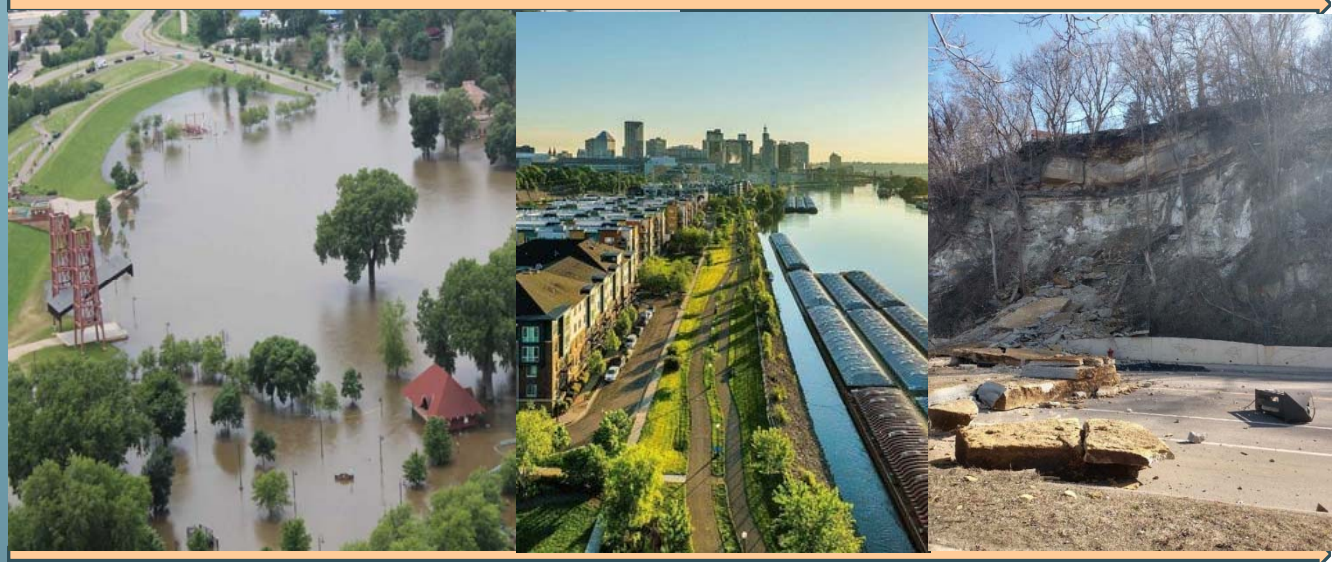
Prepared for City of Saint Paul, Minnesota
November 2019

The Most Livable City in America



City of Saint Paul All-Hazard Mitigation Plan 2019

» Cover Photo Credits: (Left to Right) Harriet Island Flooding, June 2014 – Saint Paul Emergency Management; Saint Paul, MN Levee System – U.S. Army Corps of Engineers; Wabasha Rock Slide, April 28, 2018 – Saint Paul Emergency Management

City of Saint Paul All-Hazard Mitigation Plan

TABLE OF CONTENTS

SECTION **PAGE**

EXECUTIVE SUMMARY

The City of Saint Paul is subject to many natural, technological and human-caused disasters. These events could cause injury or loss of life, property damage, damage or disruption 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.

The City of St. Paul is charged with the protection of the health, safety, and welfare of its residents and visitors. Hazard mitigation reduces disaster impacts from weather, geologic, technological and human threats by proactively reducing or eliminating long-term risk. 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.

Mitigation lessens the financial impact on individuals, communities, and society as a whole. A study by the National Institute of Building Sciences found that mitigation funding can save the nation $6 in future disaster costs, for every $1 spent on hazard mitigation. In addition, the study found that exceeding select provisions of building codes can result in significant savings in terms of public safety, property loss and disruption of day-to-day life.

The City of Saint Paul Emergency Management Department is accredited through the Emergency Management Accreditation Program. References such as the one below [EMAP 4.2.1] site the EMAP standard that applies to that specific part of the plan.

[EMAP 4.2.1] Saint Paul Emergency Management, along with a broad range of stakeholders, has drafted this all-hazard mitigation plan so that hazards are ranked by priority, strategies are identified and linked to hazards, and interim- and long-term goals and objectives are set for reducing or eliminating the effects of these hazards.

Acceptance and approval of the plan does not incur direct costs. FEMA maintains that mitigation plans form the foundation for a community's resilience through a long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. For this purpose mitigation actions may include:

- Structural hazard control or protection measures
- Retrofitting of facilities
- Acquisition and/or relocation of repetitive loss structures

- Development of mitigation standards, regulations, policies and programs
- Public awareness and education programs

A relatively small amount of money spent before a disaster, can greatly reduce the economic losses to businesses and services and help ensure a stable recovery and long-term resilience after a disaster occurs. This is best demonstrated by the progress made since the previous mitigation plan was completed in 2012.

[EMAP 4.2.3] Since the 2012 Mitigation Plan was adopted, the City of Saint Paul has instituted its mitigation efforts in earnest. In short, we are reminded that nearly everything the Department of Emergency Management does is related to mitigation in one form or fashion. A primary duty of the Department is to share with citizens knowledge that can help them better understand, prepare for, and avoid or withstand the risks that confront the city's residents and visitors. Our hazard mitigation philosophy continues to always focus on reducing loss of life and property by lessening the impact of disasters. It is most effective when implemented under a comprehensive, long-term mitigation plan such as this one. We are also reminded that hazard mitigation is any cost-effective and sustained action taken to reduce the long-term risk to human life, property, and infrastructure from hazards. Saint Paul has been implementing mitigation activities since early 2000. Rather than completing repairs and reconstruction after disasters in such a way as to simply restore damaged property to pre-disaster conditions, the implementation of the mitigation strategy presented in this plan leads to building in a stronger, safer and smarter manner.

It is the City government's priority to keep its approximately 300,000 residents safe, as well as the many commuters, tourists, and other daily visitors. This duty is both immediate and long term: we must be prepared to respond to emergencies today while also planning and preparing for future risks. The City is also responsible for informing its citizens about the work we are doing on their behalf. This means notifying the public about the risks Saint Paulites face, and helping residents gain insight into how our global City manages risks and continuously adapts to 21st century changes. The elected and appointed officials of the City also know that with careful selection, mitigation actions in the form of projects and programs, can support community resilience through long-term, cost effective methods that reduce future impacts of natural and man-made hazards.

DEC 1 1 2019

U.S. Department of Homeland Security
536 S. Clark St. 6th Floor
Chicago, IL 60605

FEMA

Ms. Jennifer Nelson
Homeland Security and Emergency Management
Minnesota Department of Public Safety
444 Cedar Street, Suite 223
Saint Paul, MN 55101

Dear Ms. Nelson:

Thank you for submitting the City of Saint Paul All-Hazard Mitigation Plan for our review. The plan was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. The City of Saint Paul plan met the required criteria for a local hazard mitigation plan. Formal approval of this plan is contingent upon the adoption by the City of Saint Paul. Once FEMA Region V receives documentation of adoption, we will send a letter of official approval to your office.

We look forward to receiving the adoption documentation and completing the approval process for The City of Saint Paul.

If there are any questions from either you or the communities, please contact Cadence Peterson at cadence.peterson@fema.dhs.gov or at (312) 408-5260.

Sincerely,

Julia McCarthy
Chief, Risk Analysis Branch
Mitigation Division

Attachment: Local Mitigation Plan Review Tool

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PROMULGATION AND RECORD OF DISTRIBUTION

Promulgation formally recognizes the adopted plan as the City of Saint Paul's all-hazard mitigation plan. The plan contained within this document supersedes all previous hazard mitigation plans produced by the City of Saint Paul.

The original plan document and all supporting data, records and files related to the *City of Saint Paul All-Hazard Mitigation Plan* are maintained by the City of Saint Paul Department of Emergency Management. Inquiries related to this plan may be made to:

City of Saint Paul Department of Emergency Management
Attention: Planning Coordinator
367 Grove Street
Saint Paul, MN 55101
Office: 651-266-5495

The official with authorized signing authority has validated this plan through the signature provided below.

Signing Authority: Rick Schute
(Name)
Director
(Title)

Signature: 

Date: 11 DEC 2019

RECORD OF DISTRIBUTION

This Record of Distribution documents the individuals and organizations accepting receipt of this plan, which ensures the widest distribution possible within the City's hazard mitigation planning network, which includes elected officials and stakeholders, as well as other interested parties.

This plan may be posted on the City's website for access by the public, within the requirements and/or restrictions of public records laws and authorities.

Name, Title, & Dept/Agency	Method	Date of Delivery	# of Copies

RECORD OF CHANGES

This record of changes documents the *administrative* and *technical* changes incorporated into this plan over the five-year planning cycle. These changes may correct and update any portion of the plan that do not change the overall principles or strategy outlined in the current plan. The revisions, removal or addition of mitigation actions may be made at any time during the lifetime of this plan, and distributed as updates without noting these changes in this record. Administrative and technical changes to the plan sections will be recorded on this page and notification of this change will be sent to plan stakeholders and other interested parties.

Substantive changes in the plan, such as changes to goals and objectives or the overall strategy, must be approved by the official with signatory authority and requires re-distribution of the entire plan.

The authority for *administrative* and *technical* changes to this plan is delegated to City of Saint Paul Mitigation Planner/Coordinator to make appropriate modifications without the senior official's signature.

DATE	SECTION/PAGE	APPROVED BY	JUSTIFICATION

SECTION 1 INTRODUCTION

44 CFR Requirements
• Although there are no specific 44 CFR requirements for the plan introduction and jurisdiction's profile, the information presented in this section provides an overview of the Planning Area and establishes context for the sections and information that follow in the Plan.

2019 Update
• This Section of the Plan was reformatted by separating it from the Executive Summary and adding a sub-section to describe how the Plan is organized. • Details related to the specific characteristics of the jurisdiction were expanded to enhance the City Profile and provide additional context to the Plan. • The climate subsection was exchanged to address current climate change data and projections. • A sub-section was added to address changes in development patterns within the city.

Disasters can strike at any time in any place, resulting in the loss of life, property, infrastructure, and income. While mitigation strategies and efforts cannot eliminate all threats and hazards, the ability of the community to prepare, respond, mitigate, and recover when confronted by these threats may mean the difference between long-term devastation and systemic resilience.

Statewide, disasters occurring between 2000 and 2017 cost nearly $334 million in Federal Emergency Management Agency (FEMA) Public Assistance[1], largely attributable to severe summer storms and flooding. Data for Federal Public Assistance Funding, available only at the County level, confirms that there have been four disaster declarations involving Ramsey County in recent years. Some level of funding from each of these disaster declarations was used by the City of St. Paul.

Table 1-1: FEMA Public Assistance Events, 2012-2019, Ramsey County, MN

Ramsey County FEMA Public Assistance Events 2012-2019
Flooding
Incident Period: March 11, 2019 - June 1, 2019
Severe Storms, Straight-line Winds, Flooding, Landslides, and Mudslides
Incident Period: June 11, 2014 - July 11, 2014
Severe Storms and Flooding
Incident Period: March 16, 2011 - May 25, 2011
Flooding
Incident Period: March 01, 2010 - April 26, 2010

Source: FEMA.gov/disasters

1.1 Plan Overview

Purpose

[EMAP 4.2.1(3)] The *City of Saint Paul All-Hazard Mitigation Plan* ("Plan") identifies hazards, capabilities and actions that can be implemented over the interim and long term to reduce risks and future losses from all hazards.

The purpose of the Plan is further illustrated in the figure below.

Figure 1-A: Purpose of the *Saint Paul All-Hazard Mitigation Plan*

Identify and Analyze Potential Hazards

Hazard Identification and Analysis is the foundation for all emergency Planning.

Assess Capabilities and Resources

The jurisdiction's capabilities and ***resources support the accomplishment of mitigation and reduce long-term vulnerability to hazards***

Develop the Mitigation Strategy

The mitigation strategy serves as the interim- and long-term blueprint for reducing potential losses identified in the risk assessment

Hazards are identified and examined in the plan for historical impacts and consequences as well as the probability of future occurrences. 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, a mitigation strategy consisting of goals, objectives, and specific actions are developed to correct those shortfalls, reduce potential threats and impacts, and to accomplish the objective of pre- and post-disaster mitigation.

Applicability and Scope

This Plan is applicable to the geographic area within the jurisdictional boundaries of the City of Saint Paul and involves participation from multiple departments, agencies and organizations within the City of Saint Paul, as well as key stakeholders (local, regional, state and federal) that provide or support services and resources to the City. In addition this Plan complements and is consistent with mitigation plans for Ramsey County and the State of Minnesota.

[EMAP 4.2.1(1)] This Plan is an update of the *2012 City of Saint Paul All-Hazard Mitigation Plan (AHMP)*, dated April 2012. It is a dynamic document that can serve as a guide for all-hazard planning, addressing natural, technological and human caused hazards in relation to prevention, preparedness, response, recovery, mitigation and long-term redevelopment.

Legal Authority and Guidance

This Plan was 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). Local mitigation planning requirements are codified in the Code of Federal Regulations (CFR) Title 44, Section 201.6 (44 CFR §201.6). DMA 2000 specifies requirements for local governments to undertake a risk-based approach to reducing the impacts and consequences from natural hazards through mitigation planning. DMA 2000 requires that local Plans be updated every five years, with each planning 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 hazard mitigation project grants for the following federal Hazard Mitigation Assistance (HMA) programs:
    - Hazard Mitigation Grant Program (HMGP)
    - Pre-Disaster Mitigation (PDM)
    - Flood Mitigation Assistance (FMA)
    - Repetitive Flood Claims (RFC)
    - Severe Repetitive Loss (SRL)

Additional FEMA program funding for cost-effective hazard mitigation for eligible facilities damaged by natural disasters under the Stafford Act, HMA and National Flood Insurance Act of 1968 is illustrated in **Figure 1-B**.

Figure 1-B: Federal Policies that Provide Funding for Local Hazard Mitigation

Stafford Act Section 406	Stafford Act Section 404	National Flood Insurance Act of 1968 NFIA	Stafford Action Section 203
PA Programs	**HMA Programs**		
Disaster-related programs	***Disaster-related programs***	***Non-disaster-related programs***	***Non-disaster-related programs***
PA: Mitigation of incident-caused damage 	**HMGP:** Multi-hazard statewide mitigation 	**FMA:** Flood mitigation for insured properties 	**PDM:** Multi-hazard project specific 
Funding: Available for disaster-damaged facilities only*	Funding: Available for damaged and non-damaged facilities based on a percentage of dollars obligated to the PA and IA programs		
NOTE: **PA** = Public Assistance **HMA** = Hazard Mitigation Assistance **HMGP** = Hazard Mitigation Grant Program		**FMA = Flood Mitigation Assistance** **PDM** = Pre-Disaster Mitigation **IA** = Individual Assistance	
** Exception for Alternative Procedures Projects (See Guide)*			

Source: Multi-hazard Mitigation Council (2017) *Natural Hazard Mitigation Saves, 2017 Interim Report: An Independent Study.*

The Minnesota Division of Homeland Security and Emergency Management (HSEM), under the Governor's Executive Order 11-03 (revised January 14, 2011), 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.

The City of Saint Paul's Emergency Management Program was first accredited in 2017 by the *Emergency Management Accreditation Program* (EMAP). With this designation comes the responsibility to maintain supporting documentation that ensures that the Program continues to meet EMAP Standards. The processes and procedures for implementing, evaluating, and revising this Plan take into consideration the appropriate EMAP standards and serve as further guidance for maintaining and updating the Plan. The hazard mitigation planning cycle is integrated into the five-year EMAP re-accreditation process.[2]

Plan Organization

The Plan is organized in alignment with the DMA 2000 planning requirements and the FEMA Plan Review Tool, as follows:

- Executive Summary
- Section 1: Introduction and City Profile
- Section 2: Planning Process
- Section 3: Hazard Identification and Risk Assessment
- Section 4: Mitigation Strategy
- Section 5: Plan Maintenance
- Section 6: Plan Adoption
- Appendices

The six sections described above, taken as a whole, serve as the "Base Plan" which contains the general information meeting the DMA 2000 requirements. In some sections, separate attachments are included to provide more detailed data, background or references that support the information provided in the Base Plan sections.

1.2 City of Saint Paul Profile

The City of Saint Paul is located in Ramsey County, Minnesota, which is geographically the smallest county by land area; however, it is also the most densely populated county in Minnesota. The City of Saint Paul, the capital of Minnesota, is referred to as one of the Twin Cities, along with the state's largest city, Minneapolis. The City of Saint Paul ranks as the second most populous city in Minnesota with a 2017 population estimated at 306,621 by the 2010 U.S. Census.

[2] References to specific EMAP standards are provided throughout this plan, as indicated in dark orange font within brackets. Example: [EMAP 4.2.1]

Saint Paul - General Overview

City Facts [3]	
Designated as Territorial & State Capital	1847 (Territory), 1848 (State of Minnesota)
Form of Government	Strong Mayor-Council
Population	306,621 (2017 estimate, based on 2010 U.S. Census)
Population Density	5,484.3 per square mile
Total Land Area	52.8 square miles (water 3.4 square miles)
Average Elevation	834 feet
Federal & State Roads in Saint Paul	122 miles owned, 91 miles maintained
City Roads in St Paul	794 miles owned, 919 maintained
Railroads tracks in City	348 miles
Number of Hospitals	6
Number of Colleges and Universities	14
Elevation	692 feet to 1,107 feet
Watershed Districts	2
Mississippi River	More City shoreline on the river than any other city.
Average Annual Precipitation	32.5 inches (https://www.citytowninfo.com/places/minnesota/st-paul)
Largest Land Owner	City of Saint Paul
Number of Companies	27,147
Median Age	31.4
Median Household Income	$50,820
Total Housing Units	112,571
Number of Languages and dialects in Public Schools	More than 100
Individuals Below Poverty Level	21.6%

Source: U.S. Census Data, 2010

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 Chapel of Saint Paul and prevented the name “Pigs Eye” from becoming the capital's name.

[3] 2012-2016 American Community Survey 5-Year Estimates, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml?src=bkmk

The City of Saint Paul grew into a regional hub for the lumber industry and fur trade due to its proximity along the Mississippi River. The city was first surveyed in 1847 and platted in 1849, based on a grid pattern oriented to the river. Later streets were laid out at a forty-five degree angle to the first plat, creating a grid unique to Saint Paul.[4] Early land use featured several parks and open spaces, including Rice Park and Smith (Mears) Park.

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, Senator, and Secretary of War.

A vibrant downtown and the state capital 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 containing its own character and community organizations.

As Saint Paul settles into the twenty-first century, it has evolved into a hub for numerous businesses and technology, a city known for its character and history, and a destination that has embraced diversity.

People

POPULATION (2010 Census)	POPULATION (2017Estimated)	HOUSEHOLDS (2012-2016)	PER CAPITA INCOME (2016)	MEDIAN HOUSEHOLD INCOME (2016)
285,068	306,621	112,571	$27,467	$50,820

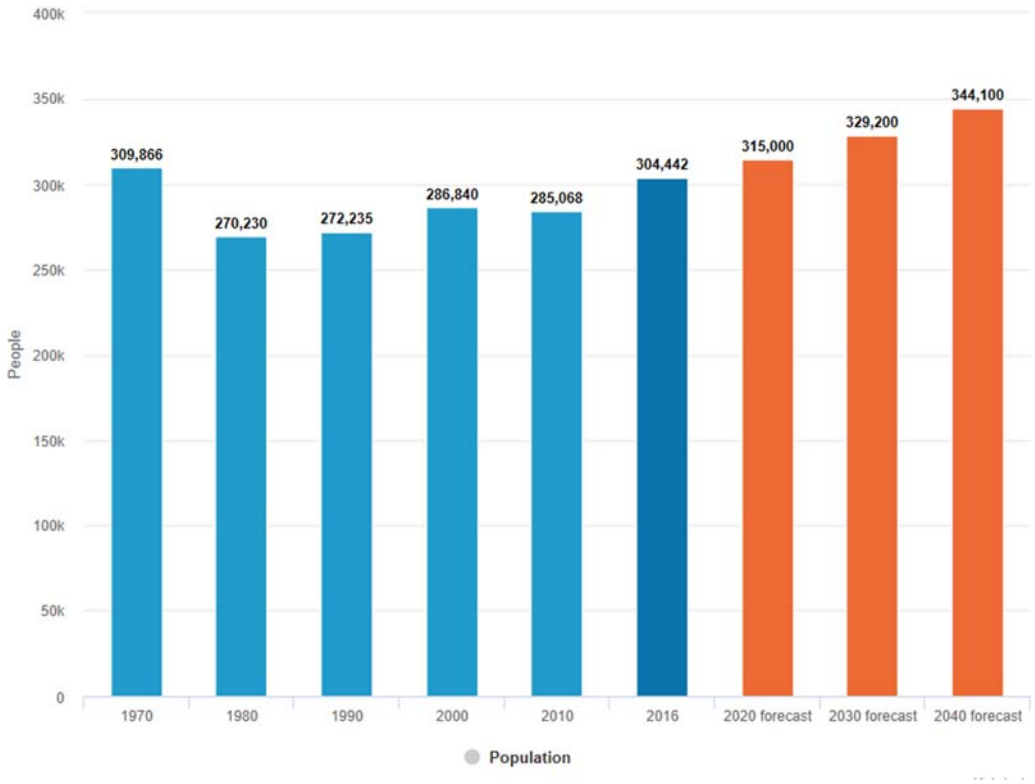
Source: U.S. Census Bureau

Saint Paul is the second most populous city in Minnesota. Although the total population of Saint Paul has varied over the years, experiencing a drop between 1970 and 2016, the population trend over the next 25 years indicates steady growth projected to exceed the 1970 population of 309,866 and reach 344,100 by 2040. In a report released by the Metropolitan Council, dated May 16, 2017, St. Paul's population grew to 306,621 in 2017, an increase of 7.6% from the 285,068 population documented in the 2010 U.S. Census. The growth is attributed to the region's diversified and competitive economy, but is somewhat dependent on "transit-friendly" development to promote efficient land use. Consideration to increasing population growth, and housing and transportation needs should be addressed in future planning.

