten years has been limited to downed trees, blocked roads, and interrupted power lines.

The map below illustrates the number of recorded tornado strikes per 1,000 square mile sectors.

**Map 3:** Tornado Strikes per 1,000 Square Mile Sectors



Source: NOAA

### c. Extent

A key point to remember is this: *the size of a tornado is not necessarily an indication of its intensity*. Large tornadoes *can* be weak, and small tornadoes *can* be violent. Another consideration is the stage in the life cycle of the tornado. A “small” tornado may have been larger, and is at the “shrinking” stage of its life cycle. Large tornadoes can also be strong and small tornadoes can be weak. The destruction caused by tornadoes may range from light to severe depending on the intensity of the storm and the travel path. Typically, tornadoes cause the greatest damages to structures of light construction, such as residential homes. Tornadoes occurring between May to August tend to be the strongest, resulting in the greatest amount of physical harm and property damage.

**The Map 4:** below illustrates that the City of Saint Paul has had 1-5 F3, F4, and F5 tornadoes per 1,000 square miles.



Number of Recorded  
Tornadoes per 1,000  
Square Miles

	<1
	1-5
	6-10

### d. History and Probability

Minnesota ranks 17 out of the 50 states for frequency of tornadoes, 18 for number of tornado related deaths, 19 for injuries and 6 for cost of damages. This is based on information from 1950-1995 from the Disaster Center Risk of Tornado by State.

Below is a table of historic tornado occurrences in the State of Minnesota with comments regarding magnitude and deaths. As a note, Minnesota had an historic year in regards to tornadoes in 2010 with 104 tornadoes reported (4 rated at the EF-4 level, 4 rated at the EF-3 level, 8 rated at the EF-2 level, 30 rated at the EF-1 level, and 58 rated at the EF-0 level). There were three deaths, 46 injuries (all were on June 17 except one injury on August 13). This year exceeded previous records of 74 tornadoes in 2001, and 27 in one day on June 16, 1992, as June 17, 2010 had 48 on one day and the year total exceeded 100.

**Table 9:** Historic tornado occurrences in the State of Minnesota

Historic Tornado Occurrences in Minnesota		
Date	Location	Comment
May 22, 2011	Minneapolis	One death
June 17, 2010	Statewide	State record one day total of tornadoes (48)
August 19, 2009	Twin Cities/ Minneapolis	Several tornadoes touched down during the same storm in the Metro area
July 10, 2008	Dakota County and Goodhue County	Both EF-0
May 25, 2008	Hugo	One death
September 20, 2007	Woodbury	EF-0
September 16, 2006	Rogers	One death
August 24, 2006	Lake Emily, near Kasota	One dead, 37 injured
June 11, 2004	Mower	F3 category tornado
June 24, 2003	Buffalo Lake	F2 category caused 5 injuries
June 13, 2001	Parkers Prairie	F3 category caused 3 injuries
July 25, 2000	Granite Falls	One death.
March 29, 1998	St. Peter and Comfrey	The greatest March tornado outbreak in Minnesota history. Two people died in a family of 13 tornadoes.
June 14, 1981	Twin Cities from Edina to Roseville	One dead, 83 injured.
August 6, 1969	Outing	Twelve dead and 70 injured.
June 13, 1968	Tracy	Nine dead, 125 injured.

On May 6, 1965	Twin Cities Metro area	The most damaging series of tornadoes in Minnesota slashed across west and north sections of the killing 14 persons and injuring 685 with damage in excess of \$50 million. On this day, eight tornadoes struck south central MN including three that were rated F4. 11 people were killed and 81 were injured. A four block wide swath was cut in the town of Waseca.
June 20, 1957	Moorhead, MN & Fargo, ND	Ten dead and more than 100 injured.
May 10, 1953	Southeast Minnesota	Seven dead and 19 injuries.
August 17, 1946	Mankato, North Mankato, Wells	About an hour apart, tornadoes slashed through the cities, leaving 11 dead and 60 injured (Mankato and North Mankato, and 200 injuries in Wells.

Source: National Weather Service Twin Cities/Chanhassen, MN

**Table 10: Historic Tornado Statistics**

**Minnesota Tornado Statistics 1950 -2011**

<b><u>1950 - 2011</u></b>	<b><u>Totals</u></b>	<b><u>Annual Averages</u></b>
Tornadoes	1684	27
Tornado Deaths	99	1.60
Tornado Injuries	1981	32.0

Source: National Weather Service Twin Cities/Chanhassen, MN

**e. Risk, Impact, Vulnerability and Consequences**

**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for tornadoes is summarized in narrative format ([Part E](#)) and in table format ([Part I](#)) in this Section.

In general, the City of Saint Paul is highly vulnerable to tornadoes which could be catastrophic to people, structures, and infrastructure, and cause large numbers of injuries and fatalities, building losses, and disruption of critical infrastructure.

Vulnerable populations identified by the jurisdiction include people who speak limited English, the elderly, lower socioeconomic status, disabled (physical and mental) and people who do not have access to traditional methods of communication in order to receive warnings (i.e. no TV, radios or internet, or are vision or hearing impaired).

Urban density is also considered vulnerability due to the increased population within the downtown core, both residents and workers who commute to the area during business hours.

Land use in the City of Saint Paul is mixed between residential, commercial and government uses. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged or lost. A tornado hitting any area of Saint Paul would likely cause severe damage to property.

#### 1) General

While tornadoes can occur in the City of Saint Paul any time of the year, most occur during the months of April through September. The month with the most activity in the past 53 years is July.

#### 2) Life Safety (Public and Responders)

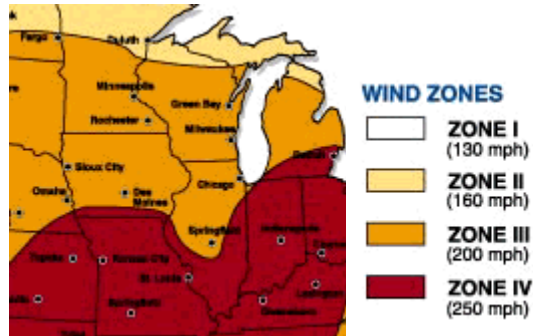
Fortunately, there are only three recorded deaths related to tornadoes (August, 1904). However, the possibility of loss of life is significant if the City is hit directly by a tornado of any magnitude due to the dense urban development of the city. In addition, the safety of emergency responders could be at risk during search and rescue operations following impact or in response to fires or hazardous material spills caused by the tornado.

#### 3) Property (Facilities and Infrastructure)

A tornado striking within the City of Saint Paul would have the high likelihood of damaging buildings (residential, commercial, industrial, and governmental) as well as critical infrastructure such as communications, transportation, electric utilities, water, sewer, and gas.

Most property losses from tornadoes occur to residential structures. People living in manufactured or mobile homes are at highest risk to damage from tornadoes. Mobile homes are not constructed to withstand the high wind speeds and intensity as well as site built structures. There are no mobile home parks in the City of Saint Paul, however there are many in Ramsey County.

**Map 5:** City of Saint Paul is in Wind Zone III.



The following chart illustrates the level of risk for the City of Saint Paul related to number of tornadoes and map Wind Zone. Because the City is in Wind Zone III and has 105 tornadoes per 1,000 square feet, this puts the city at high risk. Due of this level of risk, sheltering is the preferred protective measure.

**Table 11:** Wind Zone

		WIND ZONE			
		I	II	III	IV
NUMBER OF TORNADOES PER 1,000 SQUARE MILES	<1	LOW RISK	LOW RISK	LOW RISK	MODERATE Risk
	1-5	LOW RISK	MODERATE Risk	HIGH RISK	HIGH RISK
	6-10	LOW RISK	MODERATE Risk	HIGH RISK	HIGH RISK
	11-15	HIGH RISK	HIGH RISK	HIGH RISK	HIGH RISK
	>15	HIGH RISK	HIGH RISK	HIGH RISK	HIGH RISK
LOW RISK		MODERATE RISK		HIGH RISK	
Need for high-wind shelter is a matter of homeowner preference		Shelter should be considered for protections from high winds		Shelter is preferred for protection from high winds	

The City of Saint Paul has adopted the 2007 Minnesota State Building Code. Sections of the code that address disaster mitigation for high risk hazards include:

- 1335 Flood proofing Regulations (adopts with amendments 1972 Flood proofing Regulations)



- 1370 Storm Shelters – Manufactured Home Parks (adopts with amendments the 1980 Interim Guidelines for Building Occupant Protection from **Tornadoes and Extreme Winds**)

Information related to specific code requirements may be found at:

[http://www.dli.mn.gov/ccld/PDF/bc\\_2007msbc.pdf](http://www.dli.mn.gov/ccld/PDF/bc_2007msbc.pdf)

#### 4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a tornado. Each City department is also required to draft and maintain a COOP. The Emergency Management Department would be able to direct operations from pre-designated sites outside the city (or inside depending on the path and level of destruction) and would be less vulnerable to loss of services and resources if the storm caused damage to multiple areas in the City. In addition to communications infrastructure, resources such as facilities, vehicles, equipment and supplies could be the most vulnerable element of operations, as tornadoes can destroy everything in their path.

#### 5) Environment

The environmental vulnerabilities due to a tornado include water contamination or pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine storm clean-up, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from a tornado is low.

#### 6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of state government operations. In addition to government offices, a number of national and international businesses and industries are headquartered in the City. A significant tornado could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

#### 7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby

indicating that a high level of confidence can improve the effectiveness of preparedness<sup>1</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public. Based on this survey, 94% of survey responders believe that mitigation planning is vitally important or very important.

#### **f. Repetitive Losses**

In regards to tornadoes, repetitive loss information has not been collected or maintained. (2012 update)

#### **g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

#### **h. Hazard Analysis Summary--Tornadoes**

The tables in this section summarize the information described above in the Section H narrative for tornadoes, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating. (HIRA methodology is described in Section 2.A).

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 12: - Summary of Impact Vulnerability Ratings for Tornadoes**

<b>HAZARD</b>	<b>IMPACTS</b>					<b>VULNERABILITY (H+R+C+E+P=#; #/5=V)</b>
	Human (H)	Residential Property (R )	Business Losses (B)	Environment (E)	Program Operations (P)	
<b>Tornado</b>	4	4	4	2	2	<b>3.2</b>

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<sup>1</sup> "Understanding Public Confidence in Government to Prevent Terrorist Attacks"; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 13: - Summary of Consequence Vulnerability Ratings for Tornadoes**

<b>HAZARD</b>	<b>CONSEQUENCES</b>							<b>VULNERABILITY</b> ( $P+R+C+P+En+Ec+G=\#$ ; $\#/7=V$ )
	Public	Responders	Continuity (Ops & Services)	Property, Facilities, Infrastructure	Environment	Economic Condition	Public Confidence in Governance	
Tornado	5	2	2	5	2	3	2	<b>3.0</b>

**Table 14: - Summary of Total Risk for Tornadoes**

<b>HAZARD</b>	<b>VULNERABILITY</b> ( $I+C=V$ )	<b>PROBABILITY</b>	<b>RISK</b> $V+P=R$
<b>Tornado</b>	<b>6.2</b>	<b>5</b>	<b>11 - HIGH</b>

## DAMAGING WINDS/THUNDERSTORM

### a. General Description

Thunderstorms are the by-products of atmospheric instability, which promotes the vigorous rising of air parcels. All thunderstorms produce lightning and thunder. Some have the potential to produce damaging straight-line winds, large hail, heavy rain, flooding, and tornadoes. A typical thunderstorm may cover an area three miles wide. The National Weather Service considers a thunderstorm “severe” if it produces tornadoes; hail of 0.75 inches or more in diameter, or winds of 58 mph or more.

The following table provides a general assessment of thunderstorm activities and preparedness indicators.

<b><u>DAMAGING WINDS/THUNDERSTORM</u></b>  <b>Assessment:</b> <b>High Risk Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> – The results would be devastating towards human, property, business, environment and the Emergency Management Department <b>Probability</b> --Moderate <b>Duration</b> – Several minutes to several hours <b>Seasonal pattern</b> – Spring/Summer <b>Speed of Onset</b> - Rapid <b>Warning time</b> – Several hours <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Power/utility outages</li><li>• Traffic/roadway inaccessibility</li><li>• Visitor/staff safety</li><li>• Medical attention for visitors/staff</li><li>• Immediate need for forestry crews and equipment</li><li>• Loss of deliverable services</li><li>• Increased risk of employee injury</li><li>• Communication breakdown</li></ul>
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#### a. 1 Lightning

Lightning is the most frequent hazard associated with thunderstorms, and the hazard that causes the most loss of life. An average of 73 people die and 300 people are injured each year in the U.S. by lightning. Lightning occurs to balance the difference between positive and negative discharges within a cloud, between two clouds, or between the cloud and the ground. Lightning bolt strikes happen when the difference between the two charges becomes great enough. The charge is usually strongest on tall buildings, trees, and other objects protruding from the surface thus these are more likely to be struck than lower objects.

#### a. 2 Hailstones

Hailstorms are products of the updrafts and down drafts that develop inside the cumulonimbus clouds of a thunderstorm where super-cooled water droplets exist. What we generally call hailstones have passed through several stages of accretion, from the first stage, called graupel, to small hail, to hailstones. Sometimes only the first stage is reached; at other times

hailstones from two or more stages may fall to earth simultaneously. By scientific agreement, an icy conglomeration is called a hailstone when it reaches a diameter of 1/5 inch (5 mm). In all its forms, hail usually occurs in relatively short episodes rather than as steady precipitation. Hail causes much damage and injury to crops, livestock, property, and airplanes.

**Table 15:** Estimated Hail Size

Estimated Size	Average Diameter	Estimated Size	Average Diameter
Pea	¼ inch	Golf Ball	1 ¾ inch
Marble/mothball	½ inch	Tennis Ball	2 ½ inch
Dime/Penny	¾ inch	Baseball	2 ¾ inch
Nickel	7/8 inch	Tea Cup	3 inch
Quarter	1 inch	Grapefruit	4 inch
Ping-Pong	1 ½ inch	Softball	4 ½ inch

a. 3 Windstorms

Windstorms can include tornadoes, downbursts, and straight-line winds. Since Minnesota is not a coastal state, windstorms are usually of fairly short duration, very intense and hard to predict. Straight-line winds often impact a wider area than tornadoes.

The primary effect on buildings is structural damage due to the lifting or suction force of the wind from the exterior, as well as the blowout force of the wind if it penetrates the interior. The results can be loss of roofs, walls, porches, lifting the building off the foundation, or complete destruction. Other sources of wind damage are from trees and wind-born objects and debris. Rain during or after a windstorm is also a threat, this is because the damaged building is left unprotected and water infiltration can cause additional damage.

**Table 16:** Wind Speeds

Wind Speed	Effects
22 – 27 knots	Large branches in motion, whistling in telephone wires
28 – 33 knots	Whole trees in motion
34 – 46 knots	Twigs break off of trees, wind impedes walking
47 – 62 knots	Damage to chimneys and TV antennas, pushes over shallow rooted trees
63 – 96 knots	Peels surface off roofs, windows broken, trailer houses overturned
96+ knots	Roofs torn off houses, weak buildings and trailer houses destroyed, large trees uprooted

These downbursts are parcels of air that interact with the jet stream in the top of the thunderhead, become very dense and sink at great speed, producing shafts of air up to several miles in diameter that descend from the base of a thunderhead, hit the ground going straight downwards and splatter out in all directions, creating oval-shaped damage zones elongated in the direction of movement of the storm (individual downbursts are on the order of 5x10 miles, roughly the size of Minneapolis). Wind speeds in downbursts are usually F1 on the Fujita scale (73-112 miles per hour), but sometimes they reach F2 velocities (113-157 mph).

#### **b. Location**

All thunderstorms have lightning. Any location that is prone to thunderstorms is at risk for damaging winds due to the draft of the airflow. Hail is a product of thunderstorms. All the above mentioned risks may occur in the City of Saint Paul. There have been several severe storms since records have been kept, including 7 since the last update of this plan. See **Table 17: Historical Minnesota Severe Storm Disaster Declarations** for dates.

#### **c. Extent**

Each year, many people are killed or seriously injured by severe thunderstorms despite the advance warning. While severe thunderstorms are most common in the spring and summer, they can occur just about anytime of the year if the conditions are right.

Damage from severe thunderstorm winds account for half of all severe reports in the lower 48 states and is more common than damage from tornadoes. Many hazardous weather events are associated with thunderstorms. Lightning is responsible for many fires around the world each year, as well as causing deaths when people are struck. Under the right conditions, rainfall from thunderstorms causes flash flooding, which can change small creeks into raging torrents in a matter of minutes, washing away large boulders and most man-made structures. Hail up to the size of softballs damages cars and windows, and kills wildlife caught out in the open. Wind speeds can reach up to 100mph and can produce a damage path extending for hundreds of miles. These winds are often called "straight-line" winds to differentiate the damage they cause from tornado damage.

#### **d. History and Probability**

**Table 17:** Historical Minnesota Severe Storm Disaster Declarations

Year	Date	Incident Description
2011	28-Jul	Severe Storms, Flooding, and Tornadoes
2011	7-Jun	Severe Storms And Tornadoes
2011	10-May	Severe Storms and Flooding
2010	13-Oct	Severe Storms and Flooding
2010	2-Jul	Severe Storms, Tornadoes, and Flooding
2009	9-Apr	Severe Storms and Flooding
2008	25-Jun	Severe Storms and Flooding
2007	23-Aug	Severe Storms and Flooding
2004	7-Oct	Severe Storms and Flooding
2002	14-Jun	Severe Storms, Flooding and Tornadoes
2000	27-Jun	Severe Storms, Flooding And Tornadoes
1999	26-Aug	Severe Ice Storms, Flooding and Heavy Rains
1999	28-Jul	Severe Storms, Winds and Flooding
1998	23-Jun	Severe Storms, Straight-Line Winds And Tornadoes
1998	1-Apr	Tornadoes and Severe Thunderstorms
1997	8-Apr	Severe Storms/Flooding
1995	18-Aug	Severe Storm, Thunderstorm, High Winds, Flooding, Tornadoes, Heat
1993	11-Jun	Flooding, Severe Storm, Tornadoes
1992	26-Jun	Flooding, Severe Storm, Tornadoes
1987	6-Aug	SEVERE STORMS, TORNADOES, FLOODING
1979	30-Apr	SEVERE STORMS, FLOODING
1978	8-Jul	Severe Storms, Tornadoes, Hail, Flooding
1975	17-Jul	SEVERE STORMS, TORNADOES, FLOODING
1974	13-Jul	SEVERE STORMS, FLOODING
1972	25-Aug	SEVERE STORMS, FLOODING
1972	1-Aug	SEVERE STORMS, FLOODING

d. 1 Lightning

Lightning events have not been closely recorded. In 1998 one person in White Bear Lake was killed when lightning struck a tree he was standing under. However, lightning does have very real consequences due to the unpredictable nature of this natural event.

d. 2 Hailstorms

**Table 18:** Dates of hail in the City of Saint Paul where the hail exceeded 0.75 inches in diameter.

Date	Time	Size of Hail
06/15/1997	13:34	0.75 in.
06/28/1997	08:56	0.75 in.
05/15/1998	15:35	1.00 in.
06/16/1998	15:32	1.00 in.
06/16/1998	16:48	0.75 in.
08/09/1998	18:50	0.75 in.
08/09/1998	18:56	1.25 in.
05/01/2001	17:00	1.25 in.
04/18/2002	02:30	1.00 in.

d. 3 Windstorms

**Table 19:** Dates of windstorm with winds exceeding 50 knots.

Date	Time	Knots
05/19/1996	00:31	54 kts.
08/06/1996	08:00	60 kts.
05/15/1998	15:38	61 kts.
05/30/1998	21:55	67 kts.
06/25/1998	00:22	60 kts.
06/26/1998	10:05	65 kts.
06/06/1999	14:58	60 kts.
06/23/2003	03:00	50 kts.
06/24/2003	22:00	52 kts.

e. **Risk, Impact, Vulnerability and Consequences**



**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for Damaging Winds/Thunderstorms is summarized in narrative format (Part E) and in table format (Part I) in this Section.

In general, the City of Saint Paul is highly vulnerable to severe storms with damaging winds which could be catastrophic to people, structures, and infrastructure, and cause large numbers of injuries and fatalities, building losses, and disruption of critical infrastructure.

Vulnerable populations identified by the jurisdiction include people who speak limited English, the elderly, lower socioeconomic status, disabled (physical and mental) and people who do not have access to traditional methods of communication in order to receive warnings (i.e. no TV, radios or internet, or are vision or hearing impaired).

Urban density is also considered vulnerability due to the increased population within the downtown core, both residents and workers who commute to the area during business hours.

Land use in the City of Saint Paul is mixed between residential, commercial and government uses. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged or lost. A tornado hitting any area of Saint Paul would likely cause severe damage to property.

1) General

Severe thunderstorms/damaging winds occur in Ramsey County with great frequency. In the last 20 years there have been over 100 storms recorded in Ramsey County. While severe storms can occur in the City of Saint Paul any time of the year, most occur during the months of April through September.

2) Life Safety (Public and Responders)

Due to the dense urban development of the city, the possibility of loss of life is significant if the City is affected by a severe storm especially if more than one component is present (such as severe winds and large hail at the same time).

There are several vulnerable populations in the City, such as people who speak limited English, are elderly, socioeconomic status, have disabilities (physical and mental) and people who do not have the regular methods available to them

in order to receive warnings (i.e. No TV, internet or are hearing impaired). The density of downtown is also a vulnerable aspect.

### 3) Property (Facilities and Infrastructure)

A severe storm hitting the City of Saint Paul would have the high likelihood of damaging buildings (residential, commercial, industrial, and governmental) as well as critical infrastructure such as communications, transportation, electric utilities, water, sewer, and gas.

Most property losses occur to residential structures. Mobile homes are not structured to withstand the high speeds as well as site built structures. There are no mobile home parks in the City of Saint Paul, but there are many in the surrounding communities.

Due of this level of risk, sheltering is the preferred protective measure.

The City of Saint Paul has adopted the Minnesota State Building Code.

### 4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management Department has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a tornado. Each City department is also required to draft and maintain a COOP. The Emergency Management Department would be able to direct operations from pre-designated sites outside the city (or inside depending on the path and level of destruction) and would be less vulnerable to loss of services and resources if the storm caused damage to multiple areas in the City. In addition to communications infrastructure, resources such as facilities, vehicles, equipment and supplies could be the most vulnerable element of operations, as severe storms and damaging winds can cause serious damage to anything in their path.

### 5) Environment

The environmental vulnerabilities due to a severe storm include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine storm clean-up, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from a tornado is low.

### 6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant storm (wind, hail) could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

## 7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>2</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public. Based on this survey, 94% of survey responders believe that mitigation planning is vitally important or very important.

### **f. Repetitive Losses**

In regards to tornadoes, repetitive loss information has not been collected or maintained. *(2012 update)*.

### **g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

### **h. Hazard Analysis Summary – Damaging Winds/Thunderstorms *(2012 update)***

The tables in this section summarize the information described above in the Section H narrative for damaging winds/thunderstorms, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

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<sup>2</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 20: - Summary of Impact Vulnerability Ratings for Damaging Winds/Thunderstorms**

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Damaging Winds/Thunderstorms	4	4	4	2	2	3.2

**Table 21: - Summary of Consequence Vulnerability Ratings for Damaging Winds/Thunderstorms**

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Damaging Winds/Thunderstorms	4	3	2	5	2	3	3	3.14

**Table 22: - Summary of Total Risk for Damaging Winds/Thunderstorms**

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
Damaging Winds/Thunderstorms	6.34	5	11.34

## FLOOD

### a. General Description

Flooding occurs when climate or weather patterns, geology, and hydrology combine to create conditions where water flows outside of its usual course. For floodplain management purposes the Federal Emergency Management Agency uses the following definition of a “100 year flood”:

A 100-year flood means that the flood elevation has a 1 percent chance of being equaled or exceeded in magnitude in any given year. Therefore, the 100-year flood could occur more than once in a short period of time. A structure located within a special flood hazard area has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage.

The following provides a general assessment of flood activities and preparedness indicators.

<b><u>FLOOD</u></b>  <b>Assessment:</b> <b>High Risk Hazard</b>	<b>Location</b> – Mississippi river flood plain (Lowertown, Westside, Hidden Falls, Crosby, Harriet Island, Lilydale, Lampert’s landing, Pig’s Eye WRC, Battle Creek and Upperlanding Development) <b>Extent</b> – Major damage to buildings and property <b>Probability</b> --Moderate <b>Duration</b> – Several weeks <b>Seasonal pattern</b> – Spring/Summer <b>Speed of Onset</b> - Slow <b>Warning time</b> – Days <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Power/utility outages</li><li>• Traffic/roadway damage/closures</li><li>• Visitor/staff safety</li><li>• Increased security</li><li>• Loss of deliverable services</li><li>• Major redirect of staff/equipment</li><li>• Loss of revenue</li></ul>
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### b. Location

A floodplain is a land area that is adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding. This area acts to store water if left undisturbed, and is made up of two sections: the floodway and the flood fringe. The floodway is defined for regulatory purposes, but does not reflect a recognizable geologic feature. The NFIP defines a floodway as the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that floodways be kept open and free from development or other structures that would impede the flow of water or divert flood flows onto other properties. Floodways are not mapped for all rivers and streams, but are generally mapped in developed areas.

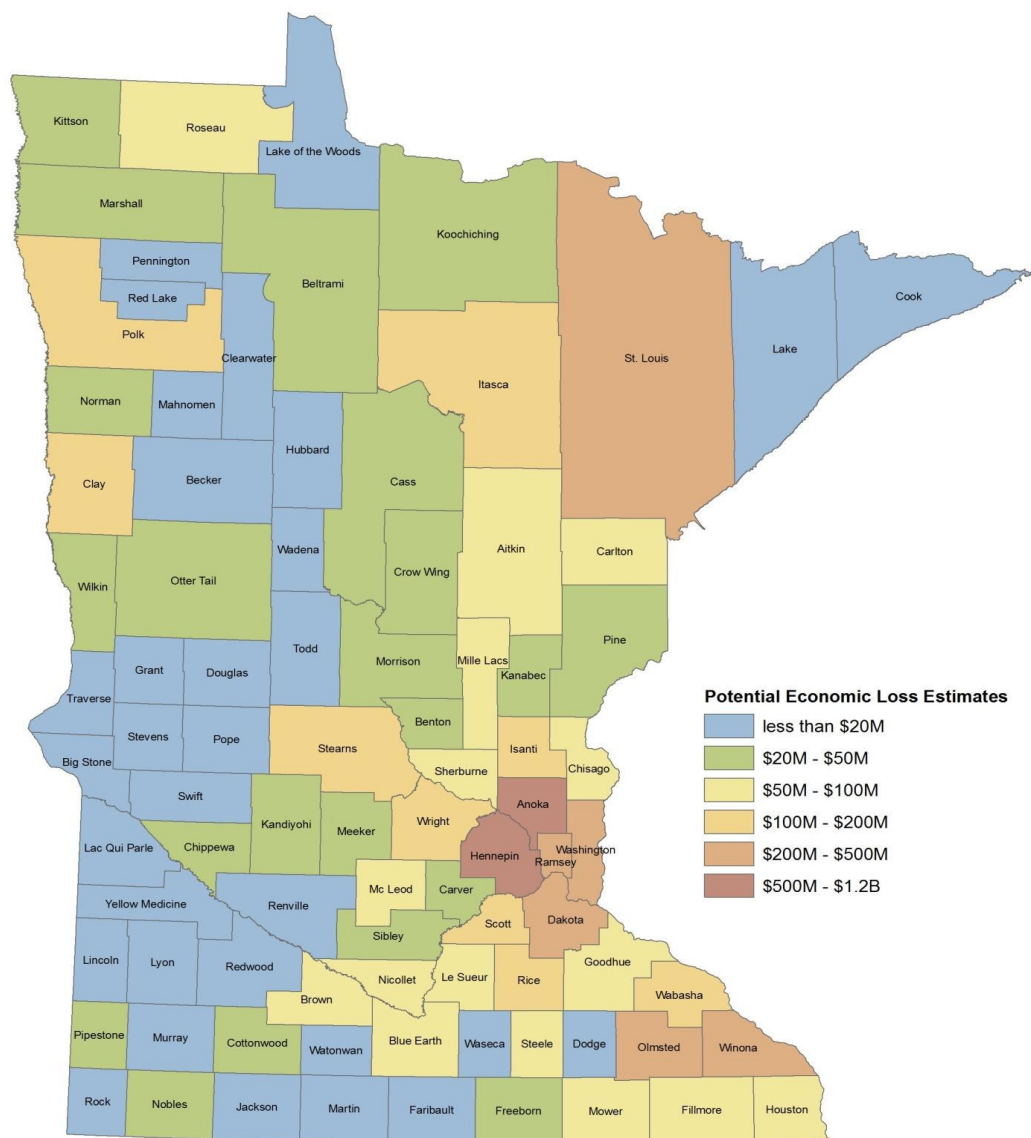
The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. The flood fringe is defined as the land area that is outside of the stream's floodway, but is subject to periodic inundation by regular flooding. This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken.

Urban flooding occurs when there is a torrential rainstorm that is beyond the capability of the existing infrastructure. Increasing development and aging storm sewer and drainage systems are two frequent contributors to urban flooding. This kind of flooding does not necessarily occur in the floodplain.

**c. Extent**

Floods are the number one hazard in Minnesota in terms of frequency of occurrence and total damages. Below is a map of Minnesota that has the potential of economic loss for 100-year flood, Ramsey County is in the dark orange, stating the damage could range from \$200-\$500 million. The economic loss in this study includes lost jobs, business interruptions, and repair and reconstruction costs.

**Table 23: Potential Economic Loss Estimates for 100 Yr. Flood**



Source: Minnesota Board of Water and Soil Resources

The term stage refers to the height of a river (or any other body of water) above a locally defined elevation. Most rivers in the United States have gauging stations where measurements are continually made of the river's stage and discharge. These are plotted on a graph called a hydrograph, which shows the stage or discharge of the river, as measured at the gauging station, versus time.

The main factors that cause flooding are heavy rainfall, sudden or heavy snow melt, and dam failure. If rainfall is heavier than normal in a particular area and

infiltration, interception, and evaporation are low then runoff can be high and the likelihood of flooding will increase.

**Table 24:** Flood Impacts in the City of Saint Paul

14 feet	Minor Flood Stage
14 feet	Water Street Closed
14 feet	Lilydale Park area begins to become submerged
17 feet	Major Flood Stage
17 feet	Secondary flood walls are deployed at Saint Paul airport
17.5 feet	Harriet Island begins to become submerged
18 feet	Sheppard / Warner Road may become impassable

The City of Saint Paul has spent considerable efforts towards flood and flood related issues. There have been flood protection plans, engineering studies and construction projects done since 2007. Recently there have been flood mitigation studies done on Lowertown in order to identify and conceptualize alternatives for constructing permanent flood protection systems.

Below is a list of flood protection plans, engineering studies, and construction projects that have been completed by the Sewer Utility (Saint Paul Public Works) since 2007.

**East Side and Lowertown Projects:**

**1. Sibley Storm Sewer Project:**

In 2011 a local storm sewer system was reconstructed in Sibley Street (between Kellogg and Shepard Road) to help reduce the impact of rising flood waters on other areas of Lowertown. A new flood sewer slide gate was also constructed.