Population Trends

Since 2010, Saint Paul has witnessed an influx of residents, and is poised to return to its mid-20th century population highs. The preliminary Metropolitan Council estimate for 2016 puts the population at 304,442. In 2015, St. Paul crossed the 300,000 mark for the first time since the 1970s.

Table 1-2: Saint Paul Population, Long Term Trend 1970 to 2016, and Forecasted

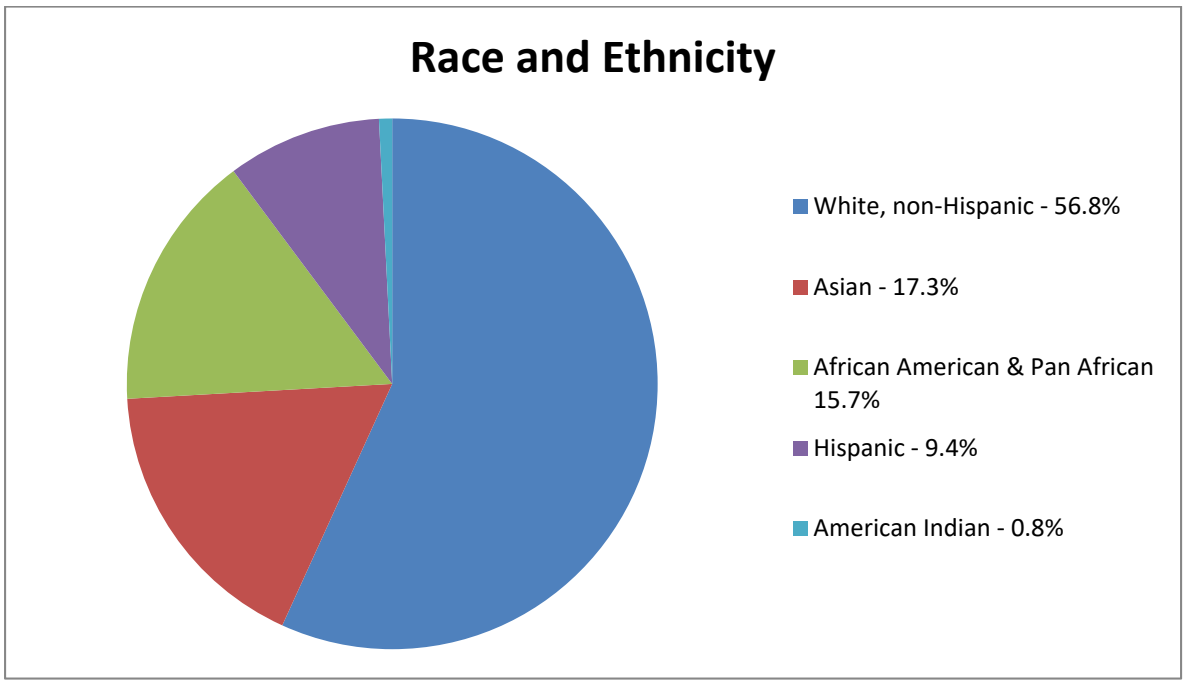


Source: Metropolitan Council population dataset. Numbers prior to 2016 are from the Decennial Census. 2016 data is a draft Metropolitan Council estimate. Future numbers are Metropolitan Council forecasts. Data compiled for this table on July 17th, 2017.

Demographics[5]

The population of Saint Paul is quite diverse in age and ethnicity. The graph below shows current trends in population by race and ethnicity.

Figure 1-C: Population by Race and Ethnicity, 2017



Source: American Community Survey 2012-2016, Tables B05006, S1601, and DP02

Special Populations at Risk

Certain population groups, such as children, elderly, disabled and individuals who do not speak English can be more susceptible to the impacts of disasters. The elderly population of Saint Paul has increased in recent years. The greatest increase in population between 2008 and 2013 was in the 60-64 (46.25%) and 65-69 (31.27%) age groups. There has also been considerable growth in the 30-34 (17.06%) and 5-9 (11.34%) age groups.

The U.S. Census data estimates approximately 9.2% (2012-2016 estimate) of Saint Paul's population under the age of 65 years have a disability.

Approximately 28.3% of residents, age 5 years and over use a language other than English in the home. The share of city residents from multiple nationalities and cultures is

[5] Source: https://www.stpaul.gov/books/population

expected to increase in coming years, which can impact the need for assistance during emergencies.

Limited English Proficiency Community

Clear, concise communication is critical during a crisis, and the ability to dispatch information to those who do not readily understand English poses a great challenge. Nearly 19 percent of the 2014 St. Paul population was born outside of the USA, compared to 7.8 percent in the state as a whole. More than 28% of the St. Paul population speak a language other than English at home. The largest immigrant groups in Saint Paul come from Laos (9,501 people), Thailand (8,433 people), Mexico (6,515 people), Burma, (4,268 people), Ethiopia (3,568 people), and Somalia (3,066 people).

Housing

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 1-3: Housing Status, City of Saint Paul

	SAINT PAUL	RAMSEY COUNTY	MINNESOTA
HOUSING STATUS	July 2018 (estimated)	July 2018 (estimated)	July 2018 (estimated)
TOTAL	119, 625	218,080	2,347,201
Occupied	11,001	20,.691	2,087,227
Owner-Occupied	56,993	123,448	1,523,859
Population in owner-occupied (number of individuals)	149,177	314,023	3,950,160
Renter-occupied (total units)	54,008	79,243	563,368
Renter-occupied (total population in units)	124,453	176,233	1,218,370
Households with individuals under 18	30,744	54,374	615,770
Vacant (total units)	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

Source: *Us Census Bureau American FactFinder*

Table 1-4: Housing Statistics, City of Saint Paul

	2005-2009	2012-2016
Owner-occupied housing unit rate	56.30%	49.5%
Housing units in multi-unit structures	44.40%	46.02%
Median value of owner-occupied housing	$206,200	$178,400
Households	110,705	112,571
Persons per household	2.42	2.56
Per capita money income in past 12 months (2016 dollars)	$25,587	$27,467
Median household income	$46,026	$50,820
People of all ages in poverty - percent	19.80%	21.6%
Persons per square mile	4954.47	5289.43

Source: Us Census Bureau QuickFacts and City of Saint Paul Planning and Economic Development Department

In the Metropolitan Council's May 16, 2017 annual report, it is noted that housing vacancy rates had fallen to an estimated 4.1 percent in the region in 2016, down from 5.8 percent in the 2010 census, still among the lowest rates in the country. The 2020 forecast suggests that, although the average household size has grown steadily smaller since 1970, an additional 8,044 housing units will be needed in the city in the coming years. Integration of mitigation planning into land use planning will help to ensure that future housing development will not encroach into hazard prone areas.

Between 2008 and 2016, the total annual number of building permits (new construction, remodel and repair) in Saint Paul rose steadily to a peak of 5,806 in 2011, and then steadily declined to 4,693 in 2016. At the same time, the annual number of permits for new construction in 2016 was the highest in the previous nine years. [6]

Visitors

In addition to a steady flow of tourists throughout the year, Saint Paul also hosts numerous professional, arts, culture, food, history, education and sporting events which bring in large groups of visitors. A significant portion of these visitors travel to the city from a 315-mile radius around the Twin Cities while additional visitors come from outside the region and the United States. Although additional preparedness and response services for this transient population could be required if a significant hazard event strikes the city with little or no warning, there is little overall impact to mitigation planning or plan implementation.

[6] Source: Saint Paul Department of Safety and Inspection Approved Building Permits Database (https://information,stpaul.gov/Buildings-Housing-Economic-Development/Approved-Building-Permits-Dataset/i8ip-eytd), updated July 3, 2017

As of November 2018, there are 1908 hotel rooms in the City, with an average occupancy rate of 65.4%.

Economy

Historically, the Saint Paul economic base was built around plentiful natural resources and related trade. Through the years, the economy has expanded in response to growth in business and industry, education, and government. The city is the home of two Fortune 500 companies, Ecolab and Securian Financial Group, as well as regional enterprises, numerous small businesses, professional firms, and government offices. As large-scale, developments such as the Central Corridor continue to evolve the growth potential in Saint Paul will expand along with changes in land use.

The City of Saint Paul Department of Planning and Economic Development (PED) offers a variety of services to assist new or expanding businesses, including small business financing, loan guarantees, and direct loans. Saint Paul is home to a number of large business interests and the regional office of many national and multinational corporations. These various enterprises generate a number of jobs and contribute significantly to the economy.

Table 1-5: Largest Employers in Saint Paul

Name of Business	Type of Business
State of Minnesota	Government
Saint Paul Public Schools	Education
Travelers	Financial Services
City of Saint Paul	Government
Ecolab	Manufacturer (though Saint Paul is nearly all administrative offices)
Securian Financial	Insurance
Ramsey County	Government
Saint Paul College	Education
Saint Joseph's Hospital	Health Care
Gillette Children's Hospital	Health Care
Comcast	Communications
US Bancorp	Financial Services
Bremer Bank	Financial Services
Merrill Corporation	Communications
University of Saint Thomas	Education

Source: Saint Paul Department of Emergency Management

Business interests cover many different sectors. Between the fourth quarters of 2015 and 2016, nine industry sectors experienced growth, with significant growth in three sectors: Information; Management of Companies and Enterprises; and Other Services.

Table 1-6: Industries that Gained Jobs, Saint Paul, MN, 2015-2016

Business/Industry	2015	2016	Percent Change
Information	5,309	6,082	14.6%
Management of Companies and Enterprises	4,157	4,691	12.8%
Other Services (except Public Administration)	6,380	6,948	8.9%
Wholesale Trade	5,564	5,661	1.7%
Healthcare and Social Assistance	43,477	44,002	1.2%
Arts, Entertainment, Recreation	4,134	4,160	0.6%
Accommodation and Food Services	11,893	11,938	0.4%
Educational Services	18,878	18,944	0.3%
Finance and Insurance	11,994	12,032	0.3%

Source: https://www.stpaul.gov/books/jobs-sector

Employment opportunities for Saint Paul residents have grown consistently in recent years with unemployment rates generally trending downwards since 2009. Future job growth over the next ten years is predicted to be 38.45%. The following table illustrates the Saint Paul rolling annual average over the statistical period of 2015-2016.

Table 1-7: Employment, Rolling Annual Average

Economic Indicator	Quarter 4 - 2015	Quarter 4 - 2016
Labor Force	153,777	154,519
Employment	147,980	148,980
Unemployment rate	3.8%	3.6%

Source: https://www.stpaul.gov/books/employment-saint-pau l

The average per capita income in 2016 was $27, 467; the median household income was $50,830 (2016 dollars).

Climate

Saint Paul is located in the area of continental climate, as defined by the Köppen Climate Classification System[7], which is exhibited by quite large variations in seasonal temperatures due to its distance from the moderating effects of the oceans' climate. Winters are long and cold; summers are warm and humid. A feature of humid continental climate in the United States is that weather can be unpredictable with extremes occurring in many phases of measurements.

Table 1-8: Climate Data – City of Saint Paul

Climate Data – City of Saint Paul	
Range of Average temperatures	Minimum – 7.5 degrees (January) Maximum – 83.5 degrees (July)
Annual High temperature	56.6 degrees
Annual Low temperature	47.05 degrees
Average temperature	47.05 degrees
Highest recorded temperature (Minnesota)	108 degrees (July 14, 1936)
Lowest recorded temperature (Minnesota)	-60 degrees (February 2, 1996)
Average annual precipitation – rainfall	32.05 inches
Average annual snowfall	51 inches
Maximum seasonal snowfall	98.6 inches (Winter, 1983-1984)
Maximum seasonal rainfall	40.15 inches (1911)
Maximum rainfall in 24 hours	10 inches (July 23-24, 1987)
Precipitation Days	61
Growing season (average number of days between freezes)	157 days

Source: https://www.bestplaces.net/climate/city/minnesota/st._paul, US. Climate Data, https://www.usclimatedata.com/climate/saint-paul/minnesota/united-states/usmn1299, date accessed 06/09/18

Severe thunderstorms, heavy rainfall, flood, potential tornadoes, damaging hail, winter storms, extreme cold, and extreme heat are routine hazard events in this region of the country.

[7] The Köppen Climate Classification System is one of the most widely used for classifying the world's climates, which influences the general pattern of weather conditions, seasons and weather extremes. Two of the most important factors determining an area's climate are air temperature and precipitation.

Land

The City of Saint Paul is located on 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.

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 are extremely dangerous. 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 published literature when the first edition of Carver's bestselling, *Travels through the Interior of North America* appeared in 1778.

Geology

The land area of Saint Paul is diverse in its geological characteristics. Its location along a major waterway, along with its bedrock geology and sand aquifer are a few of the characteristics taken into consideration.

The Minnesota Geological Survey maintains geological and natural history data for all areas of the state, including Ramsey County and the City of Saint Paul. One of the earliest reports on the geology and natural history of this area, published in 1888[8], describes the distinctly terraced contours along the Mississippi River and bluffs of Trenton limestone underlain by St. Peter sandstone rising about seventy-five feet above the river. It also notes that most of the Ramsey County area, including Saint Paul is covered by a morainic drift deposit consisting of red till varying to gravel and sand derived from the red till. Subsoil consists of a fine, laminated, gray clay. Several artesian wells were noted to be at "West St. Paul", "rising above the natural surface fifteen to thirty feet", which supplied pure water, useful for domestic purposes (MGS, Ramsey County Survey, page 108).

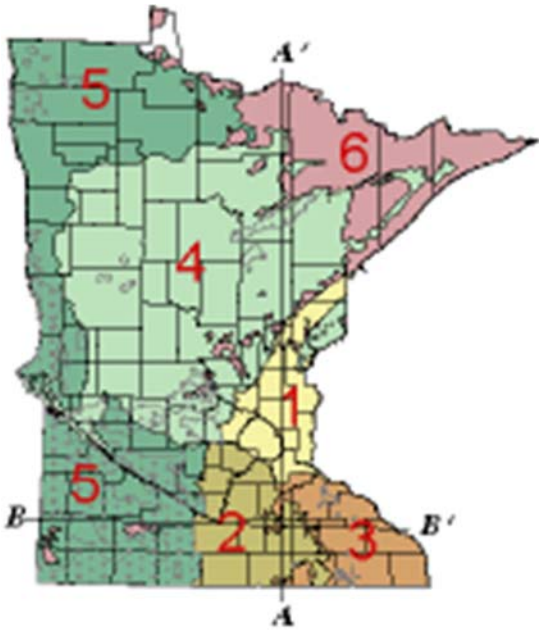
Hydrology, Water and Watersheds

Minnesota has been divided into six Groundwater Provinces based on bedrock and glacial geology. Within each province, groundwater sources and the availability of groundwater for drinking water, industrial and agricultural uses are similar. The combination of physical aquifer attributes (thickness, lateral extent, permeability, and porosity type) of the

[8] Winchell, N. H., *A Report on the Geological and Natural History Survey of Minnesota; Made in Pursuance of an Act of the Legislature of the State, Approved March 1, 1872,* the University of Minnesota; Volume VI, pp. 106-108

bedrock and unconsolidated sediments deposited by glaciers, streams and lakes distinguish each groundwater province.

Figure 1-D: Minnesota Groundwater Provinces



Map Source:
https://www.dnr.state.mn.us/groundwater/provinces/index.htm, date accessed 6/10/18

Saint Paul is located within Groundwater Province Area 1, an area noted by its bedrock aquifer consisting of thick, laterally extensive sequences of sandstone, limestone and dolostone of sedimentary origin. This type of aquifer indicates that groundwater occurs in granular pore spaces, partings, joints, fractures and dissolution features. Karst features are common in this area. Generally, these aquifers are capable of yielding sufficient quantities of groundwater for most purposes.

Interconnection of Groundwater and Surface Water

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 general availability of ground water in Area 1 is good in bedrock, and moderate in surficial sands and buried sands.

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 serve south and southwest of downtown and the suburban areas south of the Mississippi River. Each service area has a reservoir system for storage. The hilly terrain 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.

Two separate watersheds serve the City of Saint Paul:

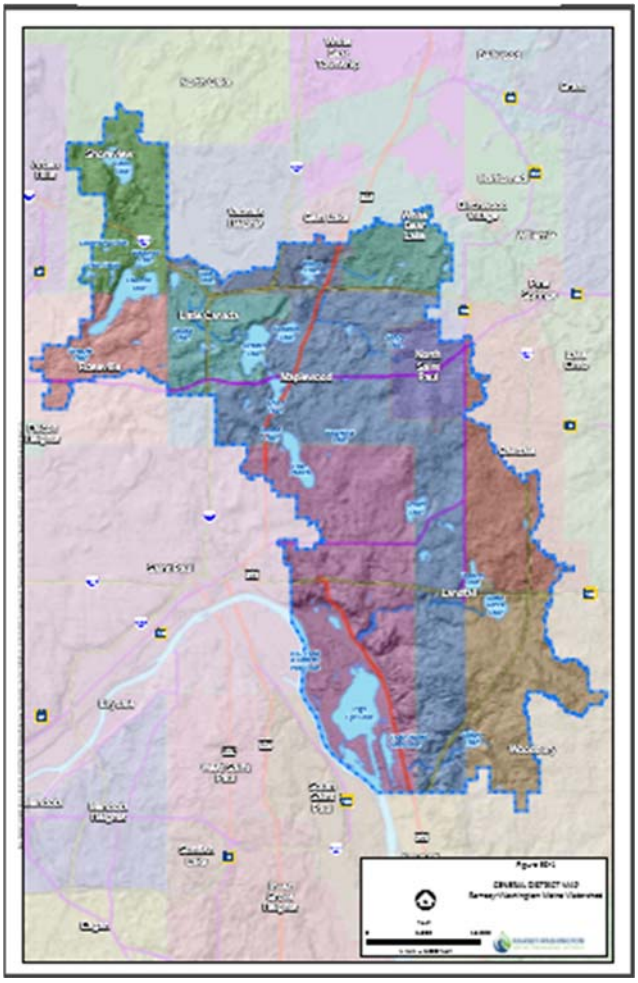
- Capitol Region Watershed District (CRWD), located within Ramsey County, covers 40 square miles and includes portions of the cities of Falcon Heights, Lauderdale, Maplewood, Roseville and Saint Paul. The CRWD serves a population of 245,000 and drains to the Mississippi River, its primary water source.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

Figure 1-E: Capitol Region Watershed District

Source: http://www.capitolregionwd.org/watershed-information/what-is-crwd/

- 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 smaller 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 five major creeks, eleven lakes and thousands of wetlands within the RWMWD. The RWMWD services all or part of ten cities in Ramsey and Washington Counties: Saint Paul, Woodbury, Oakdale, Landfall, North Saint Paul, Maplewood, Little Canada, White Bear Lake, Vadnais Heights and Gem Lake.

Figure 1-F: Ramsey-Washington Metro Watershed District



Source: https://www.rwmwd.org/wp-content/uploads/RWMWD-Management-Plan.pdf

Wetlands and Riparian Areas

Wetlands and riparian zones are highly sensitive settings since they are a direct connection of the terrestrial and aquatic systems. Wetlands help retain surface waters on the landscape and are a critical component for protecting surface water quality by filtering pollutants and trapping sediments that otherwise pollute surface water and groundwater supplies. Wetlands are also a valuable part of flood water and stormwater retention since they reduce the potential for flooding in the watershed. Wetlands and riparian areas are also important as natural habitat corridors, providing benefits to wildlife and for drought mitigation, groundwater recharge and isolating carbon in the environment. Preservation of these areas is critical to successful hazard mitigation.

Land Use

Saint Paul is considered to be a city of neighborhoods since much of its land use is dedicated to single and two-family housing units. There are also a variety of multi-family housing units distributed throughout the city, especially in the urban core and along mass transit routes.

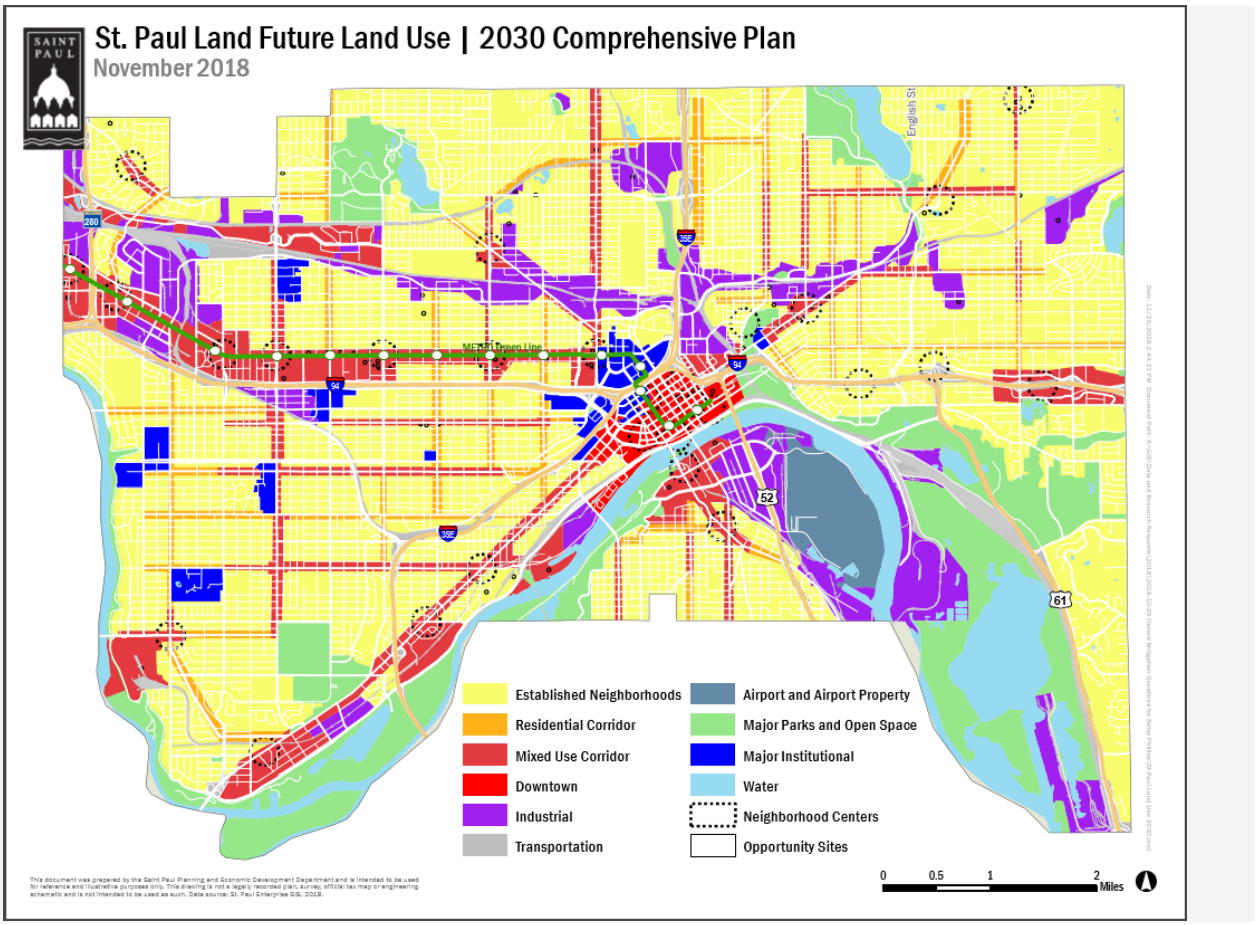
Recent land use and development has been focused on stability and redevelopment opportunities in the downtown core and a mix of residential and commercial areas along main traffic arteries in all sections of the city. Government use and a large commercial area comprise the major part of the downtown core of the city. The basic premise to use the land in the best manner for the City of Saint Paul and its residents will still be the focus.