**2. Broadway-Kellogg Storm Sewer Modifications:**

In 2012 storm sewers in and near the intersection of Broadway and Kellogg will be reconstructed to simplify the flood preventative measures needed in the area.

**3. Jackson Street Storm Water Pump Station:**

Spring 2011 installed manual transfer switch and generator plug in at Jackson Flood Station.



4. Purchase of Flood Barrier Systems:

In 2011 two types of flood barrier systems were purchased, (180) units of the Big Bag barriers, and (78) units of Hesco barriers.

**Engineering Studies and Grant Applications:**

1. Lowertown Flood Mitigation Study:

In 2010 an engineering study was completed to identify and evaluate conceptual alternatives and costs for constructing permanent flood protection systems in Lowertown.

2. 2012 State Bonding Bill Application:

In 2011 a state bonding bill application was submitted for a "Lowertown Flood Damage Reduction Project"

3. DNR Grant Application:

In 2011 a DNR grant application was submitted for a "Lowertown Flood Damage Reduction Project"

**West Side (Permanent Levee System):**

1. Relocation of Power Poles:

In 2009 and 2011 power poles and chain link fences located within or near the levee prism were relocated to comply with U.S. Army Corps of Engineers (USACE) rules.

2. Closure 8 Modification Project:

In 2011 the north sill bay for structural closure 8 was raised by 1-foot to help reduce the frequency at which the closure may need to be installed and reduce the frequency of railroad service interruptions.

3. Removal of Trees, Shrubs, Unwanted Vegetation:

To comply with U.S. Army Corps of Engineers (USACE) rules many trees and shrubs were relocated or removed from areas located within or near the levee prism. Unwanted vegetation was also removed from the ripped areas of the levee.

4. Flood Pump Stations:

In spring of 2010 relocated telephone from the wet side of levee to dry side at Moses Flood Pump Station. There was also a new telephone line installed at Custer Flood Pump Station.

**Engineering Studies, Documentation, and Tests:**

1. FEMA Levee Certification Project:

In December of 2011 levee documentation and calculations were submitted to FEMA in accordance with the Provisionally Accredited Levee (PAL) agreement.

The documentation demonstrates that the Saint Paul flood protection system meets

the criteria in the Code of Federal Regulations, Title 44, Chapter 1, Section 65.10 (44 CFR 65.10).

2. O&M Manual Update:

In 2011 the City updated its Operations and Maintenance (O&M) Manual for its flood protection system.

3. Levee Easement Research Project:

With the aid of a land surveying consultant researched levee easements, and assembled a plan set summarizing levee easements and property ownership along the levee system. The survey is in **Appendix 8**.

**d. History and Probability**

Records of past floods are used to estimate the probability of equal or greater floods in the future. Unfortunately, flood records on major rivers are poor or nonexistent prior to 1900. Records on smaller rivers and streams are even more limited.

In 1965, the City of Saint Paul suffered flooding on the Mississippi River resulting from snowmelt and rainfall. The outcome included a Presidential Disaster Declaration for 65 counties in the State of Minnesota (Presidential Disaster Declaration #188), record stages on the Mississippi River, the loss of 16 lives, and property damages estimated at \$181 million. It was the highest flood in Saint Paul history.

In 1987, severe storms, heavy rain, and tornadoes resulted in major flash flooding throughout the metropolitan area. Damages exceeded \$12 million and resulted in Presidential Disaster Declaration #797. The record set by this rainfall event still stands.

In 1969, flooding on the Mississippi resulted from snowmelt and rainfall. Flood levels in Saint Paul reached 24.5 feet. This flood event was the impetus for the State of Minnesota adopting the Comprehensive Floodplain Management Act.

In April of 1997, the Mississippi River crested at its third highest level. Low lying parking lots near downtown Saint Paul flooded. Locks and Dams from Saint Paul to Red Wing closed from 4/4/97 to 4/9/97. In addition, Harriet Island, Raspberry Island and Lilydale Park closed due to floodwaters and three quarters of Holman Field was under water by 4/9/97.

In July of 1997, severe thunderstorms deposited very heavy rainfall on portions of the Twin Cities metropolitan area in a short period of time resulting in severe basement and street flooding and a number of collapsed basements. Thirty-nine homes flooded in the Hoyt Avenue area of Saint Paul. Water levels reached eight feet in some basements and five homes were condemned. In addition, several streets collapsed in Saint Paul, one apartment building roof collapsed injuring one woman and foot bridges washed away at Highland Golf Course.

On June 25, 2003, county-wide flash flooding occurred when three-six inches of rain fell within a three hours and resulted in numerous reports of street and basement flooding. Several feet of water covered Larpenteur Avenue between Hamline and I-94.

### **Historical Crests for Mississippi River at Saint Paul from NOAA**

- (1) 26.40 ft on 04/16/1965
  - (2) 25.00 ft on 04/15/1969
  - (3) 23.76 ft on 04/18/2001
  - (4) 23.60 ft on 04/30/2001
  - (5) 22.90 ft on 04/13/1997
  - (6) 21.90 ft on 04/16/1952
  - (7) 19.65 ft on 06/26/1993
  - (8) 19.01 ft on 03/29/2011
  - (9) 18.71 ft on 04/10/2011
  - (10) 18.38 ft on 03/24/2010
  - (11) 17.90 ft on 04/16/1951
  - (12) 16.97 ft on 10/02/2010
  - (13) 16.30 ft on 05/16/1986
  - (14) 15.46 ft on 06/29/1957
  - (15) 15.45 ft on 05/04/1975
  - (16) 15.10 ft on 04/10/1994
  - (17) 14.51 ft on 06/23/2001
  - (18) 14.07 ft on 06/26/1984
  - (19) 13.98 ft on 04/26/1979
  - (20) 12.67 ft on 03/31/2009
  - (21) 12.41 ft on 04/13/2006
  - (22) 10.83 ft on 05/13/1991
  - (23) 10.28 ft on 04/07/2007
  - (24) 10.01 ft on 05/11/2008
  - (25) 9.99 ft on 06/17/2005
  - (26) 9.94 ft on 06/16/2004
  - (27) 9.52 ft on 06/29/2002
  - (28) 8.35 ft on 07/03/2003
- Source: National Climatic Data Center*

#### **e. Risk, Impact, Vulnerability and Consequences**

**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially

impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for flooding is summarized in narrative format (Part E) and in table format (Part I) in this Section.

Vulnerabilities in the City of Saint Paul due to severe flooding are vast and depend on where in the city it occurs. There are several areas that would be devastating to not only people but to infrastructure, and there are other areas such as parks that would have limited impact but still would cause problems due to lack of park usage.

Vulnerable populations identified by the jurisdiction include people who speak limited English, the elderly, lower socioeconomic status, disabled (physical and mental) and people who do not have access to traditional methods of communication in order to receive warnings (i.e. no TV, radios or internet, or are vision or hearing impaired).

Land use in the City of Saint Paul is mixed between residential, commercial and government uses. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged or lost. Severe flooding in downtown Saint Paul would cause a serious cascading effect to property and quality of life.

#### 1) General

Floods may occur at any time of year if the conditions are right. The spring and fall months are the most common time for floods to occur due to weather patterns.

Urban density is considered vulnerability in the City of Saint Paul due to the increased population within the downtown core, both residents and workers who commute to the area during business hours. This would be dangerous if a flood occurred during commuting times, such as in the morning or in the evening. Urban areas have a greater percentage of impervious surfaces such as roads and parking lots. During heavy rains, water is not absorbed, which creates a greater risk for

#### 2) Life Safety (Public and Responders)

People and buildings located in or near a floodplain are at the greatest risk, and although there is still a risk, people and businesses located outside of a floodplain have the slightest risk. The density of downtown is a vulnerable aspect in the event of a major flooding event for both residents and responders as flooding is dangerous to navigate in and around.

Health risks accompany flooding due to pooling or stagnant water. This standing water is host for bacteria from flooded septic tanks and sewage systems. Booms in insect populations increase the risk for insect-borne diseases such as West Nile

virus. After a flood, mold contamination is possible in homes and other buildings. These consequences persist long after the flood waters have receded.

3) Property (Facilities and Infrastructure)

Most property losses occur to residential structures which would cause an economic hardship for people who do not have flood insurance.

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged. Depending on the location and the intensity of the flooding the areas of concern are varied.

The City of Saint Paul has adopted the Minnesota State Building Code.

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a flood. Each City department is also required to draft and maintain a COOP. The Emergency Management Department would be able to direct operations from pre-designated sites outside the city (or inside depending on the path and level of destruction) and would be less vulnerable to loss of services and resources if the storm caused damage to multiple areas in the City. In addition to communications infrastructure, resources such as facilities, vehicles, equipment and supplies could be the most vulnerable element of operations, as tornadoes can destroy everything in their path.

5) Environment

The environmental vulnerabilities due to flooding include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine storm clean-up, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from a flood is low.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant flood event could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>3</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

#### **f. Repetitive Losses**

The taxpayers are burdened with a significant portion of the cost of responding to unwise floodplain development. These indirect costs may, in fact, equal or exceed the direct costs. The City of Saint Paul has taken many mitigation steps in previous years to reduce this burden and to minimize future complications.

The State of Minnesota has granted a Presidential Disaster Declaration to Saint Paul 7 times since 1997. Of those declarations, 4 involved river flooding, and one involved flash flooding in the Northeast part of the City (the Hoyt Avenue event of July 1997). Newly developed areas frequently cause runoff floods to land areas downstream, or displace natural ponding areas. Inadequate storm sewers also contribute to urban flooding.

The City of Saint Paul is and will continue to be a member of the National Flood Insurance Plan (NFIP). There are no properties that are NFIP insured that have repetitive losses in the City of Saint Paul. There have been no new repetitive loss properties or issues since 2007.

Previous mitigation activities include Hoyt Avenue, where 33 structures have been acquired and removed in addition to creating a multi-purpose flood water storage pond at a cost of nearly \$2 million in state funding. Total project cost is more than \$4 million. The Hoyt Ave repetitive loss incidents were done in 1997.

#### **g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

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<sup>3</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

The City's capabilities in regards to flooding are spelled out in the "Failure of Dams and Levees" section below in this plan. Please see that section for information on City and State capabilities, equipment, plans, exercises, training, public awareness, and funding sources.

**h. Hazard Analysis Summary—Flood (2012 update)**

The tables in this section summarize the information described above in the Section H narrative for damaging winds/thunderstorms, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 25: - Summary of Impact Vulnerability Ratings for Flood**

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
<b>Flood</b>	3	2	3	2	2	<b>2.4</b>

**Table 26: - Summary of Consequence Vulnerability Ratings for Flood**

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
<b>FLOOD</b>	2	2	2	4	4	3	3	<b>2.85</b>

**Table 27: - Summary of Total Risk for Flood**

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
<b>FLOOD</b>	<b>5.25</b>	<b>5</b>	<b>10.25</b>

## BLIZZARD/ICE STORM

### a. General Description

Blizzards are the most spectacular and vicious of all winter storms. They are characterized by strong winds bearing large amounts of snow. They have the capacity to completely immobilize large areas. Blizzards occur most frequently in the northern Great Plains and upper Mississippi Valley. They can occur from the first of October to the end of April, but most often occur from early November to the end of March.

<b><u>BLIZZARD/ICE STORM</u></b>  <b>Assessment:</b> <b>High Risk Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> – Shut down of daily operations, damage to buildings and exterior equipment <b>Probability</b> --Moderate <b>Duration</b> – 1 to 3 days <b>Seasonal pattern</b> – Winter <b>Speed of Onset</b> - Rapid <b>Warning time</b> – 12 to 36 hours <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Power/utility outages (NO heat)</li><li>• Traffic/roadway inaccessibility</li><li>• Safety/security</li><li>• Frozen pipes in facilities</li><li>• Animal/plant collection protection</li><li>• Vehicle fleet could be unusable</li><li>• Communication breakdown</li><li>• Downed trees &amp; power lines</li></ul>
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According to the National Weather Service (NWS), a blizzard occurs when the occurrence of the following conditions lasting for three hours or longer:

- Wind speeds of 35 miles per hour (mph) or more
- Considerable falling and/or blowing snow (reducing visibility frequently to less than 1/4 mile)
- Generally temperatures of 20 degrees Fahrenheit (F) or lower.

To be considered a severe blizzard, it must have:

- Wind speeds of 45 mph or more
- A great density of falling and/or blowing snow (reducing visibility frequently to near zero)
- Temperatures of 10 degrees F or lower

### b. Location

Minnesota averages only one "real" winter blizzard per year. Most storms fall under the "winter storm" category. The entire City of Saint Paul previously has and most likely will encounter a blizzard.

### c. Extent



Light snow showers and strong winds can create blizzard conditions very quickly. Blizzards can cause very high snow drifts due to the blowing wind. The temperatures in a blizzard can reach below-zero levels in a hurry.

Snow doesn't always even have to be falling for blizzard conditions to occur. That can be the case with just a few inches of snow on the ground if it's being whipped by strong winds and reducing visibility.

#### **d. History and Probability**

The following table represents blizzards that have affected the City of Saint Paul and details the effects.

**Table 28:** History of Blizzards in the City of Saint Paul (1940-2000)

<b>Date</b>	<b>Location</b>	<b>Remarks</b>
12/95	Western and Southern MN	The intensity of this storm prompted statewide closings of schools and many businesses on the 7th.
11/91	Statewide	November snowfall totaled 46.9" in Twin Cities
10/91	Statewide	"Halloween Monster Storm". 28.4" snow at Twin Cities; 36.9" in Duluth.
03/89	Central and Southern MN	One death. 600 traffic accidents in the Twin Cities metro area.
03/85	Statewide	Two deaths.
02/84	Statewide	Severe white out and cold. Sixteen deaths reported.
02/83	Statewide	12" of snow.
01/82	Twin Cities	37.4" of snow. One death in Lakeville (Dakota County).
01/75	Statewide	"Storm of the Century". Fourteen deaths. 1-2' of snow; winds up to 80 mph.
12/68	Statewide	6 blizzards during 12/68 - 1/69 resulted in serious negative impacts on wildlife due to deep snow.
12/50	Statewide	25.2" of snow in Twin Cities
03/41	Statewide	Thirty-two deaths. High winds up to 75 mph in Duluth.
11/40	Statewide	"Armistice Day Blizzard". Forty-nine deaths.

*Source: Minnesota Historical Society*

The above table is a survey history of blizzards in Minnesota, relevant to the City of Saint Paul, noting significant losses and/or meteorological events. Most notable are the "Armistice Day Blizzard" in November 1940 in which there were forty-nine deaths; "The Storm of the Century" in January 1975 in which there were fourteen deaths; the blizzard in February 1984 in which there were sixteen deaths; the "Halloween Monster Storm" of 1991 which did not result in any deaths, but set staggering snowfall records.

#### **e. Risk, Impact, Vulnerability and Consequences**

Vulnerabilities in the City of Saint Paul due to severe blizzards are vast and could be catastrophic to the quantity of people, structures, and infrastructure that could be affected.

##### **1) General**

Severe winter storms can produce rain, freezing rain, significant snowfall, ice and cold temperatures. Severe winter storms/blizzards have the potential to cause loss of life, infrastructure damage and economic disruptions. Prolonged events have the most potential to affect the City the most.

##### **2) Life Safety (Public and Responders)**

Due to the dense urban development of the city, the possibility of loss of life is significant if the City is affected by a severe winter storm. Storms can occur directly from the storm and cold, and it may happen indirectly due to icy roads and accidents, heart attacks while shoveling and from hypothermia due to prolonged exposure to the cold.

There are several vulnerable populations in the City, such as people who speak limited English, are elderly, socioeconomic status, have disabilities (physical and mental) and people who do not have the regular methods available to them in order to receive warnings (i.e. No TV, internet or are hearing impaired). The hazards created by blizzards create significant danger to life, travel and employment conditions.

The weather can make roads difficult to travel which may have tragic consequences for people who need emergency services and the providers of the emergency service.

##### **3) Property (Facilities and Infrastructure)**

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged. A severe blizzard hitting any area of Saint Paul would likely cause damage to property, especially if there is a great deal of snow.

Roof and building collapse can result from snow build-up that exceeds the load capacity of the roof. Collapse due to overloading can usually be prevented by removing excess snow as it accumulates. If damaged buildings are left unprotected, later storms can cause additional damage. Prolonged ice and snow buildup on roofs can cause ice dams which will allow moisture to penetrate the building and damage both interior materials and structural members.

The frequency of structural fires tends to increase during blizzards, primarily due to utility interruptions and residents' use of alternative heating methods (e.g., fireplaces, gas or propane heaters).

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations and the impact of a blizzard. Each department located in the City is required to draft and maintain a COOP plan as well. The Department of Emergency Management would be able to run operations from sites outside the city and wouldn't be as vulnerable to loss of service as they would be loss of resources if the storm caused damage to multiple areas in the City.

5) Environment

The environmental vulnerabilities due to a blizzard include water contamination/pollution, soil damage from chemical spills, and natural gas leaks—this can happen due to a lot of snow and snow melt in the spring.

6) Economic Conditions

The affects of a severe blizzard would be noticed on infrastructure damages such as communication, transportation, and other utility interruptions which in turn are costly to repair and restore.

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant blizzard event could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>4</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

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<sup>4</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. *Journal of Homeland Security and Emergency Management*, Vol 5, Issue 1, 2008.

**f. Repetitive Losses**

In regards to blizzards/ice storms, repetitive loss information has not been collected or maintained. (2012 update)

**g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

**h. Hazard Analysis Summary—Blizzard/Ice Storms (2012 update)**

The tables in this section summarize the information described above in the Section H narrative for blizzard/ice storm, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 29:** - Summary of Impact Vulnerability Ratings for Blizzard/Ice Storm

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=##/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Blizzard/ Ice Storm	4	3	3	1	2	2.6

**Table 30:** - Summary of Consequence Vulnerability Ratings for Blizzard/Ice Storm

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=##/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Blizzard/ Ice Storm	5	4	3	2	2	2	3	2.71

**Table 31:** - Summary of Total Risk for Blizzard/Ice Storm

<b>HAZARD</b>	<b>COMBINED VULNERABILITY (I+C=V)</b>	<b>PROBABILITY (P)</b>	<b>RISK V+P=R</b>
<b>Blizzard/ Snowstorm</b>	<b>5.31</b>	<b>5</b>	<b>10.31</b>

## EXTREME HEAT/COLD

### a. General Description

The City of Saint Paul is located in the center of the continent; therefore it experiences the extremes of summer heat and winter cold. Record temperatures for the City of Saint Paul range from a high of 108 degrees in 1936 to a low temperature of -34 in 1936 and again in 1970.

<b><u>EXTREME HEAT/COLD</u></b>  <b>Assessment:</b>  <b>Medium Risk</b>	<b>Location</b> – Citywide <b>Extent</b> – loss of utilities, damage to buildings, exterior equipment, breakdown of vehicles <b>Duration</b> - days to weeks <b>Probability</b> --Moderate <b>Duration</b> – days to weeks <b>Seasonal pattern</b> – Mid-winter / Late summer <b>Speed of Onset</b> - Slow <b>Warning time</b> – 12 to 36 hours <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Power/utility outages</li><li>• Overcrowded pools/ beach</li><li>• Visitor/staff safety</li><li>• Medical attention for visitors/staff</li><li>• Animal/plant collection needs</li><li>• Frozen/overheating of facility infrastructures</li></ul>
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#### 1) Excessive Cold

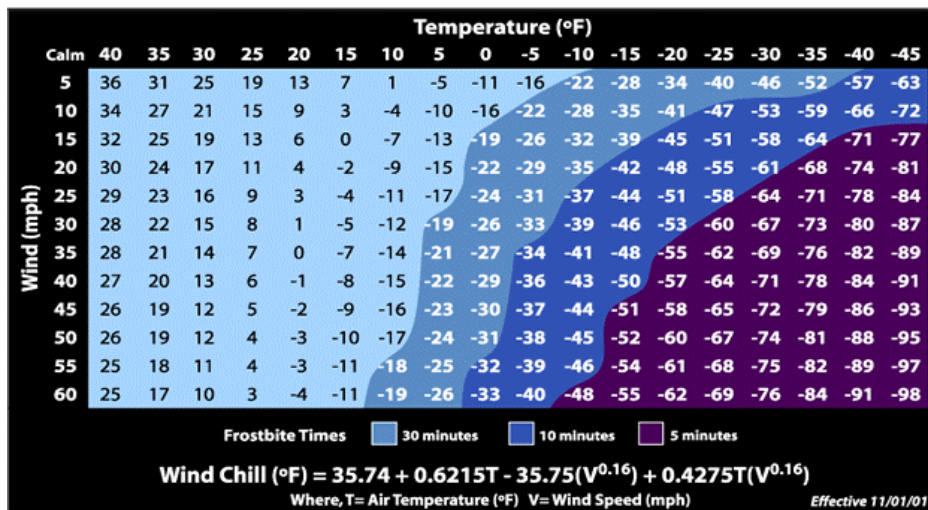
The National Weather Service issues a *Wind Chill Advisory* for the City of Saint Paul when wind chills of 35 degrees below zero with winds of at least 10 miles per hour are expected.

A *Wind Chill Warning* is issued when wind chills of 50 degrees below zero and winds greater than 10 miles per hour are expected.

**Table 32:** Wind Chill Chart



## Wind Chill Chart



### 2) Excessive Heat

The NWS issues a *Heat Advisory* for Minnesota when, during a 24-hour period, the Heat Index ranges from 105 to 114 degrees during the day, and remains at or above 80 degrees at night.

The Heat Index is obtained from a graph pictured below; it is calculated using temperature and dew point.

**Table 33: Heat Index Chart**

Heat Index Chart (Temperature & Dewpoint)																
Dew point (° F)	Temperature (° F)															
	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
65	94	95	96	97	98	100	101	102	103	104	106	107	108	109	110	112
66	94	95	97	98	99	100	101	103	104	105	106	108	109	110	111	112
67	95	96	97	98	100	101	102	103	105	106	107	108	110	111	112	113
68	95	97	98	99	100	102	103	104	105	107	108	109	110	112	113	114

69	96	97	99	100	101	103	104	105	106	108	109	110	111	113	114	115
70	97	98	99	101	102	103	105	106	107	109	110	111	112	114	115	116
71	98	99	100	102	103	104	106	107	108	109	111	112	113	115	116	117
72	98	100	101	103	104	105	107	108	109	111	112	113	114	116	117	118
73	99	101	102	103	105	106	108	109	110	112	113	114	116	117	118	119
74	100	102	103	104	106	107	109	110	111	113	114	115	117	118	119	121
75	101	103	104	106	107	108	110	111	113	114	115	117	118	119	121	122
76	102	104	105	107	108	110	111	112	114	115	117	118	119	121	122	123
77	103	105	106	108	109	111	112	114	115	117	118	119	121	122	124	125
78	105	106	108	109	111	112	114	115	117	118	119	121	122	124	125	126
79	106	107	109	111	112	114	115	117	118	120	121	122	124	125	127	128
80	107	109	110	112	114	115	117	118	120	121	123	124	126	127	128	130
81	109	110	112	114	115	117	118	120	121	123	124	126	127	129	130	132
82	110	112	114	115	117	118	120	122	123	125	126	128	129	131	132	133

*Note: Exposure to full sunshine can increase HI values by up to 15° F*

An *Excessive Heat Warning* is issued when, during a 24-hours period, the Heat Index reaches 115 degrees or more during the day, and remains at or above 80 degrees at night.

## b. Location

Extreme temperatures may affect any part of the State of Minnesota. Both extreme heat and extreme cold occur regularly in the City of Saint Paul.

## c. Extent

Damages from extreme temperatures can range from human deaths to significant energy costs, loss of work, and infrastructure problems.



Extreme heat can cause the body's temperature control to be overwhelmed and in turn the body's core temperature increases, this is worsened when the humidity level is high and sweat doesn't evaporate as quickly.

Cold weather is directly responsible for deaths through such things as hypothermia, influenza, and pneumonia. It is also an indirect factor in a number of ways such as death and injury from falls, accidents, carbon monoxide poisoning, and house fires all of which are partially attributable to cold.

#### **d. History and Probability**

##### **1) Cold Temperatures**

January 15<sup>th</sup>, 1994, an arctic air mass dropped into the north-central states from western Canada causing an extended period of record or near record cold across Minnesota. Low temperatures ranged anywhere from 20 below to 40 below zero across the state with daytime high temperatures remaining below the zero mark. As the air mass approached the area, a biting north wind accompanied the cold causing wind chill readings frequently in the 60 below to 80 below zero range.

The Governor of Minnesota closed all public schools in the state on the 18th. The University of Minnesota at both the Twin Cities and Duluth campuses were also closed on the 18th because of the cold. Many businesses were closed or closed early throughout the cold wave. Accidents were common across most of Minnesota as car exhaust froze on contact with the cold pavement causing extremely icy roadways.

More than 475 schools including those in the Saint Paul-Minneapolis metro area were closed January 18th, 1996, due to extreme cold and wind chill which lingered from the 18th when very cold air overspread the region. Wind chills were frequently 50 below zero or colder. The winds diminished on the 19th, however very cold conditions persisted into the 20th. Many locations neared record cold the morning of the 20th.

Extremely cold air settled over the area on January 31st, 1996, and remained fixed through February 4th. Numerous record low temperatures and record low high temperatures were set during the period in the Twin Cities. Saint Paul-Minneapolis set three new record low temperatures as well as recording the second coldest day on record on February 2nd. A mean temperature of 25 degrees below zero was measured that day with a high of 17 below and a low of 32 degrees below zero. This was within two degrees of tying the all-time record low temperature set in the Twin Cities and the coldest temperature recorded this century. The governor closed all schools that day.

##### **2) Hot Temperatures**

Central and south central Minnesota was belted with heat, on the 29<sup>th</sup> - 30<sup>th</sup> of July 1999. The morning of the 29th started with lows in the 70s and dew points in the middle 60s to middle 70s, producing heat indices from 70 to 85. With afternoon highs well into the 90s, and dew points ranging from the middle 60s to upper 70s,

heat indices climbed to the 95 to 114 range. Southern Minnesota bore the brunt of the heat this day with numerous triple digit indices.

A muggy night pervaded southern Minnesota, as some locations saw their low temperature remain around 80. Combined with dew points in the 70s, the heat index hovered in the lower and middle 80s in Saint Paul-Minneapolis. Central Minnesota locations had an overnight heat index in the 70s. At 0755 CST on the 30th, Saint Paul-Minneapolis tied an all-time record high dew point of 81 (equaling a mark set in 1995). By 0900 CST, the heat index had already climbed past 100 at Saint Paul-Minneapolis and many other locales.

High temperatures soared into the middle and upper 90s. Thus the heat index exceeded 110 in most areas. A sampling of the heat index revealed 119 at Eden Prairie (Flying Cloud Airport/FCM). A cold front moved in later on the 30th, bringing severe thunderstorms and an end to the heat wave.

A heat wave in 2001 began on the 30th and persisted until August 1. Temperatures on July 30 soared into the upper 80s and lower 90s across a large portion of central and southern Minnesota, while dew points climbed into the middle 70s to lower 80s, resulting in triple digit heat indexes during the afternoon and evening.

During the early morning hours of the 31st, dew points remained in the 70s, therefore nighttime heat indexes only dropped to the upper 70s and lower 80s. In fact, from 1000 CST July 30 to 1600 CST July 31 inclusive, Saint Paul-Minneapolis set a record with 31 consecutive hours during which the dew point was equal to or greater than 74 (the previous record was 25 hours in July 1977). On July 31, temperatures climbed slightly higher, while dew points remained in the middle 70s to lower 80s. Heat index values reached triple digits prior to Noon in most areas.

August 4<sup>th</sup>, 2001, an extensive heat wave persisted for five days and resulted in five fatalities in Minneapolis and its suburbs. Hot weather and tropical-like humidity pervaded the region, as virtually all stations registered highs in the 90s all five days. Saint Paul-Minneapolis reached 98 or 99 three straight days (August 5-7) when highs were 98, 99 and 98 respectively; the highs in Saint Paul-Minneapolis on August 6 and August 7 set records. Record low minima at MSP were also established three straight days: on August 6 when the low was only 80, on August 7 when the low was only 76, and again August 8 when the low only dropped to 77.

**e. Risk, Impact, Vulnerability and Consequences**

**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed

analysis for extreme heat/cold is summarized in narrative format (Part E) and in table format (Part I) in this Section.

When high temperatures mix with high humidity, older adults, the very young and people with chronic disease and mental illness are at the highest risk of heat-related illness and death—but even young and healthy individuals should take precautions. City dwellers are at particular risk because of elevated temperatures in cities, known as the "urban heat island effect" due to the magnifying effect of paved surfaces and the lack of tree cover.

Extreme cold conditions are life threatening because they literally affect the normal functioning of the body processes and increase the risk of death. Vulnerabilities to the extreme cold are similar to extreme heat, as people who have health related issues are at greatest risk, as are children and older adults. People who work outside or travel in extreme cold are also at risk for the dangers.

1) General

Extreme temperatures occur usually in the winter months and the late summer months, however due to the variability in Minnesota weather extreme temperatures could happen at any time.

2) Life Safety (Public and Responders)

Due to the dense urban development of the city, the possibility of loss of life is significant if the City is affected by an extreme temperature event. Extreme cold affects people without proper housing (homeless or socioeconomic), older adults, the very young and people with chronic respiratory disease, cardiovascular conditions, severe mental illness, and difficulties with mobility.

Vulnerability due to power outages and loss of heat or air conditioning, lack of fresh food, and running water is a problem for the quality of life.

First responders will be affected due to extreme temperatures by having to respond to more calls such as fire and medical emergencies.

3) Property (Facilities and Infrastructure)

Property is vulnerable due to buildings or roads being damaged due to the extreme temperatures. Utilities such as communications and electricity may be affected as well.

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations and the impact of an extreme temperature event. Each department located in the City is required to draft and maintain a COOP plan as well. The Emergency Management Department would be

able to run operations from sites outside the city (or inside depending on the path and level of destruction) and wouldn't be as vulnerable to loss of service as they would be loss of resources if the extreme temperatures caused damage to multiple areas in the City. Resources could be the most vulnerable area of operations, as extreme temperatures can impact several geographic areas and eliminate or reduce possible resources in the process.

5) Environment

Extreme temperatures may affect the environment if prolonged events occur due to drought; frozen pipes leak chemicals, and wild fires. Long-term effects to the environment due to an extreme temperature event are rated at low.

6) Economic Conditions

A prolonged heat wave or extreme cold snap can have a serious economic impact on a community. Increased demand for water and electricity may result in shortages of resources. Moreover, food and supply shortages may occur if the weather halts transportation of resources.

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A prolonged extreme weather event could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, "confidence" refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>5</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

**f. Repetitive Losses**

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<sup>5</sup> "Understanding Public Confidence in Government to Prevent Terrorist Attacks"; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

In regards to tornadoes, repetitive loss information has not been collected or maintained. (2012 update)

**g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

**h. Hazard Analysis Summary—Extreme Temperatures (2012 update)**

The tables in this section summarize the information described above in the Section H narrative for extreme temperatures, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 34: - Summary of Impact Vulnerability Ratings for Extreme Temperatures**

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=V; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Extreme Temperatures	4	1	2	2	1	<b>2</b>

**Table 35: - Summary of Consequence Vulnerability Ratings for Extreme Heat/Cold**

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Extreme Temperatures	3	3	2	2	1	2	3	<b>2.29</b>

**Table 36: - Summary of Total Risk for Extreme Heat/Cold**

<b>HAZARD</b>	<b>COMBINED VULNERABILITY (I+C=V)</b>	<b>PROBABILITY (P)</b>	<b>RISK V+P=R</b>
<b>Extreme Temperatures</b>	<b>4.29</b>	<b>4</b>	<b>8.29</b>

## URBAN/NATURAL FIRE

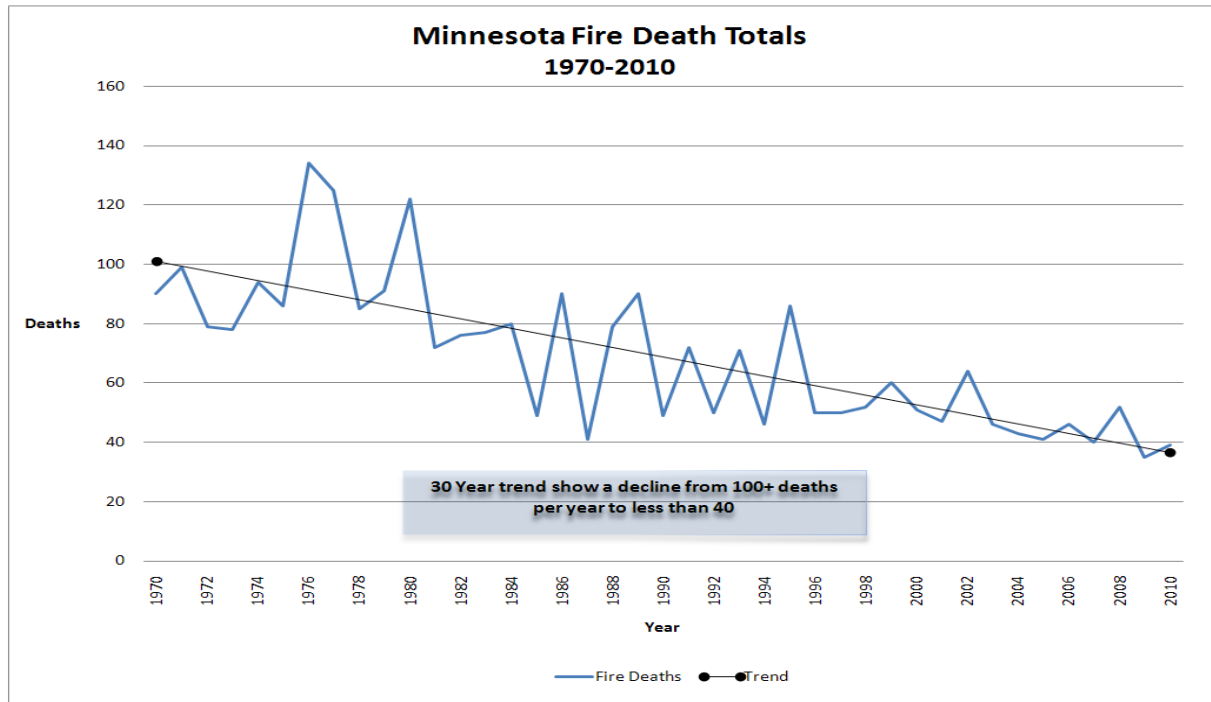
### a. General Description

The fire problem in the United States, on a per capita basis, is one of the worst in the industrial world. Thousands of Americans die, tens of thousands of people are injured, and property losses reach billions of dollars because of fires. The annual losses from floods, hurricanes, tornadoes, earthquakes and other natural disasters combined in the United States average just a fraction of the losses from fire. People cause more than 99 percent of the wildfires in Minnesota.

According to the National Fire Protection Association, the fire death rate across the country per 1 million people is 11.8, while Minnesota's is 8.6.

<b><u>NATURAL/ URBAN FIRE</u></b>		<b>CASCADING EFFECTS</b>
<b>Assessment:</b> <b>Moderate Risk Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> – Damage to property and buildings. Life safety issues. <b>Probability</b> --Moderate <b>Duration</b> – Several hours to days <b>Seasonal pattern</b> – Primarily late summer/fall <b>Speed of Onset</b> - Rapid <b>Warning time</b> – Minimal <b>Repetitive Loss</b> - N/A	<ul style="list-style-type: none"><li>• Loss of service(s)</li><li>• Evacuation of Visitor/staff</li><li>• Medical attention for visitors/staff</li><li>• Traffic/roadway closures</li><li>• Increased security/policing</li></ul>

**Table 37:** Minnesota Fire Deaths 1970-2010



## 1) Wildfires

A wildfire is an uncontrolled fire spreading through vegetative fuels, threatening to cause destruction to property. With more people making their homes in or near forests and rural areas the homeowners enjoy the beauty of the environment but face the very real danger of wildfire.

Wildfires often begin unnoticed. They spread quickly, igniting brush, trees, and homes. Human error, such as arson and carelessness, are the cause of four out of every five wildfires. As a natural hazard, wildfires are caused as a result of lightning. The destruction of timber, property, wildlife, and loss of human life are the most frequent dangers from wildfires.

## 2) Urban Fire

For the purposes of this Plan, major urban fires are those structure fires in the City of Saint Paul that were greater or equal to two alarm. The leading causes of fires nationally are arson, open flame, and cooking. The leading causes of fire deaths are smoking, arson, and heating. Between 70 and 80 percent of these fire deaths stem from residential fires. People under age 5 and over age 55 have a much higher death rate than the average population. These two age groups account for more than one-third of all deaths nationally.

### b. Location



In the City wildfires are most likely in areas near railroad tracks, brush piles and in park settings and may spread as long as there is fuel for the fire to burn. Urban fires may happen anywhere in the city where there are several buildings in close proximity.

### **c. Extent**

In the last 21 years, nearly \$3.3 billion in property was destroyed by fire; 48%, or nearly \$1.6 billion, occurred in residential property.

Due to the urban nature of the City of Saint Paul, urban fires are more of a concern to property and loss of life, however wildfires can create dangerous situations if the conditions are high. Urban fire is of concern to the City of Saint Paul because it can happen and spread to several buildings in a short time.

Wildfires can be a result of naturally occurring influences such as lightning, extreme drought, and heat as well as human influences such as a discarded cigarette butt, improperly extinguished campfire, or from the use of railroad tracks. Another cause of wildfires is the buildup of grass, leaves and twigs in a pile. This accumulation of dead matter can create heat, enough in some instances to spontaneously combust and ignite the surrounding area. The potential for threat of wildfires is dependent upon topography and slope, surface fuel characteristics, recent climate conditions, current meteorological conditions, and fire behavior. Once a wildfire threatens a community, it is often too late to protect nearby structures, and populations have to be evacuated for their own safety.

### **d. History and Probability**

From 1999 to 2010 there were around 1,400 wildfires in Minnesota. The Twin Cities is most susceptible during the months of March through October.

According to the Minnesota State Fire Marshall, in 2010 residential fires accounted for 76% of all structure fires, 64% of total dollar loss, and 97% of all fire deaths in structures. These statistics continue to identify the home as the most dangerous place to be.

Due to the fact that the City of Saint Paul is largely urban, examples of major urban fires were used to address not only the history of fires in Saint Paul, but also the potentiality. The following history is from March, 1999 to December, 2004.

- **1999**--Seven major fires resulting in \$1,792,613 damage
- **2000**--Twelve major fires resulting in \$9,541,700 damage
- **2001**-- Sixteen major fires resulting in \$4,265,682 damage
- **2002**-- Nine major fires resulting in \$3,215,000 damage

- **2003--** Six major fires resulting in \$1,350,000 damage
- **2004--** Three major fires resulting in \$2,740,000 damage
- **2005--**One major fire resulting in \$3,500,000 damage
- **2006--** Four major fires resulting in \$1,200,000 damage
- **2007--** One major fire resulting in \$700,000 in damage
- **2008--** Two major fires resulting in \$1,500,000 damage
- **2009--** Three major fires resulting in \$1,700,000 damage
- **2010—**Two major fires resulting in \$710,000 damage
- **2011—**One major fire resulting in \$1,450,000 damage

There were 51 fire deaths in Minnesota in 2011, up 31 percent the previous year, according to the state Department of Public Safety's State Fire Marshal Division. The state's all-time low total was 35 in 2009; the high was 134 in 1976.

**f. Risk, Impact, Vulnerability and Consequences**

Vulnerabilities in the City of Saint Paul due to wildfires are vast and could be catastrophic to the quantity of people, structures, and infrastructure that are contained within the City if there were to be a severe fire event that encompasses a great area. If it is a small, contained fire, the Saint Paul Fire Department can handle it.

There are several vulnerable populations in the City, such as people who speak limited English, are elderly, socioeconomic status, have disabilities (physical and mental) and people who do not have the regular methods available to them in order to receive warnings (i.e. No TV, internet or are hearing impaired). The density of downtown is also a vulnerable aspect.

1) General

Between the years 2005-2011 there were 581 wildfire, grass, natural vegetation and brush fire calls in the City of Saint Paul. In Ramsey County, the primary months of occurrence are March through October, when high temperatures, possible drought conditions, and high winds increase the likelihood of wildfires.

2) Life Safety (Public and Responders)

Due to the dense urban development of the city, the possibility of loss of life is significant if the City is affected by a large wildfire.

3) Property (Facilities and Infrastructure)

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged.

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations and the impact of an urban fire. Each department located in the City is required to draft and maintain a COOP plan as well. The Emergency Management Department would be able to run operations from sites outside the city (or inside depending on the path and level of destruction) and wouldn't be as vulnerable to loss of service as they would be loss of resources depending on the size and area of the fire. Resources could be the most vulnerable area of operations, as transportation, buildings and people would be impacted.

5) Environment

The environmental vulnerabilities due to major fire event include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine storm clean-up, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from a tornado is low.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant fire event (urban or natural) could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, "confidence" refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby

indicating that a high level of confidence can improve the effectiveness of preparedness<sup>6</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

#### **f. Repetitive Losses**

In regards to urban fires repetitive loss information has not been collected or maintained. (2012 update)

#### **g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

#### **h. Hazard Analysis Summary—Urban/Wildfires (2012 update)**

The tables in this section summarize the information described above in the Section H narrative for urban/wildfires, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 38: - Summary of Impact Vulnerability Ratings for Urban/Wildfires**

<b>HAZARD</b>	<b>IMPACTS (I)</b>					<b>VULNERABILITY</b> H+R+C+E+P=#; #/5=V
	<b>Human (H)</b>	<b>Residential Property (R)</b>	<b>Business Losses (B)</b>	<b>Environment (E)</b>	<b>Program Operations (P)</b>	
<b>Urban/Wild Fire</b>	2	3	3	3	2	<b>2.6</b>

<sup>6</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 39: - Summary of Consequence Vulnerability Ratings for Urban/Wildfires**

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#, #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Urban/Wild Fire	1	3	1	3	2	1	4	2.14

**Table 40: - Summary of Total Risk for Urban/Wildfires**

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
Urban/Wildfires	4.77	2	6.77

## DROUGHT

### a. General Description

Drought is quite different from a dry environment, which is seasonally dry. It is a condition of abnormally dry weather within a geographic region where rain is usually expected. Drought is thought to be one of the most complex, and least understood, of all natural hazards, differing from them in important ways. Unlike earthquakes, hurricanes and tornadoes, drought unfolds at an almost imperceptible pace with beginning and ending times that are difficult to determine, and with effects that often are spread over vast regions. The term drought is applied to a period in which an unusual scarcity of rain causes a serious hydrological imbalance (Water-supply reservoirs empty, wells dry up, and crop damage ensues). Droughts can affect a large area and range in size from a couple of counties to several states.

<b><u>DROUGHT</u></b>		<b>CASCADING EFFECTS</b>
<b>Assessment:</b> <b>Moderate Risk</b>	<b>Location</b> – Citywide <b>Extent</b> – damage to property, turf, urban forest, wildlife, loss of revenue <b>Duration</b> – Several weeks to months <b>Probability</b> --Moderate <b>Seasonal pattern</b> –Late summer <b>Speed of Onset</b> - Slow <b>Warning time</b> – Days to weeks <b>Repetitive Loss</b> - N/A	<ul style="list-style-type: none"> <li>• Redirect of division resources</li> <li>• Loss of revenue</li> <li>• Loss of natural resources</li> <li>• Fire hazard increase</li> </ul>

**Table 41:** Definitions of Different Types of Fire

<b>Meteorological</b>	A measure of departure of precipitation from normal. Due to climatic differences what is considered a drought in one location may not be a drought in another
<b>Agricultural</b>	Refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop.
<b>Hydrological</b>	Occurs when surface and subsurface water supplies are below normal
<b>Socioeconomic</b>	Refers to the situation that occurs when physical water shortage begins to affect people

### b. Location

The Metropolitan Council is responsible for conducting planning activities to address the water supply needs of the metropolitan area (**Minnesota Statute 473.1565**). As part of this charge, the Council has developed a Metropolitan Area Master Water Supply Plan to guide

water supply development. The Council collects information and conducts analyses to ensure the tools and resources provided in the Master Plan remain relevant and useful and supplies are developed sustainably. This is done to try to prevent dry/drought conditions from impacting the water availability for the Twin Cities area. (2012 Update).

All of Saint Paul can experience a drought as can the entire state and region.

### c. Extent

The severity of the drought is gauged by the degree of moisture deficiency, its duration, and the size of the area affected. Droughts can kill crops, grazing land, edible plants and even in severe cases, trees. If the drought is brief, it is known as a dry spell, or partial drought. A partial drought is usually defined as more than 14 days without appreciable precipitation, whereas a drought may last for years.

Dry conditions produce Low stream flows and lake levels, with abundant algae blooms

- Increased fire danger especially in forested areas
- Extensive watering of landscapes and gardens to keep them alive

Drought can impact urban water supplies due to the strain of lower amounts of available water.

The table 42 below shows the ranges for each indicator for each dryness level. Because the ranges of the various indicators often don't coincide, the final drought category tends to be based on what the majority of the indicators show. The analysts producing the map also weight the indices according to how well they perform in various parts of the country and at different times of the year. Also, additional indicators are often needed in the West, where winter snowfall has a strong bearing on water supplies.

**Table 42:** Drought Severity Classification

Category	Description	Ranges					
		Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
<b>D0</b>	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits;	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30

		pastures or crops not fully recovered					
<b>D1</b>	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
<b>D2</b>	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
<b>D3</b>	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
<b>D4</b>	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2

Source: US Drought Monitor



**D0-D4:** The Drought Monitor summary map identifies general drought areas, labeling droughts by intensity, with D1 being the least intense and D4 being the most intense. D0, drought watch areas, are drying out and possibly heading for drought, or are recovering from drought but not yet back to normal, suffering long-term impacts such as low reservoir levels. Short-term drought indicator blends focus on 1-3 month precipitation. Long-term blends focus on 6-60 months.

#### **d. History and Probability**

The City of Saint Paul has suffered its share of drought. Since the City is becoming increasingly developed, demand for water increases. Past droughts include:

1911-1914	Statewide
1931-1942	Statewide
1976-1977	Statewide
1987-1989	Statewide
2003	Statewide
2011-2012	Nearly Statewide (includes Saint Paul)

#### **e. Risk, Impact, Vulnerability and Consequences**

Vulnerabilities in the City of Saint Paul due to drought are dependant on how wide-spread the area is-- such as if it is statewide or spans to other parts of the country.

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged.

##### **1) General**

Most droughts tend to occur during summer, as the weather is hot and water is quickly evaporated.

The greatest impact from drought is the decrease in water supply. This can result in crop loss and reduce crop growth and availability. The impact on livestock is equally devastating, and can result in animal deaths from limited water supplies or feed availability. Plants can also concentrate toxins under drought conditions, making them more lethal to livestock. The dry conditions can also lead to wind erosion of top soil, or increase the risk for fire hazards, and given decreased water sources, can result in devastating losses.

##### **2) Life Safety (Public and Responders)**

There are several vulnerable populations in the City, such as people who speak limited English, are elderly, socioeconomic status, have disabilities (physical and mental) and people who do not have the regular methods available to them in order

to receive warnings (i.e. No TV, internet or are hearing impaired). The density of downtown is also a vulnerable aspect.

Responder safety is just as vulnerable as the people living in the city, due to the fact that there may be fires or lack of water for consumption.

3) Property (Facilities and Infrastructure)

Drought does not directly affect property/facilities; however it can influence the economy due to land prices decreasing, financial institutions strained due to foreclosures and business difficulties, lower economic development and recreation use curtailed.

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations due to the impact of a drought. Each department located in the City is required to draft and maintain a COOP plan as well. The Emergency Management Department would be able to run operations from sites outside the city and wouldn't be as vulnerable to loss of service as they would be loss of resources depending on availability of resources. Resources could be the most vulnerable area of operations, as transportation, buildings and people would be impacted.

5) Environment

The environmental vulnerabilities due to a severe drought include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine clean-up and maintenance, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from a drought is low.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of state government operations. In addition to government offices, a number of national and international businesses and industries are headquartered in the City. A significant drought could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, "confidence" refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the

message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>7</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

**f. Repetitive Losses**

In regards to drought, repetitive loss information has not been collected or maintained. *(2012 update)*

**g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

**h. Hazard Analysis Summary—Drought *(2012 update)***

The tables in this section summarize the information described above in the Section H narrative for drought, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 43: - Summary of Impact Vulnerability Ratings for Drought**

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
<b>Drought</b>	1	1	2	3	1	<b>1.6</b>

<sup>7</sup> "Understanding Public Confidence in Government to Prevent Terrorist Attacks"; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 44: - Summary of Consequence Vulnerability Ratings for Drought**

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
<b>Drought</b>	2	1	1	2	3	2	2	<b>1.86</b>

**Table 45: - Summary of Total Risk for Drought**

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
<b>Drought</b>	<b>3.46</b>	<b>2</b>	<b>5.46</b>

## KARST, TUNNELS & CAVES

### a. General Description

Karst topography is the name given to landscapes created by the dissolving of limestone and dolomite below the surface and the resulting dips, sinkholes, and valleys. The features form where limestone and dolostone are close to the surface. Southeastern Minnesota has the most active karst features, and the City of Saint Paul is on the northern border of the karst formations.

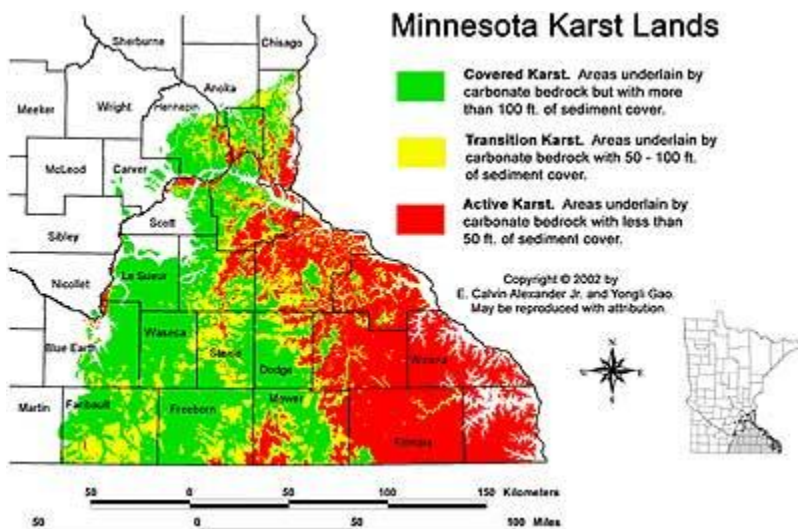
Karst topography includes features such as sinkholes, disappearing streams, and underground drainage. Karst formations are a direct path to aquifers, thus making groundwater vulnerable to pollution. The City of Saint Paul is in the northwestern edge of the Minnesota Karst sheet. The effects of karst have been minimal and relate primarily to potential groundwater sensitivity concerns.

Currently all caves in the City of Saint Paul are abandoned and sealed. The caves were previously used for growing mushrooms and making cheese. The caves in the City of Saint Paul are closer related to mines as they are all man made, but they have been called caves for many years and both labels are accepted. The only cave that is used for a purpose any longer is Echo Cave; this cave is the winter hibernation quarters for the Big Brown Bat species. This cave is off limits to people for the benefit of the bats.

<b><u>KARST, TUNNELS &amp; CAVES</u></b>  <b>Assessment:</b> <b>Moderate Risk Level</b>	<b>Location</b> – Citywide <b>Extent</b> – Loss of life & structural property damage <b>Probability</b> --Low <b>Duration</b> – Several hours to several days <b>Seasonal pattern</b> – None <b>Speed of Onset</b> - Rapid <b>Warning time</b> – Minimal to none <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Injury or loss of lives</li><li>• Redirect of staff/equipment</li><li>• Structural damage</li><li>• Infrastructure damage</li></ul>
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A large buried river valley that cuts deeply into the bedrock originates near the Minneapolis/Saint Paul International airport. This valley was filled with fine sands during early periods of glaciation and is an area of special concern because the buried valley creates a hydrologic connection between the surface and all of the bedrock aquifers in the area. On the map below, note the red areas in the east and southwest parts of Ramsey County.

### Map 6: Minnesota Karst Lands



Source: University of Minnesota

## b. Location

Karst is an efficiently drained landscape that forms on soluble rock. Karst is characterized by caves, sinkholes, a lack of surface drainage and other climatically controlled features, and is mainly, but not exclusively, formed on limestone. The area surrounding the Mississippi River is where karst, tunnels and caves are located in the City of Saint Paul.

The caves (abandoned mines) that are located in Saint Paul are located along the river area of the city.

## c. Extent

Karst terrain is characterized by springs, caves, sinkholes, and a unique hydrogeology that results in aquifers that are highly productive but extremely vulnerable to contamination. Because of the proximity of the aquifers to the surface in many karst areas, groundwater protection is very important. See Contamination of Water for further information.

## d. History and Probability

Located in downtown Saint Paul, the caves are blocked off for safety as there have been many unauthorized visits that have resulted in injury or even death to those who enter.

On Tuesday, April 27, 2004, three 17-year olds died in the caves as a result of apparent carbon monoxide poisoning. Two others, a 17-year old and 19-year old, survived.

Another danger in the caves or mines has been groups building bonfires. Heat from a fire dries out the sandstone and can cause large pieces to detach from the ceiling. On June 13, 1988 a woman was killed in the collapse of a cave ceiling from which two male companions escaped. Dry weather and a bonfire in the cave contributed to the collapse.

There is no accurate way to determine the probability of a cave collapse or a karst event, but there are protective measures that are taken in order to minimize the likelihood and the results.

#### **e. Risk, Impact, Vulnerability and Consequences**

2012 Update: The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for karst, tunnel & caves is summarized in narrative format (Part E) and in table format (Part I) in this Section.

Because of the proximity of the aquifers to the surface in many karst areas, groundwater protection is very important. Petroleum products from leaking underground storage tanks or other spills are most common. See Contamination of Water for further information.

Vulnerabilities in the City of Saint Paul due to karst, tunnels and caves are vast and could be catastrophic if the event was large enough or involved property.

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged.

##### **1) General**

Karst, tunnels, and caves are located in downtown Saint Paul near the Mississippi River. The vulnerabilities are buildings close to the area and water supply that is integrated in the system.

##### **2) Life Safety (Public and Responders)**

Due to the dense urban development of the city, the possibility of loss of life is possible, but not likely, if there is a problem with the karst, tunnels or caves in the City of Saint Paul.

##### **3) Property (Facilities and Infrastructure)**

Depending on the event, the damages to property and infrastructure could be great or minimal. The water infrastructure could be at risk if there is contamination due karst. The tunnels and caves could cause damages to buildings located near them if they collapse.

##### **4) Continuity of Operations and Continued Delivery of Services**

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a tornado. Each City department is also required to draft and maintain a COOP. Emergency Management would be able to direct operations from pre-designated sites outside the city and would be less vulnerable to loss of services and resources if unable to use current location for operations.

5) Environment

The distinction between ground water and surface water is commonly blurry when looking at karst landscapes. Ground water may emerge as a spring, flow a short distance above ground, only to vanish in a disappearing stream, and perhaps re-emerge farther downstream again as surface water. This can create an environmental problem if toxins infiltrate karst water.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant karst contamination could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>8</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

**f. Repetitive Losses**

In regards to karst, tunnels and caves, repetitive loss information has not been collected or maintained. (2012 update)

**g. Capabilities**

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<sup>8</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.



The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

**h. Hazard Analysis Summary—Karst, tunnels & caves (2012 update)**

The tables in this section summarize the information described above in the Section H narrative for karst, tunnels & caves, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 46:** - Summary of Impact Vulnerability Ratings for Karst

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=##; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
<b>Karst</b>	2	3	2	2	1	<b>2</b>

**Table 47:** - Summary of Consequence Vulnerability Ratings for Karst

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=##; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
<b>Karst</b>	2	2	1	2	3	1	2	<b>1.86</b>

**Table 48:** - Summary of Total Risk for Karst

<b>HAZARD</b>	<b>COMBINED VULNERABILITY (I+C=V)</b>	<b>PROBABILITY (P)</b>	<b>RISK V+P=R</b>
<b>Karst</b>	<b>3.86</b>	<b>2</b>	<b>5.86</b>

## EARTHQUAKE

### b. General Description

Earthquakes occur in Minnesota due to the Mid-continental rift. This rift, running from Minnesota to Kansas, is the result of the middle of the North American continent splitting apart. Rifting is the opposite of a mountain range forming. Instead of rock material being pushed up to form a mountain, rock material falls down when a wide split in the land is made. Molten material from deep within the earth rises up to fill in the gap.

<b><u>EARTHQUAKE</u></b>  <b>Assessment:</b> <b>Lowest Risk Hazard</b>	<b>Location</b> – Unknown. Primary area is the Mississippi River Valley <b>Extent</b> – Damage to infrastructure and property <b>Probability</b> —Unlikely to low <b>Duration</b> – Several minutes <b>Seasonal pattern</b> – None <b>Speed of Onset</b> - Rapid <b>Warning time</b> – Minimal <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Power/utility outages</li><li>• Traffic/roadway damage/closures</li><li>• Visitor/staff safety</li><li>• Increased security</li><li>• Loss of deliverable services</li><li>• Major redirect of staff/equipment</li><li>• Loss of revenue</li><li>• Use of facilities as hospitals, shelters/morgues</li></ul>
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### b. Location

An earthquake has never occurred in the City of Saint Paul. There have been a few small earthquakes that have occurred in northern Minnesota.

### c. Extent

Due to the unlikely event of a measurable earthquake affecting Saint Paul the extent of damages would be immeasurable. If there was to be an earthquake that was felt in Saint Paul it is possible that buildings may need minor repairs.

### d. History and Probability

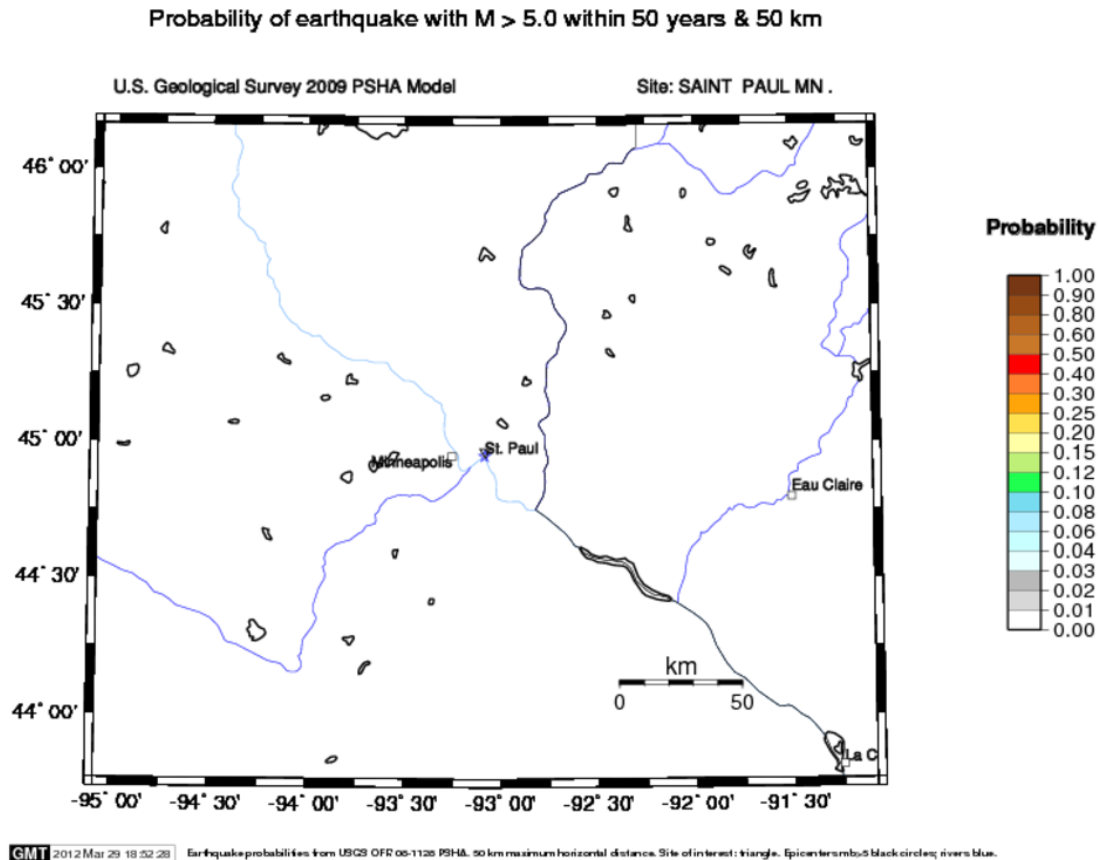
The first record of an earthquake in Minnesota was in 1860. Although the exact date is unknown, the shock was fairly strong in the central part of the State. Very little information is available about this earthquake.

There have been only three other recorded minor earthquakes in the State of Minnesota:

- 1917 an unrated (but minor) hit central part of Minnesota
- 1994 a 3.1 quake shook Granite Falls

- 2011, a 2.5 hit Alexandria

**Map 7:** Probability of Earthquake



Source: USGS

### g. Risk, Impact, Vulnerability and Consequences

**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for earthquakes is summarized in narrative format ([Part E](#)) and in table format ([Part I](#)) in this Section.

Vulnerabilities in the City of Saint Paul due to earthquakes are minimal at best. There have been no recorded earthquakes in the City of Saint Paul.

There are several vulnerable populations in the City, such as people who speak limited English, are elderly, socioeconomic status, have disabilities (physical and mental) and people who do not have the regular methods available to them in order to receive warnings (i.e. No TV, internet or are hearing impaired). The density of downtown is also a vulnerable aspect.

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged.

1) General

Earthquakes happen in the State of Minnesota very rarely, and when they do they are generally very small and cause little to no damage. There have been no recorded earthquakes occurring in the City of Saint Paul. There have been earthquakes that have happened in other states that have been felt in Saint Paul, but there was no recorded damage in those events.

2) Life Safety (Public and Responders)

Due to the fact that not only has an earthquake never hit the City of Saint Paul the only measured ones in the State have been small, the likelihood of loss of life or public safety being of concern is minimal.