Table 1-9: Land Use in Saint Paul, (2030 Estimated)

Planned Land Use	2030 (year)	
	Acres	% of Total
Airport and Airport Property	562	1.57%
Downtown	426	1.19%
Established Neighborhoods	17,330	48.35%
Industrial	2,965	8.27%
Major Institutional	663	1.85%
Major Parks and Open Space	4,039	11.27%
Mixed Use Corridor	3,733	10.41%
Residential Corridor	1,486	4.15%
Transportation	2,124	5.93%
Water	2,517	7.02%
TOTAL	**35,845**	**100.00%**

Source of Land Use data: City of Saint Paul Department of Planning & Economic Development

Figure 1-G: Future Land Use Map, Saint Paul 2030 Comprehensive Plan



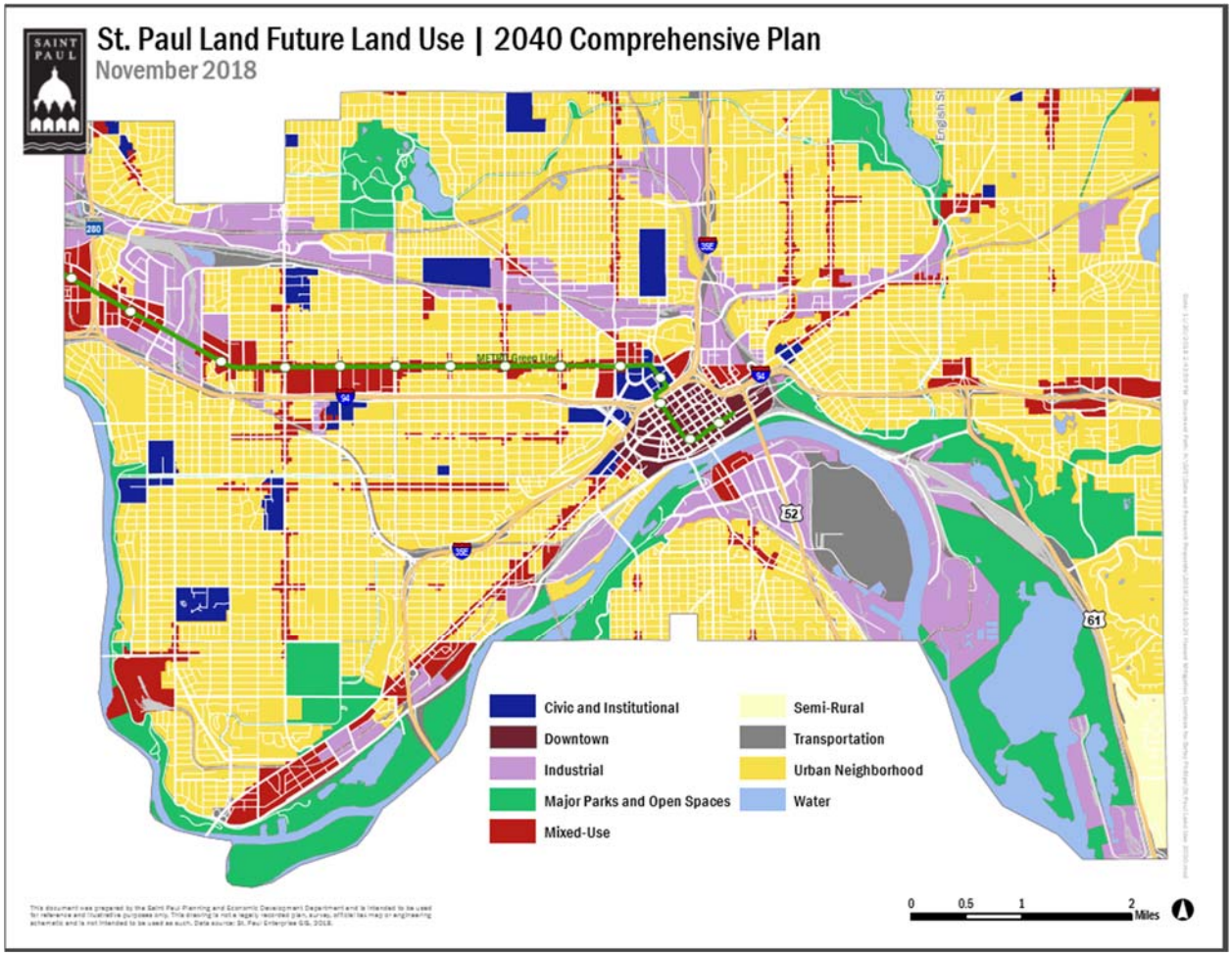
Source of Land Use data: City of Saint Paul Department of Planning & Economic Development

Table 1-10: Land Use in Saint Paul, (2040 Estimated)

Planned Land Use	2040 (year)	
	Acres	% of Total
Civic and Institutional	863	2.40%
Downtown	412	1.15%
Industrial	3,439	9.56%
Industrial Major Parks and Open Space	4,158	11.56%
Mixed Use	2,674	7.44%
Semi-Rural	262	0.73%
Transportation	2,838	7.89%
Urban Neighborhood	18,740	52.11%
Water	2,577	7.17%
TOTAL	**35,9653**	**100.00%**

Source of Land Use data: City of Saint Paul Department of Planning & Economic Development

Figure 1-H: Future Land Use Map, Saint Paul 2030 Comprehensive Plan



Source of Land Use data: City of Saint Paul Department of Planning & Economic Development

Parks and Open Spaces

Throughout its history the City of Saint Paul has provided parks and open spaces for the enjoyment of its citizens. This tradition continues and is even more imperative for the vision of a resilient and vital city of the future. In addition to the numerous historic parks that are still in use today, new projects are in development or in progress to enhance the opportunities for outdoor use and recreation:

- Capital City Bikeway – two segments of an off-street bicycle trail network in downtown Saint Paul that connect to existing bike and pedestrian trails were completed in 2018 along Jackson Avenue.

- Grand Round – a plan envisioned in the late 1800s as an unbroken chain of parkways that encircle the city connecting larger park spaces. Most of these

parkways were installed by the 1930s, including bicycle and pedestrian trails along the Mississippi River Boulevard. Currently there is an off-road trail along the entire southern half of the city, as well, as phased segments along Wheelock Parkway connecting Como and Phalen Regional Parks. Federal grant funding was solicited for trails along Johnson Parkway and Como Boulevard with construction anticipated by January 2019-2020.

- River Balcony – is a proposed project spanning 1.5 miles of the Mississippi River bluff in downtown Saint Paul that would create a publicly accessible bluff-edge connection of public spaces and redevelopment sites from Eagle Street and the Upper Landing Park along Kellogg Boulevard to Sibley and the Lower Landing Park. The River Balcony Master Plan was adopted in 2017 and implementation of the plan is being coordinated by the City of Saint Paul Parks and Recreation Department through the Great River Passage Initiative.

Past mitigation initiatives to convert flood-prone areas into parks and open spaces have already proven to be successful, as demonstrated at Harriet Island during the floods of June 2014.

Figure 1-I: Flooding at Harriet Island, June 2014.
Source Saint Paul EM

Public Infrastructure

Transportation

The City's earliest transportation route was the Mississippi River and barge traffic continues this tradition today as an essential link in the transportation chain. Nearly 10 million tons of barged material moves through the Saint Paul Harbor.

Land transportation developed with the influx of settlers from eastern states and Europe and by the early 1800s, Red River ox carts made the trip from what is now the Twin Cities to Pembina, Alberta, Canada in 75 days. With the automobile as the most heavily used mode of personal transportation by volume in the 21st Century, Saint Paul has undertaken numerous mass transit initiatives to develop an effective alternative to the automobile. The City is served by several major interstate highways (I-35 and I-94), as well as several U.S. and State highways and many Ramsey County roads. The City has the capability and the resources to maintain designated roads and highways.

Metro Transit is the main mass transit provider in Saint Paul. The Green line is an integral part of the Central Corridor Light Rail Line which is 11 miles long and connects Minneapolis and Saint Paul by way of Washington Avenue and University Avenue. Nearly

12.4 million rides were taken on the Green Line during 2014, the first year of operation. Average weekday ridership was 37,400 which is just under the 2030 forecast of 41,000 rides. Ridership in the Central Corridor, including the Green Line and bus routes 16 and 94, increased by about 30 percent from 2014 to 2015 and has nearly doubled since 2013, when service was provided by buses alone

The restoration of Union Depot, one of America's great rail stations of the early 20th century, was considered a project of regional and national significance by the federal government. When the project completed in 2012 the 290,000 square foot building and its 33-acre site housed multiple activities that complement transit and enhance the Depot's location on the Mississippi River.

The Union Depot is a multi-modal transit center that currently provides access to Amtrak's Empire Builder service, Central Corridor light rail transit, Metro Transit bus routes, Jefferson Lines and Greyhound intercity and regional bus lines, bicyclists and pedestrians. The Depot is 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. In addition, the center connects to biking, walking, taxis and rental car facilities. Restoration of the Depot also serves as an event venue. The Depot and light rail have the potential to boost residential and commercial development in the central core and around the transit lines.

Utilities

The electric provider within the city of Saint Paul is Excel Energy, a private company that serves eight western and Midwestern states. The company is headquartered in Minneapolis and provides electric power to 1.5 million customers and natural gas to half a million customers.

Special Features and Considerations

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. Successful mitigation actions completed in the past include the Kopper's Coke site which resulted in removing the site from the aforementioned list. This site continues to be monitored for any long-term impacts.

Cultural and Historical Assets

The City of Saint Paul has a strong commitment to preserving its history through the built environment. Its numerous Local Heritage Preservation Districts and designated individual sites represent potentially vulnerable sites and structures that could be impacted by hazard events.

The City has nine Local Heritage Preservation Districts (* indicates National Register listing):

- Como Shops (1985)
- Dayton's Bluff Heritage Preservation District (1992)
- Historic Hill Heritage Preservation District* (1980)
- Irvine Park Heritage Preservation District* (1982)
- Jackson Street Shops (1985)
- Jacob Schmidt Brewing Company Heritage Preservation District (2011)
- Lowertown Heritage Preservation District* (1984)
- Summit Avenue West Heritage Preservation District* (1990)
- University-Raymond Commercial Heritage Preservation District (certified*) (2005)

In addition, there are multiple individually designated properties located on 45 streets around the city.

The City's Heritage Preservation Ordinance, #16006, adopted in 1976, guides the designation of historical properties within the City and gives the city the authority to regulate and protect heritage sites and districts. Additional local policies and regulatory tools can be used to overlay additional protections for historic sites and structures. An example of this local tool is the Lowertown Historic District Design Guidelines which establish a basis for making consistent sustainable decisions about the treatment of historic resources that may potentially come in conflict with future hazard mitigation actions within the Lowertown district

Potential mitigation actions planned in Historic Preservation Districts, individually designated properties, or potential historic sites should be thoroughly reviewed for

protective policies and regulations, as well as potential impacts to the site or structure. All federally-funded mitigation projects include a requirement for a Historic Preservation review.

Special Events

The City of Saint Paul has areas of concern regarding mitigation planning that include special events at:

- Large recreational venues, including the Xcel Energy Center (professional hockey arena), Allianz Field, River Centre Convention Center, CHS Field, and Harriet Island.

- The State Capitol and great number of state office buildings along with a number of religious, cultural, medical institutions, and private sector facilities which 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.

Changes in Development Patterns

Development patterns in the City of Saint Paul have been influenced in recent years by several major concepts:

Sustainability

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 Compliant
- Saint Paul Port Authority Green Design Review (as applicable)

Residential projects identify three potential rating systems:

- 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 not in hazard-prone areas, and encourage infill and "brownfield" development, thus supporting sustainability without compromising disaster mitigation principles.

The Planning process for the City's 2040 Comprehensive Plan overlapped the Plan update cycle, providing the opportunity to ensure that mitigation goals and objectives align with those of future development. One of the Core Values for the Comprehensive Plan update is Resiliency and Sustainability, noting that the City "understands the importance of environmental stewardship of our abundant natural resources." https://www.stpaul.gov/departments/Planning-economic-development/Planning/2040-comprehensive-Plan/core-values

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 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. Recent TOD projects include:

- METRO Green Line– this regional line connects Saint Paul Union Depot to the Minneapolis Target Field running along University and Washington Avenues

Reduction in Building Permits and Decline in Values of Real Property

Statistics compiled by the Metropolitan Council indicate that the post-recession building boom peaked in 2015, but slowed in 2016 resulting in both fewer and a lower total value of construction permits. However, the number of residential permits with values exceeding $1million almost doubled from 2015 to 2016 and the value of permits issued for single-family homes reached its highest level since before 2009. https://www.stpaul.gov/books/building-and-development

SECTION 2 PLANNING PROCESS

Requirements
• **§201.6(c) (2) (1)** – [The] plan documents the planning process, including how it was prepared and who was involved in the process for each jurisdiction. • **§201.6(b)(2) -** [The] plan documents an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process. • **§201.6(b) (1) –** [The] plan documents how the public was involved in the planning process during the drafting stage. • **§201.6(b) (3) –** [The] plan describes the review and incorporation of existing plans, studies, reports, and technical information. [*Also addressed in Section 4: Mitigation Strategy.]*

2019 Update:
• This Section was reorganized for consistency with the review criteria.

The City of Saint Paul is committed to creating a comprehensive and functional emergency management program. The mitigation planning process utilized by the city for this 2019 plan update followed multiple steps that built on previous planning efforts and ensured that it is not only compliant with the current FEMA regulations and Emergency Management Accreditation Program (EMAP Standards), but is also an appropriate fit for the City of Saint Paul.

2.0 Overview

The initial *Saint Paul All-Hazards Mitigation Plan* was developed between 2001 and 2004. The Plan was guided by the City of Saint Paul Department of Emergency Management and involved a steering committee with broad representation from a stakeholder group. The City's first mitigation Plan was adopted by resolution of the City of Saint Paul on February 28, 2007, and was approved by FEMA in March 2007.

The Plan underwent a comprehensive review and revision for its 2012 update. The update process was based on the accepted planning principles and guidance used in 2007 and the Plan criteria contained in 44 CFR 201.6, and the FEMA *Local Multi-Hazard Mitigation Planning Handbook (LHMP Handbook)* (October 2011). In addition, the 2012 planning process first addressed criteria outlined in the 2013 EMAP Standard with the intent to continue integration of the EMAP Standard in future mitigation plan updates.

Revisions made in the 2019 Plan update follows updated guidance in the *LHMP Handbook* (March 2013), and brings the plan into compliance with the EMAP 2016 Emergency Management Standard. This standard is a nationally recognized standard of excellence, and ensures continuation of the City's accreditation status.

Whole Community Approach

In order to improve the community's resiliency in the face of disaster, the planning process involved a whole community approach to identify and analyze hazards, assess vulnerabilities and enhance the mitigation strategy previously developed in the 2012 Plan. By engaging and empowering all sectors of the community, existing policies, programs, and practices will more readily integrate mitigation into existing plans and functions.

The following four steps describe the general methodology for mitigation planning:

- Identify and analyze natural, technological and human-caused hazards and their associated impacts that could impact the community.
- Assess the community's vulnerability to natural, technological, and human-caused hazards.
- Assess the community's capabilities, including current policies, ordinances and resources, to implement mitigation initiatives that reduce or avoid the impacts of disasters.
- Develop hazard mitigation strategies that can be implemented to reduce future vulnerability.

2.1 Planning Process

[EMAP 4.2.1(2)] The planning process followed the step-by-step framework described in the *LHMP Handbook* (March 2013).

The 2019 Plan update was funded by a Hazard Mitigation Grant Program (HMPG) planning grant provided through the Minnesota Department of Homeland Security and Emergency Management in June 2016.

Planning Team

Because many of those involved in the 2012 planning process were no longer with the jurisdiction or were in different positions, a new stakeholder group was designated for the 2019 update. The Emergency Management Council (EMC) (having key representation from City departments, agencies and organizations) was tasked as the Stakeholder Working Group (SWG) with the oversight of the 2018 update. This group had previous involvement in a 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 participated in a stakeholder survey in 2011 that established the baseline on which to the 2012 update process was built.

Since the 2012 update, the EMC has maintained its responsibilities as the oversight group for monitoring, evaluating and revising the plan and will continue this function in

overseeing and implementing the 2019 Plan.

A key focus of the 2018-2019 planning effort was the importance of the process in working as a team to ensure jurisdiction-wide involvement and to develop all components of the plan. Representatives from key stakeholders and partner agencies and organizations gathered data and critical information throughout the planning phase, which was then analyzed and validated by the planning team as a whole. This process provided the planning team with the ability to identify the greatest opportunities for loss reduction addressing the most frequent hazards, build support and ownership of the strategy and its identified activities, and ensure that the resulting strategy would lead to overall progress in reducing risk.

The planning process was initiated by Saint Paul EM staff in July 2017, with development of a scope of work and request for proposals from consultants to potentially serve as a subject matter expert for the plan update project. With selection of a vendor and contract approval, the Project Team was formed and work began in late December 2017. In January 2018, the Project Team formally initiated the planning process by establishing a work plan and schedule that addressed project coordination, stakeholder engagement, group meetings, one-on-one stakeholder meetings, public outreach and input, data review and updates, other community engagement and briefings to key officials. Consideration was given to the following issues/needs at the outset of the process:

- What are the key hazard concerns of the community?
- What partnerships should be forged in order to understand these concerns?
- How can the whole community and emergency management support each other?
- How can those members of the community who have not typically participated in public meetings and committees be more effectively engaged?
- How is interest in disaster preparedness generated among these groups, and how can members of the community participate in developing mitigation strategies that will build upon what already works within their community to better serve their concerns?
- How can these partnerships and networks be maintained?

The planning process was carried out through various methods, including Project Team coordination meetings; SWG planning meetings; face-to-face data collection and validation meetings conducted by Saint Paul EM staff with participating stakeholders; periodic updates to key officials and the EMC; public engagement opportunities; and phone and email communication to facilitate work flow and validate data and information.

Planning organization roles and responsibilities were defined as an initial step in the Planning process. Roles were described as:

- Project Team
- Stakeholder Working Group
  - Emergency Management Council (EMC)
  - Subject Matter Experts

Project Team

The City of Saint Paul Emergency Management (Saint Paul EM) is the responsible agency for coordinating, drafting and monitoring this plan. A consultant, who also participated in the 2012 update, was brought on board to assist the Project Team with planning requirements and technical assessments, as well as community engagement. Staff members of Saint Paul EM coordinated with the consultant to establish the work plan and schedule for the 2019 update. The Project Team met periodically for face-to-face coordination and also conducted communication electronically throughout the planning period in order to maintain work flow and production.

Stakeholder Working Group (SWG)

[EMAP 4.2.1(2)] Members of the Emergency Management Council participated in the Stakeholder Working Group for the 2019 update. Representation included key city departments and agencies; county, regional and state; and, disaster-related organizations. In addition, representatives from other government agencies, discipline-specific fields, disaster-related organizations, and the private sector participated as Subject Matter Experts.

Table 2-1: Planning Entities, Participants and Responsibilities.