3) Property (Facilities and Infrastructure)

Due to the dense urban development of the city, if a large magnitude earthquake were to hit the City there could damage to infrastructure and property. Due to the fact that an earthquake has never directly hit the City of Saint Paul, the total affect it would have is immeasurable.

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of an earthquake. Each City department is also required to draft and maintain a COOP. The Emergency Management Department would be able to direct operations from pre-designated sites outside the city (or inside depending on the path and level of destruction) and would be less vulnerable to loss of services and resources if the storm caused damage to multiple areas in the City. In addition to communications infrastructure, resources such as facilities, vehicles, equipment and supplies would be the most vulnerable element of operations if a large earthquake did hit Saint Paul.

5) Environment

The environmental vulnerabilities due to a catastrophic earthquake include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine storm clean-up, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from an earthquake is extremely low.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant earthquake could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>9</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

**f. Repetitive Losses**

In regards to earthquakes, repetitive loss information has not been collected or maintained because there has never been an earthquake in Saint Paul. (2012 update).

**g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

**h. Hazard Analysis Summary—Earthquake (2012 update)**

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<sup>9</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

The tables in this section summarize the information described above in the Section H narrative for earthquake, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 49:** - Summary of Impact Vulnerability Ratings for Earthquake

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Earthquake	1	1	1	1	1	1

**Table 50:** - Summary of Consequence Vulnerability Ratings for Earthquake

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Earthquake	1	1	1	1	1	1	1	1

**Table 51:** - Summary of Total Risk for Earthquake

<b>HAZARD</b>	<b>COMBINED VULNERABILITY (I+C=V)</b>	<b>PROBABILITY (P)</b>	<b>RISK V+P=R</b>
<b>Earthquake</b>	<b>2</b>	<b>1</b>	<b>3</b>



## FAILURE OF A DAM OR LEVEE

### a. General Description

Below are definitions as it applies to the City of Saint Paul and its Dam/Levee system, along with a general location of the dam and levee system in the City of Saint Paul.

**Dam** – a barrier preventing the flow of water, or a barrier built across a watercourse for the purpose of impounding water

Saint Paul has a dam on the western boundary of the City: The Ford Dam (Lock and Dam #1). Original construction was completed in 1917, and was reconstructed in 1929. Main Lock completed May 1932. Last major rehabilitation was in 1978-1983.

**Map 8:** St. Anthony Falls Lock & Dam



Source: US Army Corps of Engineers, Saint Paul District

**Levee** – is an embankment for preventing flooding, or a continuous dike or ridge for the confining of water.

Saint Paul has a system of levees along the Mississippi River front along the downtown area.

When a dam fails, huge quantities of water rush downstream with great destructive force. Dam failure or levee breaches can occur with little warning, sometimes within hours of the first signs of breaching. In other cases, failures and breaches can take much longer to occur, from days to weeks, as a result of debris jams, the accumulation of melting snow or other events.

<p><b><u>FAILURE OF LEVEE/ DAM</u></b></p> <p><b>Assessment:</b> <b>High Risk Hazard</b></p>	<p><b>Location</b> – Mississippi river flood plain (Hidden Falls, Crosby, Harriet Island, Lilydale, Lampert’s landing, Pig’s Eye WRC, Battle Creek)</p> <p><b>Extent</b> – Major damage to buildings and property</p> <p><b>Probability</b>--Low</p> <p><b>Duration</b> – Several weeks</p> <p><b>Seasonal pattern</b> – None</p> <p><b>Speed of Onset</b> -Rapid</p> <p><b>Warning time</b> – Minimal</p> <p><b>Repetitive Loss</b>- N/A</p>	<p><b>CASCADING EFFECTS</b></p> <ul style="list-style-type: none"> <li>• Power/utility outages</li> <li>• Traffic/roadway damage/closures</li> <li>• Visitor/staff safety</li> <li>• Increased security</li> <li>• Loss of deliverable services</li> <li>• Major redirect of staff/equipment</li> <li>• Loss of revenue</li> </ul>
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#### **b. Location**

**Dam**—Located on Mississippi River mile 847.9, which is 6 miles downstream from St. Anthony Falls and 2 miles upstream of Ft. Snelling.

**Levee**— Located in Lowertown along the Mississippi river flood plain. There are several aspects to the levee system in the City of Saint Paul. All are maintained and positioned for the greatest benefit for protecting life and property.

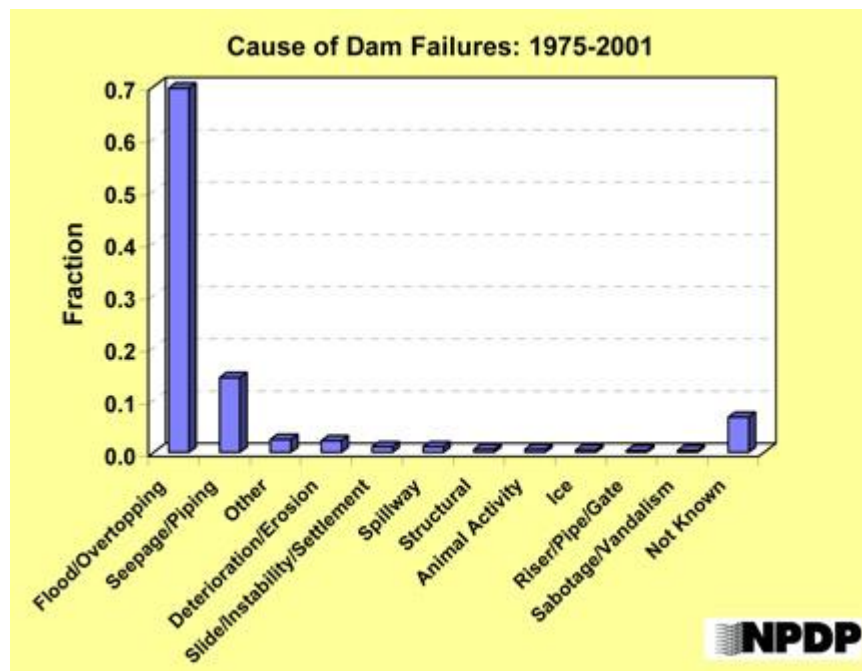
#### **c. Extent**

The failure of a dam or levee can pose one of the most significant hazards to life safety, property, and/or natural resources. The main hazard surrounding a dam or levee failure is flooding, and usually is sudden and causes extreme damage to property and infrastructure.

#### **d. History and Probability**

The Ford Dam in the City of Saint Paul was constructed in 1917 as part of the Upper Mississippi Lock and Dam system. Levees have been constructed along the Mississippi River to protect against potential flooding hazards. No dam or levee failure record has been located. A national list of causes of dam failures from 1975-2001 is below. The causes are important to look over and understand to prevent occurrences.

**Table 52: Cause of Dam Failures 1975-2001**



Source: [National Performance of Dams Program](#)

#### **e. Risk, Impact, Vulnerability and Consequences**

Vulnerabilities in the City of Saint Paul due to a dam/levee failure, which would result in a massive flood event, are vast and could be catastrophic to the considerable quantity of people, structures, and infrastructure.

There are several vulnerable populations in the City, such as people who speak limited English, are elderly, socioeconomic status, have disabilities (physical and mental) and people who do not have the regular methods available to them in order to receive warnings (i.e. No TV, internet or are hearing impaired). The density of downtown is also a vulnerable aspect.

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged.

##### **1) General**

Floodplain areas around the river and areas thought to be protected from flood events may also experience dramatic inundation if levees fail during the stress of flood events.

##### **2) Life Safety (Public and Responders)**

People and buildings located in or near a floodplain are at the greatest risk, and although there is still a risk, people and businesses located outside of a floodplain have the slightest risk. The density of downtown is a vulnerable aspect in the event of a major flooding event for both residents and responders as flooding is dangerous to navigate in and around.

Health risks accompany flooding due to pooling or stagnant water. This standing water is host for bacteria from flooded septic tanks and sewage systems. Booms in insect populations increase the risk for insect-borne diseases such as West Nile virus. After a flood, mold contamination is possible in homes and other buildings. These consequences persist long after the flood waters have receded.

### 3) Property (Facilities and Infrastructure)

Most property losses occur to residential structures which would cause an economic hardship for people who do not have flood insurance.

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged. Depending on the location and the intensity of the flooding the areas of concern are varied.

The City of Saint Paul has adopted the Minnesota State Building Code.

### 4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a flood. Each City department is also required to draft and maintain a COOP. The Emergency Management Department would be able to direct operations from pre-designated sites outside the city (or inside depending on the path and level of destruction) and would be less vulnerable to loss of services and resources if the storm caused damage to multiple areas in the City. In addition to communications infrastructure, resources such as facilities, vehicles, equipment and supplies could be the most vulnerable element of operations, as severe floods can destroy everything in their path.

### 5) Environment

The environmental vulnerabilities due to flooding include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine storm clean-up, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from a flood is low.

### 6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant flood event could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

#### 7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>10</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

#### **f. Repetitive Losses**

There has been no documented loss of life or property in a dam or levee failure in the City of Saint Paul in modern times. NFIP insured structures in the City of Saint Paul that have repetitive losses at the current time is zero.

#### **g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

#### **h. Hazard Analysis Summary—Dam/Levee Failure (2012 update)**

The tables in this section summarize the information described above in the Section H narrative for dam/levee failure, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

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<sup>10</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 53: - Summary of Impact Vulnerability Ratings for Dam/Levee Failure**

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Failure of a Dam/ Levee	3	2	3	2	2	2.4

**Table 54: - Summary of Consequence Vulnerability Ratings for Failure of a Dam/ Levee**

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Failure of a Dam/ Levee	2	2	2	4	4	3	3	2.85

**Table 55: - Summary of Total Risk for Failure of a Dam/ Levee**

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
Failure of a Dam/ Levee	5.25	2	10.25

## INFECTIOUS DISEASE (HUMAN OR ANIMAL)

### a. General Description

An infectious disease is an organism that has the potential to spread or affect a population in undesirable ways. New and reemerging infectious diseases will pose a rising global health threat and will complicate not only Minnesota's, but also the United States and global security over the next 20 years. These diseases will endanger American citizens at both home and abroad.

Three terms are commonly used to classify disease impacts: endemic, epidemic and pandemic. An endemic is present at all times at a low frequency, an epidemic is a sudden severe outbreak of disease, and a pandemic is an epidemic that becomes very widespread and affects a whole region, a continent, or the world.

Infectious diseases are one of the leading causes of death. The spread of infectious diseases results as much from changes in human behavior--including lifestyles and land use patterns, increased trade and travel, and inappropriate use of antibiotic drugs--as from mutations in pathogens.

Over twenty well-known diseases--including tuberculosis (TB), malaria, and cholera--have reemerged or broadened geographically since 1973, often in more potent and drug-resistant forms.

At least 30 previously unknown disease agents have been identified since 1973, including HIV, Ebola, Hepatitis C, and Nipah virus, for which no cures are available.

Of the seven prevalent killers worldwide, TB, malaria, hepatitis, and, in particular, HIV/AIDS continue to surge, with HIV/AIDS and TB likely to account for the overwhelming majority of deaths from infectious diseases in developing countries by 2020.

<b><u>INFECTIOUS DISEASE</u></b>		<b>CASCADING EFFECTS</b>
<b>Assessment:</b> <b>Medium Risk Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> – Sickness in humans and/or animals, quarantine and possible death. May result in lost time for employees <b>Probability</b> --Moderate <b>Duration</b> – Several weeks to several months <b>Seasonal pattern</b> – None <b>Speed of Onset</b> - Slow <b>Warning time</b> – Days <b>Repetitive Loss</b> - N/A	Closure of facilities Loss of revenue Loss of resources (animal death) Quarantine animals humans Illness to employees Loss of employee work Drain on workforce

Acute lower respiratory infections--including pneumonia and influenza--as well as diarrheal diseases and measles, appear to have peaked at high frequency levels.

**b. Location**

Infectious disease can affect any species. Some can be transferred between species, such as the swine flu, and cause problems for the receiving population. The Minneapolis-Saint Paul International airport is a likely place where disease from other parts of the world could be introduced into the City of Saint Paul.

**c. Extent**

The severity of a pandemic virus can be evaluated from two perspectives: that of the individual who has been infected and from the population level which is how many complications and deaths might be expected as a whole.

**d. History and Probability**

Pandemics occur when disease affects large numbers of the population worldwide. Epidemics occur when large numbers are affected in a more localized area such as a city, region, state, or nation. Pandemics have occurred three times in the world's human population.

**Table 56:** Diseases in Ramsey County Minnesota, 2010 and 2005-2009:



DISEASE	2010 TOTAL	2005-2009		
		5 Year Ave.	Highest No. Cases	Lowest No. Cases
Aseptic Meningitis	33	12	19	8
Campylobacteriosis	113	70	78	59
Chlamydia	2481	2278	2393	2038
Cryptosporidiosis	17	7	10	6
Encephalitis	2	2	5	0
E.coli O157:H7	31	17	25	11
Giardiasis	198	208	408	87
Gonorrhea	339	661	775	472
Haemophilus Influenza Invasive disease	3	8	12	7
Hepatitis A	3	4	10	1
Hepatitis B	2	6	12	2
Hepatitis C	0	2	4	0
HIV Infection AIDS Cases	86	91	103	70
Legionellosis	8	4	7	2
Listeriosis	0	1	3	0
Lyme Disease	85	75	95	61
Malaria	4	7	10	4
Meningococcal Disease	2	2	2	0
Mumps	0	4	14	1
Pertussis	99	51	110	16
Rubeola ( Measles)	0	0	0	0
Salmonellosis	102	71	76	64
Shigellosis	6	26	36	17
Strep gr A Invasive disease	28	20	30	13
Strep gr B Invasive disease	67	49	61	38
S.pneumoniae Invasive	55	23	36	4
Syphilis (Total)	84	54	67	36
Tuberculosis	34	42	47	36
West Nile	2	2	5	0

Source: Saint Paul Ramsey County Public Health

The 1918-1919 Spanish Flu caused the highest number of deaths. India had 16 million deaths. The U.S. had 675,000 deaths. Worldwide, the estimated fatalities were 20 million to 50 million.

The 1957-58 Asian flu was identified in February 1957 in China. By June, it entered the U.S. Globally it caused a million deaths. In the U.S., 70,000 persons died. It was a Type A virus.

The 1968-69 Hong Kong Flu caused four million deaths worldwide and 34,000 deaths in the U.S. It was a Type A virus.

**e. Risk, Impact, Vulnerability and Consequences**

**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for infectious disease summarized in narrative format ([Part E](#)) and in table format ([Part I](#)) in this Section.

1) General

In the United States, the public health system works at the federal, state and local levels to monitor diseases, plan and prepare for outbreaks and prevent epidemics where possible. But, in the age of air travel and worldwide shipping, it is becoming increasingly difficult to contain localized outbreaks as infected or exposed people travel and work, sending the disease across the globe in a matter of hours. Global travel and international business increases the vulnerability level of the City of Saint Paul.

Based on historic occurrence and population density, the potential severity and impact of an infectious disease outbreak could be substantial resulting in multiple deaths and complete shutdown of facilities and public buildings for 30 days or more.

2) Life Safety (Public and Responders)

A pandemic or serious infectious disease outbreak would result in critical workers not being able to perform their jobs. Impacted professions include medical personnel, public safety personnel, and utility staff.

3) Property (Facilities and Infrastructure)

A pandemic would not directly destroy property; however it could be damaged by lack of maintenance because of inadequate staff.

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a tornado. Each City department is also required to draft and maintain a COOP. Saint Paul Emergency Management would be able to direct operations from pre-designated sites outside the city or telecommute and would be less vulnerable to loss of services and resources if the infectious disease event lasted an extended period.

5) Environment

The environmental vulnerabilities due to an infectious disease event include water contamination/pollution; soil damage from chemical spills, and natural gas leaks if they are not cleaned up or dealt with due to inadequate workforce. The City maintains the capacity to perform routine storm clean up under normal circumstances, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant infectious disease could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby

indicating that a high level of confidence can improve the effectiveness of preparedness<sup>11</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

**f. Repetitive Losses**

In regards to infections diseases (human/animal), repetitive loss information has not been collected or maintained. (2012 update)

**g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

**h. Hazard Analysis Summary—Disease Human/Animal (2012 update)**

The tables in this section summarize the information described above in the Section G narrative for animal escape, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 57:** - Summary of Impact Vulnerability Ratings for Infectious Disease

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Infectious Disease	5	1	3	4	5	3.6

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<sup>11</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 58: - Summary of Consequence Vulnerability Ratings for Infectious Disease**

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Infectious Disease	2	3	4	1	4	4	4	3.14

**Table 59: - Summary of Total Risk for Infectious Disease**

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
Infectious Disease	6.74	2	8.74

## INVASIVE SPECIES

### a. General Description

Species that have been introduced, or moved, by human activities to a location where they do not naturally occur are termed "exotic," "nonnative," "alien," and "nonindigenous." Conversely, "native" describes a species living in an area where it is found naturally. An exotic species is not necessarily harmful; in fact the majority exotic species have beneficial purposes. When a non-native species invades lands or waters "particularly natural communities" causing ecological or economic problems, it is termed "invasive." The terms "harmful exotic species," "plant pest," "pest plant," "nonindigenous aquatic nuisance species," and "non-native invasive species" are all groups of nonnative invasive species.

Invasive species are species that are not native to Minnesota and cause economic or environmental harm or harm to human health.

Minnesota's natural resources are threatened by a number of invasive species such as zebra mussels, Eurasian water milfoil, common buckthorn, bark beetles, Khapra beetle, gypsy moth, and emerald ash borer.

<b><u>INVASIVE SPECIES</u></b>		<b>CASCADING EFFECTS</b>
<b>Assessment:</b> <b>Moderate Risk</b> <b>Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> – Damage to river/lake and tree/plant depending on type <b>Probability</b> —Moderate to high <b>Duration</b> – Extended periods <b>Seasonal pattern</b> – None <b>Speed of Onset</b> – Slow to rapid <b>Warning time</b> – Days to weeks <b>Repetitive Loss</b> - N/A	<ul style="list-style-type: none"><li>• Closure of facilities</li><li>• Loss of revenue</li><li>• Loss of resources (trees, plants, animals, water facilities)</li><li>• Redirect of staff/equipment</li><li>• Redirect of resources to combat disease</li><li>• Closure of some park areas</li></ul>

### b. Location

There are many avenues of introduction and spread of invasive species depending on the type. Most species introductions are the result of people's actions. Some introductions, such as common carp (*Cyprinus carpio*), European buckthorn (*Rhamnus cathartica*), and purple loosestrife, were intentional and caused unexpected harm. Many other invasive species introductions are unintentional.

Invasive species are often unknowingly carried in or on animals, vehicles, ships, commercial goods, produce, wood, water, and even clothing. Experience has shown that it is more productive to manage the pathways than species by species.

### **c. Extent**

According to the Minnesota DNR:

“A number of invasive plants and animal species have been severe world-wide agents of habitat alteration and degradation, and competition for native species. They are the major cause of biological diversity loss throughout the world, and are considered "biological pollutants." Their populations can often rapidly increase allowing them to disrupt native plant communities and crowd out native species. By changing habitat, they can also affect species beyond those they may directly displace. They can cause problems for those who use natural resources, whether for recreational use of land or waters or industrial use of public waters. Once established, invasive species rarely can be eliminated.”

The cost to control invasive species and the damages they inflict upon property and natural resources in the U.S. is estimated at \$137 billion annually. The USDA did a study in 2011 and determined that non-native wood-boring insects, such as the emerald ash borer and the Asian longhorned beetle, are costing an estimated \$1.7 billion in local government expenditures and approximately \$830 million in lost residential property values every year.

### **d. History and Probability**

An invasive species problem is not a new problem in Minnesota, and in fact there have been many programs over the years to deal with invasive species. The problem, however, does continue to grow and is a costly problem to not only homeowners, but the government.

Below is a list of programs that have been established since 1987 in order to deal with the problem of invasive species.

- 1987: purple loosestrife program established
- 1987: 1<sup>st</sup> Eurasian watermilfoil infestation
- 1989: EWM program established
- 1989: 1<sup>st</sup> zebra mussel infestation
- 1991: Invasive Species program established

### **e. Risk, Impact, Vulnerability and Consequences**

<p><b>2012 Update:</b> The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency</p>
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Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for insect infestation is summarized in narrative format (Part E) and in table format (Part H) in this Section.

1) General

Vulnerabilities for the City of Saint Paul in regards to invasive species are limited to natural habitats such as rivers, lake and landscape. The affects of invasive species on the general public is negligible as a whole as most do not have any experience with them.

2) Life Safety (Public and Responders)

Invasive species do not pose an immediate danger or threat to life safety. The damages they cause are slow and take time to progress. There can be health risks associated with invasive species but it is not a risk that requires great attention.

3) Property (Facilities and Infrastructure)

Invasive species can over time break down infrastructure or property, but it is slow and the impact can be altered through careful elimination of the problem species. This is not always done, however, and the problem needs to be monitored and carefully eliminated in order to protect property and infrastructure.

4) Continuity of Operations and Continued Delivery of Services

The continuity of operations and continued delivery of services would not be impacted by an invasive species event. The City of Saint Paul Emergency Management has Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of an extreme invasive species event. Each City department is also required to draft and maintain a COOP.

5) Environment

The environmental vulnerabilities due to an invasive species are vast and an ongoing issue. The native species to the area have to fight to exist and some of the procedures to eliminate invasive species can cause cascading effects in the ecosystem. The level of risk for long-term environmental impacts from an invasive species event is medium.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global



businesses and industries are headquartered in the City. Invasive species as a whole can cause many economic cascading effects as they progress and take over natural habitats.

#### 7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>12</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

#### **f. Repetitive Losses**

In regards to insect infestation, repetitive loss information has not been collected or maintained. *(2012 update)*

#### **g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

#### **h. Hazard Analysis Summary—Insect Infestation** *(2012 update)*

The tables in this section summarize the information described above in the Section G narrative for insect infestation, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

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<sup>12</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 60: - Summary of Impact Vulnerability Ratings for Invasive Species**

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=V; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Invasive Species	1	2	1	3	1	1.6

**Table 61: - Summary of Consequence Vulnerability Ratings for Invasive Species**

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Invasive Species	1	1	2	1	3	1	1	1.43

**Table 62: - Summary of Total Risk for Invasive Species**

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
Invasive Species	3.03	2	5.03

## Technological or Manmade Hazards

This section is made up of technological and manmade hazards. The technological and manmade hazards listed have been previously identified as a risk to the City of Saint Paul. This is due to either previous incidents in the city or risks that are known through other identification processes.

FEMA defines a technological hazard as “originating from technological or industrial conditions, including accidents, dangerous procedures, infrastructure failures or specific human activities, that may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage”.

Manmade hazards are those hazards caused by direct human intervention and create a potential threat to the health, safety, and welfare of citizens. The major manmade hazards that will be discussed in this section are animal escape, major community events, large scale threats of violence/criminal acts, and terrorism.

**2012 Update:** No technological hazards have been added or eliminated from the jurisdiction’s plan update, but they have been readjusted or renamed in order to remove duplication. Information on each type of disaster has been reviewed and updated from the previous mitigation plan (2007), the State of Minnesota mitigation plan (2011), National Oceanographic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), The U.S. Army Corps of Engineers (USACE), and Saint Paul Campus Climatological Observatory (University of Minnesota).

(2012 Update) The category “Infrastructure Failure” has been created in order to encompass nine hazards that were previously identified as individual hazards. They are hazards that either involve actions that the City can do little to mitigate against, or are more of a cascade effect from other hazards that don’t impact the City by themselves, but could potentially cause serious impact or consequences to the City infrastructure. The “Terrorist and Criminal Acts” hazard category encompasses both Large Scale Threats of Violence (Criminal Acts) and Terrorism and CBRNE (Terrorism).

The only other reconfiguration made to the threat/hazard list in the 2012 update is that “Failure of a Dam/Levee” was moved to the natural hazard section due to the flooding impact that results from the dam/levee failure. This alteration is consistent with change made in the 2011 State of Minnesota plan update.

## INFRASTRUCTURE FAILURE

### a. General Description

Infrastructure failure is defined as an event that either stops the use of or creates an interruption of a known infrastructure system. Infrastructure failure may result from natural hazards, technological hazards, from failure due to human error, man-made occurrences, simple equipment failure, or poor maintenance. The risks of infrastructure failure can be significant.

The City of Saint Paul is including (but not limiting to this list) large scale fuel shortage, computer virus/hacker, water supply contamination, natural gas leak, chemical leak/spill, hazardous material event, explosion, communication failure, and labor strikes as infrastructure failure.

Other areas of infrastructure include transportation and airport issues. Transportation systems in the City of Saint Paul include air, rail, water and road. All of these systems and supporting transportation resources provide services on a national, regional and local basis and are critical to local, regional, national and international commerce. While highway traffic accidents are a daily occurrence, transportation accidents with impacts to local commerce or resulting in transportation diversions are fairly rare. The major issue surrounding transportation systems revolves around hazardous material and major accidents that create a temporary shut down of transportation mechanisms.

Due to aging infrastructure, there is concern surrounding maintenance and use. On Wednesday, August 1, 2007 the I-35W highway bridge over the Mississippi River in Minneapolis experienced a catastrophic failure in the main span of the deck truss. Although this did not occur in the City of Saint Paul, it happened in a neighboring city and affected more than just Minneapolis. The collapse resulted in 13 deaths and 145 people injured. Major safety issues identified in the investigation included insufficient bridge design, lack of quality control procedures for designing bridges, insufficient Federal and State procedures for reviewing and approving bridge design plans and calculations, lack of guidance for bridge owners, and lack of inspection guidance for conditions of gusset plate distortion. This is just an example of infrastructure failure, and why mitigating against future failures is extremely important.

## Computer Virus/Hacker

So far, the most common threat agents have been unintentional threats caused by publicly released worms/viruses, accidents and incidents caused by disgruntled employees, former employees, and others that have worked within the organization.

To date, there have been remarkably few documented intentional cyber attacks on U.S. critical infrastructure networks. However, any disruption in communication and information technology infrastructure, including the Internet and telecommunication networks can result in significant impact on the operation of critical systems.

<b><u>COMPUTER VIRUS/HACKER</u></b>  <b>Assessment:</b> <b>Moderate Risk Hazard</b>	<b>Location</b> – Citywide, but also variable. Primary targets: Downtown, Como Campus, Central Service Facility. <b>Extent</b> – damage to/loss of computer network and documentation <b>Probability</b> —Moderate to high <b>Duration</b> – Extended periods <b>Seasonal pattern</b> – None <b>Speed of Onset</b> – Slow to rapid <b>Warning time</b> – Minimal <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Protection of system</li><li>• Containment and clean-up</li><li>• Network security</li><li>• Police/FBI if considered a crime</li><li>• Loss of service(s) if computers affect programming/cash registers</li><li>• redirect of staff/resources</li></ul>
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## Chemical Leak/ Spill

The danger level of chemical spills depend on several factors, which include but are not limited to nature of spilled substances/chemicals (hazardous or not), spill volume, work area (well-ventilated area or not), spill location and conditions (pressure and temperature) of the spilled chemicals.

Chemicals may be combustible, flammable, explosive, toxic, corrosive, oxidator or reactive.

<p><b><u>CHEMICAL LEAK/SPILL</u></b></p> <p><b>Assessment:</b> <b>Medium Risk Hazard</b></p>	<p><b>Location</b> – Citywide  <b>Extent</b> – Damage to people, property and buildings  <b>Probability</b>—Moderate to high  <b>Duration</b> – Several hours to a few days  <b>Seasonal pattern</b> – None  <b>Speed of Onset</b> –Rapid  <b>Warning time</b> – Minimal  <b>Repetitive Loss</b>- N/A</p>	<p><b>CASCADING EFFECTS</b></p> <ul style="list-style-type: none"> <li>• Evacuation/safety of visitors and staff</li> <li>• Medical attention to visitors/staff</li> <li>• Containment and clean-up</li> <li>• Security</li> <li>• Notification of OSHA/inspection</li> <li>• Environmental threats</li> <li>• Noxious fumes/gasses</li> </ul>
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### Natural Gas Leak

Natural gas is used by more than 50 percent of American households as their main heating source. Natural gas is clean, efficient, and relatively safe

The biggest hazard of a gas leak is an explosion. When natural gas builds up in an enclosed area, it becomes extremely volatile. A gas build up has the potential to be explosive, or could make those in the area very sick.

<p><b><u>NATURAL GAS LEAK</u></b></p> <p><b>Assessment:</b> <b>Moderate Risk Hazard</b></p>	<p><b>Location</b> – Citywide  <b>Extent</b> – Damage people, property and buildings  <b>Probability</b>—Moderate to high  <b>Duration</b> – Several hours to a few days  <b>Seasonal pattern</b> – None  <b>Speed of Onset</b> –Rapid  <b>Warning time</b> – Minimal  <b>Repetitive Loss</b>- N/A</p>	<p><b>CASCADING EFFECTS</b></p> <ul style="list-style-type: none"> <li>• Evacuation/safety of visitors and staff</li> <li>• Medical attention to visitors/staff</li> <li>• Containment and clean-up</li> <li>• Security</li> <li>• Notification of OSHA/inspection</li> <li>• Environmental threats</li> <li>• Noxious fumes/gasses</li> </ul>
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### Hazardous Material Event

Hazardous materials are chemical substances, when, released or misused, pose a threat to the environment or to the health of people and animals. These chemicals are used in industry, agriculture, medicine, research, and consumer goods.

Hazardous materials come in the form of explosives, flammable and combustible

substances, poisons, and radioactive materials. These substances are most often released as a result of transportation or industrial accidents.

The City of Saint Paul has a list of 302 Facilities. This information is kept and maintained by the Emergency Management Department for the City.

<b><u>HAZARDOUS MATERIAL EVENT</u></b>  <b>Assessment:</b> <b>Medium Risk Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> – Damage to people, property and buildings <b>Probability</b> —Low to moderate <b>Duration</b> – Several hours to a few days <b>Seasonal pattern</b> – None <b>Speed of Onset</b> –Rapid <b>Warning time</b> – Minimal <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Evacuation/safety of visitors and staff</li><li>• Medical attention to visitors/staff</li><li>• Containment and clean-up</li><li>• Security</li><li>• Notification of OSHA/inspection</li><li>• Environmental threats</li><li>• Noxious fumes/gasses</li></ul>
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### Water Supply Contamination

Drinking water comes from surface water and from ground water. Large-scale water supply systems tend to rely on surface water resources such as rivers, lakes, and reservoirs. Smaller water systems tend to use ground water pumped from wells that are drilled into aquifers, geologic formations that contain water.

Microbiological and chemical contaminants can enter water supplies, and this would be considered a water supply contamination. Chemicals can breach through soils from leaking underground storage tanks, feedlots and waste disposal sites. Human wastes and pesticides can also be carried to lakes and streams during heavy rains or snow melt.