Planning Entity	Participants	Responsibilities
Project Team	Terry Sieben, Planning Coordinator, Saint Paul EM	• Project Coordinator • Oversight of St. Paul Emergency Management planning program • Ensure consistency with all emergency plans and format
	Betsy Phillips, Hazard Mitigation Planning Specialist, Saint Paul EM	• Coordinate hazard mitigation planning process • Develop plan data and coordinate data analysis and graphics • Point of Contact for stakeholders and technical experts • Coordinate community outreach to the public

	Nancy Freeman, Consultant	• Coordinate plan review and writing schedule with EM Staff, update formats, and information to meet compliance requirements • Technical assistance to EM Staff and SWG during the planning, writing, review, approval, and adoption process
Stakeholder Working Group (SWG)	Department/Agency Representatives and Key Stakeholders	• Participate in SWG meetings through attendance and assistance in identifying, locating, collecting, compiling, and/or analyzing relevant information and data • Participate with the SWG in developing the risk assessment and mitigation strategy • Coordinate review of the plan and feedback from the entity being represented • Validate specific data and topics related to area of authority and/or responsibility • Identify potential resources from the agency, department, discipline, or organization that could support the mitigation strategy, including specific mitigation actions and potential funding sources
	Subject Matter Experts (other government, not-for-profits, private sector)	• Assist in identifying, locating, collecting, compiling, and/or analyzing information and data relevant to expertise • Assist the SWG in developing the risk assessment and mitigation strategy • Validate specific data and topics related to area of authority and/or responsibility • Review the plan and provide feedback relevant to expertise • Identify potential resources from the agency, department, discipline, or organization that could support the mitigation strategy, including specific mitigation actions and potential funding sources

Participation

With the participating entities in the 2007 and 2012 plans as a guide, Saint Paul EM facilitated the 2018-2019 planning process with the Stakeholder Working Group, comprised of EMC representatives, Subject Matter Experts, as well as other key stakeholders including:

- Saint Paul Mayor's Office

- Saint Paul District Councils
- Saint Paul Fire and Safety Services
- Saint Paul Libraries
- Saint Paul Park and Recreation
- Saint Paul Police
- Saint Paul Public Works
- Saint Paul/Ramsey County Department of Public Health
- Saint Paul Safety and Inspections
- Saint Paul Human Resources – Risk Management
- Saint Paul Public Schools
- Ramsey County Emergency Management and Homeland Security
- Minnesota State Patrol/Capital Security
- Minnesota Department of Homeland Security and Homeland Security
- Minnesota State Office of Climatology
- Saint Paul Emergency Management
- Children's Minnesota Saint Paul Hospital
- Capital Regional Watershed District
- University of Minnesota, Geology Department
- Science Museum of Minnesota
- Saint Paul Regional Water Services
- U.S. Army Corps of Engineers
- Saint Paul Human Rights and Equal Economic Opportunity
- Ramsey County Emergency Communications Center
- National Weather Service – Twin Cities
- Ramsey-Washington Metro Watershed District
- Metropolitan Council
- Saint Paul City Council
- Minnesota Department of Health
- Minnesota Department of Natural Resources
- Saint Paul Planning and Economic Development

Table 2-2: Summary of Participation by Agency/Organization

See Appendix A for details.

The Stakeholder Working Group was charged with providing community asset and capabilities data, assessing those mitigation strategies and action items involving their departments, and evaluating the integrity of the plan as a whole. Because these agencies have the responsibility and expertise for implementing mitigation actions, they were actively involved in the planning process at all stages. Much of this communication and work was conducted via email and one-on-one meetings due to scheduling difficulties in convening such a large group.

Meetings

A variety of meeting formats were used in the planning process.

Table 2-3: SWG Meeting Schedule, Purpose and Outcomes

Meeting Format	Purpose & Outcomes	Date and Location
SWG Kick-off Meeting	Kick-Off Meeting and Confirmation of SWG as the planning committee	February 27, 2018 The Wellstone Center, Saint Paul, MN (49 participants)
Department/Agency Meetings	Multiple one-on-one meetings conducted to obtain hazard, risk, capabilities, and strategy information and data	Multiple meetings with various departments and agencies
SWG Plan Review	Initial draft plan was posted on (website) for SWG member review	May 14, 2019
SWG Plan Approval Meeting	Presentation to SWG on 2019 Draft Plan	May 28, 2019

Meeting agendas and formats varied based on whether it was a large group meeting or a one-on-one department meeting. These interactions provided a step-by-step approach to accomplish the planning objective.

Documentation of the SWG meetings, including agendas, minutes, handouts, and presentations, is provided in **Appendix A**.

Leadership

City and state leadership received periodic updates during the planning process. These sessions included an introduction to hazard mitigation planning, reviews of the focused outreach efforts and a discussion of the draft plan document and submittal process.

Focused Outreach

St. Paul's population is growing and diversifying, adding residents and visitors that have not traditionally been involved in public participation in emergency management planning. In order to maximize limited resources, the Project Team decided to focus outreach efforts on the most accessible methods of reaching the public through social media.

Although designated representatives of the public did not participate in the stakeholder group of the 2019 Plan update organization, the planning process provided several

outreach opportunities for the public to be informed about hazard mitigation, review the draft 2019 Plan update, and to provide comments. Despite these efforts, public input was limited during this plan update. A summary of input received is provided in **Appendix A-1.** A detailed description of future efforts to expand public involvement and input in the next planning cycle is addressed in **Section 5** Plan Maintenance.

Key Activities Timeline

Each step in the Planning process was built on the foundation of activities conducted at the Stakeholder Working Group and face-to-face meetings, providing a high level of assurance that the mitigation actions proposed by the participants and the priorities for implementation are valid.

Planning milestones measured the successful outcome of each step in the Planning process.

Table 2.4: Milestones in the Planning Process

Event/Product	Milestone	Method of Completion
Stakeholder Working Group Meetings (General)	• Developed local hazard mitigation planning network • Built components of the plan • Provided frequent opportunities for input and technical assistance	Meetings with this group occurred throughout the update process
Capabilities Assessment	• Analysis of planning and regulatory, administrative and technical, education and outreach, smart growth and funding & NFIP capabilities	Completed December 2018
Hazards Profiles and Risk Assessment	• Description of methodology –scope, steps, data sources and validation • Identification of a comprehensive list of hazards to be addressed in the plan • Qualitative and quantitative examination of the vulnerability of critical community facilities, systems and neighborhoods to the impacts of future disasters (maps, GIS modeling, specific vulnerabilities)	Completed August 2018
Outreach and Education	• Hazard survey for stakeholders	February 2018; 24 participants. See **Appendix B – Hazard Survey summary**
Mitigation Strategy & Implementation Plan	• Goals, objectives and development of the mitigation strategy	Completed February 2019
Plan Maintenance Procedures and Schedule	• Indicators to measure progress in next planning cycle ▪ Monitoring ▪ Evaluation ▪ Updating	Completed December 2018

Public Input	• Comment period for review and input of draft Plan	May 10-May 21, 2019
Plan Approval	• Plan reviewed by MN HSEM; FEMA Approvable Pending Adoption ("APA")	Pending
Plan Adoption	• Plan adopted by City of Saint Paul	Pending
Final Plan Approval	• FEMA letter documenting final approval	Pending

Relationship to Existing Plans, Data and Information Sources

The *2019 City of Saint Paul All-Hazard Mitigation Plan* is not a stand-alone document. It is meant to function in conjunction with other plans that address and impact Saint Paul.

The plan provides the foundation for all emergency planning by identifying and analyzing the impacts and consequences of all natural, technological, and human-caused threats and hazards. Planners may use the hazard risk assessment data to consider preparedness measures, capabilities, resource needs, and training. Additionally, hazard information is used to develop exercise scenarios that in turn provide responders and support agencies with realistic settings for disaster preparedness.

- ***City of Saint Paul Emergency Operations Plan***
    - The City of Saint Paul developed the *Emergency Operations Plan (EOP*) to ensure that all of the City's emergency management functions are coordinated to the maximum extent practicable with the comparable functions of the federal government, state and local governments, and private agencies. The *EOP* describes the City of Saint Paul's authorities and approach to disaster and emergency situations, encompassing early detection, disaster response activation, resource management, and interim and long-term community recovery. Tasks and responsibilities for emergency and disaster functions are assigned to specific agencies with the authority or responsibility to perform them.
- **Threat and Hazard Identification and Risk Assessment (THIRA)**
    - The City of Saint Paul developed a THIRA in 2010. It is reviewed and revised annually within the Saint Paul Emergency Management, and disseminated to all stakeholders every five years. The current version was last disseminated in 2015.
- **Saint Paul Hazard Identification and Risk Assessment Evaluation Tool**

- The comprehensive hazard risk assessment and consequence analysis is summarized in the *Saint Paul Hazard Identification and Risk Assessment (HIRA) Evaluation Tool*, dated 2015 which serves to identify natural, technological and human-caused hazards, and assesses impacts and consequences based on a model based on Emergency Management Accreditation Program (EMAP) Standard 4.1 Hazard Identification, Risk Assessment and Consequence Analysis, and is consistent with the FEMA *Local Mitigation Planning Handbook*. The Saint Paul HIRA is the primary source for information pertaining to hazards that could impact the city. The *Evaluation Tool* is maintained by Saint Paul Emergency Management and is updated on an annual basis and published every five years.

- **Saint Paul Comprehensive Plan [land use, transportation, housing, river corridor critical area, natural resources, parks and open spaces, etc.]**

  - The *Saint Paul Comprehensive Plan*. is a multi-focus planning document that addresses the broad range of community planning needs. As such, components of the Comprehensive Plan, such as the land use and transportation plans have been considered in the development of the Hazard Mitigation Plan and its strategies. The plan will be considered when other Comprehensive Plan components are updated and implemented.
  - The draft 2040 plan is currently in review and will be considered for adoption by the City Council following public hearings scheduled for May 2019.

- **Saint Paul Capital Improvement Plan (CIP)**

  - Mitigation Actions adopted by this Plan, as appropriate, will be integrated in the Saint Paul Capital Improvement Plan in order to fund the implementation. The CIP plan is updated on an annual basis and reviewed by all city departments.

- Other relevant plans, data and information sources

  - Minnesota State Mitigation Plan (2014 update)
  - Ramsey County Multi-Jurisdictional Hazard Mitigation Plan (2018 update in progress)
  - Hennepin County Multi-Jurisdictional Hazard Mitigation Plan (2018 in progress)
  - U.S. Census Bureau data
  - Watershed Plans
  - National Oceanographic and Atmospheric Administration (NOAA)

- National Weather Service (NWS)
- U.S. Geological Survey (USGS)
- U.S. Army Corps of Engineers (USACE)
- University of Minnesota, Saint Paul Campus Climatological Observatory
- Minnesota State Climatology Office
- FEMA Hazard Mitigation Planning Guidance
- Emergency Management Accreditation Program (EMAP) Standards
- Infrastructure maps (sewer, water, etc.)
- Utility maps
- Metropolitan Council data
- Historical information

SECTION 3

HAZARD AND RISK ASSESSMENT

44 CFR Requirements

- **§201.6(c)(2)(i)** –
  - [The] plan includes a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)
  - [The] plan includes information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction
- **§201.6(c)(2)(ii)** –
  - [The] plan includes a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction
  - [The] plan addresses NFIP insured structures within the jurisdictions that have been repetitively damaged by floods

2019 Update:

The hazards identified in the 2012 plan have been re-aligned. All natural, technological, and human-caused hazards identified and profiled in the 2012 plan were reviewed and reconsidered for this update; however, in some cases the hazards were reorganized or redefined and some hazards are presented in an overarching category, such as Severe Winter Storm which includes Blizzard and Ice Storm.
In addition, the following changes were made to the ***natural*** hazards list:

- Infectious Disease is separated into two hazards, Human Infectious Disease and Infectious Disease (Animal). Because the urban nature of the jurisdiction does not have a large livestock animal population, only Human Infectious Disease is addressed in the 2019 Plan.
- Hail is added to the Damaging Wind/Severe Thunderstorm definition for initial consideration as a natural hazard.
- Landslide/Slope Failure is added for initial consideration as a natural hazard.

The **technological and human-caused** hazards were reorganized into six categories and are presented in **Appendix B**. In some cases, these hazards are redefined for consistency with other planning references.

Specific data and information related to each hazard type has been reviewed and updated from the 2012 Plan. In addition, the hazard and risk assessment methodology has been enhanced, and the format used for the impact and consequence analysis conducted for each hazard in this section is new to this update.

The *Minnesota State Hazard Mitigation Plan 2014,* dated March 14, 2014, was used as a reference for this section to supplement data, where available, and to provide a framework for consistency.

Climate change is addressed at the end of this section and each individual hazard section, emphasizing potential impacts and consequences. In addition, a summary of *Climate Acton and Resilience Draft Plan*, City of Saint Paul Mayor's Office (April 2019) is provided in **Appendix B** as a reference for integrating hazard mitigation planning into ongoing climate change planning and as guidance for the next planning cycle.

Overview

[EMAP 4.1.1, 4.2.1(1)] Resilient communities must assess the hazards and threats to their community assets in order to establish policies and actions that serve to mitigate their potential impact or risk. This section of the plan presents the hazard and risk assessment, which includes detailed descriptions of ***natural, technological*** and ***human-caused*** hazards that are known to impact the City of Saint Paul or are considered to be a threat to the people, property, infrastructure, environment, economy, and/or disaster response and recovery operations of the City. The hazards described in this update are compiled from the following sources:

- Review of the *2012 Saint Paul Hazard Mitigation Plan*
- Review of the *2014 Minnesota All-Hazard Mitigation Plan*
- Review of the *2012 Ramsey County Multijurisdictional Hazard Mitigation Plan*
- Review of historical data of events that occurred over the past five years, including input from subject matter experts and lessons learned from previous years
- Review of hazards identified in guidance materials provided by the FEMA Region V Office
- Assessment of current data archives provided by the National Centers for Environmental Information (Storm Events Database)
- Review of vulnerability and risk analyses contained in adjacent jurisdictions' Local Hazard Mitigation Plans.
- Review of the climate change studies and publications from the City of Saint Paul and the State of Minnesota
- Review of past county, state and federal disaster declarations
- Research of historical records, predictive models, and other verified data collected from a broad range of sources

Hazard risk and vulnerability data and information presented in this plan should also be used in the development and update of other City plans to provide a consistent foundation for all policies, plans and programs that address hazards and the potential for reduction of the risk, impacts, consequences and costs of disasters.

This section presents the process that results in the prioritized list of hazards of highest concern, identified through a comprehensive risk assessment and consequence analysis. Hazard profiles are described in terms of the location and extent of hazards, history and probability of occurrence, impacts and consequences, repetitive losses associated with the hazard (when applicable), and overall analysis of vulnerability. Hazards that are ranked with a minimal potential for occurrence or consequences were excluded from the hazard

profile and did not receive further consideration in relation to vulnerability or mitigation actions.

3.0.1 Hazard Identification and Risk Assessment Process

This section describes the risk assessment process utilized to identify the hazards and vulnerabilities for the City of Saint Paul Planning Area ("Planning Area"). The general approach used for each hazard addressed in this Plan update is described in the Federal Emergency Management Agency (FEMA) publication, *Local Mitigation Planning Handbook*, March 2013, and is broken down into four steps:

- Describe Hazards
- Identify Community Assets
- Analyze Risk
- Estimate Losses

The process to identify hazards that could affect the Planning Area began with a broad look at all hazards: ***natural, technological*** and ***human-caused***. Although currently Title 44 CFR, Part 201.6 requires that the plan must address only ***natural*** hazards, plans may include other hazards but these will not be reviewed by FEMA to meet the requirements for natural hazards[1]. Consequently, the Stakeholder Working Group (SWG) considered the full scope of ***technological*** and ***human-caused*** hazards in addition to ***natural*** hazards that should be addressed in the Plan. The following definitions guided hazard identification.

Natural Hazard[2]	Source of harm or difficulty created by, or resulting from acts of nature, including meteorological, environmental, or geological events. Human and animal disease outbreaks are considered to be natural hazards.[3]
Technological Hazard	Incidents originating from technological or industrial conditions that cause loss of life, injury, illness, property damage, loss of services, and economic and social disruption, such as a hazardous material spill or transportation accident.
Human-Caused Hazard or Threat	Intentional[4] actions of an adversary, such as a threatened or actual chemical or biological attack or cyber event

[1] FEMA, *Local Mitigation Plan Review Guide*, October 1, 2011, p. 19
[2] LMP Guide, p. 19
[3] FEMA, *Threat and Hazard Identification and Risk Assessment Guide*, Second Edition, August 2013, p. 5
[4] The EMAP Standard (2016 edition, Chapter 2, #2.11) notes this definition to include either accidental or intentional incidents. (2016 edition, Chapter 2, #2.11)

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

For the purpose of this plan, hazards are grouped into two categories; 1) ***natural***, and 2) ***technological/human-caused*** (combined as a single category). This section of the plan presents the hazard profile for all ***natural*** hazards. ***Technological/human-caused*** hazards are defined in this section; however, the profiles for these hazards are presented in **Appendix B**.

Risk Assessment Terminology

- **Risk** – *Potential for damage, loss, or other impacts created by the interaction of hazards with community assets.*
- **Vulnerability** – *Characteristics of community assets that make them susceptible to damage from a given hazard or threat.*
- **Exposure** – *People and property within the area the potential hazard could affect.*
- **Risk Assessment** – *Product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.*

For the 2012 Plan update, the risk assessment methodology was based on a quantitative analysis of risk developed to meet hazard mitigation planning criteria for both FEMA's ***natural*** hazard planning requirements under Title 44 CFR, Part 201.6, and the ***all-hazard (natural, technological and human-caused)*** planning requirements defined by the Emergency Management Accreditation Program (EMAP) Standard, Chapter 4.3, Hazard Identification, Risk Assessment and Consequence Analysis (2013 edition). Because FEMA's mitigation planning requirements are limited to natural hazards only, the EMAP Standard was used to enhance the all-hazard process, and allow consideration of other threat and hazard planning processes such as the Threat and Hazard Identification and Risk Assessment (THIRA), a capabilities-based assessment that considers a sub-set of hazards of highest concern.

Because of the disparate elements within the multiple hazard risk assessment planning requirements and processes previously conducted in 2012, the Saint Paul Emergency Management (EM) Department determined the need for a single, comprehensive, detailed assessment of all ***natural, technological*** and ***human-caused*** hazards based on common criteria that could be applied to meet the planning requirements of Title 44 CFR, Part 201.6, EMAP, THIRA and others. The *Saint*

Paul Hazard Identification and Risk Analysis Evaluation Tool ("Evaluation Tool"), dated November 2015, was the product resulting from this effort and is the foundation of the hazard and risk assessment for this 2019 Plan update. The *Evaluation Tool* data, which incorporated all hazards addressed in the 2012 Plan, is a compilation of risk/vulnerability scores, consequence scores, and frequency/probability scores.

The *Evaluation Tool* is maintained by Saint Paul Emergency Management (EM) office and with input from stakeholders and is reviewed annually to consider the previous year's incidents (local and global), make revisions, and re-prioritize hazards, as appropriate. The *Evaluation Tool* is distributed internally on an annual basis within the EM department and published and distributed every five-years to a broad range of program stakeholders. The criteria used for analysis of impacts and consequences in the *Evaluation Tool* are based on the EMAP Standard 4.1 (2016 edition) which provides specific guidance to the all-hazard assessment process in three applicable standards:

> ***4.1.1*** *The Emergency Management Program identifies the natural and human-caused hazards that potentially impact the jurisdiction using multiple sources. The Emergency Management Program assesses the risk and vulnerability of people, property, the environment, and its own operations from these hazards.*
>
> ***4.1.2*** *The Emergency Management Program conducts a consequence analysis for the hazards identified in Standard 4.1.1 to consider the impact on the following:*
> *(1) public;*
> *(2) responders;*
> *(3) continuity of operations including continued delivery of services;*
> *(4) property, facilities, and infrastructure;*
> *(5) environment;*
> *(6) economic condition of the jurisdiction; and*
> *(7) public confidence in the jurisdiction's governance.*
>
> ***4.1.3*** *The Emergency Management Program has a method and schedule for evaluation, maintenance, and revision of its Hazard Identification, Risk Assessment (HIRA) and Consequence Analysis identified in Standard 4.1.1.*

The 2019 Plan also takes into consideration the criteria defined in EMAP Standard 4.2 – Hazard Mitigation[5].

Prioritizing the Hazards

[5] The *Emergency Management Standard by EMAP (2016 Edition)* is available at: http://www.emap.org/index.php/what-is-emap/the-emergency-management-standard

The process to prioritize hazards for the 2019 Plan update based on their risks involved several levels of analysis which began with review of the current *Evaluation Tool*. Next, a *Hazard and Risk Survey ("Survey")* was developed and disseminated to Stakeholder Working Group (SWG) members and other subject matter experts in February 2018 for consideration and input. Finally, the results of the *Survey* were reviewed by EM staff and reconciled with the *Evaluation Tool's* hazard analysis to produce the full list of prioritized ***natural,*** and ***technological/ human-caused*** hazards that serve as the foundation of this mitigation plan. See **Appendix B** for the complete *Evaluation Tool* and Hazard Survey summary.

This three-step process describes the method by which the jurisdiction identified and prioritized hazards and risk levels for all-hazard mitigation planning for the 2018 Plan update.

Table 3.0-1: Hazard Selection and Prioritization Process

Step 1: Review of *Saint Paul Hazard Identification and Risk Analysis Evaluation Tool*, dated November 2015
The 2019 plan update continues to support the ***natural*** hazards approach by FEMA, as well as the ***all-hazards*** approach established by EMAP and THIRA planning criteria. The *Evaluation Tool* process analyzed specific impacts and consequences and established a quantitative risk score for 34 ***natural, technological*** or ***human-caused*** hazards. These hazards were then assessed for their impacts on lifeline sectors, resulting in a prioritized list of all hazards. 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 full list of hazards was reviewed by EM staff, and presented for initial consideration by the Stakeholder Working Group (SWG).
Step 2: Dissemination and Analysis of *Hazard and Risk Survey*
The list of 34 hazards (15 ***natural*** and 19 ***technological/human-caused***) served as the foundation for the *Hazard and Risk Survey*, which was distributed to members of the SWG at the 2019 Hazard Mitigation Plan Update Kick-Off Meeting on February 27, 2018. Definitions and ranking criteria were provided with the survey and respondents were asked to select the appropriate numerical score to rank each hazard in four categories: location, probability of future occurrences, magnitude/severity and significance. The sum of these scores resulted in an "Overall Risk Score" for each hazard. Survey results were summarized by EM staff following the meeting.
Step 3: Reconciliation of Hazard Priorities

The Hazard Survey results were reviewed and reconciled with the *Evaluation Tool* risk scores using a qualitative evaluation to determine hazard priorities. Reconsideration was also given at this step to the prioritized hazards described in the *2012 Saint Paul All-Hazard Mitigation Plan (AHMP)*, as well as those identified in the *Minnesota State Hazard Mitigation Plan (SHMP) 2014* to ensure consistency. In summary, the following hazard and risk assessments were considered to select the comprehensive list of prioritized hazards for the jurisdiction:

- Evaluation Tool Risk Score
- Hazard Survey Risk Score/priority
- Consistency with 2012 AHMP hazard priorities
- Consistency with 2014 SHMP hazard priorities

A summary of the final individual hazard ranking scores are illustrated in each hazard section.