<p><b><u>WATER SUPPLY CONTAMINATION</u></b></p> <p><b>Assessment:</b> <b>Medium Risk Hazard</b></p>	<p><b>Location</b> – Citywide  <b>Extent</b> – Risk to life and industrial processes  <b>Probability</b>—low to moderate  <b>Duration</b> – Several hours to a few days  <b>Seasonal pattern</b> – None  <b>Speed of Onset</b> –Rapid  <b>Warning time</b> – Minimal  <b>Repetitive Loss</b>- N/A</p>	<p><b>CASCADING EFFECTS</b></p> <ul style="list-style-type: none"> <li>• Illness and epidemics in both humans and animals</li> <li>• Business loss due to decreased productivity</li> <li>• Loss of employee work</li> <li>• Panic</li> <li>• Water may not be suitable for fire suppression due to contaminants</li> <li>• Shortage may cause dislocation of population (universities, hospitals, etc).</li> </ul>
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### Communication Failure

Telecommunication networks are vitally important component of the community's basic infrastructure and essential to public safety. Multiple companies provide, voice, data, and video services using a variety of technologies. The local system is generally reliable but is vulnerable to the effects of a disaster. Telecommunications can be disrupted due to an electrical power failure.

A major electrical power failure is defined as a failure of the electrical distribution system that will exceed twenty-four hours in duration and affect greater than 33% of the geographical area of the county. Electrical distribution systems can be interrupted for a number of reasons, but those that have historically been the main cause are high winds, severe thunderstorms and winter storms. A prolonged major electrical distribution system failure during the middle of winter, accompanied by very cold temperatures, can have dramatic effects on a population

<p><b><u>COMMUNICATION FAILURE</u></b></p> <p><b>Assessment:</b> <b>Moderate Risk Hazard</b></p>	<p><b>Location</b> – Citywide  <b>Extent</b> – Loss of service(s), reduced response time  <b>Probability</b>—low to moderate  <b>Duration</b> – Unknown  <b>Seasonal pattern</b> – None  <b>Speed of Onset</b> –Rapid  <b>Warning time</b> – Minimal  <b>Repetitive Loss</b>- N/A</p>	<p><b>CASCADING EFFECTS</b></p> <ul style="list-style-type: none"> <li>• Major redirect of staff/equipment</li> <li>• Loss of deliverable services</li> <li>• Visitor/staff safety</li> <li>• Increased security</li> <li>• Loss of revenue</li> <li>• Increased use of radio</li> </ul>
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## Explosion

When certain chemicals, gases, and other substances are kept in an unstable state or are exposed to heat or fire, they may pose the risk of exploding. When a substance explodes, it usually involves a quick increase in volume and the release of energy in a violent manner. Explosions may involve the release of chemicals, high temperatures, and shock waves.

If an unstable substance explodes when people are present, the blast may cause serious injuries or even death. It is important to understand the different types of explosions and where they typically occur in order to keep yourself as safe as possible. Everyday substances that can be found at home, in the workplace, and in public areas can potentially cause a devastating explosion.

People who are walking, standing, or working near the site of a blast may suffer injuries resulting from flying debris, impact injuries, burns, heat / smoke / chemical inhalation, and other trauma. Explosions and blasts may be caused by improper transport, storage, or treatment, and may result in physical injuries and serious property damage.

<b><u>EXPLOSION</u></b>  <b>Assessment:</b> <b>Medium Risk Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> – Damage to people, property, buildings and infrastructure <b>Probability</b> —low <b>Duration</b> – Several hours to a few days <b>Seasonal pattern</b> – None <b>Speed of Onset</b> –Rapid <b>Warning time</b> – Minimal <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Evacuation/safety of visitors and staff</li><li>• Medical attention to visitors/staff</li><li>• Containment and clean-up</li><li>• Increased Police/Security needs</li><li>• Notification of OSHA/inspection</li><li>• Noxious fumes/gasses</li><li>• Loss of service(s)/revenue</li></ul>
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## Labor Strikes

A general strike is a work stoppage involving the entire labor force in a given region, rather than being isolated to workers in a specific industry or workplace. General strikes were used as a tool for labor organizing into the 20th century, at which point they became less common. In some regions, people may use this term to refer to strikes involving everyone in a particular union, industry, or workplace, rather than the workforce as a whole, although this usage is technically incorrect.

The general strike results in a ripple effect where the entire economy grinds to a halt and people cannot access services like public transit. This tends to lead to more pressure on the people or industry being asked to make reforms for their workers. As members of the general public are inconvenienced or public health threats emerge as a result of cessation of services like garbage collection, negotiators are subjected to close scrutiny.

<p><b><u>LABOR STRIKES</u></b></p> <p>Assessment:  <b>Moderate Risk Hazard</b></p>	<p><b>Location</b> – Citywide  <b>Extent</b> – Loss of service(s), reduced response time, redirect of staff/equipment  <b>Probability</b>—low to moderate  <b>Duration</b> Unknown  <b>Seasonal pattern</b> – None  <b>Speed of Onset</b> –Slow  <b>Warning time</b> – Weeks  <b>Repetitive Loss</b>- N/A</p>	<p><b>CASCADING EFFECTS</b></p> <ul style="list-style-type: none"> <li>• Redirect of staff/equipment</li> <li>• Loss of deliverable services</li> <li>• Visitor/staff security</li> <li>• Facility/computer protection</li> <li>• Loss of revenue</li> <li>• Closure of facilities</li> <li>• Media attention</li> </ul>
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### Large Scale Fuel Shortage

The disruption of the fuel supply could be a result of many things including:

- an industrial dispute;
- a targeted disruptive protest;
- an overseas supply failure or refusal to supply fuel;
- an industrial accident.

<p><b><u>LARGE SCALE FUEL SHORTAGE</u></b></p> <p>Assessment:  <b>Moderate Risk Hazard</b></p>	<p><b>Location</b> – Citywide  <b>Extent</b> –Loss of services/ facility shutdown  <b>Probability</b>—low to moderate  <b>Duration</b> – Unknown  <b>Seasonal pattern</b> – None  <b>Speed of Onset</b> –Slow  <b>Warning time</b> – Days to weeks  <b>Repetitive Loss</b>- N/A</p>	<p><b>CASCADING EFFECTS</b></p> <ul style="list-style-type: none"> <li>• Redirect of service(s)/resources</li> <li>• Closure of facilities</li> <li>• Protection of plant/animal collections</li> <li>• Increased security</li> </ul>
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**b. Location**

Infrastructure Failure includes large scale fuel shortage, water supply contamination, natural gas leak, computer virus/hacker chemical leak/spill, hazardous material event, explosion, communications failure, and labor strikes. These events may happen on a large or small scale, but can regardless cause serious problems due to the everyday needs of the community. Each infrastructure system may be dependant on another infrastructure area, which in turn makes each very vulnerable to failure.

**c. Extent**

Infrastructure failure would cause many serious effects to the citizens of Saint Paul, as well as create a ripple effect throughout the region. Infrastructure is used in daily life by people who live and work in Saint Paul. If there was to be a catastrophic loss of an aspect of infrastructure the cascading effects would multiply the devastation and amount of people it affects.

**d. History and Probability**

Serious infrastructure failure is a rare occurrence. There are many safeguards in place to ensure that the infrastructure in place works as desired. In the event of a natural disaster the chances of infrastructure failure as a result of the disaster increases.

**e. Risk, Impact, Vulnerability and Consequences**

**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for infrastructure failure is summarized in narrative format ([Part E](#)) and in table format ([Part I](#)) in this Section.

1) General

Infrastructure failure is especially vulnerable to not only human error but also intentional attacks. This causes levels of cascading effects and in turn can cause other failures along the way.

The vulnerability of all of these infrastructures is increased by their mutual interdependence. The electricity and communication networks are particularly vital

for the smooth functioning of other infrastructures. In addition, intra-dependence means that the failure of one section of a network can have negative impacts on other parts: this is a major risk in electricity, rail and communications.

Each individual utility undertakes comprehensive asset management planning to reduce the chance that they will no longer be able to provide services, and undertakes recovery planning to enhance their speed of recovery in a crisis. The cascade effect that occurs with infrastructure failure is a vulnerable aspect to the City's operations and public safety.

2) Life Safety (Public and Responders)

Infrastructure failure can pose an immediate threat to the public and responders due to the necessity of most in daily life for the public and responders.

3) Property (Facilities and Infrastructure)

Property and facilities operations can be affected due to an infrastructure failure, depending on the level of failure and the length. This can cause relocation of populations due to property damage and lack of energy resources.

4) Continuity of Operations and Continued Delivery of Services

The continuity of operations and continued delivery of services would be minimally affected by some infrastructure failure as the department depends on communications and electricity. The City of Saint Paul Emergency Management has Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a tornado. Each City department is also required to draft and maintain a COOP. Saint Paul Emergency Management would be able to direct operations from pre-designated sites outside the city.

5) Environment

The environmental vulnerabilities due to an infrastructure failure include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine storm clean up, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from a tornado is low.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A large scale infrastructure failure would affect the economic development and maintenance of the city, residents, businesses that are located inside and people who work in the city.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>13</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

**f. Repetitive Losses**

In regards to infrastructure failure, repetitive loss information has not been collected or maintained. *(2012 update)*

**g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

**h. Hazard Analysis Summary— Infrastructure Failure *(2012 update)***

The tables in this section summarize the information described above in the Section G narrative for insect infestation, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

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<sup>13</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. *Journal of Homeland Security and Emergency Management*, Vol 5, Issue 1, 2008.

**Table 63:** - Summary of Impact Vulnerability Ratings for Infrastructure Failure

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R )	Business Losses (B)	Environment (E)	Program Operations (P)	
INFRASTRUCTURE FAILURE						
Large scale fuel shortage	1	1	3	1	3	1.8
Water supply contamination	4	1	3	5	1	2.8
Natural gas leak	3	2	1	3	1	2
Computer virus/hacker	1	1	3	1	3	1.8
Chemical Leak/Spill	4	3	3	5	1	3.2
Explosion	4	4	3	4	2	3.4
Hazardous materials	4	2	2	4	1	2.6
Communication failure	2	2	2	1	1	1.6
labor strikes	1	1	2	1	1	1.2
TOTAL						20.4
Combined risk					Divided by 9	2.27

**Table 64: - Summary of Consequence Vulnerability Ratings for Infrastructure Failure**

HAZARD	CONSEQUENCES							VULNERABILITY P+R+C+P+En+Ec +Go=#; #/7=V
	Public	Respon- ders	Continuity - Operations and Services	Property, Facilities and Infrastructure	Environment	Economic Condition	Public Confidence in Governance	
<b>INFRASTRUCTURE FAILURE</b>								
Fuel shortage	2	2	2	2	1	4	4	2.43
Water contamination	4	2	2	2	4	2	4	2.86
Natural gas leak	2	2	2	1	3	1	2	1.86
Computer virus	1	1	2	1	1	4	4	2
Chemical Leak/Spill	2	2	2	2	4	2	4	2.86
Explosion	3	2	2	2	2	2	4	2.43
Hazardous materials	4	2	2	2	4	2	4	2.86
Comm. failure	1	3	3	1	1	3	3	2.14
labor strikes	1	1	1	2	2	2	4	1.86
<b>TOTAL</b>								21.3
Combined risk							divided by 9	2.37

**Table 65:** - Summary of Total Risk for Infrastructure Failure

ISK			
HAZARD	VULNERABILITY ( I + C)= V	PROBABILITY (P)	RISK V+P=R
<b>INFRASTRUCTURE FAILURE</b>			
<b>Large scale fuel shortage</b>	4.23	2	6.23
<b>Water supply contamination</b>	5.66	2	7.66
<b>Natural gas leak</b>	3.86	2	5.86
<b>Computer virus/hacker</b>	3.8	3	6.8
<b>Chemical Leak/Spill</b>	6.06	3	9.06
<b>Explosion</b>	5.83	2	7.83
<b>Hazardous materials</b>	4.74	3	7.74
<b>Communication failure</b>	3.74	3	6.74
<b>labor strikes</b>	3.06	2	5.06
<b>TOTAL</b>			62.98
Combined risk		Divided by 9	7



## ANIMAL ESCAPE

### a. General Description

According to the Como Park Zoo and Conservatory website:

“For over one hundred years, Como Park has played a vital role in meeting the recreational needs of residents of Saint Paul and surrounding communities. Inspired in part by the landscape designs of H.W.S. Cleveland, Frederick Nussbaumer, Superintendent of Parks from 1891 to 1922, worked tirelessly to create an outdoor haven for the area’s urban population. Nussbaumer strongly advocated for a wide variety of free or reasonably priced recreational activities, services, and educational opportunities for all park visitors. The park as we know it today continues to carry out this original vision.

Today Como Park Zoo & Conservatory is operated by the Saint Paul Parks and Recreation Department. The zoo features a seal island, a large cat exhibit, a variety of aquatic life, primates, birds, African hoofed animals and a world class polar bear exhibit. The Marjorie McNeely Conservatory is a half acre indoor and outdoor facility with a number of different wings dedicated to a variety of plant life including bonsai trees, ferns, orchids and seasonal flowers. The Zoo & Marjorie McNeely Conservatory is open year round. During the winter, the zoo and conservatory are open from 10AM until 4PM.”

The 384 acre park and zoo is owned and operated by the Saint Paul Parks and Recreation. The park includes 1.67 miles of paved paths, a fishing pier, picnic shelters, pavilions, paddleboat rentals, an amusement park, a golf course, a historic carousel, the Black Bear Crossing restaurant and mini-golf.

[Link to Como Zoo Website](#)

<b><u>ANIMAL ESCAPE</u></b>  <b>Assessment:</b> <b>Moderate Risk</b> <b>Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> –Loss of services/ facility shutdown <b>Probability</b> —low to moderate <b>Duration</b> – Unknown <b>Seasonal pattern</b> – None <b>Speed of Onset</b> –Slow <b>Warning time</b> – Days to weeks <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Redirect of service(s)/resources</li><li>• Closure of facilities</li><li>• Protection of plant/animal collections</li><li>• Increased security</li></ul>
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**b. Location**

The Como Zoo is located in Como Park, Saint Paul. Map to and of the zoo is linked below. There are several different types of dangerous animals located in the zoo. The area that an animal escape would impact would be the area directly attached to the zoo area such as the golf course, the park or picnic area. The residential area nearby would be in minimal danger as the situation would be under control in a reasonable amount of time.

[Link to Como Zoo Map](#)

**c. Extent**

An escaped animal poses the greatest danger to visitors of the zoo. Visitors of the park would be in danger only if the escaped animal breached the perimeter of the zoo. Como Zoo maintains a “Animal Escape Procedure and Recapture Policy” that requires the zoo have training on a regular basis with staff and police. The protocols in place protect the situation from becoming out of control or severely dangerous.

**d. History and Probability**

There was a previous escape in the mid 1990s, when Casey the gorilla popped out of his enclosure and wandered around the zoo for about 45 minutes. No one was hurt and Casey eventually returned voluntarily to his pen. After the event, fencing was added to the enclosure to raise the security.

In 1991, a Como Zoo zookeeper suffered a broken leg and cuts when an adult Amur tiger clawed the man's leg and pulled it under a fence before a fellow zookeeper scared the tiger away.

In 2010 there was a report of a child being scratched by a cougar when the parent held the child over an enclosure, which was a violation of the safety rules posted throughout the zoo. It was reported that the cougar was able to reach through the second set of fencing to get the boy. The child had minor scratches and received medical attention. After the event, as a preventative and warning for visitors, additional signage was added to the exhibit advocating precaution.

**e. Risk, Impact, Vulnerability and Consequences**

**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for infrastructure failure is summarized in narrative format ([Part E](#))

and in table format ( <u>Part I</u> ) in this Section.
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1) General

Animal Escape vulnerabilities include mostly life safety for employees and visitors of Como Zoo. There is a EOP to follow in regards to a dangerous animal escape. Employees are trained, and they practice with the Saint Paul Police Department in order to bring the incident to a quick conclusion. An escaped animal could have levels of cascading affects and in turn can cause other failures along the way. The zoo has staff members that are trained to shoot and kill escaped animals, if all else fails.

2) Life Safety (Public and Responders)

There can be health risks, public safety and responder safety associated with an animal escape. Getting the site locked down, public out of harms way and the animal locked up or taken out.

3) Property (Facilities and Infrastructure)

Little to no vulnerabilities in regards to property or infrastructure due to an animal escape. There is a EOP that outlines how to minimize the danger and damages of an animal escape.

4) Continuity of Operations and Continued Delivery of Services

The continuity of operations and continued delivery of services would not be impacted by an animal escape. The City of Saint Paul Emergency Management has Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a tornado. Each City department is also required to draft and maintain a COOP.

5) Environment

The vulnerabilities to the environment due to an animal escape are minimal and have never been documented. The level of risk for long-term environmental impacts from a tornado is low.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. If the situation was not under control in a short period of time or there was loss of life, this could affect the economic conditions of the City.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>14</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public. See **Appendix 4** for Mitigation Survey Results.

**f. Repetitive Losses**

In regards to animal escape, repetitive loss information has not been collected or maintained. *(2012 update)*

**g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87

**h. Hazard Analysis Summary— Animal Escape *(2012 update)***

The tables in this section summarize the information described above in the Section G narrative for insect infestation, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

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<sup>14</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 66:** - Summary of Impact Vulnerability Ratings for Animal Escape

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=##/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Animal Escape	2	1	1	1	1	1.2

**Table 67:** - Summary of Consequence Vulnerability Ratings for Animal Escape

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=##/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Animal Escape	2	1	1	1	1	1	2	1.29

**Table 68:** - Summary of Total Risk for Animal Escape

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
Animal Escape	2.49	2	4.49

## MAJOR COMMUNITY EVENTS

### a. General Description

The City of Saint Paul is host to many large events every year. Previous major events have been Republican National Convention in 2008, Red Bull Flugtag in 2010, Red Bull Crashed Ice and Live Nation in 2012. Each of those major events brought with it tens of thousands of people into the City at one time. There are many yearly reoccurring events such as the Saint Paul Winter Carnival, Saint Patrick's Day Parade, Festival of Nations, Cinco de Mayo Festival, Grand Old Day, Hmong Soccer Tournament, Rondo Days, Twin City Marathon, and Irish Fair. There are several smaller events on a regular basis throughout the City. Each event has the potential to grow and become be larger than anticipated and cause problems on many different levels.

A risk of hosting several events each year is civil disorder. Civil disorder is defined as any incident intended to disrupt community affairs and threaten the public safety. Civil disorders include: riots, mobs, large acts of violence, any demonstration resulting in police intervention and arrests.

Civil disturbance spans a wide variety of actions and includes, but is not limited to: labor unrest; strikes; civil disobedience; demonstrations; riots; prison riots; or rebellion leading to revolution. Triggers could include: racial tension; religious conflict; unemployment; a decrease in normally accepted services or goods, such as extreme water, food, or gasoline rationing; or unpopular political actions.

Looting and general vandalism are the most common activities associated with civil disturbance. Fire setting is also quite common and can quickly spread due to slow response times of overwhelmed fire departments. Transportation routes can become blocked making it difficult for non-rioters to leave the area and difficult for the emergency response personnel to arrive.

<b><u>MAJOR COMMUNITY EVENT</u></b>  <b>Assessment:</b> <b>Moderate Risk Hazard</b>	<b>Location</b> – Citywide and varies <b>Extent</b> –Loss of services, reduced response time <b>Probability</b> —High frequency <b>Duration</b> – Unknown <b>Seasonal pattern</b> – Warmer months <b>Speed of Onset</b> –Rapid <b>Warning time</b> – Days to weeks, or possibly minimal <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Major redirect of staff/equipment</li><li>• Reduction of deliverable services</li><li>• Visitor/staff safety</li><li>• Increased security</li><li>• Increased threat of violence</li><li>• Increased use of radio</li><li>• Media coverage</li></ul>
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**b. Location**

Civil disturbances, while possible in any area where people live, typically occur today in areas of dense population such as Downtown Saint Paul. Saint Paul uses its many attributes to hold year-round community events. Downtown Saint Paul is used for big and small events such as musical events, marathon events, parades and other various community events. Saint Paul is home to more than 170 parks and many are large enough to handle community events.

**c. Extent**

Civil disturbance can, in extreme cases, cause extensive social disruption, loss of jobs, death, and property damage. These may result either from those involved in the action or initiated by those in higher authority in response to what they perceive as a threat to either the status quo or their own authority.

The manageability of each event Saint Paul hosts is always a concern, but the City has plans in place and well-trained officers and employees that are equipped to deal with potential problems.

**d. History and Probability**

There over one hundred permitted events in the City of Saint Paul each year. The probability of a small event getting out of control is minor; the City of Saint Paul is able to manage every event it hosts. There is very little history of events becoming dangerous and unmanageable beyond the scope of normal operation. There are minor incidents at each event, but people's safety is of utmost concern for the City of Saint Paul and all incidents are kept under control quickly.

**e. Risk, Impact, Vulnerability and Consequences**

**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for infrastructure failure is summarized in narrative format (Part E) and in table format (Part I) in this Section.

1) General

The main vulnerability regarding a major community event is life safety. If an event becomes out of control, life safety becomes an issue.

The City of Saint Paul is the Capitol City of the State and in turn has added vulnerabilities due to the governmental operations housed inside the city. There are many levels of governmental agencies located in the City of Saint Paul, this is a known vulnerability and is addressed as such.

2) Life Safety (Public and Responders)

There can be health risks, public safety and responder safety associated with a major community event. This is because of the close proximity of people to roads and if an event became out of the normal span of control.

3) Property (Facilities and Infrastructure)

Major community events pose vulnerabilities to property such as facilities and infrastructure in the manner of damages if the event gets out of control and can not be managed. This is not common in the City of Saint Paul, in fact most events happen without loss of life or damage to property.

4) Continuity of Operations and Continued Delivery of Services

The continuity of operations and continued delivery of services would not be impacted by a major community event. The City of Saint Paul Emergency Management has Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a tornado. Each City department is also required to draft and maintain a COOP.

5) Environment

The vulnerabilities to the environment due to the results of a major community event are minimal and have never been documented. The level of risk for long-term environmental impacts from a tornado is low.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. If the situation was not under control due to a major community event, in a short period of time or there was loss of life, this could impact the economic situation of the City and its businesses.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby



indicating that a high level of confidence can improve the effectiveness of preparedness<sup>15</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

#### **f. Repetitive Losses**

In regards to major community events, repetitive loss information has not been collected or maintained. *(2012 update)*

#### **g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87

#### **h. Hazard Analysis Summary— Major Community Events *(2012 update)***

The tables in this section summarize the information described above in the Section G narrative for insect infestation, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 69:** - Summary of Impact Vulnerability Ratings for Major Community Events

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
<b>Major Community Events</b>	1	1	1	1	1	<b>1</b>

<sup>15</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

**Table 70: - Summary of Consequence Vulnerability Ratings for Major Community Events**

<b>HAZARD</b>	<b>CONSEQUENCES (C)</b>							<b>VULNERABILITY</b> (P+R+C+PI+En+Ec+G=V; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
<b>Major Community Events</b>	1	2	1	1	1	2	2	<b>1.43</b>

**Table 71: - Summary of Total Risk for Major Community Events**

<b>HAZARD</b>	<b>COMBINED VULNERABILITY (I+C=V)</b>	<b>PROBABILITY (P)</b>	<b>RISK V+P=R</b>
<b>Major Community Events</b>	<b>2.43</b>	<b>4</b>	<b>6.43</b>

## LARGE SCALE THREATS OF VIOLENCE/CRIMINAL ACTS

### a. General Description

There are several types of gangs that are located in Minnesota that could potentially turn into large scale acts of violence and are criminal acts. The main enterprise for gangs is drug trafficking. This is a dangerous situation and can escalate quickly.

Other aspects of large threats of violence are addressed under civil disorder in the Major Community Events hazard above. This is because most large scale acts of violence are due to a large event or occur when large groups of people interact.

<b><u>LARGE SCALE THREATS OF VIOLENCE/CRIMINAL ACTS</u></b>  Assessment: <b>Moderate Risk Hazard</b>	<b>Location</b> – Citywide, variable <b>Extent</b> – Loss of service(s), reduced response time <b>Probability</b> —Low <b>Duration</b> – Unknown <b>Seasonal pattern</b> – None <b>Speed of Onset</b> – Slow to rapid <b>Warning time</b> – Days to weeks, to minimal <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Visitor/staff safety</li><li>• Education and protection</li><li>• Media coverage</li><li>• Increased security and police</li><li>• Loss of revenue</li><li>• Fear/paranoia by public &amp; staff</li></ul>
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### b. Location

Violent events may occur in any part of Saint Paul, most likely where people hang out or attend events. This means downtown Saint Paul and park locations.

### c. Extent

The extent of an event could cause many ripple effects throughout the services offered through the city. If an event was prolonged and over a great geographical area, it would increase the issues associated with violent occurrences.

### d. History and Probability

The City of Saint Paul has not had any major issues of large threats of violence or criminal acts in recent years. The Republican National Convention brought with it many protestors and acts of violence, but it was all brought under control through the plan for the event.

### e. Risk, Impact, Vulnerability and Consequences

<b>2012 Update:</b> The hazard analysis methodology was revised in this update to address
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new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for large scale threats of violence or criminal acts is summarized in narrative format (Part E) and in table format (Part H) in this Section.

1) General

There are several vulnerable populations in the City, such as people who speak limited English, are elderly, socioeconomic status, have disabilities (physical and mental) and people who do not have the regular methods available to them in order to receive warnings (i.e. No TV, internet or are hearing impaired). Large scale violence and prolonged criminal acts could seriously impact the people who live and work in the City of Saint Paul.

2) Life Safety (Public and Responders)

Large scale violent events would put not only put the public in harms way, but also the first responders that are trying to diffuse the situation and treat the injured.

3) Property (Facilities and Infrastructure)

Property as well as important infrastructure would be at risk for damages.

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management Department has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of large scale violence and criminal acts. Each City department is also required to draft and maintain a COOP.

5) Environment

The environmental vulnerabilities due to large scale violence and criminal acts include water contamination/pollution, soil damage from chemical spills, and natural gas leaks if they are not cleaned up or dealt with due to inadequate workforce. The City maintains the capacity to perform routine clean-up under normal circumstances, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant large scale act of violence or criminal act could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

#### 7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>16</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

#### **f. Repetitive Losses**

In regards to large scale violence and serious criminal acts, repetitive loss information has not been collected or maintained. *(2012 update)*

#### **g. Capabilities**

The City has assessed and all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87

#### **h. Hazard Analysis Summary—Large Scale Threats of Violence, Criminal Acts (2012 Update)**

The tables in this section summarize the information described above in the Section G narrative for animal escape, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

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<sup>16</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. *Journal of Homeland Security and Emergency Management*, Vol 5, Issue 1, 2008.

**Table 72:** - Summary of Impact Vulnerability Ratings for Large Scale Threats of Violence, Criminal Acts

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
Large Scale Threats of Violence, Criminal Acts	4	2	3	2	2	2.6

**Table 73:** - Summary of Consequence Vulnerability Ratings for Large Scale Threats of Violence, Criminal Acts

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
Large Scale Threats of Violence, Criminal Acts	2	3	2	2	2	3	3	2.43

**Table 74:** - Summary of Total Risk for Large Scale Threats of Violence, Criminal Acts

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
Large Scale Threats of Violence, Criminal Acts	5.03	2	7.03

## TERRORISM CBRNE

### b. General Description

Federal Bureau of Investigation (FBI) defines terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. For the purpose of this report, the FBI will use the following definitions:

- Domestic terrorism involves groups or individuals whose terrorist activities are directed at elements of our government or population without foreign direction.
- International terrorism involves groups or individuals whose terrorist activities are foreign-based and/or directed by countries or groups outside the United States or whose activities transcend national boundaries.
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Source: [Terrorism 2002-2005](#)

<b><u>TERRORISM/ CBRNE</u></b>  <b>Assessment:</b> <b>Medium Risk Hazard</b>	<b>Location</b> – Citywide <b>Extent</b> – Damage to river/lake and tree/plant depending on type <b>Probability</b> —Moderate to high <b>Duration</b> – Extended periods <b>Seasonal pattern</b> – None <b>Speed of Onset</b> – Slow to rapid <b>Warning time</b> – Days to weeks <b>Repetitive Loss</b> - N/A	<b>CASCADING EFFECTS</b> <ul style="list-style-type: none"><li>• Closure of facilities</li><li>• Loss of revenue</li><li>• Loss of resources (trees, plants, animals, water facilities)</li><li>• Redirect of staff/equipment</li><li>• Redirect of resources to combat disease</li><li>• Closure of some park areas</li></ul>
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**Note:** This section of the plan includes information pertinent to Chemical, Biological, Radiological, Nuclear, and Explosives hazards, regardless of whether the event was triggered by a natural, accidental, or intentional event. It also includes specific information related to a terrorist event using a Weapon of Mass Destruction (WMD) or a CBRNE device.

### b. Location

Future terrorism events cannot be predicted. The City of Saint Paul, being the Capitol of Minnesota, is not immune from the risk. Terrorists have the knowledge and the capability to strike anywhere in the world. We have seen that when properly motivated they will achieve their goals by any means necessary. Recent examples of terrorist attacks include the World Trade Center attacks in 1993 and in 2001; the Tokyo Subway nerve agent attack and the Oklahoma City bombing in 1995. There have been smaller bombing incidents, not necessarily classed as terrorist events, at the 1996 Olympics, at family planning clinics, and, recently, at social clubs. The list most likely will continue to grow.

Despite our security awareness, if terrorists intend to wreak havoc, it would be difficult to stop them. An act of terrorism can occur anywhere, at any minute, when you would least expect it. No jurisdiction, urban, suburban, or rural, is completely untouchable.

**c. Extent**

A major terroristic attack on the City of Saint Paul would be devastating. The density of the population and the large number of governmental agencies located in the City increase the level vulnerability.

**d. History and Probability**

**Table 75:** The Minnesota Bureau of Criminal Apprehension reports

Year	Location	Threat
2000	International Society for Animal Genetics Conference Minneapolis, MN	Discovery of Chemical/Biological devices
2000	McDonalds	Cyanide Attack
1999	University of Minnesota research facility	Animal Liberation Front attack

The most recent reports from the FBI show an erratic history of terrorist activity but the overall trend appears to be increasing. When taken in conjunction with the data reported by the Minnesota Bureau of Criminal Investigation the mandate for action is unavoidable. There have been increasing terror ties to Minnesota in recent years. Police departments have started outreach programs to different communities in order to strengthen the trust and relationship.

**e. Risk, Impact, Vulnerability and Consequences**



**2012 Update:** The hazard analysis methodology was revised in this update to address new FEMA mitigation planning requirements (Local Mitigation Plan Review Guide, released October 1, 2011), as well as relevant standards described in the Emergency Management Accreditation Program (EMAP), September 2010. Specifically, EMAP Standards 4.3.1 and 4.3.2 require a comprehensive analysis of all natural and human-caused hazards related to risk, vulnerability, and consequences that could potentially impact the jurisdiction and its operations. This comprehensive assessment of all hazards also meets the FEMA mitigation planning requirements for natural hazards. The detailed analysis for terrorism CBRNE summarized in narrative format (Part E) and in table format (Part H) in this Section.

1) General

An attack by terrorists using weapons of mass destruction resulting in casualties in the thousands or tens of thousands may not be as likely as a smaller scale attack, but has been proven possible and must not be overlooked.

Vulnerable populations identified by the jurisdiction include people who speak limited English, the elderly, lower socioeconomic status, disabled (physical and mental) and people who do not have access to traditional methods of communication in order to receive warnings (i.e. no TV, radios or internet, or are vision or hearing impaired).