In addition to guiding mitigation planning, the detailed analysis of specific impact and consequence factors provides guidance for all prevention, preparedness, response, and recovery plans, actions and resources when a hazard occurs. For this hazard and risk assessment exercise to be truly successful, the results must also inform the community's other planning efforts, such as land use, transportation, capital projects, and comprehensive plans, as well as be informed by them. The *2019 City of Saint Paul All-Hazard Mitigation Plan* will be adopted as part of the city's comprehensive planning approach. This intentionally synergistic focus will facilitate key decision making at all levels.

The following table presents the all-hazard priority rankings for thirty-four (34) potential ***natural*** and ***technological/human-caused*** hazards initially considered by the SWG and key stakeholders for the 2018 update. The detailed scoring profile of the fifteen (15) ***natural*** and nineteen (19) ***technological/human-caused*** hazards is provided in **Appendix B**.

Table 3.0-2: Natural Hazards Considered for Inclusion in the 2019 Plan

ALL-HAZARD RISK ASSESSMENT RANKING TABLE	*VULNERABILITY*	*FREQUENCY/ PROPABILITY*	*RISK SCORE*
NATURAL HAZARDS			
Urban Fire	6.7	5	11.7
Damaging Wind/Thunderstorm	6.6	4	10.6
Extreme Heat/Extreme Cold	6.1	4	10.1
Blizzard/Ice Storm	6.9	3	9.9
Tornado	6.8	3	9.8
Flood	5.8	4	9.8
Human Infectious Disease	6.4	3	9.4
Landslide/Slope Failure	6.1	3	9.1

Hail	5.6	3	8.6
Dam/Levee Failure	7.1	1	8.1
Infectious Disease (Animal)	5.1	3	8.1
Natural Fire (Wildland)	5.6	2	7.6
Drought	4.5	3	7.5
Karst (Tunnels and Caves)	5.1	2	7.1
Earthquake	2.3	1	3.3

In addition to the hazards listed above, ***avalanche, coastal erosion, hurricane/tropical storms, land subsidence/expansive soils, tsunami*** and ***volcano*** were initially considered by the Saint Paul EM office in the hazard identification process; however, due to geographic location, low potential for occurrence, or low potential for impact, these hazards were not included for further consideration in this plan update.

Table 3.0-3: Technological and Human-Caused Hazards Considered for Inclusion in the 2019 Plan

ALL-HAZARD RISK ASSESSMENT RANKING TABLE	*VULNERABILITY*	*PROPABILITY*	*RISK SCORE*
TECHNOLOGICAL/HUMAN-CAUSED HAZARDS			
Oil by Rail Incident	8.1	2	10.1
Transportation Incidents	6.8	3	9.8
CBRNE Incident – Terrorism Nexus	7.8	2	9.8
Cyber Attack	6.7	3	9.7
CIKR Lifeline Sectors Failure	7.6	2	9.6
Active Shooter/Conventional Attack	6.5	3	9.5
Major Community Event Disruption	5.5	4	9.5
Hazardous Material Incident	6.4	3	9.4
Critical Supply Chain Disruption	6.0	3	9.0
Sabotage/Theft	6.0	3	9.0
Civil Disorder	5.9	3	8.9
Invasive Species	5.1	3	8.1
Airplane Crash	6.0	2	8.0
Maritime Attack	5.8	2	7.8
Arson/Incendiary Attack	5.7	2	7.7
Animal Escape	4.4	3	7.4
Aircraft as Weapon	6.3	1	7.3
Communication Systems Failure	6.3	1	7.3
REP/Ingestion Pathway Planning Zone	5.9	1	6.9

3.0.2 All-Hazard Profiles and Risk/Vulnerability Assessment

Risk considers the impact that a hazard potentially has on people, facilities, structures and services in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage, as well as impact to the economy, natural environment, emergency operations, and other community assets.

This section of the Plan provides general information that may be applicable to all hazards having the potential to impact Saint Paul. Individual characteristics of specific hazards are further described in the individual hazard sections that follow.

Location

In general, all of Saint Paul is susceptible to most ***natural*** hazards, such as severe weather, drought, and human infectious disease. Other types of hazards, such as tornado, flood, and karst, typically have localized areas of impact. Potential impact areas for each hazard profiled in this plan are described in the specific hazard sections.

Extent

The severity, strength or magnitude of each hazard is described in its hazard profile. A combination of descriptions is used depending on the hazard, such as:

- The value on an established scientific scale or measurement system, such as the *Enhanced Fujita Scale* for tornadoes.
- Other measures of magnitude, such as water depth or wind speed.
- The speed of onset
- The duration of the hazard events. For most hazards, the longer the duration, the greater the extent of impact
- Additional narrative or graphics illustrating the characteristics of the hazard

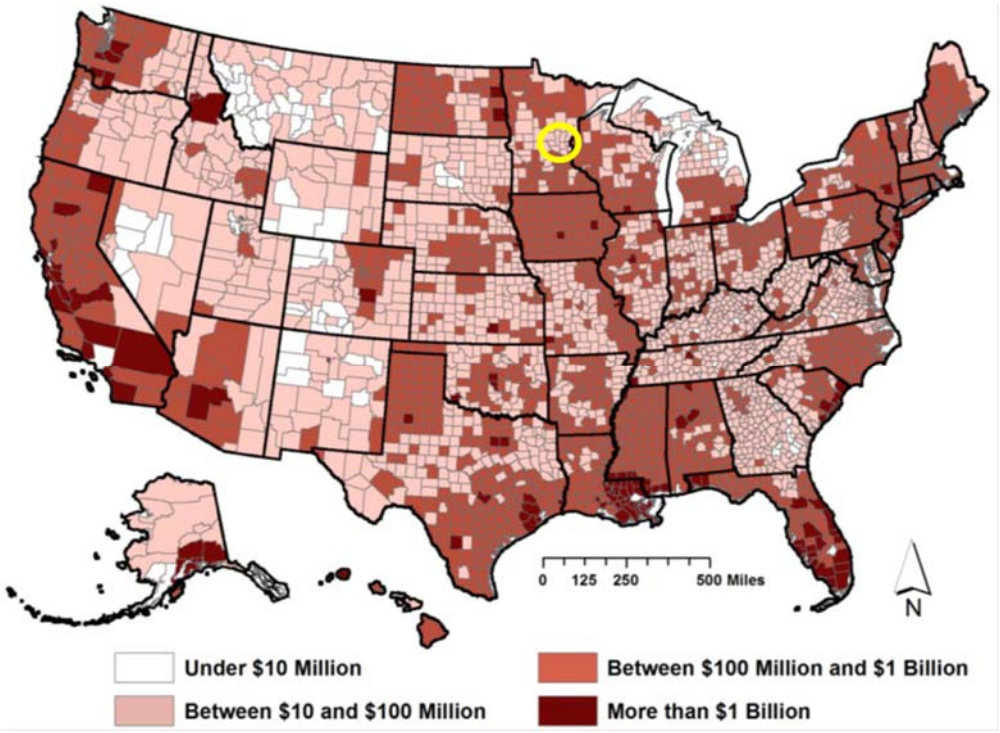
Previous Hazard Events

There is some challenge in using statistics to document past natural hazard events due to the difference in hazard definitions, how incidents are reported, and the type of database that produces analysis of these events. For the purpose of this plan, the National Environmental Information Center (NEIC), Storm Events Database serves as the primary data source for documenting previous weather occurrences and calculating future probability. In some instances, where more recent data was not available, other data that provided significant quantification of hazards in the 2012 Plan risk and vulnerability assessments either supplemented or were used in place of more recent data.

Figure 3.0-A illustrates the total losses from ***natural*** hazards for all jurisdictions in the United States between 1960 and 2014. Of particular note, the State of Minnesota is ranked

15th in the country for the number of Presidential Disaster Declarations (52) during this time period. Ramsey County, including the City of Saint Paul, is one of the counties in the state included in declarations that totaled between $10 million and $100 million during this time period. (*The approximate location of Ramsey County* and the *City of Saint Paul is highlighted with a yellow circle.)*

Figure 3.0-A: Total Losses from Natural Hazards, (by state and county) 1960 - 2014



Source: "U.S. Hazard Losses, 1960 – 2014", Hazards and Vulnerability Research Institute, University of South Carolina

Ramsey County has had only one state-declared disaster, which was for the Wabasha Street slope failure in 2019. The City of Saint Paul most recently declared a local flood emergency on March 20, 2019 in preparation for flood response due to Spring flooding events.

Ramsey County and its municipalities, including the City of Saint Paul, have been included in three federal disaster declarations between 2010 and 2019, all for flooding resulting from severe storms.

Table 3.0-4: Federal Disaster Declarations – Ramsey County, 2011 – 2019

Disaster Type/No.	*Declaration Date*	*Incident Type*	*Title*	*Disaster Assistance*

TBD	3/12/19	Flood	Rapid spring snowmelt, excessive rain	Public Assistance (PA), Hazard Mitigation Grant Program (HMGP)
DR 4182	7/21/2014	Flood	Severe Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides	PA & HMGP
DR 1982	5/10/2011	Flood	Severe Storms and Flooding	PA & HMGP
DR 1900	6/29/2010	Flood	Flash Flooding and Hail	PA & HMGP

Source: FEMA

In addition to the three most recent disaster declarations associated with flood, Saint Paul has experienced previous Federal Disaster Declarations related to other natural hazards.

Table 3.0-5: Federal Disaster Declarations – Ramsey County, 1965-2014

Incident	Declaration Date	Major Disaster Declaration	Emergency Declaration
Flooding	4/10/1965	DR-188	
Flooding	4/17/1969	DR-255	
Drought	6/16/1976		EM-3013
Severe Storms, Tornadoes, Flooding, Hail	7/7/1978	DR-560	
Severe Storms, Tornadoes, Flooding	8/5/1987	DR-797	
Severe Storms, Tornadoes, Flooding	6/10/1993	DR-993	
Severe Storms, Flooding	4/7/1997	DR-1175	
Flooding	8/24/1997	DR-1187	
Severe Storms, Straight-line Winds, Tornadoes	6/22/1998	DR-1225	
Severe Storms, Flooding, Tornadoes	6/26/2000	DR-1333	
Flooding	5/15/2001	DR-1370	
MN Hurricane Katrina Evacuation*	9/12/2005		EM-3242

Flooding	3/18/2010		EM-3310
Flooding	4/18/2010	DR-1900	
Severe Storms, Flooding	5/9/2011	DR-1982	
Severe Storms, Straight-line Winds, Flooding, Landslides, and Mudslides	7/20/2014	DR-4182	

Source: Ramsey County Emergency Management
* Not a disaster in Minnesota. Funds appropriated for sheltering victims of the hurricane

Probability for Future Occurrences

Within the hazard sections that follow **Section 3.0**, probabilities for future occurrences have been determined using the best data available. Because the process used to assess hazards for the *Saint Paul Hazard Identification and Risk Assessment (HIRA) Evaluation Tool* (see **Appendix B-1**) resulted in the collection of information and data related to probability or future occurrences based on historical frequencies, this numerical ranking system was used to provide a consistent method of determining probability for future hazard events. Each hazard section the follows presents a probability ranking score. If sufficient data allowed a calculation of a return interval, or map data exists to support the ranking, that is also provided in the hazard section. In some cases, where insufficient data did not allow calculation of the probability in this format, an explanation of this limitation is provided.

The ranking system used to determine probability in the *Saint Paul HIRA Evaluation Tool* utilizes the following scoring method:

- **1 pt. - Unlikely:** No previous record of occurrence; recurrent interval of greater than every 100 years
- **2 pt. - Low:** Occurs less than once every 10 years or more
- **3 pt. - Medium:** Occurs less than once every 5 to 10 years
- **4 pt. - High:** Occurs once every year or up to once every five years
- **5 pt. - Extremely High:** Occurs multiple times a year or more than five times in 5 years

The probability estimate was a contributing element to the overall risk score.

3.0.3 Analysis of Community Assets

The Saint Paul EM staff and SWG members identified and analyzed community assets at risk and determined the potential population at risk. This activity consisted of a high-level estimation of potential exposure of population, existing structures (including community assets and critical facilities), natural environment, and the economy (direct and indirect

losses). Where data was not available, a narrative description of the potential impacts to these community assets was made.

Population at Risk

The City of Saint Paul has a total population of 306,621 residents (2017 estimated/2010 U.S. Census), who are potentially at risk for all hazards. Additional population estimates and demographic distribution in the Planning Area are provided in **Section 1.**

Critical Assets and Infrastructure

For the purpose of this plan, a critical facility or community asset is defined as a facility, structure or asset that, if damaged, would have devastating impacts on disaster response and/or recovery. A critical facility is classified by one of the following categories: (1) Essential Facilities; (2) High Potential Loss Facilities, including At-Risk Population Facilities; and (3) Transportation and Lifeline Facilities.

Table 3.0-6: Critical Facility Categories and Types

Essential Facilities	High Potential Loss Facilities	Transportation and Lifeline
Emergency medical facilities	Dams/levees	Airports
Emergency Operations Centers	Day care centers	Bus facilities
Fire stations	Hazardous material sites	Highways, bridges, and tunnels
Government administration	Main government buildings	Natural gas facilities and pipelines
Police stations	Military installations	Oil facilities and pipelines
	Nursing homes	Railroads and facilities
	Power plants	Water treatment facilities
	Schools	

The table below provides a summary overview of the types and numbers of critical facilities or community assets at potential risk. In addition to this summary, hazard sub-sections provide additional details related to community assets at risk.

Table 3.0-7: Critical Facilities Summary Table

Category	Type	Facility Count
Essential Facilities	Government administration	**15**

	Emergency Medical Services	**1**
	Police stations	**1**
	Fire stations	**17**
	Emergency Operations Centers	**1**
High Potential Loss Facilities	Power plants	**2**
	Dams/levees	**2**
	Military installations	**1**
	Hazardous material sites	**14**
	Public Schools	**72**
	Colleges/Universities	**13**
	Day care centers	**0**
	Nursing homes	**89**
	Main government buildings	**2**
Transportation and Lifeline Facilities	Highways, bridges, and tunnels	**6**
	Railroads and facilities	**3**
	Bus facilities	**0**
	Commercial/Private Airports	**1**
	Electric Substations	**2**
	Water treatment /Waste water facilities	**2**
	Natural gas facilities & pipelines	**0**
	Oil facilities and pipelines	**0**
	Communication towers	**0**
TOTAL		**244**

Vulnerability of Cultural, Historical and Natural Resources

Assessing Saint Paul's vulnerability to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important because:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of natural, historical and cultural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.

- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian habitat which help absorb and disperse floodwaters and thus support overall mitigation objectives.

Specific hazard sections describe potential impacts to cultural and/or historical resources, if such sites are located within applicable hazard zones. There are ten (10) historic districts and dozens of historic sites in the city.

Future Growth and Development

As part of the planning process, Saint Paul EM staff and the SWG looked at current development practices along with potential changes in growth and development patterns, and examined these changes in the context of hazard-prone areas, and how the changes in growth and development could affect loss estimates and vulnerability. Each hazard section addresses consideration of future growth and development in relation to that hazard.

3.0.4 Final List of Hazards Addressed in the 2019 Plan

The Overall Risk Score defined in the *Evaluation Tool,* following the process described previously, served as the basis for ranking all hazards in order of importance to determine which should be addressed in the plan as the hazards of highest concern. Based on the final prioritization ranking lists for the ***natural*** and ***technological/human-caused*** hazards noted in **Tables3.0-2** and **3.0-3**, the SWG determined that ten (10) ***natural*** hazards and thirteen (13) ***technological/human-caused*** hazards (grouped within six (6) hazard categories) pose a level of risk sufficient for inclusion in the comprehensive analysis of risk and vulnerability and to be addressed in the mitigation strategy of this Plan. It should be noted that the hazard rankings were not the final determining factor in that some hazards with a lower risk score, when compared with other planning references, presented a sufficient level of specific challenges and concerns to be included in this plan update.

Table 3.0-8: All Hazards Addressed in the 2019 Plan

Hazard Type	Ranking (Score)	Final Disposition in Plan
Natural Hazards		
Urban Fire/Wildland Fire*	11.7	Profiled and full risk assessment conducted
Damaging Wind/Thunderstorm**	10.6	Profiled and full risk assessment conducted
Extreme Heat/Extreme Cold	10.1	Profiled and full risk assessment conducted
Severe Winter Storm	9.9	Profiled and full risk assessment conducted
Tornado	9.8	Profiled and full risk assessment conducted

Flood	9.8	Profiled and full risk assessment conducted
Human Infectious Disease	9.4	Profiled and full risk assessment conducted
Landslide/Slope Failure	9.1	Profiled and full risk assessment conducted
Dam/Levee Failure	8.1	Profiled and full risk assessment conducted
Drought	7.5	Profiled and full risk assessment conducted
Technological/Human-Caused Hazards*		
Oil by Rail Incident	10.1	Considered under Hazardous Materials
Transportation Incidents	9.8	Considered under CIKR Lifeline Sectors Failure
CBRNE Incident – Terrorism	9.8	Considered under Terrorism
Cyber Attack	9.7	Considered under CIKR Lifeline Sectors Failure
CIKR Lifeline Sectors Failure	9.6	
Active Shooter/Conventional Attack	9.5	Considered under Criminal Acts
Major Community Event Disruption	9.5	Considered under Civil Disorder
Hazardous Material Incident	9.4	Considered under Hazardous Materials Incident
Critical Supply Chain Disruption	9.0	Considered under Critical Supply Chain Disruption
Civil Disorder	8.9	Considered under Civil Disorder
Arson/Incendiary Attack	7.7	Considered under Criminal Acts & Terrorism
Communication Systems Failure	7.3	Considered under CIKR Lifeline Sectors Failure
Water Supply Contamination****	N/A	Considered under CIKR Lifeline Sectors Failure

***** Natural fire was renamed Wildland Fire and combined with Urban Fire
******Hazard category includes ***hail***
*** Individual technological and human-caused hazards are grouped into six categories
****Not ranked as individual hazard in the *Evaluation Tool*

Other natural hazards initially considered were determined to be a low risk due to infrequent occurrence and/or negligible impacts and did not provide a sufficient level of risk to conduct further analysis related to vulnerability or exposure. For those hazards, the SWG determined that a vulnerability assessment would not be conducted at this time, but would be reconsidered in the next planning cycle. Consequently, the following hazards were removed from further consideration for mitigation planning purposes. This determination in no way indicates that these hazards should not be considered in relation to other planning purposes such as preparedness, prevention, response and/or recovery.

Table 3.0-9: Hazards Excluded or Minimally Addressed in the 2019 Plan

Hazard Type	Why Hazard was not Assessed for Risk and Loss	Final Disposition in Plan
Natural Hazards		

Infectious Disease (Animal)	Due to the urban nature of the Planning Area, the potential for occurrence and impact is considered to be low.	Not included in the 2019 update; will be reconsidered in the next planning cycle.
Earthquake	The hazard occurs only very infrequently, generally less than every five years on a large scale.	Not included in the 2019 update; will be reconsidered in the next planning cycle.
Karst Regions	The hazard occurs only very infrequently, generally less than every five years, and has minimal impact.	Not included in the 2019 update; will be reconsidered in the next planning cycle.
Technological/Human-Caused Hazards		
Animal Escape	The hazard occurs only very infrequently and has minimal impact.	Not included in the 2019 update; will be reconsidered in the next planning cycle.
Maritime Attack	The hazard occurs only very infrequently and has minimal impact.	Not included in the 2019 update; will be reconsidered in the next planning cycle.
REP/Ingestion Pathway Planning Zone	The hazard occurs only very infrequently and has minimal impact.	Not included in the 2019 update; will be reconsidered in the next planning cycle.
Sabotage/Theft	The hazard occurs only very infrequently and has minimal impact.	Not included in the 2019 update; will be reconsidered in the next planning cycle.

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. Understanding what these events are and assessing their potential impacts will go a long way to mitigate negative consequences. **Sections 3.1** to **3.10** that follow address each ***natural*** hazard in relation to:

- General Description of the hazard
- Type
- Location
- Extent

- Previous Occurrences and Probability of Future Events
- Impacts, Consequences, Vulnerability and Risk
    - A narrative description of each impact and consequence element that could potentially occur in relation to the hazard
    - A summary of the measured rating in matrix format for each impact and consequence element as well as overall vulnerability and risk related to the hazard
- Potential Impacts from Future Growth and Development
- Potential Impacts from Climate Change
- Factors for Consideration in the Next Planning Cycle

Natural Hazards are addressed in **Sections 3.1** through **3.10**.

TECHNOLOGICAL/HUMAN-CAUSED HAZARDS

In reviewing the list of technological and human-caused hazards considered by the SWG, it was determined that these hazards could be more concisely addressed through organizing individual hazards and threats with comparable impacts and consequences into the following six categories:

1. **CIKR Lifeline Sectors Failure**
    - Communication Systems
    - Cyber-Attack
    - Transportation Systems Incident
    - Water Supply Contamination
    - Waste Water System

2. **Critical Supply Chain/Commodity Disruption**
    - Large Scale Fuel Shortage
    - Food Supply
    - Health and Medical Supply

3. **Terrorism**
    - CBRNE (Chemical, Biological, Radiological, Nuclear, Explosive)
    - Aircraft as Weapon

4. **Hazardous Materials**

- Explosives, flammable and combustible substances, poisons and radioactive materials
- Chemical leak/spill
- Natural gas leak

5. **Criminal Acts**
   - Active Shooter/Hostile Incident
   - Arson/Incendiary Attack

6. **Civil Disorder**
   - Major Community Events
   - Demonstrations and Riots
   - Labor Strike

Technological/human-caused hazard profiles and risk assessments are compiled in **Appendix B**. Each hazard addressed in the appendix follows a format similar to the natural hazard sections.

Impacts of Climate Change

Based on scientific observations and projections, changes in climate patterns are likely to increase extreme weather events in Saint Paul in coming years. The table below describes some of the observed trends and confidence level related to changes that are already occurring for some of the weather hazards that routinely impact Saint Paul.