Urban density is also considered vulnerability due to the increased population within the downtown core, both residents and workers who commute to the area during business hours.

2) Life Safety (Public and Responders)

The safety of emergency responders could be at risk during search and rescue operations following impact or in response if there is a terrorist event, especially if the event is chemical or biological in nature.

3) Property (Facilities and Infrastructure)

Depending on the nature of the terrorist event, property may be damaged and critically altered. Clean up and maintenance would be difficult, if not impossible.

Land use in the City of Saint Paul is mixed between residential, commercial and government uses. There are also several bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located downtown as well as throughout the entire city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged or lost, which would be likely in a terrorist event.

4) Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operation in the event of the impact of a tornado. Each City department is also required to draft and maintain a COOP. Emergency Management would be able to direct operations from pre-designated sites outside the city (or inside depending on the path and level of destruction) and would be less vulnerable to loss of services and resources if the storm caused damage to multiple areas in the City.

5) Environment

The environmental vulnerabilities due to a terrorism event include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine storm clean-up, but would coordinate with responsible parties for cleanup and/or remediation of hazardous materials, unless they posed a life/safety threat to the public. The level of risk for long-term environmental impacts from a terrorism event is high depending on the materials used.

6) Economic Conditions

The City of Saint Paul, as the Capitol of the State of Minnesota, is the seat of State government operations. In addition to government offices, a number of global businesses and industries are headquartered in the City. A significant terrorism event within the City could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses in the jurisdiction.

7) Public Confidence in Governance

In the context of this plan, “confidence” refers to the subjective assessment by the public about the ability of the government of the City of Saint Paul to prevent or mitigate the risks and/or consequences of impacts from hazards. A large body of academic research substantiates that individuals interpret messages and act upon them differently depending upon the confidence they have in the source of the message. If the public has confidence in the source (government officials), then they are more likely to follow warnings and protective action messages thereby indicating that a high level of confidence can improve the effectiveness of preparedness<sup>17</sup> as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a survey that had broad distribution to key community stakeholders as well as members of the public.

**f. Repetitive Losses**

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<sup>17</sup> “Understanding Public Confidence in Government to Prevent Terrorist Attacks”; Baldwin, Ramaprasad and Samsa. Journal of Homeland Security and Emergency Management, Vol 5, Issue 1, 2008.

In regards to terrorism, repetitive loss information has not been collected or maintained. (2012 update)

**g. Capabilities**

The City has assessed all State and local authorities, policies, programs, and resources and the capabilities are documented in Section VI in Tables 86 & 87.

**h. Hazard Analysis Summary—Terrorism, CBRNE (2012 update)**

The tables in this section summarize the information described above in the Section G narrative for terrorism, and provide numerical impact and consequence vulnerability scores in addition to a total risk rating.

Individual ranking tools for Hazard Impact, Consequence, and Vulnerability are provided in the **Threat and Hazard Identification and Risk Assessment Methodology** on page 30 of this document.

**Table 76:** - Summary of Impact Vulnerability Ratings for Terrorism, CBRNE

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R)	Business Losses (B)	Environment (E)	Program Operations (P)	
<b>Terrorism, CBRNE</b>	5	3	3	4	4	<b>3.8</b>

**Table 77:** - Summary of Consequence Vulnerability Ratings for Terrorism, CBRNE

HAZARD	CONSEQUENCES (C)							VULNERABILITY (P+R+C+PI+En+Ec+G=#; #/7=V)
	Public (P)	Responders (R)	Continuity (Ops & Services) (C)	Property, Facilities, Infrastructure (PI)	Environment (EN)	Economic Condition (EC)	Public Confidence in Governance (G)	
<b>Terrorism, CBRNE</b>	3	3	3	3	3	3	5	<b>3.29</b>

**Table 78:** - Summary of Total Risk for Terrorism, CBRNE

HAZARD	COMBINED VULNERABILITY (I+C=V)	PROBABILITY (P)	RISK V+P=R
Terrorism, CBRNE	7.09	2	9.09

**NOTE:** In addition to 2012 updates noted in this plan, the *City of Saint Paul All-Hazard Mitigation Plan* includes an overall reorganization of the 2007 plan; although the most current information has been used when available, significant details from the 2007 plan have been retained and irrelevant information has been omitted.

**Table 79:** Natural, Technological and Man Made Hazard Analysis Summary Charts

HAZARD	IMPACTS					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human	Residential Property	Business Losses	Environment	Program Operations	
Tornado	4	4	4	2	2	3.2
Damaging Winds/Thunderstorms	4	4	4	2	2	3.2
Flood	3	2	3	2	2	2.4
Blizzard/Ice Storm	4	3	3	1	2	2.6
Extreme Heat/Cold	4	1	2	2	1	2
Natural Fire	2	3	3	3	2	2.6
Drought	1	1	2	3	1	1.6
Karst, Tunnels and Caves	2	3	2	2	1	2
Earthquake	1	1	1	1	1	1
Dam/Levee Failure	3	2	3	2	2	2.4
Infectious Disease	5	1	3	4	5	3.6
Invasive Species	1	2	1	3	1	1.6
Animal Escape	2	1	1	1	1	1.2
Major Community Event	1	1	1	1	1	1

Large Scale Threats of Violence	4	2	3	2	2	2.6
Terrorism/CBRNE	5	3	3	4	4	3.8

**Table 80:** Infrastructure Failure Impact Summary Table

HAZARD	IMPACTS (I)					VULNERABILITY H+R+C+E+P=#; #/5=V
	Human (H)	Residential Property (R )	Business Losses (B)	Environment (E)	Program Operations (P)	
<b>INFRASTRUCTURE FAILURE</b>						
Large scale fuel shortage	1	1	3	1	3	1.8
Water supply contamination	4	1	3	5	1	2.8
Natural gas leak	3	2	1	3	1	2
Computer virus/hacker	1	1	3	1	3	1.8
Chemical Leak/Spill	4	3	3	5	1	3.2
Explosion	4	4	3	4	2	3.4
Hazardous materials	4	2	2	4	1	2.6
Communication failure	2	2	2	1	1	1.6
labor strikes	1	1	2	1	1	1.2
<b>TOTAL</b>						20.4
Combined risk					<b>Divided by 9</b>	2.27

**Table 81:** Hazard Vulnerability Summary

HAZARD	VULNERABILITY ( I + C)= V	PROBABILITY	RISK V+P=R
Tornado	6.2	5	11
Damaging Winds/Thunderstorms	6.34	5	11.34
Flood	5.25	5	10.25
Blizzard/Ice Storm	5.31	5	10.31
Extreme Heat/Cold	4.29	4	8.29
Natural Fire	4.77	2	6.77
Drought	3.46	2	5.46

Karst, Tunnels and Caves	3.86	2	5.86
Earthquake	2	1	3
Dam/Levee Failure	5.25	2	7.25
Infectious Disease	6.74	2	8.74
Invasive Species	3.03	2	5.03
Animal Escape	2.49	2	4.49
Major Community Event	2.43	4	6.43
Large Scale Threats of Violence	5.03	2	7.03
Terrorism/CBRNE	7.09	2	9.09

**Table 82:** Infrastructure Failure Risk Summary

HAZARD	VULNERABILITY (I + C)= V	PROBABILITY (P)	RISK V+P=R
<b>INFRASTRUCTURE FAILURE</b>			
Large scale fuel shortage	4.23	2	6.23
Water supply contamination	5.66	2	7.66
Natural gas leak	3.86	2	5.86
Computer virus/hacker	3.8	3	6.8
Chemical Leak/Spill	6.06	3	9.06
Explosion	5.83	2	7.83
Hazardous materials	4.74	3	7.74
Communication failure	3.74	3	6.74
Labor strikes	3.06	2	5.06
<b>TOTAL</b>			62.98
Combined risk		Divided by 9	7

**Table 83:** All Hazards Consequences/ Vulnerability Summary

HAZARD	CONSEQUENCES							VULNERABILITY P+R+C+P+En+Ec+G o=#; #/7=V
	Public	Respon ders	Contin uity - Operat ions and Service s	Property , Facilities and Infrastru cture	Environ ment	Econo mic Condi tion	Public Confid ence in Govern ance	
Tornado	5	2	2	5	2	3	2	3
Damaging Winds	4	3	2	5	2	3	3	3.14
Flood	2	2	2	4	4	3	3	2.85
Blizzard/Ice Storm	5	4	3	2	2	2	3	2.71
Extreme Heat/Cold	3	3	2	2	1	2	3	2.29
Natural Fire	1	3	1	3	2	1	4	2.14
Drought	2	1	1	2	3	2	2	1.86
Karst, Tunnels and Caves	2	2	1	2	3	1	2	1.86
Earthquake	1	1	1	1	1	1	1	1
Dam/Levee Failure	2	2	2	4	4	3	3	2.85
Infectious Disease	2	3	4	1	4	4	4	3.14
Invasive Species	1	1	2	1	3	1	1	1.43
Animal Escape	2	1	1	1	1	1	2	1.29
Major Community Event	1	2	1	1	1	2	2	1.43
Large Scale Violence	2	3	2	2	2	3	3	2.43
Terrorism/CB RNE	3	3	3	3	3	3	5	3.29

**Table 84:** Infrastructure Failure Consequences Summary

HAZARD	CONSEQUENCES							VULNERABILITY P+R+C+P+En+Ec+Go=#; #/7=V
	Public	Responders	Continuity - Operations and Services	Property, Facilities and Infrastructure	Environment	Economic Condition	Public Confidence in Governance	
<b>INFRASTRUCTURE FAILURE</b>								
Fuel shortage	2	2	2	2	1	4	4	2.43
Water contamination	4	2	2	2	4	2	4	2.86
Natural gas leak	2	2	2	1	3	1	2	1.86
Computer virus	1	1	2	1	1	4	4	2
Chemical Leak/Spill	2	2	2	2	4	2	4	2.86
Explosion	3	2	2	2	2	2	4	2.43
Hazardous materials	4	2	2	2	4	2	4	2.86
Comm. failure	1	3	3	1	1	3	3	2.14
labor strikes	1	1	1	2	2	2	4	1.86
<b>TOTAL</b>								21.3
Combined risk							<b>divided by 9</b>	2.37



## Mitigation Strategy

### *Existing Authorities, policies, programs and resources*

Throughout the planning process the Planning Committee reviewed various City and area plans, documents, historical records, and other information. This valuable information was incorporated into the final plan. Each City Department active in mitigation, planning, response and recovery activities provided a historical account of past disasters, Department plans and procedures, and information useful to mitigation planning efforts.

Among the most valuable existing plans examined for mitigation impacts were:

- Dealing with a State shutdown in 2011
- Department preparations and responses to Mississippi River flooding in 1993, 1997, 2001, 2007, 2010, and 2011.
- Our plan to standardize electrical connections at critical infrastructure points so that mobile generators could quickly restore electrical power in the event of commercial power failure
- First responders, emergency service personnel, and city leadership were involved in extensive preparation for the 2008 Republican National Convention
- Response to severe weather events such as flooding, extreme snow occurrences, tornadoes
- The FEMA-approved Ramsey County All Hazard Mitigation Plan
- The Minnesota All Hazard Mitigation Plan
- The City Readiness Initiative (CRI) as part of the Strategic National Stockpile as exercised in the Postal Plan
- Zoning Ordinance
- City Comprehensive Plan
- Watershed Reports
- Neighborhood Reports/Plans

### *National Flood Insurance Program Participation*

The City of Saint Paul is involved in the National Flood Insurance Program (NFIP). The function of the National Flood Insurance Program (NFIP) is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost. In exchange, The City would agree to regulate new development and substantial improvement to existing structures in the floodplain, or to build safely above flood heights to reduce future damage to new construction. The program is based upon

mapping areas of flood risk, and requiring local implementation to reduce flood damage primarily through requiring the elevation of structures above the base (100-year) flood elevations.

**Table 85: Firm Zones and Explanation**

<b>Firm Zone</b>	<b>Explanation</b>
<b>A</b>	Areas of 100-year flood; base flood elevations and flood hazard not determined.
<b>AO</b>	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet, average depths of inundation are shown but no flood hazard factors are determined.
<b>AH</b>	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet, base flood elevations are shown but no flood hazard factors are determined.
<b>A1-A30</b>	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
<b>B</b>	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.
<b>C</b>	Areas of minimal flooding.
<b>D</b>	Areas of undetermined, but possible, flood hazards.

Development permits for all new building construction, or substantial improvements, are required by the City in all A, AO, AH, A-numbered Zones. Flood insurance purchase may be required in flood zones A, AO, AH, A-numbered zones as a condition of loan or grant assistance. An Elevation Certificate is required as part of the development permit. The Elevation Certificate is a form published by the Federal Emergency Management Agency required to be maintained by communities participating in the NFIP. According to the NFIP, local governments maintain records of elevations for all new construction, or substantial improvements, in floodplains and to keep the certificates on file. There are no Repetitive Loss Properties in the City of Saint Paul at this time.

### ***Capabilities***

For the 2012 update, a comprehensive listing of capabilities was compiled from the capability information previously included in each hazard section of the 2007 plan. Information was checked for accuracy and to ensure that it was current. Websites were included where available.

The capabilities are divided into two tables, one with all mitigation-related capabilities of the City of Saint Paul. The second table lists capabilities of other local, state and federal partners. Both tables provide information that describes the City's existing authorities and policies, programs, and resources including potential funding for mitigation-related projects. Information in both tables is linked to the broad range of hazards identified by the City of Saint Paul.

**Table 86: City Capabilities**

RESOURCE	DESCRIPTION	CATEGORY	HAZARD
<b>GENERAL</b>			
<i>St Paul/Ramsey County Public Health</i>	<ul style="list-style-type: none"> <li>• Prevention and control of infectious disease</li> <li>• Mass clinics for administering vaccines or other prophylaxis</li> <li>• Safe food and lodging at mass care sites</li> <li>• Reduce secondary health effects of an event</li> </ul>	Public Health	All Hazards
<i>Minnesota Volunteers Active in Disaster (MNVOAD)</i>	<ul style="list-style-type: none"> <li>• Provide assistance in the areas of food, clothing, and shelter</li> <li>• Coordinate private and volunteer agency response</li> <li>• Act as liaison to state and federal human services agencies</li> </ul>	Volunteers & Donations	All Hazards
<i>Saint Paul Fire Department</i>	<ul style="list-style-type: none"> <li>• Perform disaster analysis</li> <li>• Provide technical expertise</li> <li>• Maintain rescue and response</li> </ul>	Fire Response	All Hazards
<i>Emergency Management Department</i>	<ul style="list-style-type: none"> <li>• Assist elected officials and city departments with disaster activities</li> <li>• Provide a functional primary and secondary EOC</li> <li>• Liaison with state and federal agencies</li> </ul>	Emergency Management	All Hazards
<i>Public Works/Parks Division</i>	<ul style="list-style-type: none"> <li>• Provide city-level emergency engineering services</li> <li>• Provide liaison to major utilities</li> <li>• Clear debris from city right-of-ways and dispose of it per city procedure</li> <li>• Provide overall plan to capture/take out the animal</li> <li>• </li> </ul>	Public Works, Utilities & Debris	Tornadoes, Damaging Winds, Severe Thunder Storms, Animal Escape
<i>Ramsey County Medical Examiner's Office</i>	<ul style="list-style-type: none"> <li>• Provide overall disaster services to the dead</li> <li>• Activate temporary morgue if needed</li> <li>• Establish appropriate teams (scene evaluation, forensic pathology, etc.)</li> </ul>	Medical Examiner	All Hazards

<i>Communications</i>	<ul style="list-style-type: none"> <li>Communicate emergency information to the public</li> <li>Set up JPIC and news conferences</li> <li>Handle rumor control and public updates and inquiries</li> </ul>	Emergency Public Information and warnings	All Hazards
<i>Law Enforcement</i>	<ul style="list-style-type: none"> <li>Maintain law and order</li> <li>Respond to needs of citizens</li> <li>Provide traffic and crowd control</li> <li>Animal capture</li> </ul>	Law Enforcement	All Hazards
<i>National Oceanic and Atmospheric Administration (NOAA)</i>	<p>National Weather Service (NWS) Weather Radio Alert Program (<a href="http://www.nws.noaa.gov/nwr">http://www.nws.noaa.gov/nwr</a>)</p> <ul style="list-style-type: none"> <li>NOAA Weather Radio broadcasts NWS warnings, watches, forecasts, and other hazard information 24 hours a day.</li> </ul>	Preparedness/Warning	Natural Hazards and Civil Emergencies
<i>Saint Paul Regional Water Services</i>	<ul style="list-style-type: none"> <li>Prevention and control of water source contamination</li> <li>Monitoring of water quality</li> <li>Maintenance and protection of water treatment facilities</li> </ul>	Water Supply Management	Water Contamination; Infrastructure Failure
<b>RESPONSE PLANS</b>			
<i>City of Saint Paul Emergency Operations Plan</i>	The City of Saint Paul EOP is a document designed to assist local officials respond to an emergency or disaster.	Disaster Management	All Hazards
<i>Emergency Communications Plan</i>	<p>Developed during Y2K to prepare for possible telephone outages, the plan incorporates community-based vehicles and facilities, equipped with radio communications linking neighborhoods directly to the Public Safety Dispatch Center</p> <p><u>Drought</u> - Because drought is such a slow moving, insidious disaster, the public will not be aware of it until it is happening. Public awareness would take place after the fact, with messages crafted to deal with the event that is already here. Normal emergency communications channels would most likely not be used unless there was a water emergency.</p>	Disaster Communications	All Hazards
<i>Standardized Generator Electrical Connection Plan</i>	Developed during Y2K to standardize electrical connections on the outside of key facilities in the City, which allow quick connection to a small fleet of trailer-mounted portable generators.	Response Plan	All Hazards
<b>EXERCISES AND CORRECTIVE ACTIONS</b>			
<i>City of Saint Paul Emergency Management</i>	The City of Saint Paul employs an Emergency Management Coordinator who coordinates exercises designed	All-Hazard and Hazard-Specific Exercises	All Hazards

<i>Department</i>	<p>to measure the effectiveness of the City of Saint Paul EOP. State and city departments work together to design and implement a variety of scenarios applicable to the range of natural and human-caused hazards identified by the jurisdiction. Recommendations and lessons learned from these exercises are incorporated into the City's Corrective Action Plan and assigned to a responsible party with a timeline for completion.</p> <ul style="list-style-type: none"> <li>Statewide Tornado Drill – The City participates in the statewide tornado drill every spring as part of Severe Weather Awareness Week.</li> <li>State and city departments work together to design and implement a variety of CBRNE scenarios.</li> </ul>		
<b>MUTUAL AID</b>			
<i>County Fire Mutual Aid Compact</i>	Resource that can be requested in a major fire incident	Resource	Fire
<i>Fire Mutual Aid agreement</i>	Agreement between Saint Paul and Minneapolis for fire resource support	Resource	Fire
<i>Minnesota Interagency Fire Center in Grand Rapids</i>	Equipment and personnel support that includes tanker aircraft, fire apparatus, and smaller equipment and supplies.	Resource	Fire
<i>Regional Hazardous Material Emergency Response Teams (ERT), Regional Chemical Assessment Teams (CAT), Hazardous Materials Responders, Local Bomb Squads, Radiological Incident Response Teams</i>	These teams are able to assist with mitigation of a terrorist incident, and have the specialized CBRNE equipment and training to respond to an incident.	Resource	Infrastructure Failure/Terrorism (CBRNE)

**Table 87: Partner Capabilities**

RESOURCE	DESCRIPTION	CATEGORY	HAZARD
<b>MITIGATION-RELATED POLICIES AND PROGRAMS</b>			
<i>Federal Emergency</i>	This site contains FEMA sponsored mitigation	Mitigation	Natural

<i>Management Agency (FEMA), Mitigation Program</i>	programs and activities. ( <a href="http://www.fema.gov/government/mitigation.shtm">www.fema.gov/government/mitigation.shtm</a> )	Policies and Programs	Hazards
<i>National Lightning Safety Institute (NLSI)</i>	This site provides information on lightning mitigation plans as well as information on Codes and Standards on Lightning Safety. ( <a href="http://www.lightningsafety.com">http://www.lightningsafety.com</a> )	Mitigation codes and planning standards for lightning	Lightning
<i>Minnesota Department of Transportation (MN/DOT) Living Snow Fence Program</i>	MN/DOT's living snow fence program aims at improving winter driving conditions, reducing accidents caused by blowing and drifting snow, and minimizing snow removal costs. Once a specific site on a state highway has been identified as a problem area, a work group representative will personally contact landowners. If a landowner decides to take part in the program, they become actively involved in all the processes that the partnering agencies work through. MN/DOT is implementing a statewide road condition and weather telephone system. The system will allow motorists access to route specific road condition and weather information via cellular phones. The second phase of the project will allow "land line" access to the same information. Currently, only road condition information is available via a toll free phone number and that information is typically regional.	Mitigation Program	Blizzards
<i>Federal Emergency Management Agency (FEMA), National Flood Insurance Program (NFIP)</i>	FEMA is the lead agency in providing emergency assistance immediately following a Presidential Disaster Declaration. FEMA administers the NFIP and can provide information on non-structural flood management measures to those communities seeking a preventative approach in dealing with flood problems. ( <a href="http://www.fema.gov/">http://www.fema.gov/</a> ). The following publications are available to provide information about the National Floodplain Insurance Program (NFIP): <ul style="list-style-type: none"> <li>• Avoiding Damage: A Checklist for Homeowners</li> <li>• Coping with a Flood – Before, During and After</li> <li>• Flood: Are You Protected From the Next Disaster?</li> <li>• Here's What to Tell Your Clients About the Benefits of Flood Insurance</li> <li>• How the NFIP Works</li> <li>• Mandatory Purchase of Flood Insurance Guidelines</li> <li>• Resources for Lenders, Services, and Examiners</li> <li>• Things You Should Know About Flood Insurance Claim</li> <li>• Top 10 things Every Consumer Needs to Know About the NFIP</li> </ul>	Flood Prevention and Mitigation Program	Flood, Dam/Levee Failure
<i>U.S. Department of Agriculture (USDA), Natural Resources Conservation Services (NRCS)</i>	Activities include: providing financial and technical assistance to remove debris from streams, to protect destabilized stream banks, and to establish cover on critically eroding lands; repairing conservation practices; and purchasing of flood plain easements. The program is designed for installation of recovery measures.		Dam/Levee Failure

<i>Minnesota Department of Natural Resources (DNR), Division of Waters,</i>	<p>Administers the State Floodplain Management Program:</p> <ul style="list-style-type: none"> <li>• Floodplain zoning</li> <li>• Flood insurance</li> <li>• Flood proofing</li> <li>• Flood warning and response planning</li> </ul> <p>The following publications are available from the Division of Waters:</p> <ul style="list-style-type: none"> <li>• Flood Insurance in Minnesota, January 1998</li> <li>• Flood Plain Management: A Handbook for Local Officials, October 1984</li> <li>• Flood Damage Reduction Program Grant Assistance Guidebook</li> <li>• Flood Damage Reduction: What Minnesota Has Done And Still Needs To Do...</li> </ul> <p>(<a href="http://www.dnr.state.mn.us/waters/">http://www.dnr.state.mn.us/waters/</a>)</p>	Mitigation Program	Flood
<i>Domestic Terrorism - Consequence Management Advisory Committee (DT-CMAC)</i>	<p>DT-CMAC was formed as a steering group representing key response and recovery agencies that have a response related mission or role. DT-CMAC reviews specialized equipment from the Office of State and Local Domestic Preparedness Services approved list to meet response needs identified in the statewide assessment and this implementation plan. The goals of the DT-CMAC are:</p> <ul style="list-style-type: none"> <li>• Review and make recommendations on state domestic terrorism plan supplement</li> <li>• Ensure statewide application of initiatives</li> <li>• Serve as a sounding board on CBRNE issues</li> <li>• Raise concerns in regard to domestic terrorism planning, training and response</li> <li>• Enable statewide input into planning processes</li> <li>• Policy level feedback</li> <li>• Review progress of activities</li> <li>• Review and comment on policies, procedures, and local guidance documents</li> </ul>	Prevention and Response	Infrastructure Failure/Terrorism (CBRNE)
<b>GENERAL</b>			
<i>Lightning Storm.com</i>	<p>Provides specific lightning conditions within the United States, and can be accessed at the web site. (<a href="http://www.lightningstorm.com/">http://www.lightningstorm.com/</a>)</p>	Disaster Preparedness	Lightning
<i>National Weather Service (NWS)</i>	<p>NWS provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas. (<a href="http://www.crh.noaa.gov">http://www.crh.noaa.gov</a>)</p>	Weather Warnings	Natural Hazards and Civil Emergencies Messages
<i>Texas Tech University (TTU), Lubbock Texas</i>	<p>The TTU Wind Engineering Research Center web site is a source for information about windstorms. (<a href="http://www.wind.ttu.edu">http://www.wind.ttu.edu</a>)</p>	Disaster Preparedness	Damaging Winds
<i>U.S. Department of Agriculture (USDA), Natural Resources Conservation Services (NRCS)</i>	<p>(<a href="http://www.nrcs.usda.gov">http://www.nrcs.usda.gov</a>)</p>	Disaster Preparedness and Planning	Drought, Animal Disease, Environmental Incidents
<i>Minnesota Department</i>	(1) DNR Division of Waters has water engineers on	Disaster	Drought,

<i>of Natural Resources (DNR)</i>	<p>staff to provide advice on drought. DNR is responsible for water supply management. (<a href="http://www.dnr.state.mn.us/waters">www.dnr.state.mn.us/waters</a>)</p> <p>(2) Minnesota DNR manages and identifies aquatic and terrestrial invasive species throughout the state of Minnesota</p> <p>(3) <i>Aquatic Invasive Species</i> - Questions on invasive species identification and management (aquatic invasive species, purple loosestrife management and bio-control), prevention activities, and invasive species situations in specific lakes. (<a href="http://www.dnr.state.mn.us/invasives/contacts.html#aquatic">http://www.dnr.state.mn.us/invasives/contacts.html#aquatic</a>)</p> <p>(4) <i>Terrestrial Invasive Species</i>- Questions on the identification, prevention, and management of terrestrial invasive species. (<a href="http://www.dnr.state.mn.us/invasives/contacts.html#terrestrial">http://www.dnr.state.mn.us/invasives/contacts.html#terrestrial</a>)</p>	Preparedness and Planning	Infectious disease (waterborne)
<i>The Minnesota Department of Health (MDH), Environmental Health Division (EDH)</i>	<p>EDH is responsible for safe drinking water programs. (<a href="http://www.health.state.mn.us/divs/eh/index.html">http://www.health.state.mn.us/divs/eh/index.html</a>)</p> <p>Flood: The following publications are available from the MDH: (<a href="http://www.dnr.state.mn.us/waters/">http://www.dnr.state.mn.us/waters/</a>)</p> <ul style="list-style-type: none"> <li>• Cleaning up after a disaster</li> <li>• Cleaning up your business after a flood</li> <li>• Disinfecting Flooded Wells</li> <li>• Fuel Oil Contamination Guidance</li> <li>• Mold Problems after a Flood</li> <li>• Sewage: Flooding</li> <li>• Tips for Flood Volunteers</li> </ul>	Disaster Preparedness and Planning	Water Contamination, Flood
<i>Environmental Protection Agency</i>	EPA has state-specific information on their web site.	Disaster Preparedness and Planning	Water Contamination and Air Issues
<i>Center for Disease Control (CDC), National Center for Infectious Diseases</i>	CDC coordinates with state and local health departments, academic centers and other federal agencies, health care providers and health care networks, international organizations, and other partners to monitor potential outbreaks of infectious disease. ( <a href="http://wwwnc.cdc.gov/eid/">http://wwwnc.cdc.gov/eid/</a> )	Disaster Preparedness and Planning	Infectious Disease
<b>RESPONSE PLANS</b>			
<i>National Incident Management System (NIMS)</i>	The Minnesota Incident Management System (NIMS) is Minnesota's application of the National Interagency Incident Management System (NIIMS).	Incident Management	Tornadoes
<i>Minnesota Emergency Operations Plan (MEOP)</i>	MEOP is the all-hazards emergency response plan for the State of Minnesota government agencies.	Response	Tornadoes
<i>Minnesota Department of Transportation (MN/DOT)</i>	MN/DOT has standard procedures for responding to any snow and ice event, which includes a "bare lanes" target level of service.	Disaster Response	Blizzards, Winter Storms



<i>Minnesota Department of Health (MDH), Division of Disease Prevention and Control</i>	Division of Disease Prevention and Control has prepared a draft report “Minnesota Pandemic Influenza Control and Prevention Guidelines” in the event of influenza pandemic. ( <a href="http://www.health.state.mn.us/divs/dpc/dpc.html">http://www.health.state.mn.us/divs/dpc/dpc.html</a> ) MDH assists local public health agencies, health care organizations and public safety officials to be able to respond swiftly and effectively to significant public health threats, especially bioterrorism.	Prevention and Response	Infectious Disease, Bioterrorism
<i>Minnesota Department of Public Safety, Division of Homeland Security and Emergency Management (HSEM)</i>	HSEM is the lead for all consequence management activities and coordinates state assets that are needed to respond. ( <a href="http://www.hsem.state.mn.us">http://www.hsem.state.mn.us</a> )	Prevention and Response	Infrastructure Failure/Terrorism
<i>Bureau of Criminal Apprehension (BCA)</i>	The Bureau of Criminal Apprehension protects the public by providing accurate, timely and complete investigative assistance, forensic laboratory services, criminal justice information systems, fingerprint information and training to the criminal justice community throughout Minnesota.	Prevention and Response	Infrastructure Failure/Terrorism
<i>Minnesota National Guard, Civil Support Team (CST)</i>	The CBRNE Civil Support Teams were established to deploy rapidly to assist a local incident commander in determining the nature and extent of an attack or incident; provide expert technical advice on CBRNE response operations; and help identify and support the arrival of follow-on state and federal military response assets. They can also serve as an advance party that can liaise with the Joint Task Force Civil Support.	Prevention and Response	Infrastructure Failure/Terrorism, Hazardous Materials
<b>RESPONSE TRAINING</b>			
<i>International Code Council (ICC)</i>	ICC provides training seminars regarding tornadoes and others natural hazards as they apply to building construction. ( <a href="http://www.iccsafe.org">http://www.iccsafe.org</a> )	Building Construction	Natural Hazards
<i>Minnesota Department of Labor and Industry (DLI)</i>	DLI administers the State Building Code, certifies local building officials, and collects surcharges on municipal issued permits. ( <a href="http://www.buildingcodes.admin.state.mn.us/">http://www.buildingcodes.admin.state.mn.us/</a> )	Permitting	Tornadoes, Damaging Winds
<i>Minnesota Department of Public Safety (DPS), Division of Homeland Security and Emergency Management (HSEM)</i>	HSEM provides emergency management training ( <a href="http://www.hsem.state.mn.us">http://www.hsem.state.mn.us</a> )	Emergency Management	All Hazards
Federal Emergency Management Agency (FEMA), Emergency Management Institute (EMI)	EMI offers a variety of courses through resident and Independent Study in both general mitigation and emergency management ( <a href="http://training.fema.gov/emiweb">http://training.fema.gov/emiweb</a> )	Emergency Management	All Hazards
METRO Skywarn	Using a training program jointly developed by the National Weather Service and Metro Skywarn, volunteers train about 600 Radio Amateurs every two years. The training program runs from March to May annually. ( <a href="http://www.skywarn.org">http://www.skywarn.org</a> )	Weather Warnings	Tornadoes
<i>Association of State</i>	ASFPM is a sponsor of national and	Floodplain	Floods