Table 3.0-10: Observed Trends in Climate Change in Minnesota[6]

Hazard	*Observed Trend*	*Confidence Change is Occurring*
Extreme Cold	Rapid decline in severity and frequency	HIGHEST
Extreme rainfall	Becoming larger and more frequent	
Heavy snowfall	Large events more frequent	High
Severe thunderstorms and tornadoes	Overall numbers not change but tendency toward more "outbreaks"	Moderately low
Heat Waves	No recent increases or worsening	Lowest
Drought		

[6] Interagency Climate Adaptation Team, State of Minnesota; *Adapting to Climate Change in Minnesota[6],* May 2017.

Source: Adapting to Climate Change in Minnesota, 2017 Report of the Interagency Climate Adaptation Team. Accessed at: https://www.pca.state.mn.us/featured/adapting-climate-change-minnesota Note: table has been updated since original report was issued.

Comparison of total temperature changes between 1895 and 2015 indicate the annual average temperature in the central Minnesota area has risen +2.0 degrees F; the winter lows have risen +4.0°; and the summer highs have declined -0.2°. [7]

Specific changes related to climate are projected in Minnesota in the years and decades ahead, with two leading symptoms of climate change being winter warming and increased rainfall. The following table describes the projected impacts of climate change in relation to specific hazards, and provides a level of confidence related to each projection.

Table 3.0-11: Projected Climate Changes in Minnesota[8]

Hazard	*Projections through century*	*Confidence in projected changes*
Extreme Cold	Continued loss of cold extremes and dramatic warming of coldest conditions	HIGHEST
Extreme rainfall	Continued increase in frequency and magnitude; unprecedented flash-floods	
Heat waves	More hot days with increases in severity, coverage, and duration of heat waves	High
Drought	More days between precipitation events, leading to increased drought severity, coverage, and duration	Moderately High
Heavy snowfall	Large events less frequent as winter warms, but occasional very large snowfalls	Moderately low
Severe thunderstorms and tornadoes	More "super events" possible, even if frequency decreases	

Source: 2014 National Climate Assessment and data, Minnesota Department of Natural Resources, State Climatology Office

The *Strategic Framework for Community Resiliency*, City of Saint Paul (*Strategic Framework*), (DRAFT) dated May 11, 2016, was developed and published to promote measures to increase the city's resiliency to environmental threats from conditions related

[7] Minnesota Department of Natural Resources, State Climatology Office
[8] Interagency Climate Adaptation Team, State of Minnesota; *Adapting to Climate Change in Minnesota[8],* May 2017.

to climate change. As the document notes, *"The framework will help the City integrate climate resiliency strategies into existing emergency management and community planning documents and increase the community's adaptive capacity while promoting a healthy and prosperous community and to continue to make Saint Paul "The Most Livable City in America."*[9] Specific threats from climate change stated in the framework indicate that Saint Paul will become "warmer and wetter"[10] leading to hazard events such as these three types of flooding:

- Prolonged wet periods lasting weeks or months can lead to unusually high lake and river levels flooding low-lying areas and shutting down recreational opportunities
- Shorter time scales – extreme rainfall lasting a period of hours that overwhelm drainage systems and lead to dangerous flash-flooding that threatens human safety and damages public and private property
- Deep winter snows that melt quickly during the spring and overflow the Mississippi River and backwater lakes

It is the warm-season floods from prolonged wet spells and extreme rainfall that have increased notably during the past few decades and are projected to worsen in the years and decades ahead.

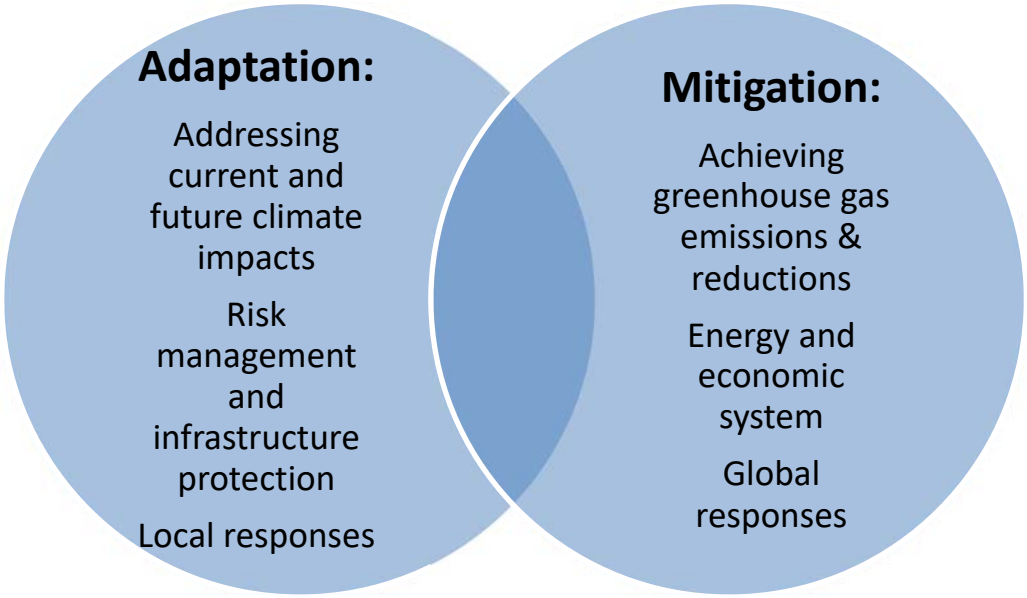
Even though precipitation has increased and is expected to increase over time, the Saint Paul area can still experience episodes of severe drought and will continue to do so in the future.

A summary of The City of Saint Paul

The Interagency Climate Adaptation Team, State of Minnesota issued the report, *Adapting to Climate Change in Minnesota*[11] in May 2017 as a tool to guide Minnesota state and local agencies in two approaches to climate change; climate adaptation and climate mitigation. The report develops and implements strategies, initiatives and measures to help human and natural systems prepare for and address climate change impacts and manage its risks. Additional information from this and the *Strategic Framework* are integrated throughout appropriate areas of this Plan, as described in **Section 4. Figure 3.0-B** illustrates the relation between climate adaptation and mitigation.

[9] *Strategic Framework for Community Resiliency*, City of Saint Paul (DRAFT), dated May 11, 2016, page 4.
[10] Ibid, page 9.
[11] *Adapting to Climate Change in Minnesota* is available online at https://www.pca.state.mn.us/sites/default/files/p-gen4-07c.pdf.

Figure 3.0-B: Connection between climate adaptation and mitigation



The intent of the City's *Strategic Framework* is to incorporate community resilience into relevant local and regional plans and projects using multi-discipline and multi-jurisdiction working groups to examine areas of potential hazards, exposures and vulnerability. Integration of the mitigation planning process into this initiative will enhance the jurisdiction's ability to identify and conduct acceptable and effective mitigation actions.

The State of Minnesota is taking several steps to address climate adaptation[12], including planning initiatives, assessments and implementation efforts. Agencies participating in the state's Interagency Climate Adaptation Team (ICAT) are implementing programs to address climate impacts, such as:

- **Minnesota Department of Commerce** – Weatherization Assistance Program providing free home energy upgrades to income-eligible homeowners and renters to build resilience to heat and cold, while lowering energy bills.
- **Minnesota Pollution Control Agency** – partnering with youth conservation programs to support community resilience projects that focus on new green infrastructure in underserved urban neighborhoods, which helps to reduce stormwater runoff, improve air quality and increase shaded areas.

[12] *Adapting to Climate Change in Minnesota*, 2017 Report of the Interagency Climate Adaptation Team. Report may be accessed at: https://www.pca.state.mn.us/featured/adapting-climate-change-minnesota

- **Minnesota Department of Transportation** – conducted a vulnerability assessment of the effects of climate hazards on transportation systems, which scored and ranked 316 bridges, 521 large culverts, 920 pipes and approximately 45 miles of road segments in southeast and northeast regions of the state.
- **Metropolitan Council** – maintains and rehabilitates wastewater infrastructure to ensure that the system has capacity to handle future demands and support community efforts to reduce excessive flows through inflow and infiltration reduction strategies; thereby helping to reduce volumes event as precipitation, rainfall intensities, and populations have increased.

Five statewide climate adaptation indicators have been developed to help track the state's progress:

- Climate adaptation planning by state agencies, local units of government and tribal governments
- Disruptions to the power grid
- Emergency department data for heat-related health impacts
- Inflation adjusted damages from extreme weather
- Canopy cover of urban and community forests

The ICAT also identified six priority recommendations for needed action in climate adaptation by the state government, which focuses on:

- Resilience to extreme precipitation
- Health of vulnerability populations
- Preserving ecosystems
- Strengthening agricultural water management
- Managing climate impacts in population centers
- Improving the use of climate data

These priorities were taken into consideration during the hazard risk and vulnerability assessment process and are consistent with the overall strategy presented within this plan update.

The *Climate Action and Resilience Draft Plan; A Framework for Our Community to Address the Impact of Climate Change*, City of Saint Paul, Mayor Melvin Carter, dated April 2019, was released as the mitigation plan was being completed for initial review. Key elements of the

Climate Action plan related to potential impacts, vulnerabilities and adaptive initiatives are summarized in **Appendix B**. During the next planning cycle, the Department of Emergency Management will monitor the planning process related to the Climate Action Plan, and work with the appropriate departments, agencies and disciplines to integrate the mitigation goals, objectives and actions into the City's climate change initiatives. In addition, risk and vulnerability data presented in the Climate Action Plan will be taken into consideration during the annual hazard risk and vulnerability analysis to determine whether significant changes in hazards, risks or vulnerabilities have occurred that could result in changes in mitigation priorities, goals and actions.

> Changing conditions related to the climate are already affecting our state's environment, economy, and communities. They have damaged buildings and infrastructure, limited recreational opportunities, altered our growing seasons, impacted natural resources, and affected the conditions of lakes, rivers, wetlands, and our groundwater aquifers that provide water for drinking and irrigation. In the years and decades ahead, winter warming and increased extreme rainfall will continue to be Minnesota's two leading symptoms of climate change.
>
> - *Adapting to climate change in Minnesota, 2017 report of the Interagency Climate Adaptation Team*

SECTION 3.1 DAM/LEVEE/FLOODWALL FAILURE

2019 Plan Updates
• Updated statistical data and general information related to Dam/Levee Failure has been added. • All hazard incidents were reviewed to determine if any dam/levee events have occurred since the 2012 Plan was adopted.

3.1.1 Hazard Profile

Dams and levees are manmade structures built for a variety of uses, including flood protection, power generation, agriculture, water supply, and recreation. Floodwalls are vertical man-made concrete or steel structures used to control flood waters, and are included in this chapter because they are incorporated into various levee systems within Saint Paul. When constructed for flood protection, all three of these types of structures are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam or levee may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail.

Hazard Description

Overtopping is the primary cause of earthen dam/levee failure in the United States. Dam failure can also result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity
- Improper design
- Improper maintenance
- Negligent operation
- Failure of upstream dams/levees on the same waterway

When one of these systems fails, there is an uncontrolled release of impounded water resulting in huge quantities of water rushing downstream with great destructive force. Dam failure or levee/floodwall 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 conditions. In general, there are four types of dams/levees/floodwalls which display different characteristics in relation to failure:

Type of Structure	Failure Characteristics
Concrete Arch or Hydraulic Fill	Can fail almost instantaneously: the flood wave builds up rapidly to a peak then gradually declines
Earth and Rock fill	Fails gradually due to erosion of a breach
Concrete Gravity	Fails instantaneously or gradually with a corresponding building and decline of the flood wave.
Floodwalls	Can fail almost instantaneously; flood wave builds up rapidly to a peak, then gradually declines.

With proper maintenance, these structures can provide a safeguard to control the release of water during potential flood events; however, many systems are more than 50 years old, in need of maintenance, or are now subject to stricter criteria as a result of increased downstream development and advancing scientific knowledge predicting flooding, earthquakes and dam failures.

DAM FAILURE Assessment: High Risk Hazard	**Location** – Lock and Dam #1 (at former Ford site). Area affected: floodplain downstream through Saint Paul **Extent:** • **Duration** – One to three days • **Speed of Onset** – Rapid • **Warning Time** – Minimal **Seasonal Pattern** – Annual river flooding due to snow melt in the spring increases the risk for a period of time **Probability** – Low **Impacts**: Major damage to buildings, property, and parklands **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Power/utility outages (No heat) • Traffic/roadway damage/closures • Visitor/staff safety • Increased security • Loss of deliverable services • Major redirect of staff/equipment • Loss of revenue

LEVEE/FLOODWALL FAILURE Assessment: High Risk Hazard	**Location** – Saint Paul Levee/Floodwall System, protecting the West Side. Area affected: West Side public and private properties **Extent:** • **Duration** – three to seven days • **Speed of Onset** – Rapid • **Warning Time** – Minimal **Seasonal Pattern** – Annual river flooding due to snow melt in the spring increases the risk for a period of time **Probability** – Low **Impacts**: Major damage to buildings, property, and parklands **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Power/utility outages (No heat) • Traffic/roadway damage/closures • Visitor/staff safety • Increased security • Loss of deliverable services • Major redirect of staff/equipment • Loss of revenue

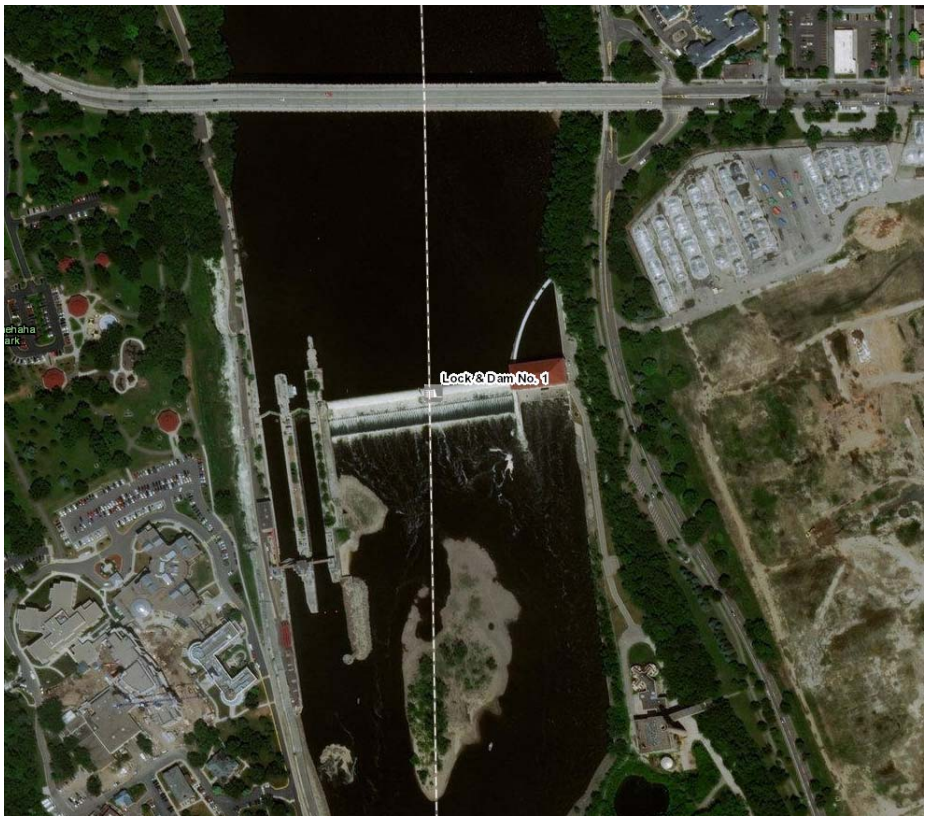
Saint Paul Area Dam/Levee/Floodwall Types and Inventory

The definitions below apply to the Dam/Levee/Floodwall systems in proximity to the City of Saint Paul:

- Dams – A dam is any artificial barrier capable of impounding water. There are three dams located in or near the City of Saint Paul. The data provided below has been obtained from the Minnesota Department of Natural Resources Dam Safety Program.

    - Lock & Dam No. 1: Owned by U.S. Army Corps of Engineers, Ford Motor Company & Brookfield Power. This dam was constructed in 1917 on the Mississippi River, has a height of 50 feet, and provides storage of 9,300 acre-feet. Classification: Unknown.

Figure 3.1-A: Lock and Dam No. 1



- Arlington Detention Dam: Owned by the City of Saint Paul. This dam was constructed in 1989 for stormwater ponding purposes, has a height of 10 feet, and provides storage of 50 acre-feet. Classification: Class II Significant.

Figure 3.1-B: Arlington Detention Dam

- Battle Creek Dam: Owned by Ramsey-Washington Metro Watershed District. This dam is located just outside of the City limits, on Battle Creek at McKnight Road. The Dam was constructed in 1982, has a height of 23 feet, and provides storage of 340 acre-feet. The National Inventory of Dams lists Battle Creek Dam as high hazard.

Figure 3.1-C: Battle Creek Dam

Table 3.1-1: Dam Classifications*

Dam Classification	Description
Class 1 – High Hazard	Any loss of life or serious hazard, or damage to health, main highways, high-value industrial or commercial properties, major public utilities, or serious direct or indirect, economic loss to the public
Class II – Significant Hazard	Possible health hazard or probable loss of high-value property, damage to secondary highways, railroads or other public utilities, or limited direct or indirect economic loss to the public other than that described in Class III.
Class III – Low Hazard	Property losses restricted mainly to rural buildings and local county and township roads which are an essential part of the rural transportation system serving the area involved.
Additional Conditions	Any dam whose failure, mis-operation, or other occurrences or conditions would result only in damages to the owner and would not otherwise affect public health, safety, and welfare as described in Classes I, II, and III, shall not be subject to this hazard classification.

Source: Minnesota Administrative Rules 6115.0340 Classification of Dams

- Levee/Floodwall – A Levee is an embankment for preventing flooding, or a continuous dike or ridge for the confining of water. A Floodwall is a vertical structure built of concrete or steel used to control flood waters. These can be permanent structures or temporarily installed during period of flood activities. Many public and private entities operate and maintain floodwalls in various locations along the Mississippi River in Saint Paul.

    - Metropolitan Wastewater Treatment Plant Levee: Owned by the Metropolitan Council protects the Regional Wastewater Treatment Plant.

Figure 3.1-D: Metropolitan Wastewater Treatment Plant Levee

Metropolitan Waste Water Treatment Levee
Source: https://water.weather.gov/ahps2/inundation/index.php?gage=stpm5

- Saint Paul Flood Control Project: Owned by the City of Saint Paul protects the public and private properties located on the West Side of Saint Paul. The U.S. Army Corps of Engineers, in conjunction with the City of Saint Paul, constructed a levee/floodwall system to protect approximately 500 acres of Saint Paul's West Side. The levee/floodwall system is comprised of approximately 2 ½ miles of earthen levee section and ½ mile of concrete floodwall. Other critical components associated with the levee/floodwall system include: pumping plants, closure structures and storm sewers. The City of Saint Paul conducts regular inspections of the flood fight facilities, and routinely receives positive feedback from the U.S. Army Corps of Engineers in the operation and maintenance of the system.

Figure 3.1-E: Saint Paul Flood Control Project

Saint Paul Levee System
Source: https://water.weather.gov/ahps2/inundation/index.php?gage=stpm5

Saint Paul Levee System
Source: https://water.weather.gov/ahps2/inundation/index.php?gage=stpm5

- Holman Field Levee: Owned by the Metropolitan Airports Commission protects the Downtown Saint Paul Airport.

Figure 3.1-F: Holman Field Levee System

Holman Field Levee System
Source: https://water.weather.gov/ahps2/inundation/index.php?gage=stpm5

- Private Levees: Many permanent and temporary levees are operated by private entities for flood protection during river flood events. These areas generally include industrial-based properties located on: Barge Channel Road, Childs Road, Randolph Avenue, etc.

Figure 3.1-G: Randolph Avenue Private Levee System

Randolph Ave Private Levee Systems
Source: https://water.weather.gov/ahps2/inundation/index.php?gage=stpm5

Construction, Operation and Maintenance

Dams/Levees/Floodwalls must be constructed, operated and maintained with the understanding that the failure of any of these systems, no matter how small, could present a danger to downstream life, property, and the environment. In Saint Paul, various regulatory programs exist to aid in the efficient construction, operation, and maintenance of dam and levee systems. Many of these programs are regulated by FEMA, USACE and the State of Minnesota. A few resources include:

- Minnesota Department of Natural Resources (DNR)
  - Dam Safety Program - Minnesota Administrative Rule 6115.0300 – 6115.0520
  - Dam Inspection rules – Minnesota Statutes, Section 103G.515
- Federal Energy Regulatory Commission (FERC)
  - 18 CFR 12.22-24
- U.S. Army Corps of Engineers (USACE), EP 1110-2-13, Dam Safety Preparedness

Failure Occurrences and Event Probability

The **Minnesota Administrative Rule 611.0490 - Warning Systems and Emergency Procedures**, requires Class I dam owners to:

> "prepare and file for approval a contingency plan for notifying any persons whose lives, property, or health may be endangered by failure, misoperation, or other circumstances or occurrence affecting the dam, identifying most practical and expeditious means for warning considering the time factor involved based on the proximity of the dam to affected parties. If there is no feasible or practical means to provide for adequate evacuation warning in sufficient time if a catastrophe occurs the owner shall be responsible for notifying affected downstream property owners of that fact."

If a dam, levee, or floodwall were to fail, the local government's responsibilities encompass the response activities that would be undertaken to protect the life, safety and property of citizens potentially in harm's way.

An EAP is required for all *High Hazard* or Class I dams, and is strongly recommended for *Significant Hazard* dams (Class 2) Source: https://www.dnr.state.mn.us/waters/surfacewater_section/damsafety/emergency_plans.html

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Occurrences

There is no record of dam, levee, or floodwall failure in Saint Paul.

Probability of Future Events

***Saint Paul HIRA Evaluation Tool* Probability Score - Dam/Levee/FloodWall Failure: 1 (unlikely)**

Although dam/levee/floodwall failure has not previously occurred in the Planning Area, and there is a low risk for such an occurrence, the suddenness of such a failure and the resulting impacts to life, property, and the economy create the potential for significant consequences. Although a quantitative level of probability based on calculated return

intervals cannot be determined, the potential exists due to multiple factors that cause dam/levee/floodwall failure which could occur in the Saint Paul area, including flood/overtopping, seepage/piping, deterioration/erosion, aging infrastructure, lack of maintenance, or ice jam accumulation. Levee failure risk is low due to ongoing inspections and maintenance.