<i>Floodplain Managers (ASFPM)</i>	regional conferences and workshops for local and state floodplain managers.	Management	
<i>National Association for Flood and Storm-water Management (NAFSMA)</i>	NAFSMA is a sponsor of a national conference each year for locals involved in floodplain and storm-water management. <a href="http://www.nafsm.org">http://www.nafsm.org</a>	Floodplain Management	Floods
<b>PREPAREDNESS/WARNING ACTIVITIES AND SYSTEMS</b>			
<i>Contractors Register, Inc</i> ( <a href="http://www.thebluebook.com">www.thebluebook.com</a> )	For lightning mitigation equipment including lightning arrestors, air terminals, industrial surge suppressors, and grounding equipment.	Lightning Warnings	Damaging Winds, Lightning
<i>National Oceanic and Atmospheric Administration (NOAA)</i>	National Weather Service (NWS), Weather Radio Alert Program, ( <a href="http://www.nws.noaa.gov/nwr/index.html">http://www.nws.noaa.gov/nwr/index.html</a> ) <ul style="list-style-type: none"> <li>NOAA Weather Radio broadcasts NWS warnings, watches, forecasts, and other hazard information 24 hours a day.</li> </ul>	Weather Warning Equipment	Natural Hazards and Civil Emergencies
<i>National Weather Service (NWS)</i>	NWS provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas. ( <a href="http://www.crh.noaa.gov">http://www.crh.noaa.gov</a> )	Weather Warnings	Natural Hazards
<i>Minnesota Department of Public Safety (DPS), Division of Homeland Security and Emergency Management (HSEM), Severe Weather Awareness Week.</i>	Minnesota HSEM sponsors the statewide Severe Weather Awareness Week and Winter Weather Awareness weeks annually.  HSEM provides information on Domestic Preparedness issues.	Disaster Preparedness	All Hazards
<i>Minnesota Department of Public Safety (DPS), Department of Homeland Security and Emergency Management (HSEM), Winter Hazard Awareness Week</i>	<ol style="list-style-type: none"> <li>(1) Every winter HSEM sponsors a statewide Winter Hazard Awareness Week to increase awareness of winter hazards and to encourage people to take appropriate actions to eliminate or reduce their vulnerability to winter dangers. (<a href="http://www.dps.state.mn.us">www.dps.state.mn.us</a>)</li> <li>(2) Through the Minnesota Duty Officer (MDO), HSEM is authorized to activate the Minnesota National Guard or other state-level resources as requested. For severe winter weather events, they can usually gear-up for such deployments in advance.</li> </ol>	Disaster Preparedness	Winter Storms, Blizzards
<i>Minnesota Department of Transportation (MN/DOT)</i>	MN/DOT has manpower and equipment resources to remove snow and ice and to maintain primary roads except under the most extreme conditions. MN/DOT maintains a fleet of approximately 850 plows trucks, motor graders, and other heavy equipment for snow and ice removal and anti-icing of the state highways. Many "Truck Stations" also have generators and portable lighting systems for emergency operations and night maintenance operations. MN/DOT is currently implementing a statewide network of Environmental Sensing Stations for	Preparedness & Response	Blizzards, Winter Storms

	collection of atmospheric and road condition data. That data is combined with customized weather and road condition forecasts for use by MN/DOT maintenance staff in operational decision-making. ( <a href="http://www.dot.state.mn.us">http://www.dot.state.mn.us</a> )		
<i>Minnesota Department of Transportation (MN/DOT), Winter Work Zone Safety</i>	MN/DOT provides safety tips for driving near snowplows ( <a href="http://www.dot.state.mn.us/winter.html">http://www.dot.state.mn.us/winter.html</a> )	Citizen & Responder Safety	Blizzards, Winter Storms
<i>Minnesota Emergency Alert System (EAS)</i>	The Federal Communications Commission developed the EAS to replace the Emergency Broadcast System. The EAS is capable of alerting the general public effectively, reliably, and with built in redundancy.	Emergency Warnings	All Hazards
<i>Minnesota Department of Commerce</i>	The Minnesota Department of Commerce has five 15KW truck-mounted mobile generators, which can be made available upon request during a major emergency. The generators are normally located in the following five Minnesota cities: Raymond, Hewitt, Savage, Mapleton and Burnsville. ( <a href="http://www.state.mn.us/cgi-bin/portal/mn/jsp/home.do?agency=Commerce">http://www.state.mn.us/cgi-bin/portal/mn/jsp/home.do?agency=Commerce</a> )	Response Equipment	All Hazards
<i>Minnesota Department of Military Affairs (National Guard)</i>	Through contact with the Minnesota Duty Officer, the National Guard may be able to provide blankets, other camping/survival gear, and generators. ( <a href="http://www.dma.state.mn.us/#">http://www.dma.state.mn.us/#</a> )	Response Equipment	All Hazards
<i>Minnesota Department of Public Safety (DPS), State Fire Marshal Division (SFMD)</i>	Equipment available from the SFMD includes small generators and lighting equipment. ( <a href="http://www.dps.state.mn.us/fmarshal/fmarshal.html">http://www.dps.state.mn.us/fmarshal/fmarshal.html</a> )	Response Equipment	All Hazards
<i>Minnesota Department of Health (MDH)</i>	<u>Immunization web site:</u> ( <a href="http://www.immunize.org/">http://www.immunize.org/</a> ) This is a good source of childhood, adolescent and adult immunization information and hepatitis B educational materials.	Public Awareness	Infectious Disease
<i>National Weather Service (NWS)</i>	NWS data and products form a national information database for the protection of life and property, and are available to governmental agencies, the private sector, and the general public. NWS issues severe thunderstorms watches and warnings. A storm is considered severe if it produces: <ul style="list-style-type: none"> <li>• Damaging wind gusts – 58 miles per hour (50 knots) or higher</li> <li>• Large hail – ¾ inch in diameter (penny size) or larger</li> <li>• Tornadoes</li> </ul>	Disaster Information	Natural Hazards
<i>National Snow and Ice Data Center (NSIDC)</i>	NSIDC is an information and referral center that distributes data and maintains information about snow cover, avalanches, glaciers, ice sheets, freshwater ice, sea ice, ground ice, permafrost, atmospheric ice, paleo-glaciology, and ice cores. <a href="http://nsidc.org/index.html">http://nsidc.org/index.html</a>	Disaster Planning and Warning	Blizzards, Winter storms
<i>U.S. Army Corps of Engineers (USACE),)</i>	Provides drinking water and ice, debris clearance, auxiliary power, and repairs. Also provides technical advice to officials inspecting and assessing damaged	Disaster Planning	Blizzard, Winter

	<p>areas.</p> <p><u><i>Cold Regions Research and Engineering Laboratory (CRREL)</i></u> seeks to gain knowledge of cold regions through scientific and engineering research, including mitigation measures on the impact of human activity on the environment in cold regions. <a href="http://www.crrel.USACE.army.mil/">http://www.crrel.USACE.army.mil/</a></p> <p><u>Dam/levee failure:</u> Helps communities reduce damages caused by flooding by building and maintained dams and reservoirs hold excess water gradually to prevent or reduce downstream flooding. Providing Technical assistance including flood frequency, depth, inundated areas and flood duration.</p>	and Warning	Storms
<i>U.S. Department of Interior, U.S. Geological Survey (USGS),</i>	Maintains an extensive collection of data including stream gauge heights, discharge run-off, and time of travel, sediment discharge, historic flood peaks, and inundated areas. ( <a href="http://www.usgs.gov">http://www.usgs.gov</a> )	Disaster Warning	Flood, Dam/Levee Failure
<i>U.S. Department of Transportation, Federal Highway Administration (FHWA)</i>	Insures the construction and maintenance of highways comply with existing regulations and directives as the affect flooding in floodplains. Assists in surveying roadway damage in flood stricken areas ( <a href="http://www.fhwa.dot.gov">http://www.fhwa.dot.gov</a> )	Disaster Assistance and Mitigation	Flood, Dam/Levee Failure
<i>FEMA for Kids</i>	Winter Storms web site provides information for children about winter weather and safety tips ( <a href="http://www.fema.gov/kids/wntstrm.htm">http://www.fema.gov/kids/wntstrm.htm</a> )	Disaster Preparedn ess	Blizzards, Winter Storms
<i>National Weather Service (NWS)</i> ( <a href="http://www.crh.noaa.gov/mpx/">http://www.crh.noaa.gov/mpx/</a> ) <i>The Warning and Forecast Branch</i>	Winter storm safety information and statistics: "National winter storms...the Deceptive Killers - A Guide to Survival". ( <a href="http://www.nws.noaa.gov/om/brochures/wntstrm.htm">http://www.nws.noaa.gov/om/brochures/wntstrm.htm</a> )	Disaster Preparedn ess	Blizzards, Winter Storms
<i>American Red Cross</i>	<p>Winter storm safety information. (<a href="http://www.redcross.org/services/disaster/0,1082,0_595_00.html#Kit">http://www.redcross.org/services/disaster/0,1082,0_595_00.html#Kit</a>)</p> <p>Heat Wave Preparedness - Checklist of preparedness safety tips for extreme heat events. (<a href="http://www.redcross.org/press/archives/060900.html">http://www.redcross.org/press/archives/060900.html</a>)</p>	Disaster Preparedn ess	Blizzards, Winter Storms
<b>FUNDING SOURCES</b>			
<i>U.S. Small Business Administration (SBA)</i> ( <a href="http://www.sba.gov/">http://www.sba.gov/</a> )	Homeowners who receive a disaster assistance loan from the U.S. SBA to repair or rebuild a damaged or destroyed home may use some of the loan proceeds to construct a safe room. The loan can be increased by up to 20 percent to cover the cost of adding a safe room.	Disaster Loans to Business and Home Owners	Natural Hazards
<i>Flood Mitigation Assistance Program</i>	<p>Goal is to reduce or eliminate claims under the <u>National Flood Insurance Program</u> (NFIP) There are 3 types of grants:</p> <ul style="list-style-type: none"> <li>• <b>Planning Grants</b> to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply</li> <li>• <b>Project Grants</b> to implement projects such as elevation, acquisition, or relocation of NFIP-insured structures. Repetitive loss properties</li> </ul>	Flood Mitigation Assistance	Floods

	<p>should be prioritized for FMA funds (structures with 2 or more losses each with a claim of at least \$1,000 within any ten-year period since 1978)</p> <ul style="list-style-type: none"> <li>• <b>Management Cost Grants</b> for the State to help administer the FMA program and activities. Up to ten percent (10%) of Project grants may be awarded to States for Management Cost Grants.</li> </ul>		
<i>Pre-Disaster Mitigation Program</i>	<p>The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. 2012 Federal Ranking Factors:  <a href="http://www.fema.gov/library/viewRecord.do?id=4408">http://www.fema.gov/library/viewRecord.do?id=4408</a>.</p>	Mitigation Funding Program	Natural Hazards
<i>Hazard Mitigation Grant Program</i>	<p><b>Hazard Mitigation Grant Program (HMGP)</b>  Authorized under Section 404 of the Stafford Act, the HMGP provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration.</p> <p>HMGP funds may be used to fund projects that will reduce or eliminate the losses from future disasters on public or private property. Projects must provide a long-term solution to a problem instead of a temporary fix (ex sandbags). In addition, a project's potential savings must be more than the cost of implementing the project. Funds may be used to purchase property that has been subjected to, or is in danger of, repetitive damage. Examples include:</p> <ul style="list-style-type: none"> <li>• Acquisition of real property from willing sellers and demolition or relocation of buildings to convert the property to open space use</li> <li>• Retrofitting structures and facilities to minimize damages from high winds, earthquake, flood, wildfire, or other natural hazards</li> <li>• Elevation of flood prone structures</li> <li>• Development and initial implementation of vegetative management programs</li> <li>• Minor flood control projects that do not duplicate the flood prevention activities of other Federal agencies</li> <li>• Localized flood control projects, such as certain ring levees and floodwall systems, that are designed specifically to protect critical facilities</li> <li>• Post-disaster building code related activities that support building code officials during the reconstruction process</li> </ul>	Mitigation Funding Program	Natural Hazards
<i>U.S. Department of Agriculture (USDA)</i>	<a href="http://www.usda.gov">www.usda.gov</a>		
<i>U.S. Department of Commerce, Economic Development Administration (EDA)</i>	<p>EDA assistance is available in rural and urban areas experiencing high unemployment, low-income levels, or sudden and severe economic distress.  <a href="http://www.doc.gov/eda">http://www.doc.gov/eda</a></p>	Economic Recovery Assistance	All-Hazards
<i>Minnesota Department</i>	DNR administers the Flood Hazard Mitigation Grant	Flood	Flood,

<i>of Natural Resources (DNR), Division of Waters</i>	Assistance Program, a state-local cost-sharing program for structural and non-structural flood mitigation projects. ( <a href="http://www.dnr.state.mn.us/waters">www.dnr.state.mn.us/waters</a> ).	Mitigation Assistance	Dam/Levee Failure
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### ***Hazard Mitigation Goals, Strategies and Action Steps***

This section discusses potential remedies for the gaps discovered during the mitigation planning process. Many of these goals came directly from an analysis of our capabilities and gaps in our ability to mitigate specific hazards. Others came directly from citizen input at our community meetings and through our surveys. Finally, some goals, strategies, and action steps came from Mitigation Planning Team members who have long known some inherent deficiencies in our critical infrastructure or mitigation efforts. This corporate knowledge contributed to a large extent in the preparation of this section.

Overarching Goals are broad-based measures that will prevent loss of life and damage to property while reducing future risks in the City of Saint Paul. Strategies are means to accomplish the broad based, overarching goals. Specific Mitigation Action Steps are practical, specific actions that can be taken by City Departments, partners in industry, state and local governments, business and private sector organizations, and individual workers assigned to complete remediation, mitigation, prevention, and preparation activities.

Some strategies are specific to certain locations; others are more general. This is because of the nature of the hazard. For example, floods occur in fairly predictable places and windstorms do not.

The Emergency Management Department will seek mitigation grants, City budget funds, and private/corporate donations and partnerships in support of Mitigation Goals, Strategies, and Action Steps.

**A. Goal:** Save lives and eliminate or reduce damage to property and infrastructure during major community events, electrical outages or infrastructure failure.

**1. Strategy:** Continue implementation of the Standardized Electrical Connection Plan by all City Departments

➤ **Mitigation Action Step:** Standardize Electrical Connections at Water Lift Stations Develop Electrical Supply Options for critical Public Works, Sewer, and Water facilities.

➤ **Mitigation Action Step:** Police Department to standardize electrical connections at all police facilities and substations.

➤ **Mitigation Action Step:** Parks and Recreation Department to standardize electrical connections at all City-owned emergency shelter locations

2. **Strategy:** Develop operational plans to address Light Rail Transit, train (heavy) derailments and bridge failures.

➤ **Mitigation Action Step:** Emergency Management and Public Works will develop railroad (heavy) derailment plans

➤ **Mitigation Action Step:** Develop Action Plans dealing with Light Rail Issues: Large event plans, pedestrian/traffic hazards, signage/cameras, patrol/dept manning requirements

➤ **Mitigation Action Step:** Develop bridge infrastructure failure plans.

3. **Strategy:** Encourage the use of portable or mobile generators at key facilities or private industries

➤ **Mitigation Action Step:** Emergency Management to partnership with electrical utilities to develop educational materials for small business owners in the use of portable or mobile emergency generators.

- B. **Goal:** Save lives and eliminate or reduce damage to property and infrastructure due to blizzards and other related weather events.

1. **Strategy:** Encourage City Departments to apply lessons learned for blizzards and other hard-to-simulate emergencies.

**Mitigation Action Step:** Emergency Management Department to coordinate lessons learned information discussions following blizzards and weather related events.

2. **Strategy:** Enforcement of Building Codes

**Mitigation Action Step:** Ensure local building officials enforce codes to avoid structural damage due to blizzards and other heavy load situations.

3. **Strategy:** Promote Public Education for blizzards and other weather related events



- **Mitigation Action Step:** Urge public to heed winter weather warnings and advisories
- **Mitigation Action Step:** Promote winter survival kits during Winter Weather Awareness Week and beyond
- **Mitigation Action Step:** Educate citizens on the availability of low interest loans for improving structural ability of homes/businesses.

**C. Goal:** To eliminate or reduce damage to property and infrastructure due flood damage.

**1. Strategy:** To prevent spring runoff (river) flood damage to property

- **Mitigation Action Step:** Examine existing levees and identify areas of additional levee constructions so as to reduce need for repetitive and time-consuming sandbag levee construction

**2. Strategy:** To increase City's ability to mitigate, prepare for, and respond to flooding incidents in Saint Paul.

- **Mitigation Action Step:** Continue development and maintenance of a Resource Manual that would list available equipment for a flooding situation.
- **Mitigation Action Step:** Emergency Management to host or provide flood flight training to applicable city staff.
- **Mitigation Action Step:** Emergency Management Department to insert a flood scenario into the annual exercise schedule to practice long range mitigation and recovery phases.

**D. Goal:** Save lives and eliminate or reduce damage to property and infrastructure due to terrorist or CBRNE threats.

**1. Strategy:** Continue to harden critical infrastructure, and continue to make security and response plans for the protection of those facilities

- **Mitigation Action Step:** Police Department to continue work on building plans for increased protection of and patrolling of critical infrastructure nodes.
- **Mitigation Action Step:** Police Department to continue use of



Law Enforcement Terrorism Prevention Program grants to harden critical infrastructure and build capability to detect, interrupt, and prevent terrorism at key infrastructure sites.

2. **Strategy:** Continue training response personnel in prevention, protection, response, and recovery roles for CBRNE incidents.
  - **Mitigation Action Step:** Public Safety Departments to continue to use Technical Advisory visits and training available from agencies supporting domestic preparedness training; to detect, disrupt, prevent, respond to and recover from CBRNE incidents.
  - **Mitigation Action Step:** Police, Fire, and Public Works Department to continue training on NIMS.
  - **Mitigation Action Step:** All Departments to continue comprehensive implementation of NIMS through their training, policy, and indoctrination programs.
  - **Mitigation Action Step:** Emergency Management Department to continue organizing or hosting training sessions for Standardized WMD Awareness and Incident Response to Terrorist Bombing classes to all applicable personnel.
  - **Mitigation Action Step:** Develop Plans and Procedures to fully integrate NIMS into Fire Dept Opns (Unified Command and Ongoing Opns) for Severe Weather, Large Scale Fire, and Large Structural Collapse.
  - **Mitigation Action Step:** Community Outreach Education/Planning Discussions on EOP and subsequent ESF's
3. **Strategy:** Continue equipment acquisition and planning efforts using new technology for CBRNE incidents.
  - **Mitigation Action Step:** Continue to work with federal, state, regional, and local agencies and authorities to build regional assets, interoperable communications, and organizational structures consistent with the National Incident Management System (NIMS)

**E      Goal:** Development of a Mass Feeding operational plan.

1. **Strategy:** Ensure that plans for mass feeding of several thousand people are addressed in the event of a disaster.

➤ **Mitigation Action Step:** Emergency Management, VOAD, The Salvation Army and Private Sector Develop will develop a mass Feeding plans for several thousand people.

**F. Goal:** To reduce death, injury and property damage from tornadoes, windstorms, straight-line winds, and thunderstorms.

1. **Strategy:** To build a more robust public education campaign related to severe weather events.

➤ **Mitigation Action Step:** Emergency Management Department to take a greater role in Severe Weather Awareness Week in April each year, including an expanded public awareness campaign to urge public to heed weather warnings and advisories.

➤ **Mitigation Action Steps:** Emergency Management Department to disseminate information on the purchase and use of NOAA weather radio alert devices to District Community Councils, Neighborhood Watch Groups, and the general public via public safety announcements.

➤ **Mitigation Action Step:** Discourage the use of video cameras to film dangerous storms

2. **Strategy:** To improve City's ability to warn the public and public safety response teams to severe weather conditions or the approach of severe weather.

➤ **Mitigation Action Step:** Emergency Communications Center is to develop Alert and Notification policies and procedures strategies that include the use of Emergency Alert System (EAS) so it is available for use by dispatcher during severe weather incidents or any hazardous situation.

**G. Goal:** Save lives and eliminate or reduce damage to property due to extreme temperatures.

1. **Strategy:** Improve partnerships with local social service organizations leading to early identification and increased support to vulnerable populations during extreme temperatures.

➤ **Mitigation Action Step:** Work with Ramsey County Social Services, the State Health Department, and local social services organizations to identify those who are susceptible to heat-related illness, including the elderly & very young

➤ **Mitigation Action Step:** Emergency Management Department to ensure that City Resource Manual and Database identifies sources of fans and air conditioners

➤ **Mitigation Action Step:** Continue work with the SuperHot Task Force in regards to early alert system and sheltering and transportation plans during dangerously hot weather conditions.

2. **Strategy:** Improve plans for sheltering people and pets during times of extreme temperatures or other hazardous situations.

➤ **Mitigation Action Step:** Ensure shelters have adequate supplies for both hot and cold weather emergencies

➤ **Mitigation Action Step:** Identify shelters that are co-located with pet shelters.

➤ **Mitigation Action Step:** Develop shelter plan for each shelter.

H. **Goal:** To reduce the risk of death, bodily injury, or property loss due to incidents involving fire or police personnel.

1. **Strategy:** Continue to improve public education efforts related to fire safety

➤ **Mitigation Action Step:** Fire Department will continue to seek federal grant and private institution funding for smoke detector education and giveaway programs.

2. **Strategy:** Continue to seek public and private funding to improve Police and Fire Department equipment and staffing

➤ **Mitigation Action Step:** Fire Department will continue to seek Assistance to Firefighter and SAFER Act grant funding to recruit, train, equip, and retain firefighters

➤ **Mitigation Action Step:** The Police Dept will seek funding to improve police staffing and equipment.

- I. Goal:** To mitigate losses to people and property in the event of a health emergency.
- 1. Strategy:** Continue planning efforts with jurisdictions and agencies to ensure more robust mitigation, preparation, response, recovery actions are taken for a health emergency.
    - **Mitigation Action Step:** Conduct tabletop exercises to discuss implementation of isolation and quarantine
    - **Mitigation Action Step:** Identify sites for mass clinics and off-site care facilities, and identify the logistical support necessary to active and maintain their operations.
    - **Mitigation Action Step:** Educate public on precautions to take to prevent the spread of infectious diseases.
  - 2. Strategy:** Provide health facilities (surge) designed to serve the community in the event of a health emergency.
    - **Mitigation Action Step:** Identify Points of Dispensing (PODS) facilities, negotiate MOUs, and train POD partners.
    - **Mitigation Action Step:** Develop ability to establish and manage a Community Reception Center (CRC) following the detonation of a RDD. Develop OPLAN for CRC
- J. Goal:** To help the community survive a terrorist incident whether from a domestic or foreign origin.
- 1. Strategy:** Make sure first responders are organized, prepared, equipped, trained, and exercised to prevent, disrupt, respond to and recover from terrorist incidents.
    - **Mitigation Action Step:** Ensure grant money is spent to close gaps identified in jurisdictional assessment, and to build capabilities set forth in the State Homeland Security Strategy and the Urban Areas Securities Initiative Homeland Security Strategy.
    - **Mitigation Action Step:** Continue to use federal and state assistance in training and planning to close gaps identified in the jurisdictional assessment, and to build capabilities set forth in the State Homeland Security Strategy and the Urban Areas Securities Initiative Homeland Security Strategy.

➤ **Mitigation Action Step:** Police Department to complete the writing of the Terrorism Annex for the City's Emergency Operations Plan.

➤ **Mitigation Action Step:** Emergency Management to continue to work with State and County officials in the development of a Resource database that will support the response to and recovery from a terrorist incident.

2. **Strategy:** Improve public awareness of prevention, preparation, response and recovery actions they can take in regards to terrorism.

➤ **Mitigation Action Step:** Emergency Management to coordinate the gathering and dissemination of common sense directions for terrorism prevention, preparation, response, recovery actions.

➤ **Mitigation Action Step:** Emergency Management to promote the use of family emergency plans

**K. Goal:** To mitigate the effects of an incident caused by Karst topography.

1. **Strategy:** To avoid placing sensitive structures in areas where earthquakes or karst features could cause structure damage or collapse, i.e. sinkholes

➤ **Mitigation Action Step:** Department of Safety and Inspection to be aware of geology in each community and know if these hazards exist there.

2. **Strategy:** To continue current mitigation and prevention activities for the mine shafts and caves on the West Side of the City.

➤ **Mitigation Action Step:** Police, Public Works, Parks and Recreation, and Fire Department to continue to ensure mitigation plans are carried out, and that protective measures remain in place over time.

**L. Goal:** To lessen the effects of a radiological incident or release on people and property.

1. **Strategy:** To eliminate exposure to radiological sources

➤ **Mitigation Action Steps:** Train first responders on time,

distance and shielding

**2. Strategy:** Enhance ability to detect radiological sources

➤ **Mitigation Action Step:** To have a trained cadre to monitor exposure to radiation

➤ **Mitigation Action Step:** Saint Paul Fire and Ramsey County Public Health staff will be trained in radiological monitoring

➤ **Mitigation Action Step:** Saint Paul Fire and Ramsey County Public Health emergency response personnel will participate in any nuclear generating plant drill and exercise training opportunities.

**M. Goal:** To lessen the effects of a hazardous materials release on people and property.

**1. Strategy:** Maintain copies of 302 facility plans in the emergency management office and/or the fire department Know locations of fixed facilities

➤ **Mitigation Action Step:** Obtain a 302 list from HSEM every year and ensure the plans are available in this Plan and the City's Emergency Operations Plan

➤ **Mitigation Action Step:** Perform Risk Management Plan Compliance Audit at those facilities posing the greatest risk to the City of Saint Paul.

➤ **Mitigation Action Step:** Continue current initiative to get 302 plans placed into electronic format and available to first responders via Computer Aided Dispatch System and Fire Mobile Computer planning efforts.

**2. Strategy:** Build closer working partnership with hazardous material facility personnel and commercial vendors active in hazardous materials response and recovery operations. Work with facility coordinators so that they are aware of City capabilities and vice versa

➤ **Mitigation Action Step:** Train and exercise together with hazmat facility operators and commercial hazmat response vendors.

**N. Goal:** To lessen or eliminate negative effects of water supply contamination or disruption of delivery systems.

**1. Strategy:** Maintain physical safeguards on key water facility sites to prevent unauthorized access.

➤ **Mitigation Action Step:** Lock doors on water facilities

➤ **Mitigation Action Step:** Require proper identification or code for access to water facilities

➤ **Mitigation Action Step:** During orange (or higher) alerts, put on extra patrols

➤ **Mitigation Action Step:** Safeguard aquifers by maintaining a strong wellhead protection program

**2. Strategy:** Develop alternative supply sources

➤ **Mitigation Action Step:** Look into sharing supplies with neighboring jurisdictions, especially the City of Minneapolis

➤ **Mitigation Action Step:** Identify additional sources of potable water

**3. Strategy:** Ensure lift stations have continuous electrical power

➤ **Mitigation Action Step:** Standardize Electrical Connections at Water Lift Stations Develop Electrical Supply Options for critical Water facilities

➤ **Mitigation Action Step:** Emergency Management to acquire or ensure prompt delivery of a trailer mounted electrical generator of sufficient power to operate essential lift stations throughout the City.

**O. Goal:** Address actions in the event of an animal escape at Como Zoo.

**1. Strategy:** Ensure that Como Zoo of Parks and Recreation Department has an Operational Plan addressing animal escape.

➤ **Mitigation Action Step:** Develop plans for Como Zoo in the event of animal escape.

## Analysis of Past Mitigation Actions and/or Projects

**Table 88: Completed Projects**

	<b>Action Step</b>	<b>Responsible Department</b>	<b>Potential Funding Source</b>	<b>Timeline</b>	<b>2007 Goal</b>	<b>Completed? (Yes, No, or In Process)</b>	<b>Anticipated Completion Date mo/yr</b>	<b>Continue in 2012 Plan?</b>
<b>1</b>	Flash flood & flood insurance awareness campaign	Emergency Management & Public Works	Annual Operating Budgets	Develop in 2006 and implement continually thereafter	<b>C-2</b>	Yes	N/A	No
<b>2</b>	Ensure 302 lists are included in Hazard Mitigation Plan and EOP	Emergency Management and Fire	Annual Operating Budget	Continue in 2006, and include in annual updates of the plan thereafter.	<b>M-1</b>	Yes	N/A	No
<b>3</b>	Identify areas of flash flooding runoff & develop mitigation strategies for each	Emergency Management and Public Works	Annual Operating Budget and Federal Mitigation Grants	Identify options and implementation plan in 2006 and Implement solution in 2007-2010	<b>C-2</b>	Yes	N/A	No
<b>4</b>	Water Conservation Program	Emergency Management and Water Utility	Annual Operating Budgets	Begin planning and implementation activities in 2006, complete in 2007, and implement continually thereafter	<b>N-3</b>	Yes	N/A	No
<b>5</b>	Holman Field flooding mitigation solution	Emergency Management, Public Works, private businesses, and Metropolitan Airports Commission	Public and private funding & Federal Mitigation Grants	Identify options and implementation plan in 2006 and Implement solution in 2007-2010	<b>C-1</b>	Yes	N/A	No



<b>6</b>	Siren control system replacement	Emergency Management, Ramsey County Communications Center, and Police Radio Shop	Annual Operating Budget, EMPG grant funding, & Federal Mitigation Grant	Develop options and Request for Proposals 2006 and 2007, purchase & implement in 2008	<b>F-2</b>	Yes	Apr-12	No
<b>7</b>	Emergency Management to develop and implement a public information campaign during droughts	Emergency Management and Water Utility	Annual Operating Budgets	Begin planning and implementation activities in 2006, complete in 2007, and implement continually thereafter	<b>E-2</b>	No	N/A	No
<b>8</b>	Emergency Management Department to Work with city, county and state officials on the development and implementation of water conservation strategies during dry periods.	Emergency Management and Water Utility	Annual Operating Budgets	Begin planning and implementation activities in 2006, complete in 2007, and implement continually thereafter	<b>E-1</b>	No	N/A	No

**Table 89:** Deleted Projects from 2007 Plan

	<b>Action Step</b>	<b>Responsible Department</b>	<b>Potential Funding Source</b>	<b>Timeline</b>	<b>2007 Goal</b>	<b>Completed? (Yes, No, or In Process)</b>	<b>Anticipated Completion Date mo/yr</b>	<b>Continue in 2012 Plan?</b>
<b>1</b>	Incorporate City Watch in alert and notification process	City and County Emergency Management	Annual Operating Budget	Implement and test in 2006 for ongoing use thereafter	<b>F-2</b>	No	N/A	No

<b>2</b>	Gather & disseminate safe room testimonials	Emergency Management	Annual Operating Budget	Gather in 2006, develop public information in 2007 & disseminate thereafter	<b>F-3</b>	No	N/A	No
<b>3</b>	Ensure builders to use safe rooms	Emergency Management	Annual Operating Budget	Gather info in 2006, develop information in 2007 & disseminate thereafter	<b>F-3</b>	No	N/A	No
<b>4</b>	Encourage private shelter owners to adopt Standardized Electrical Connection Plan	Emergency Management	Private & Corporate funding, Annual Operating Budget	Develop plan in 2006 and deliver continually thereafter	<b>A-1</b>	No	N/A	No
<b>5</b>	Encourage private shelter owners to explore use of portable & mobile generators	Emergency Management	Private & Corporate funding, Annual Operating Budget	Develop plan in 2006 and deliver continually thereafter	<b>A-2</b>	No	N/A	No
<b>6</b>	Expand SPEARS membership	Emergency Management	Annual Operating Budget, Citizen Corps funding, and private/corporate sponsorship	Continue in 2006 and beyond	<b>A-3</b>	No	N/A	No
<b>7</b>	Expand equipment capabilities of SPEARS	Emergency Management	Annual Operating Budget and private/corporate sponsorship	Continue in 2006 and beyond	<b>A-3</b>	No	N/A	No

<b>8</b>	Continue building amateur radio partnerships	Emergency Management	Annual Operating Budget, Citizen Corps funding, and private/corporate sponsorship	Continue in 2006 and beyond	<b>A-3</b>	No	N/A	No
<b>9</b>	Publicize drought-resistant landscaping ideas	Emergency Management and Water Utility	Annual Operating Budgets	Begin planning and implementation activities in 2006, complete in 2007, and implement continually thereafter	<b>E-2</b>	No	N/A	No
<b>10</b>	Identify trigger points on contents of water conservation program & restrictions	Water Utility	Annual Operating Budget, Private & corporate funding	To continue in 2006 for final policy delivery in 2007.	<b>N-3</b>	No	N/A	No
<b>11</b>	Investigate the use of privately owned wells for alternative water supplies	Water Utility and DSI	Private and Corporate funding, Annual Operating Budget and Federal Mitigation Grants	Begin analysis of options in 2006 and continue to implement as resources become available.	<b>N-2</b>	No	N/A	No

### ***Prioritization Process***

The City's approach to prioritizing identified mitigation projects and actions is to assign relative scores to the actions based on qualitative factors. By rating costs and benefits as High, Medium, and Low, this method clearly emphasizes the Benefit-Cost Review. The process uses a set of criteria commonly called "*STAPLEE*", which stands for Social, Technical, Administrative, Political, Legal, Economic, and

Environmental factors. (See **Table 90** below for considerations and guidance on the *STAPLEE* process.) They are typically used for evaluating planning alternatives.