Failure of the Ford Dam would likely cause flood related damages in downstream areas including Lilydale and Hidden Falls/Crosby Farm riverfront areas, private riverfront properties, and public road systems.

Except during periods of flooding, the Mississippi River remains within its banks and is not restrained by the levee or floodwalls. Therefore, failure of any sections of the levee/floodwall system would only result in widescale damage during a flood event.

3.1.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Vulnerabilities in the City of Saint Paul due to a dam/levee/floodwall failure, which would result in a massive flood event, are vast and could be catastrophic to the considerable quantity of people, structures, and infrastructure. Floodplains and low-lying areas around the river may experience dramatic inundation (if levees fail during flood events).

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 a lesser risk. The downtown density is a vulnerable aspect in the event of a major flooding event for both residents and responders due to the dangers of navigating flooded roads and waterways.

Health risks accompany flooding due to pooling or stagnant water. This standing water is a 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.

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).

Property (Facilities and Infrastructure)

Most property losses related to this risk would 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 utilities (electricity, water, and sewer) located throughout the entire city. 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.

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 caused by dam or levee failure. 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 inside or outside the city limits; having the ability to manage crisis operations from an adjacent jurisdiction's EOC, for example, would ensure continuity of operations and make the City less vulnerable to loss of EOC services and resources if a levee/dam failure 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 elements of operations, as severe floods can destroy everything in their path.

Environment

The environmental vulnerabilities due to flooding caused by dam, levee, or floodwall failure include water contamination/pollution, soil damage from chemical spills, and natural gas leaks. The City maintains the capacity to perform routine 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.

Economic Conditions

The City of Saint Paul, as the Capital 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

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[1] as well as mitigation.

[11] "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.

A dam/levee/floodwall failure event has the potential to test the public's confidence in its elected leadership if critical preparedness and response information is not timely, consistent, coordinated, and accurate.

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.

Repetitive Losses

[EMAP 4.2.4(2)] There has been no documented loss of life or property in a dam/levee/floodwall failure in the City of Saint Paul in modern times. National Flood Insurance Program (NFIP) insured structures in the City of Saint Paul have recorded no repetitive losses at the current time.

That does not mean that there are no impacts from repetitive flooding, however. Areas outside the floodwall/levee system are still vulnerable to significant damages during Mississippi River flooding events. Areas that should be considered for enhanced protection from mitigation efforts include:

- The Lowertown areas where significant investment has recently occurred including (Union Depot, Custom House and CHS Ballpark).
- Harriett Island Park
- Upper Landing housing complexes
- The private lands along the Mississippi River near Childs Road, Barge Channel Road, (including the land used as the Police Impound Lot).

Capabilities

The City has assessed all State and local authorities, policies, programs, and resources and the capabilities, documented in **Section 4**.

Current projects that contribute to dam/levee/floodwall safety capabilities and aid in reducing flood risk include:

- Levee Safety Program – Minnesota

  The basic objectives of the Levee Safety Program are to develop balanced and informed assessments of levees within the program; evaluate, prioritize and justify levee safety decisions; and recommend improvements to public safety associated with levee systems. The U.S. Army Corps of Engineers (Corps) created the National Levee Database, inventoried all levees in the program and improved inspection procedures.

The Corps developed a method to manage its portfolio of levee systems and reviewed and revised current levee-related policies and procedures. (Published 2/26/2015 at: http://www.mvp.usace.army.mil/Home/District-Projects/)

- West Side (Permanent Levee System)

  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.

  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.

  Removal of Trees, Shrubs, Unwanted Vegetation: To comply with U.S. Army Corps of Engineers (Corps) 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 rip-rapped areas of the levee. Public Works and the Army Corps of Engineers inspects the levee system twice a year: in the spring and in the fall, looking for trees, animal burrows, and man-made intrusions into levee integrity. The Corps is typically very pleased with Saint Paul efforts to maintain levee integrity.

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

The focus for risk reduction in relation to dam/levee/floodwall failure is generally on prevention and response measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, such as evacuation routes, and safe driving in potential flood conditions, and flood clean-up guidance
- Issuing timely warnings
- Ensuring that dam owners maintain and update Emergency Action Plans
- Conducting multi-agency training and exercises related to appropriate dam/levee/floodwall safety, prevention, and response measures
- Removal of tree debris from riverfront areas. This is a repetitive action, and failure to remove the debris can result in additional infrastructure damage, including impacts on the levee/floodwall protective systems.

The following organization's websites provide dam/levee/floodwall safety preparedness information:

- FEMA – https://www.fema.gov/dam-safety
- Association of State Dam Safety Officials - https://damsafety.org/NDSAD
- United States Society on Dams - https://www.ussdams.org/dam-levee-education/
- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for dam/levee failure, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in Section 3.0.

Table 3.1-2: Summary of Risk/Vulnerability Scores for Dam/Levee/Floodwall Failure

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Dam/Levee/Floodwall Failure	4	3	3	4	3.5

Table 3.1-3: Summary of Consequence Scores for Dam/Levee/Floodwall Failure

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements)*
Damaging Wind/Severe Thunderstorm	4	4	4	3	2	4	4	3.6

Table 3.1-4: Summary of Overall Risk for Dam/Levee/Floodwall Failure

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Dam/Levee/Floodwall Failure	3.5	3.6	7.1	1	8.1	4

Potential Impacts of Climate Change

Information related to the potential impacts of climate change for this hazard are addressed in **Sections 3.0** and **3.5**.

Future Population and Development Trends

Because the potential consequence of dam/levee/floodwall failure is flooding, the flood zones identified in the current Digital Flood Insurance Rate Map (DFIRM) serve as guidance to appropriate development near dams, levees and floodwalls. In addition, Federal and State regulations restrict significant development in these areas. Current land use codes incorporate standards that address and mitigate dam and levee failure.

The potential for impacts of future growth and development on dam/levee/floodwall failure will be monitored and evaluated in the next planning cycle to consider whether the

level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Summary of Needed Mitigation Strategies and Actions:

There are several significant enhancements that could be made for ensuring/increasing the integrity and protective features of the floodwall/levee system in the City. They include:

- The adoption of the Lowertown Flood Mitigation plan, which includes significant investments for levee/floodwall construction. It should be noted that in spite of flood control measures envisioned for that area, seepage, sub-surface intrusion, and ground saturation will remain a concern even after the installation of floodwalls and levees. Public and civic leaders need to understand and expect that there is a limit to what mitigation efforts can do to combat flooding in this area of the City.

- The development of evacuation plans for both the West Side and the Lowertown areas of the City. These plans are needed for the eventuality of a levee/floodwall failure, as well as other significant man-made or natural disasters.

- Funding for annual log/debris removal as noted above.

- Ongoing resources and support for inspections, maintenance, and actions for levee system.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to dam/levee/floodwall failure as well as other information from the Minnesota SHMP updates:

- Have any dam/levee/floodwall failure events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict dam/levee/floodwall failure events or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to dam/levee/floodwall failure?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to dam/levee/floodwall failure?

SECTION 3.2 DAMAGING WIND/SEVERE THUNDERSTORM

2019 Plan Updates

- Updated statistical data and general information related to Severe Winter Storm has been added.
- Table of previous occurrences has been updated to add significant severe damaging wind events since 1995.

3.2.1 Hazard Profile

Severe thunderstorms 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 1 inch or more in diameter, or winds of 58 mph or more.

The focus for risk reduction in relation to damaging wind/thunderstorm is generally on preparedness measures, which include the following:

- Public information and education relating to protective measures for individuals and families, such as sheltering-in-place, and construction of tornado safe areas/rooms
- Issuing timely warnings

Hazard Description

Damaging winds and severe thunderstorms are a hazard associated with severe weather conditions that can affect Saint Paul at any time of the year; however, severe weather conditions are most prevalent in the early spring and throughout the summer.

DAMAING WIND/ SEVERE THUNDERSTORM Assessment: High Risk Hazard	**Location -** Citywide **Extent:** • **Duration** – Minutes to an hour • **Speed of Onset** – Rapid • **Warning Time** – Minimal (minutes); hours/days for accompanying storm pattern **Seasonal pattern** – Spring/Summer/Fall **Probability** – Moderate **Impacts:** The results could be devastating for humans, property, business, environment, and emergency operations **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Downed trees & power lines • Communication outages • Property damage • Health and safety concerns • Blocked roads Increased risk to responders

Type

Lightning

Lightning is the most frequent hazard associated with thunderstorms, that causes loss of life, injuries and property damage. Although the number of deaths and injuries due to lightning has decreased significantly in the United States in recent years, in 2018 there were 20 fatalities and 82 injuries reported, and more than $16 million in property damage across the country. (*Summary of Natural Hazard Statistics for 2018 in the United States,* National Weather Service, NOAA) Lightning is usually attracted to tall buildings, trees, and other objects protruding from the surface thus more likely to be struck than lower objects.

Hail

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. In Saint Paul expected hail damage would be to vehicles, gardens, homes, property and airplanes.

The National Weather Service (NWS) classifies hail by diameter size, and corresponding everyday objectives to help relay scope and severity to the population.

Table 3.2-1: Hailstone Measurements

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

Windstorms

The types of damaging winds defined in this section are straight line wind, downdraft, downburst, microburst, gust front, and derecho. 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.

Table 3.2-2: Damaging Wind Definitions

Type of High Wind	Definition
Straight-line Winds	Wind that comes out of a thunderstorm, but is not associated with rotation
Downdraft	Small-scale column of air that rapidly sinks toward the ground.
Downburst	Strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground.
Microburst	Small, short lived, concentrated downburst that produces an outward burst of damaging winds at the surface.
Gust Front	A wind shift, temperature drop and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
Derecho	Widespread wind storm that is associated with a band of rapidly moving showers or thunderstorms, it consists of numerous microbursts, downbursts, and downburst clusters.

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, due to the damaged buildings being left exposed and water infiltration causing additional damage.

Table 3.2-3: Wind Speeds and Related Effects

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

Location

All areas of Saint Paul are susceptible to damaging wind, severe thunderstorms.

On the basis of more than 100 years of data from previous wind events, including tornadoes and hurricanes, the United States has been divided into four zones that geographically reflect the number and strength of extreme windstorms. These wind zones are primarily used for establishing Design Wind Speeds for building codes; however, they also provide a visual guide for determining hazard preparedness measures, risk, and potential mitigation actions. Based on the map depicted in **Figure 3.2-A**, all of Saint Paul is located within Zone III with a map wind speed of 200 miles per hour (mph).

Figure 3.2-A: Wind Zones in the United States, with designation of Saint Paul, MN

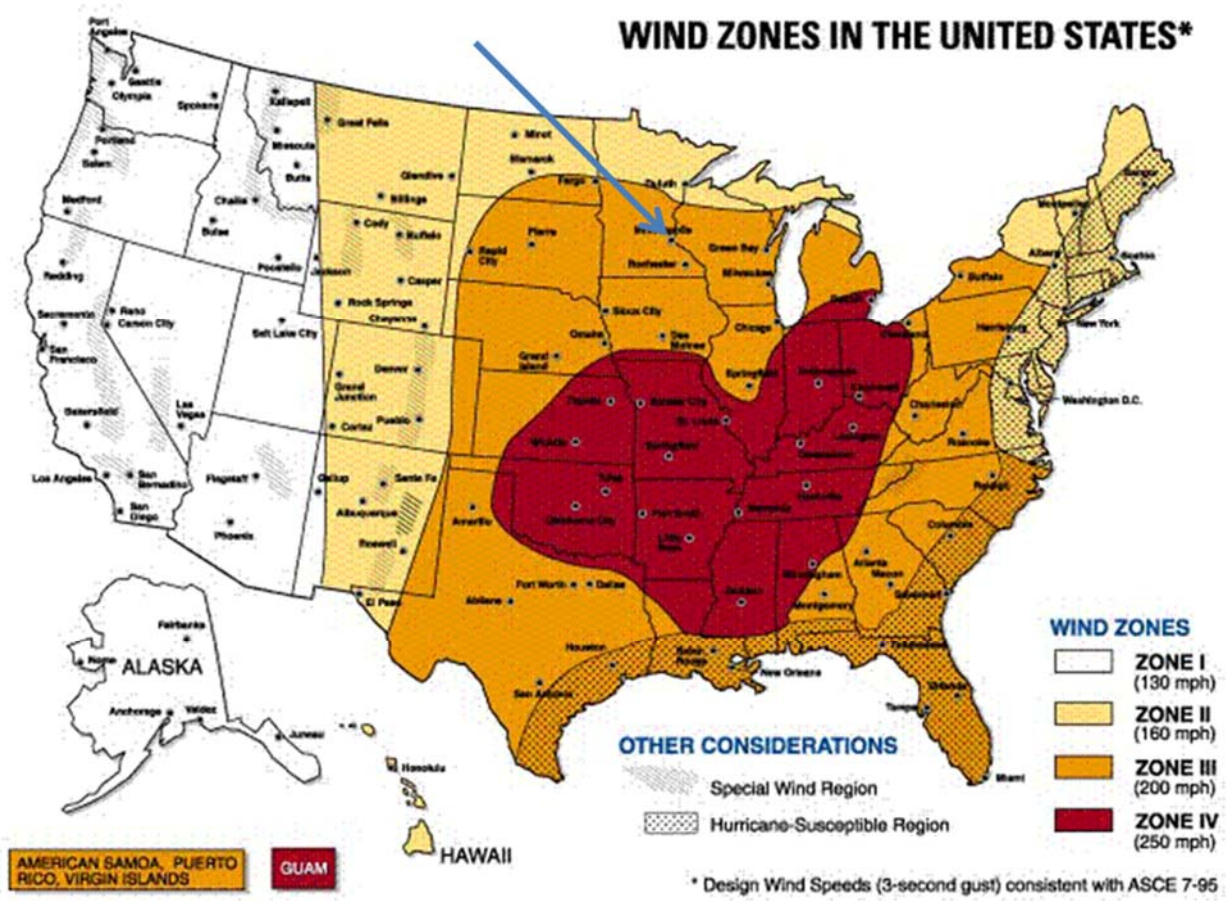


Figure I.2 Wind zones in the United States

Source: https://www.fema.gov/graphics/library/wmap.gif

Extent

Each year, people are killed or seriously injured by severe thunderstorms despite advance warnings. While severe thunderstorms are most common in the spring and summer, they can occur any time of the year.

Many hazardous weather events are associated with thunderstorms. 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. 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.

Lightning is responsible for fires around the world each year, as well as deaths when people are struck. Rainfall from thunderstorms can cause flash flooding, which can change small creeks into raging torrents in a matter of minutes, washing away large boulders and man-made structures. Large hail damages cars and windows, and can kill wildlife or livestock caught out in the open.

In the City of Saint Paul, most wind damage in the past ten years has been limited to downed trees and power lines, blocked roads, and interruption of electrical power.

Previous Occurrences

Numerous severe thunderstorm events have been documented in Saint Paul, producing weather conditions that resulted in multiple types of impacts, including hail, straight-line winds, tornadoes, heavy rains and flooding.

Table 3.2-4: Historic Damaging Wind/Thunderstorm/ Hail Occurrences in Saint Paul

Date	Event	Wind (Knots)	Hail (Inches)
8/6/1996	Thunderstorm Wind	60	
5/15/1998	Hail		1
5/30/1998	Thunderstorm Wind	67	
6/16/1998	Hail		1
6/25/1998	Thunderstorm Wind	60	
6/26/1998	Thunderstorm Wind	65	
8/9/1998	Hail		1.25
6/6/1999	Thunderstorm Wind	60	
5/1/2001	Hail		1.25
4/18/2002	Hail		1
6/23/2003	Thunderstorm Wind	50	
6/24/2003	Thunderstorm Wind	52	
5/9/2004	Thunderstorm Wind Hail	63	
9/23/2004	Thunderstorm Wind	58	
6/8/2005	Thunderstorm Wind	50	

Date	Event	Wind (Knots)	Hail (Inches)
6/13/2005	Hail		1
6/20/2005	Thunderstorm Wind Hail	57	1.75
7/23/2005	Thunderstorm Wind	52	
9/12/2005	Thunderstorm Wind	50	
4/6/2006	Hail		1
7/24/2006	Thunderstorm Wind Hail	53	1.5
7/8/2007	Hail		1.5
7/26/2007	Thunderstorm Wind	55	
8/11/2007	Thunderstorm Wind	55	
8/28/2007	Thunderstorm Wind Hail	50	1
9/20/2007	Thunderstorm Wind Hail	50	
5/25/2008	Thunderstorm Wind	55	
7/11/2008	Thunderstorm Wind	50	
6/25/2010	Hail		1.75
7/14/2010	Thunderstorm Wind	51	
7/17/2010	Thunderstorm Wind	55	
9/21/2010	Thunderstorm Wind Hail	52	1.5
7/19/2011	Hail		1.25
5/19/2012	Thunderstorm Wind Hail	50	1.75
6/10/2012	Thunderstorm Wind	61	
11/10/2012	Thunderstorm Wind	61	
6/16/2013	Thunderstorm Wind	52	
6/21/2013	Thunderstorm Wind Hail	56	
6/29/2015	Hail		1.5
7/17/2015	Thunderstorm Wind	54	
7/5/2016	Thunderstorm Wind	58	
7/27/2016	Thunderstorm Wind	53	
6/11/2017	Thunderstorm Wind	50	
6/13/2017	Thunderstorm Wind	56	
7/9/2017	Hail		1
10/3/2018	Thunderstorm Wind	50	

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

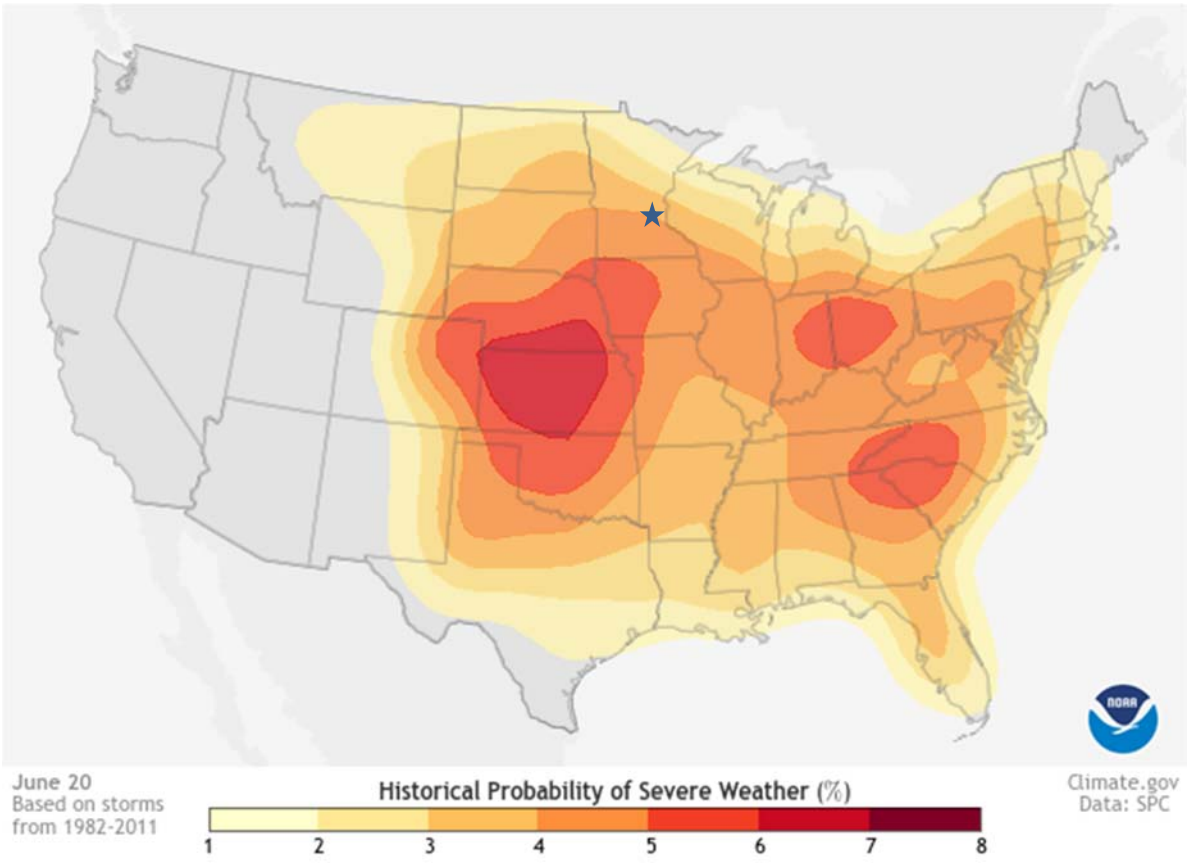
Probability of Future Events

Saint Paul HIRA Evaluation Tool Probability Scores: Combined Score – 4 (High)

- **Damaging Winds – 4 (high)**
- **Lightning** *[Not addressed in the Tool as a separate hazard, but probability is provided based on previous occurrences]* **– 1 (unlikely)**
- **Hail – 3 (medium)**
- **Combined Score – 4 (high)**

Multiple methodologies are used for various hazards to attempt to predict the probability of future events, such as severe weather and its specific conditions related to damaging winds, lightning and hail. These methodologies support and enhance the probability findings based on historical frequencies. One such method used by the NOAA Storm Prediction Center (SPC) determines the historical probability of severe weather based on analysis of previous severe weather event frequency. **Figure 3.2-B** illustrates the application of the SPC data in one such format, which shows that the area of Minnesota where Saint Paul is located has a historical probability of severe weather in the range of three percent (3%).

Figure 3.2-B: Severe Weather Climatology Map, 1982 - 2011



City of Saint Paul is noted by a blue star.
Source: Severe Weather Climatology, NOAA/National Weather Service Storm Prediction Center; accessed at https://www.climate.gov/maps-data/data-snapshots/data-source-severe-weather-climatology [This map represents the most current map data available as of February 2019.]