Emphasis was placed on the following principles when developing the prioritization process:

- The specific project/action step's overall beneficial impact for the greatest number of citizens;
- The City's ability to accomplish the task over the next 5 years given the resources available; and
- The integration of the action step into previously identified "gaps" in previous capability assessments, as well as the goals and objectives of the National Preparedness Goal and the Urban Area Securities Initiative Homeland Security Strategy.

**Table 90:** Prioritization Considerations and Guidance for the "STAPLEE" Process

<i><b>Prioritization Category</b></i>	<i><b>Considerations</b></i>	<i><b>Sources of Information</b></i>
<b>Social</b>	Community Acceptance	<ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Interviews with government staff, non-profit organizations, and neighborhood advocacy organizations</li> <li>• Community plans</li> <li>• Newspaper articles</li> </ul>
	Adversely Affects Segment of Population	<ul style="list-style-type: none"> <li>• Maps showing demographics (race, age, income, voting districts, etc.) with locations of proposed mitigation actions</li> </ul>
<b>Technical</b>	Technical Feasibility	<ul style="list-style-type: none"> <li>• Judgment of mitigation experts, scientists, and engineers</li> <li>• Existing literature/studies on the action</li> </ul>
	Long-term Solution	<ul style="list-style-type: none"> <li>• Judgment of mitigation experts</li> <li>• Existing literature/studies on the action</li> </ul>
	Secondary Impacts	<ul style="list-style-type: none"> <li>• Judgment of mitigation experts</li> <li>• Existing literature</li> <li>• Maps showing environmentally sensitive resources with locations of proposed mitigation actions</li> <li>• Scientific and/or engineering evaluations</li> </ul>
<b>Administrative</b>	Staffing (sufficient number of staff and training)	<ul style="list-style-type: none"> <li>• Capability assessment</li> <li>• Jurisdiction organizational chart</li> </ul>

		<ul style="list-style-type: none"> <li>• Availability of technical assistance from regional or state agencies</li> <li>• Interviews with department heads and relevant staff</li> </ul>
	Funding Allocated	<ul style="list-style-type: none"> <li>• Capability assessment</li> <li>• Annual operating budget <ul style="list-style-type: none"> <li>• Capital improvement budget</li> <li>• Interviews with department heads and relevant staff</li> </ul> </li> </ul>
	Maintenance/Operations	<ul style="list-style-type: none"> <li>• Capability assessment</li> <li>• Existing literature on maintenance costs</li> <li>• Interviews with department heads and relevant staff</li> </ul>
<b>Political</b>	Political Support	<ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Interviews with elected officials</li> <li>• Newspaper articles</li> </ul>
	Local Champion or Plan Proponent (respected community member)	<ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Interviews with elected officials, community leaders, and private sector participants in planning process</li> </ul>
	Public Support (Stakeholders)	<ul style="list-style-type: none"> <li>• Survey(see <b>Appendix 4</b>)</li> <li>• Interviews with government staff, non-profit organizations, and neighborhood advocacy organizations</li> <li>• Newspaper articles</li> <li>• Public meetings</li> </ul>
<b>Legal</b>	State Authority	<ul style="list-style-type: none"> <li>• Research of state codes</li> <li>• Contact with state attorney general's office</li> </ul>
	Existing Local Authority	<ul style="list-style-type: none"> <li>• Research of local codes and ordinances</li> <li>• Local legal counsel</li> </ul>
	Action Potentially Subject	<ul style="list-style-type: none"> <li>• Research by local legal</li> </ul>

	to Legal Challenge by Opponents (stakeholders who would be negatively affected)	<ul style="list-style-type: none"> <li>counsel</li> <li>Maps, census, plans</li> </ul>
<b>Economic</b>	Benefit of Mitigation Action	<ul style="list-style-type: none"> <li>Benefit-cost analysis software/methodology</li> <li>Judgment of experts</li> <li>Existing literature</li> <li>Case studies of similar implemented actions</li> <li>Economic impact assessment</li> </ul>
	Cost of Mitigation Action	<ul style="list-style-type: none"> <li>Order of magnitude cost estimate (e.g., Action A costs five times more than Action B)</li> <li>Judgment of experts</li> <li>Local contractors</li> <li>Case studies</li> </ul>
	Contributes to Economic Goals	<ul style="list-style-type: none"> <li>Judgment of experts</li> <li>Evaluation of community's comprehensive plan, economic development plan, and other community plans and policies</li> </ul>
	Outside Funding Required	<ul style="list-style-type: none"> <li>Order of magnitude cost estimate</li> <li>Evaluation of state and federal funding programs</li> </ul>
<b>Environmental</b>	Affects Land/Water Bodies	<ul style="list-style-type: none"> <li>Maps, studies, plans</li> <li>Coordination with state and federal resource agencies, including compliance with all relevant statutes and regulations</li> </ul>
	Affects Endangered Species	<ul style="list-style-type: none"> <li>Maps, studies, plans</li> <li>Coordination with state and federal resource agencies, including compliance with all</li> </ul>

		relevant statutes and regulations
	Affects Hazardous Materials and Waste Sites	<ul style="list-style-type: none"> <li>• Maps, studies, plans</li> <li>• Hazardous waste site databases</li> <li>• Coordination with state and federal resource agencies, including compliance with all relevant statutes and regulations</li> </ul>
	Consistent with Community's Environmental Goals	<ul style="list-style-type: none"> <li>• Maps of land use, zoning, sensitive areas, projected growth</li> <li>• Interviews with government staff</li> <li>• Review of local plans and policies</li> </ul>
	Consistent with Federal Laws	<ul style="list-style-type: none"> <li>• Contact with federal agencies</li> </ul>

**Table 91:-**The format that is used for documenting the prioritization of projects

Actions → Criteria ↓	e.g. – Standardize Electrical Connections at Water Lift Stations		Protection and patrol plans for critical infrastructure nodes		Expand Sever Weather Awareness activities		Urge public to heed weather warnings	
	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit
Social	-	-						
Technical	H	H						
Administrative	M	-						
Political	-	M						
Legal	-	-						
Economic	H	H						
Environmental	-	-						
<b>PRIORITY</b>	(H, M or L)							

Definition of rating scale: H=High, **Priority 1**; M=Medium, **Priority 2**; L=Low, - None/Not applicable – **Priority 3**

The following procedure describes the process for submitting and prioritizing potential mitigation projects or actions:

<b>Table 92:</b> Procedure for Submitting and Prioritizing Mitigation Actions		
<b>Submitting a potential mitigation project/action</b>	<b>Step 1:</b> Identify the issue or problem.	Base information on documented post-disaster reports, after-action plans, studies, reports, or other statistics or data.
	<b>Step 2:</b> Identify and develop a potential solution or project to address the issue or problem.	Complete a <b>Project Submission Form</b> : Provide the Title; develop a description of the problem and potential solution; link the project to a specific hazard; designate a responsible entity; describe the benefits of the project; provide a cost estimate; provide a potential timeline.
	<b>Step 3:</b> Submit the project for consideration	Send <b>Project Submission Form</b> to Saint Paul Emergency Management.
<b>Accepting the project</b>	<b>Step 4:</b> Saint Paul EM provides technical review	Is it consistent with the Mitigation Plan? Does it address a priority hazard? Is it feasible? Is it potentially cost effective?
	<b>Step 5:</b> Project is submitted to Stakeholder Work Group for approval	Saint Paul EM coordinates the submission and approval process.
	<b>Step 6:</b> Approved Project is added to the mitigation list	Saint Paul EM is responsible for maintaining the comprehensive list of mitigation projects/actions
<b>Prioritizing the project</b>	<b>Step 7:</b> Approved Project is considered for prioritization	Saint Paul EM coordinates the prioritization process using the criteria described in the Mitigation Plan.
<b>Implementing the Project</b>	<b>Step 8:</b> Prioritized Project is considered for implementation	Is the responsible entity willing to implement the project? Is there funding available? Is it an eligible project under the funding criteria? Does the Benefit-Cost ratio confirm that it is cost-effective?

### *Assessment of Benefits and Costs*

DMA 2000 mandates an emphasis on Benefit-Cost Review as part of the prioritization process. Directly linking the prioritization process to the Benefit-Cost Review clearly shows that costs and benefits were emphasized. There are many



ways of determining whether potential projects and actions are cost-effective. The full Benefit-Cost Analysis process is costly to carry out for all projects; however, the City has identified a prioritization process that includes consideration of benefit-cost in determining high, medium and low priorities. A full Benefit-Cost Analysis is conducted for individual projects that are determined to be feasible and eligible for funding at the time that funding opportunities are available.

Benefit-Cost Analysis data related to specific projects is maintained by the responsible entity for implementing the project.

### ***Integration of Mitigation into Other Planning Mechanisms***

Throughout the planning process the stakeholders reviewed various City and area plans, documents, historical records, and other information. Much of this information was incorporated into the final plan. In addition, the stakeholder group reviewed actions steps (projects) to confirm currency and provide status updates. This process also allows the opportunity to assess the relation between information and strategies in the mitigation plan with other planning documents and processes. The mitigation strategy serves as the long-term blueprint for reducing potential losses identified in the risk assessment, and mitigation strategies, goals and action steps. The integration of the mitigation planning process and methods of implementation will be considered in other planning processes, including but not limited to the following:

1. Emergency Management Program Strategic Plan  
The annual review cycle of the Strategic Plan will include review of:
  - hazard priorities (based on frequency and level of risk/vulnerability)
  - mitigation strategy, goals and action steps
  - available or potential funding sources
  - disaster events that have occurred since the last update
2. City of Saint Paul Comprehensive Growth Management Plan (adopted February 2010)  
The annual review cycle of the Strategic Plan will include review of:
  - Hazard priorities (based on frequency and level of risk/vulnerability)
  - Mitigation strategy, goals and action steps
  - Available or potential funding sources
  - Disaster events that have occurred since the last update
3. Budget/Capital Improvement Plan Cycles  
The annual budget and capital improvement planning cycle provides the opportunity to assess mitigation projects against available and potential funding sources. Mitigation action steps (projects) will be reviewed annually during the budget and capital improvement plan cycle to determine those projects which could potentially be implemented with available funding.

The concept of mitigation is integrated into other planning mechanisms using

various methods. Members of the Stakeholder Work Group (EM Council) serve as the central points of coordination for ensuring that concepts of mitigation are addressed in policy development; plan development, review and update; and resourced allocations during other planning processes.

Several plans have scheduled review cycles which are noted and monitored by Saint Paul EM, and others are periodically reviewed and revised. Other planning mechanisms that have potential opportunities for integration of mitigation include:

- Saint Paul Emergency Operations Plan and Pandemic Influenza Supplement (Saint Paul EM) (updated 2012)
- Ramsey County Hazard Mitigation Plan
- State of Minnesota Hazard Mitigation Plan
- Urban Area Security Initiative planning
- Mayor's Strategic Plan -
  - *"Embrace an ethic of sustainability that informs all of the city's operations and investment."*
- District Council planning
- Pipeline Safety and Awareness response planning
- Local Emergency Planning Council

## Plan Review, Evaluation and Implementation

### Changes in Development Patterns

Development patterns in the City of Saint Paul have been influenced in recent years by several major concepts:

#### 1. Sustainability

FEMA's publication, "Planning for a Sustainable Future", (page 4), states that "Unsustainable development is the root cause underlying the mounting cost of natural disasters." This document highlights the links between hazard mitigation and sustainability and promotes comprehensive land use planning as a means to ensure that future development won't be impacted by or contribute to disasters. Until recently, sustainable development has tended to focus on environmental protection and energy savings, with less emphasis on other planning concerns such as disaster resistance. However, a community that is not disaster-resistant cannot be sustainable. Hazard mitigation reduces future disaster losses through appropriate land use planning which includes zoning, site design, construction, engineering, and retrofitting of homes, structures, schools, public buildings, and businesses.

*Saint Paul Sustainable Building Policy for Private Development* – In 2009, the City adopted a sustainability policy that impacts new commercial and residential construction receiving more than \$200,000 from any City or Housing Redevelopment Act funding and any combination of loan, grant or other government-funded vehicle. The Policy required the creation of a joint Sustainable Building Technical Committee (Committee) by the Department of Planning and Economic Development and the Department of Safety and Inspections. A private sector representative also serves on the Committee.

The Policy breaks projects down into two major types: commercial projects and residential projects. Commercial projects are required to comply with one of four possible rating systems:

- Leadership in Energy and Environmental Design (LEED) New Construction (NC), Silver;
- Green Globes 2;
- State Guidelines Building Benchmarking and Beyond (B3) Compliant;
- Saint Paul Port Authority Green Design Review (as applicable)

For residential projects three rating systems are identified:

- LEED for Homes (H) or LEED NC 1, Silver;
- Minnesota GreenStar, Silver;

- Green Communities, Minnesota Overlay Compliant

Sustainability can often be factored into reconstruction or redevelopment initiatives following a disaster. However, because properties in hazard-prone areas tend to be “affordable”, pressures to rebuild with inappropriate land uses may be significant and protective measures at the policy-level may be required to prohibit such development. The guiding principles, strategies, goals and objectives in this plan will serve as the foundation of such efforts.

Land uses that encourage effective sustainability through the appropriate use of open space can prevent development from encroaching upon floodplains, active fault zones, and other hazard areas. Communities that encourage appropriate development also take advantage of underutilized urban areas and encourage infill and “brownfield” development, thus supporting sustainability without compromising disaster mitigation principles.

## 2. Transit-Oriented Development

Transit-oriented development (TOD) is important for local planning practitioners, transit agencies, community members, and other stakeholders in their efforts to plan for new transit investments and foster compatible development that is also disaster resilient.

TOD supports development patterns with regard to:

- Proximity to downtowns and other major employment centers;
- The location and extent of vacant or “underutilized” property that might offer opportunities for development or redevelopment;
- Block patterns that influence “walkability”;
- Transit connectivity; and
- Household incomes

The **Hiawatha Line**, which started operation in 2004, is the first in a series of major transit investments planned for the Minneapolis - Saint Paul region. When completed, the corridor will connect Saint Paul with a series of important regional destinations including downtown Minneapolis, the Saint Paul-Minneapolis Airport, and the Mall of America. The neighborhoods along the Hiawatha Line offer a limited number of opportunity sites for new development, but has demonstrated a focus in and around the downtown area of the city which is associated with long-term efforts aimed at revitalizing the downtown riverfront and warehouse district. The majority of development along the line consists of new condominiums and apartments built in the downtown and elsewhere along the line. The residential uses benefit from proximity to the new transit line because they will offer easy access to several key regional destinations which will increase over time as the existing network expands.

Transit-oriented development in the City of Saint Paul has generally not been targeted to areas that are considered to be prone to hazards, but has instead

encouraged appropriate infill construction along rail lines which are not in areas susceptible to hazards. For this reason, this type of development has been compatible with disaster mitigation principles and practices.

### **3. Reduction in Building Permits and Decline in Values of Real Property**

Statistics compiled by the Metropolitan Council indicate that the overall volume of housing construction has declined significantly since its peak in 2004. In that year, an estimated 1,800 permits were issued for various types of single- and multi-family homes. By 2010, the number had declined to an estimated 200 permits. (Source: Metropolitan Council, <http://stats.metc.state.mn.us/profile/detail.aspx?c=02396511#commuting>). The decline in permitting is reflective of general economic trends between 2008 and 2012, and may provide opportunities for cost-effective buy-outs in flood prone areas, if appropriate.

### **4. Relocation of Major Employers from the City**

In the 2007 plan, it was noted that the City of Saint Paul was host to at least seven global corporations who established headquarters in the city. As of 2010, this number had fallen to four with one Fortune 500 company and one Fortune 1000 company. Relocation of these and other major employers to suburban areas and other cities has had a slightly negative impact on employment opportunities within the city and has resulted in a number of vacant large buildings and corporate complexes. The primary impact to hazard mitigation in the City could be a decline in private-sector support for mitigation projects and initiatives.

Land use planning entities should continue to consider areas vulnerable to impact from hazards and integrate hazard mitigation strategies relating to sustainability, transit-oriented development and economic incentives into development efforts and activities that support mitigation-appropriate land use practices.

### **Progress in Mitigation Efforts**

The 2007 All-Hazards Mitigation Plan included a comprehensive list of 68 mitigation projects that were prioritized as “highest”, “higher” and “high”. For the 2012 plan update, the comprehensive list was reviewed and divided into three lists, (1) Completed Projects; (2) Projects Removed (including reasons for removal); and (3) Current Projects. (See **Appendix 6** for all lists.)

Although several major mitigation initiatives have been completed in recent years, data related to the project scopes, costs, benefits and success in reducing the impact of the hazards they address has not been captured. These projects include:

- Sewer modifications to address localized flooding
- Levee system built in 1964 and raised 4.5 in 1996 to address riverine flooding
- Floodwall to protect Lower Town installed in 2007-2008 to address riverine flooding

Because significant progress has been made in the past to implement hazard mitigation projects that address repetitive flood losses, mitigation efforts in recent years have been related more to enhancement of the City's impact and consequence analysis and re-evaluation of priority hazards. In addition to natural hazards, efforts in the 2012 update have emphasized consideration and assessment of human-caused hazards with the potential for manmade events and incidents to impact the City and its citizens. Because mitigation projects that address man-made hazards are difficult to identify and carry out, and frequently fail to meet benefit-cost guidelines for public funding, a renewed focus on public education, which includes prevention and preparedness, will be at the forefront of future mitigation efforts.

While data related to completed projects has not been tracked in detail in the past, a new list of completed projects has been developed for the 2012 update, and future annual reviews will include an update of these projects and summary of progress that reduces the impact of specific hazards. The format that will be used to collect detailed data on completed projects for future updates is:

**Table 93:** Completed Projects Table (Sample)

<b>Priority</b> (Low, Medium, High)	<b>Project/Action</b>	<b>Responsible Entity</b>	<b>Hazard Addressed</b>	<b>Funding Source(s)</b>	<b>Date of Completion</b>	<b>Project Cost</b>	<b>Estimated Dollars Saved</b>
H	[e.g. Physical safeguards on Water facility sites	[e.g. Water Dept. & Waste Water Treatment Plan	[e.g. Terrorism]	[e.g. HMGP]	[Date]	[\$\$\$]	[\$\$\$]

### Changes in Priorities

The 2007 All-Hazards Mitigation Plan included a comprehensive list of 68 mitigation projects that were prioritized as "highest", higher" and "high". Although the priority

hazards have not changed with the 2012 update, the priority categories of mitigation projects has been redefined to “low”, “medium” and “high” priority projects.

The prioritized projects and actions identified during the 2012 update (**Appendix 7**) serve as the long range work plan for various City Departments and Divisions.

Priorities that influence implementation of mitigation projects and actions are constantly changing. Disaster declarations, budgets, policies, and transitions in elected officials can affect what is considered important. Saint Paul Emergency Management is committed to keeping mitigation itself a high priority and will continue to pursue opportunities to mitigate or eliminate the effects of disasters on our citizens, property, infrastructure, environment and economic condition.

### **Status of Mitigation Actions in Previous Plan**

Mitigation goals, strategies, and action plans are described in Section IV of this plan. Implementation of the defined strategies and action steps accomplish the goals of mitigation. The timeline of implementation is dependent on the availability of mitigation funds and staffing resources from City departments, agencies, private sector partners and other entities tasked with carrying out the specific action steps.

The comprehensive listing of mitigation actions was reviewed by the Stakeholder Group for the 2012 Update. This review consisted of documenting completed actions, removing those actions that were no longer applicable or feasible, and confirming actions that were still applicable or had not yet been completed.

Although the 2007 plan did not include information related to completed projects, a new list of completed projects was developed for the 2012 Update and is included in **Appendix 6**.

## **Plan Adoption**

### ***Plan Approval***

The process for finalizing the Saint Paul All-Hazards Mitigation Plan includes submitting the final draft of the plan to the Minnesota State Hazard Mitigation Officer for approval. Following State approval, the plan is forwarded to FEMA Region V for approval. This will provide the final level of approval of the plan prior to adoption by the City.

### ***Formal Adoption***

Code of Federal Regulations (CFR) Part 44 Section 201.6(c) (5) requires that a jurisdiction's mitigation plan be formally adopted by the governing body of the jurisdiction requesting approval. Adoption of the plan also demonstrates the City's commitment to fulfilling the hazard mitigation goals and actions outlined in this plan. The adoption process legitimizes the plan and authorizes responsible agencies to execute their responsibilities. Re-adoption of the plan every five years also demonstrates the community's recognition of the current planning process and changes that have occurred with the previous five years, and revalidates priorities for hazard mitigation actions.

The Saint Paul City Council and Mayor of Saint Paul will formally adopt the City of Saint Paul Hazard Mitigation plan after the State of Minnesota Division of Homeland Security and Emergency Management and FEMA have approved the plan. The approval of the plan, signed by the Mayor of Saint Paul, [will be included upon approval] just after the cover page, and is a clear statement of intent to adopt the final approved plan for citywide implementation.

### ***Update of Mitigation Projects***

Mitigation goals, strategies, and action plans described in Section IV of this plan are dynamic and change with disaster priorities, timing, available resources and funding opportunities. The implementation of individual projects supports the defined strategies, goals and objectives of the approved and adopted plan. The timeline of implementation of individual projects is dependent on the availability of mitigation funds and staffing resources from City departments, agencies, private sector partners and other entities tasked with carrying out the specific action steps. Consequently the periodic review and update of the mitigation projects list will not require re-adoption of the plan, but will be addressed as an administrative update.



## **Additional Requirements**

### **Appendices List**

#### **Appendix 1—Strategic Working Group (SWG) Roster**

#### **Appendix 2—February, March & April Emergency Management Council Roster**

2.1—February EM Council Roster

2.2—March EM Council Roster

2.3—April EM Council Roster

#### **Appendix 3—Public Meeting 4-13-2012**

3.1—Public Meeting Notice

3.2—Public Meeting Power Point

3.3—Public Meeting Sign

3.4—Saint Paul Ramsey Major Disaster Declarations Handout

3.5—Survey Results

#### **Appendix 4—Mitigation Survey Results**

4.1—Additional Actions for City

4.2—Community Wide Activities

4.3—Concerned about Disaster

4.4—How Confident

4.5—Local Government Steps

4.6—Neighborhood Concerns

4.7—Other Issues

4.8—Taken any Actions

4.9—Types of Hazards

4.10—Wants to be notified

## **Appendix 5—Comments and Changes from SWG Project Meeting**

- 5.1—2007 VOAD Hazard Mitigation Projects
- 5.2—Copy of 2007 Fire Hazard Mitigation Projects
- 5.3—Hazard Mitigation Comment Form
- 5.4—Project Comment Form
- 5.5—Stakeholder Meeting PowerPoint

## **Appendix 6— Completed & Deleted Projects**

- 6.1—Completed Mitigation Projects
- 6.2—Project Comment Form
- 6.3—Flash Flooding Comment Form
- 6.4—Flood Insurance Comment Form
- 6.5—Holman Field Comment Form
- 6.6—Siren Project Comment Form
- 6.7—Water Conservation Comment Form
- 6.8—Amateur Radio Comment Form
- 6.9—City Watch Comment Form
- 6.10—Deleted Mitigation Projects
- 6.11—Drought Awareness Comment Form
- 6.12—Drought Landscaping Comment Form
- 6.13—Electrical Connection Comment Form
- 6.14—Private Wells
- 6.15—Safe Room Project Comment Form
- 6.16—Water Conservation

## **Appendix 7—Prioritized Projects**

## **Appendix 8— Threat List from Digital Sandbox**

## **Appendix 9—Levee Easement**

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- 9.2—Levee Easement Page 2 of 13
- 9.3—Levee Easement Page 3 of 13
- 9.4—Levee Easement Page 4 of 13
- 9.5—Levee Easement Page 5 of 13
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- 9.13—Levee Easement Page 13 of 13
- 9.14—Invoice # 1
- 9.15—Invoice # 2
- 9.16—Invoice # 3

## **Abbreviations and Acronyms**

ASDSO	Association of State Dam Safety Officers
ASFPM	Association of State Floodplain Managers
ATF	Alcohol, Tobacco and Firearms
BAH	Minnesota Board of Animal Health
BCA	Benefit Cost Analysis
CAP	Community Action Program
CAT	Chemical Assessment Team
CBRNE	Chemical, Biological, Radiological, Nuclear
CDBG	Community Development Block Grant
CDC	Center for Disease Control
CFM	Certified Flood Managers
CFR	Code of Federal Regulations
COOP	Continuity of Operations Plan
CRREL	Cold Regions Research and Engineering Laboratory
CST	(National Guard) Civil Support Team
CRI	City Readiness Initiative
DFIRM	Digital Floodplain Mapping
DLI	Minnesota Department of Labor and Industry
DMA	Disaster Mitigation Act
DMA2K	Disaster Mitigation Act of 2000
DNR	Minnesota Department of Natural Resources
DSI	Department of Licensing, Inspection
DT-CMAC	Consequence Management Advisory Committee
DPS	Minnesota Department of Public Safety
EAP	Emergency Action Plan
EAS	Emergency Alert System
EF	Enhanced Fujita Tornado Scale
EMAP	Emergency Management Accreditation Program
EMPG	Emergency Management Grant Program
EMI	Emergency Management Training
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	U.S. Environmental Protection Agency
ERT	Emergency Response Team (Hazardous Material)
ESF	Emergency Support Function
FBI	Federal Bureau of Investigation
FDR	Flood Damage Reduction
FHWA	Federal Highway Administration
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Act
GIS	Geographic Information System
HIRA	Hazard Identification Risk Assessment

HAZMAT	Hazardous Materials
HLRW	High Level Radioactive Waste
HMGP	Hazard Mitigation Grant Program
HSEM	Division of Homeland Security and Emergency Management (MN)
ICC	International Code Council
JFO	Joint Field Office
JPIC	Joint Public Information Center
LEED	Leadership in Energy and Environmental Design
MDH	Minnesota Department of Health
MEMA	Minnesota Emergency Managers Association
MEOP	Minnesota Emergency Operations Plan
MFIRS	Minnesota Fire Incident Rating System
MGS	Minnesota Geological Survey
MHIRA	Multi-Hazard Identification and Risk Assessment
MN/DOT	Minnesota Department of Transportation
MNAFRPM	Minnesota Association of Floodplain Managers
MNRTF	Minnesota Recovers Task Force
MNVOAD	Minnesota Volunteers Active in Disaster
MOU	Memorandum of Understanding
NAFSMA	National Association for Flood and Storm-water Management
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFIA	National Flood Insurance Act of 1968
NFIF	National Flood Insurance Fund
NFIP	National Flood Insurance Program
NFIRA	National Flood Insurance Reform Act of 1994
NLSI	National Lightning Safety Institute
NIIMS	National Interagency Incident Management System
NIMS	National Incident Management System
NIEH S	National Institute of Environmental Health Services
NOAA	National Oceanographic and Atmospheric Administration
NSIDC	National Snow and Ice Data Center
NWS	National Weather Service
O&M	Operations and Maintenance
PAL	Provisionally Accredited Levee
PED	Planning and Economic Development
PDM	Pre-Disaster Mitigation
PDSI	Palmer Drought Survey Index
PIO	Public Information Officer
POD	Points of Dispensing
RFC	Repetitive Flood Claims
RWMWD	Ramsey-Washington Metro Watershed District
SBA	U.S. Small Business Administration
SFM	State Fire Marshal
SFMPST	State Fire Marshal Pipeline Safety Team
SHMO	State Hazard Mitigation Officer

SHMPRT	State Hazard Mitigation Plan Review Team
SHMT	State Hazard Mitigation Team
SPHMP	Saint Paul Hazard Mitigation Plan
SOP	Standard Operating Procedure
SRL	Severe Repetitive Loss
SWG	Stakeholder Work Group
TOD	Transit Oriented Development
TTU	Texas Tech University
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

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## Hazard Mitigation Plan

### *Distribution List*

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Mayor	Chris Coleman		<input type="checkbox"/>
Mayor's Chief of Staff			<input type="checkbox"/>
Director of Emergency Management	Rick Larkin		<input type="checkbox"/>
Fire Emergency Management Chief			<input type="checkbox"/>
Fire Chief			<input type="checkbox"/>
Police Chief			<input type="checkbox"/>
Police Chief of Staff			<input type="checkbox"/>
Park & Recreation Director			<input type="checkbox"/>
Public Works Director			<input type="checkbox"/>
DSI Director			<input type="checkbox"/>
Ramsey County EM Director	Judd Freed		<input type="checkbox"/>
MN HSEM Regional Coordinator			<input type="checkbox"/>
MN HSEM Mitigation Planner			<input type="checkbox"/>
MN HSEM Mitigation Planner			<input type="checkbox"/>
Emergency Management Staff			<input type="checkbox"/>

**NOTE:** In addition to 2012 updates noted in this plan, the *City of Saint Paul All-Hazard Mitigation Plan* includes an overall reorganization of the 2007 plan; although the most current information has been used when available, significant details from the 2007 plan have been retained and irrelevant information has been omitted.