3.2.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] 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.

In general, the City of Saint Paul is highly vulnerable to damaging wind/severe thunderstorms which may be catastrophic to people, structures, and infrastructure, and

cause large numbers of injuries and fatalities, building losses, and disruption of critical infrastructure.

There is potential for impacts to Saint Paul's natural environment and economy through and indirect consequences described in the primary and secondary impact descriptions below.

Life Safety (Public and Responders)

All residents of the planning area are potentially at risk for damaging wind/severe thunderstorm impacts.

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. This is especially true if more than one component is present, such as severe winds and large hail at the same time. In addition, the safety of emergency responders may be at risk during search and rescue operations following impact or in response to fires or hazardous material spills caused by lightning, hail and/or damaging wind.

Vulnerable populations identified by the jurisdiction include people who are:

- limited-English speakers
- elderly
- of lower socioeconomic status
- disabled (physical and mental)
- unable to access traditional methods of communication e.g. television
- homeless

Property (Facilities and Infrastructure)

A severe storm hitting 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 constructed to withstand the high wind speeds as site-built structures.

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

The City of Saint Paul has adopted the 2015 Minnesota State Building Code. Sections of the code that address disaster mitigation for high risk hazards include:

- 1335 Flood Proofing Regulations (The "1972 Flood Proofing Regulations" as promulgated by the Office of the Chief Engineers, U.S. Army, is incorporated by

reference and made a part of the State Building Code , as amended.)

- 1370 Storm Shelters – Manufactured Home Park Storm Shelter Design (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/codes15.asp

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 program operations in the event of resource shortfalls such as personnel or services. 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, should that be required.

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 damaging wind or thunderstorm is low.

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.

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[1] as well as mitigation.

A damaging wind/thunderstorm event has the potential to test the public's confidence in its elected leadership if critical preparedness information is not timely, consistent, coordinated, and accurate.

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.

Repetitive Losses

Repetitive loss information has not been collected or maintained in relation to tornadoes for the City of Saint Paul.

Capabilities

For the purpose of saving lives and preventing injury, the focus for risk reduction in relation to damaging wind/severe thunderstorm is on preparedness measures as well as mitigation, which includes the following:

- Public information and education relating to protective measures for individuals and families, such as sheltering-in-place, and construction of tornado safe areas/rooms.
- Issuing timely warnings
- Storm Spotter training

The City of Saint Paul Department of Emergency Management presents all-hazard (including severe weather) preparedness education and information to the public throughout the year. The primary focus for preparedness measures is life safety for the public and responders through timely warnings, safe-room construction, and shelter-in-place guidance. In addition, Ramsey County's designation as a "StormReady®[2]" county

[11] "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.

[2] StormReady® is a National Weather Service program designed to recognize communities that have reached a high level of severe weather preparedness. To be recognized as StormReady®, a community must meet criteria established jointly between the NWS and state and local emergency management officials related to receiving and issuing timely warning and alerts, public education, spotter training, drills and exercises, and interaction with the local NWS office.

ensures a higher level of preparedness for all severe weather events, including high wind and tornadoes.

Hazardous weather preparedness information from trusted sources provides guidance for people in effective and timely ways to protect themselves from high wind events. National Weather Service watches and warnings, issued through the media and local emergency management, generally provide lead time to seek shelter in safer locations. For this reason, individuals are asked to shelter-in-place by seeking the safest location within six minutes of the warning being issued. Preparedness measures for high wind can be accessed through a number of sources, including:

- FEMA – https://www.ready.gov/tornadoes
- American Red Cross - http://www.redcross.org/get-help/prepare-for-emergencies/types-of-emergencies/tornado
- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for damaging wind/thunderstorm, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0**.)

Table 3.2-5: Summary of Risk/Vulnerability Scores for Damaging Wind/Severe Thunderstorm

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Damaging Wind/Severe Thunderstorm	4	4	2	3	3.3

Table 3.2-6: Summary of Consequence Scores for Damaging Wind/Severe Thunderstorm

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements)*
Damaging Wind/Severe Thunderstorm	4	4	4	4	2	3	2	3.3

Table 3.2-7: Summary of Overall Risk for Damaging Wind/Severe Thunderstorm

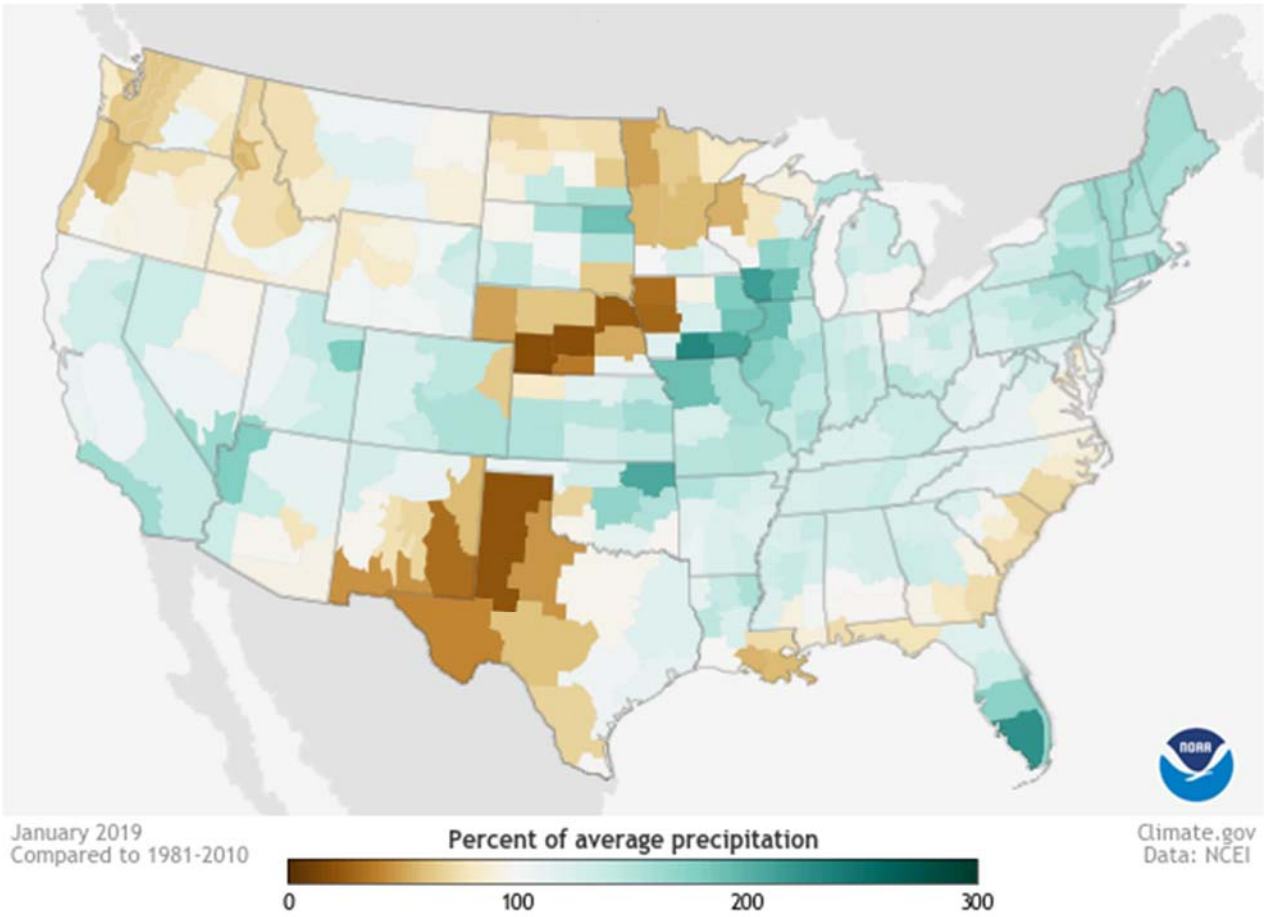
Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Damaging Wind/ Severe Thunderstorm	3.3	3.3	6.6	4	10.6	4

Potential Impacts of Climate Change

As noted in *Adapting to Climate Change in Minnesota, 2017 Report of the Interagency Climate Adaptation Team (ICAT)*, dated May 2017, trends in the changing climate are already being felt in the state. Science is unclear about the future trends in the frequency and severity of damaging thunderstorms in Minnesota. Tornadoes and damaging thunderstorm hazards may become more concentrated on fewer days, indicating the potential for more major outbreaks. However, the ICAT report notes that there is a moderately low level of confidence in forecasting in that although the overall numbers of severe thunderstorms are not changing, there is a tendency toward more outbreaks. On the other hand, there is an extremely high level of confidence in the prediction of more frequent and larger extreme rainfall events, contributing to increased chances of flooding. Scientific data indicates that one-inch rainfall events in Minnesota have been up to 26 percent more frequent during the past 40 years than the 1916-1960 average. The effects of this change are seen in detrimental impacts on the increased potential for severe storms and flash flooding.

The following figure presents a visual comparison of the current precipitation conditions of the average percent of precipitation for January 2019, as compared to 1981-2010.

Figure 3.2-C: Percent of Average Precipitation, January 2019 (Compared to 1981-2010)



Source: NOAA, https://www.climate.gov/maps-data/data-snapshots/start

Additional information related to the impacts of climate change are provided in **Section 3.0**.

Future Population Trends

Although the total population of Saint Paul has varied over the years, experiencing a drop between 1970 and 2016, the population trend over the next 25 years indicates steady growth projected to exceed the 1970 population of 309,866 and reach 344,100 by 2040. Changes in economic development and land use could impact population growth or decline. Trends in population will be monitored and evaluated in the next planning cycle.

Future Development Trends

Because the entire Planning Area is potentially susceptible to damaging wind/severe thunderstorm, all new growth and development could fall in areas potentially affected by the hazard. However, given the building codes currently in effect, development in potential hazard areas that may occur in the future will not increase the level of vulnerability to damaging wind/thunderstorm.

The potential for future growth and development will be monitored and evaluated in the next planning cycle to consider whether the level of high wind risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to damaging wind/thunderstorm as well as other information from NYS HMP updates:

- Have any damaging wind/thunderstorm events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict damaging wind/thunderstorm events or assess risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to damaging wind/thunderstorm?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to tornado?

SECTION 3.3 DROUGHT

2019 Plan Updates
• Updated statistical data and general information related to Drought has been added. • Table of previous occurrences has been updated to consider any significant drought events since 2012.

3.3.1 Hazard Profile

Drought is a condition of abnormally dry weather within a geographic region where rain is usually expected, and is thought to be one of the most complex and least understood of al natural hazards. Drought is different from a dry environment, which is seasonally dry, in the drought is a condition that extends into multiple seasons and/or years.

Hazard Description

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.

DROUGHT Assessment: Moderate Risk	**Location** – Citywide **Extent:** • **Duration** – Several weeks to months • **Speed of Onset** – Slow • **Warning Time** – Days to weeks **Seasonal Pattern** – Late summer **Probability** – Moderate **Impacts** - damage to property, turf, urban forest, wildlife, loss of revenue **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Water shortage • Loss of natural resources • Increased fire hazard • Economic loss

Types

Drought can be described as meteorological, agricultural, hydrological or socioeconomic, or may be any combination of these types.

Table 3.3-1 Definitions of Different Types of Drought

Meteorological	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
Agricultural	Refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop
Hydrological	Occurs when surface and subsurface water supplies are below normal
Socioeconomic	Refers to the situation that occurs when physical water shortage begins to affect people

Location

All areas of Saint Paul are susceptible to drought.

Extent

Most droughts occur during summer, as the weather is hot and water evaporates quickly.

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, vegetation in pastures, edible plants and 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 months or years.

Dry conditions produce:

- Low stream flows and lake levels, with abundant algae blooms
- Increased fire danger, especially in forested areas

Drought can impact urban water supplies due to the strain of lower amounts of available water. This is frequently exacerbated by extensive watering of landscapes and gardens.

The Drought Severity Classification system provides dryness levels with related ranges for each indicator. Because the ranges of the various indicators often do not 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. Additional indicators are often needed in the western U.S., where winter snowfall has a strong bearing on water supplies.

Table 3.3-2: Drought Severity Classification

Drought Severity Classification

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: ▪ short-term dryness slowing planting, growth of crops or pastures Coming out of drought: ▪ some lingering water deficits ▪ pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	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 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: U.S. National Drought Mitigation Center; accessed at National Weather Service

The *U.S. 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 areas which 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. The short-term drought indicator blends focus on one- to three-month precipitation. The long-term indicator blends the focus on 6-60 months.

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 plan remain relevant and useful and that supplies are developed sustainably. This is done to try to prevent dry/drought conditions from impacting the water availability for the Twin Cities area.

Occurrences

The City of Saint Paul has experienced 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)

There have been no recorded droughts in Saint Paul since 2012.

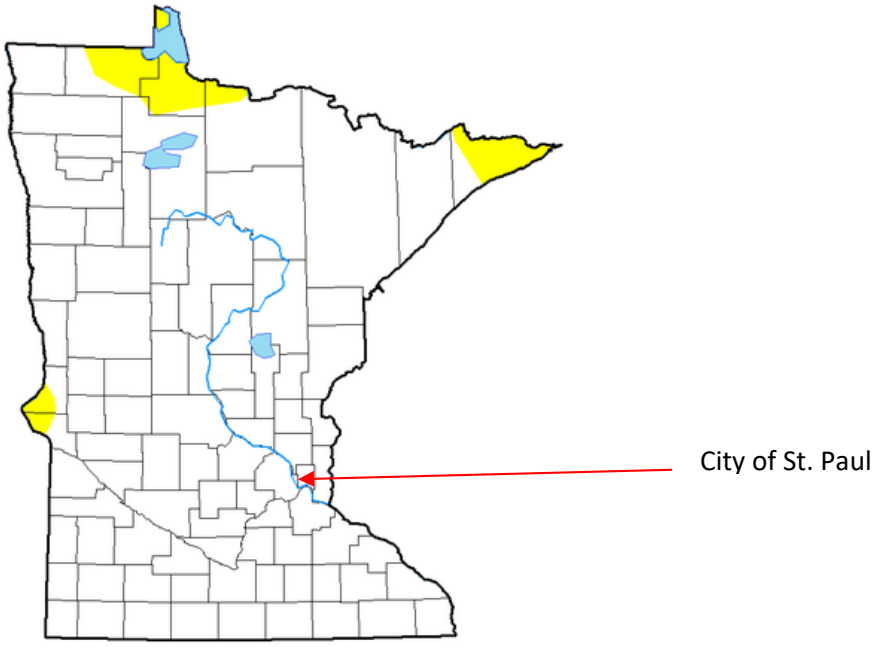
Probability of Future Events

***Saint Paul HIRA Evaluation Tool* Probability Score - Drought: 3 (medium)**

Multiple methodologies are used for various hazards to attempt to predict the probability of future events. These methodologies support and enhance the probability findings based on historical frequencies. As noted above, Saint Paul has experienced several previous drought events. It is possible to predict short-term probabilities for this type of event using weather and climate monitoring tools, and the city can probably expect a drought to occur within multi-decadal cycles.

An example of short-term drought monitoring tools is the *U.S. Drought Monitor*, which updates the status by state weekly. It is more difficult to project the long-term potential for drought based on analysis of previous event frequency due to widespread impacts, changes in climate and numerous other factors.

Figure 3.3-A: U.S. Drought Monitor – Minnesota, July 10, 2018



Source: https://www.drought.gov/drought/states/minnesota

The U.S. Drought Monitor also provides statistical summaries for drought conditions (percent area) for the current week, previous week, three previous months, start of the calendar year and the one year previously. This statistical analysis provides a perspective of the overall trend related to drought conditions.

3.3.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Drought is caused by lack of rainfall. The greatest impact is a decrease in the water supply. This can result in reduction or growth or loss of crops, and limit availability to food products. The impact on livestock is equally devastating, and can result in animal deaths from limited water supplies or lack of feed availability. Toxins can concentrate in plants under drought conditions making them lethal to livestock. The dry conditions may lead to wind erosion of top soil, or increase the risk for fire hazards. This can lead to decreased water sources, which may result in devastating losses.

Life Safety (Public and Responders)

All residents of Saint Paul are at risk for impacts of drought. The impacts resulting from drought create significant danger to life safety, the environment and the economy.

There are several vulnerable populations in the city, such as people who speak limited English, are elderly, are of a lower 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 when water supply is considered.

Emergency responses may be negatively impacted by lack of water for fire control.

Property (Facilities and Infrastructure)

Drought does not directly affect property/facilities; however, it can influence the economy.

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. Departments would be able to run operations from sites outside or around the city. The availability of critical resources could be the most vulnerable area of operations, as transportation, buildings and people would be impacted.

Environment

Drought impacts are wide-reaching. A reduction of electric power generation and water quality deterioration are potential effects. Drought conditions can cause soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion. A drought may also increase the speed at which dead and fallen trees dry out and become more potent fuel sources for wildfires. An ongoing drought which severely inhibits natural plant growth cycles may impact critical wildlife habitats. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline. The level of risk for long-term environmental impacts from a drought is low.

Economic Conditions

The impacts of drought-related conditions pose problems for many important sectors in Minnesota including agriculture, recreation, tourism, and municipal water supplies.

- Decreasing land prices
- Strained financial institutions due to foreclosures and business difficulties
- Less economic development
- Reduced use of port facilities due to crop failure
- Recreation uses curtailed.

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), 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 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.

Repetitive Losses

[EMAP 4.2.4(2)] In regards to drought, repetitive loss information has not been collected or maintained.

Capabilities

The city has assessed all state and local authorities, policies, programs, and resources for drought and the capabilities are documented in **Section 4**.

The focus for risk reduction in relation to drought is generally on preparedness measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, restricting unnecessary water usage, and identifying alternate water sources
- Issuing timely warnings

The City of Saint Paul Emergency Management Office presents all-hazard (including drought) preparedness education and information to the public throughout the year. The primary focus for preparedness measures is life safety for the public and responders through timely warnings, guidance, and protection of city resources.

Hazardous weather preparedness information from trusted sources provides guidance for people in effective and timely ways to protect themselves from severe winter storm events. National Weather Service watches and warnings, issued through the media and local emergency management, generally provide lead time to make preparations and take appropriate actions. Preparedness measures for drought can be accessed through a number of sources, including:

- FEMA – https://www.ready.gov/drought
- National Integrated Drought Information System - https://www.drought.gov/drought/resources/planning-preparedness
- American Red Cross - http://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies/drought
- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for drought, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0**.)

Table 3.3-3: Summary of Risk/Vulnerability Scores for Drought

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Drought	2	2	3	2	2.3

Table 3.3-4: Summary of Consequence Scores for Drought

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements)*
Drought	2	2	2	2	3	3	2	2.3

Table 3.3-5: Summary of Overall Risk for Drought

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Drought	2.3	2.3	4.6	3	7.6	3

Future Population and Development Trends

Because drought is not limited to geographic boundaries or population groups, it is difficult to identify development and population trends that impact this hazard. Current land use and building codes incorporate standards that address and mitigate water supply and resources.

The potential for impacts of future growth and development on drought will be monitored and evaluated in the next planning cycle. Whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future will be considered.

Potential Impacts of Climate Change

As noted in *Adapting to Climate Change in Minnesota*, 2017 Report of the Interagency Climate Adaptation Team (ICAT), dated May 2017, trends in the changing climate are already being felt in the state. Climate models project that Minnesota will have a greater tendency toward extreme heat, especially by the middle of the 21st century. The majority of models used for the 2014 National Climate Assessment indicate that although drought will remain a part of Minnesota's climate, the state will continue growing wetter through the century.

- In lower-emissions scenarios, these models project no significant change statewide in the number of consecutively dry days between precipitation events, indicating that climate change will not significantly increase the likelihood of drought in a given year.

- With the same models using higher emissions scenarios, they indicate that Minnesota may become more prone to dry periods. Combined with significant increases in hot days, the dry periods would increase the possibility of short-term and even long-term drought risk, suggesting that drought could become worse as a result of climate change. The effects of this change would be seen in detrimental impacts to agriculture and the environment, including water supplies and feed crops.

Additional information related to the impacts of climate change are provided in Section 3.0

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to drought as well as other information from the Minnesota SHMP updates:

- Have any drought events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict drought events or assess risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to drought?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to drought?

SECTION 3.4 EXTREME HEAT/COLD

2019 Plan Updates
• Updated statistical data and general information related to Extreme Heat/Cold has been added. • Table of previous occurrences has been updated to add significant extreme heat/cold events between 1950 and 2018. • The return interval for extreme heat/cold has been added to determine probability for future events.

3.4.1 Hazard Profile

Heat is one of the leading weather-related killers in the United States, despite the ability to prevent or reduce the risk of heat exhaustion and heat stroke through outreach and intervention[1]. Based on previous occurrences and the potential for impacts to the population, built environment, natural environment and economy, extreme heat/cold is profiled to determine an overall risk to Saint Paul. This section emphasizes the preparedness role of public education and early warning in reducing the threat to humans from extreme heat and cold.

Hazard Description

Although extreme heat/cold conditions can occur in combination with other weather events, such as drought and winter storms, extreme heat/cold are the conditions with the highest potential to impact the health of the population.

EXTREME HEAT/COLD Assessment: High Risk	**Location** – Citywide **Extent:** • **Duration** – Days to weeks • **Speed of Onset** – Slow • **Warning Time** – 12 to 36 hours **Seasonal Pattern** – Mid-winter to late summer **Probability** – Moderate **Impacts -** Loss of utilities, damage to buildings and exterior equipment, breakdown of vehicles **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Power/utility outages • Medical attention for vulnerable populations • Vulnerable animals and plants • Frozen or overheated facilities and infrastructure • Mass care in shelters

Types

[1] *EPA's Excessive Heat Events Guidebook at: www.epa.gov/heatisland/about/pdf/EHEguide_final.pdf).*

Extreme Heat

Extreme heat is defined as a **long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees**. In extreme heat, evaporation is slowed and the body must work extra hard to maintain a normal temperature. This can lead to death by overworking the human body.

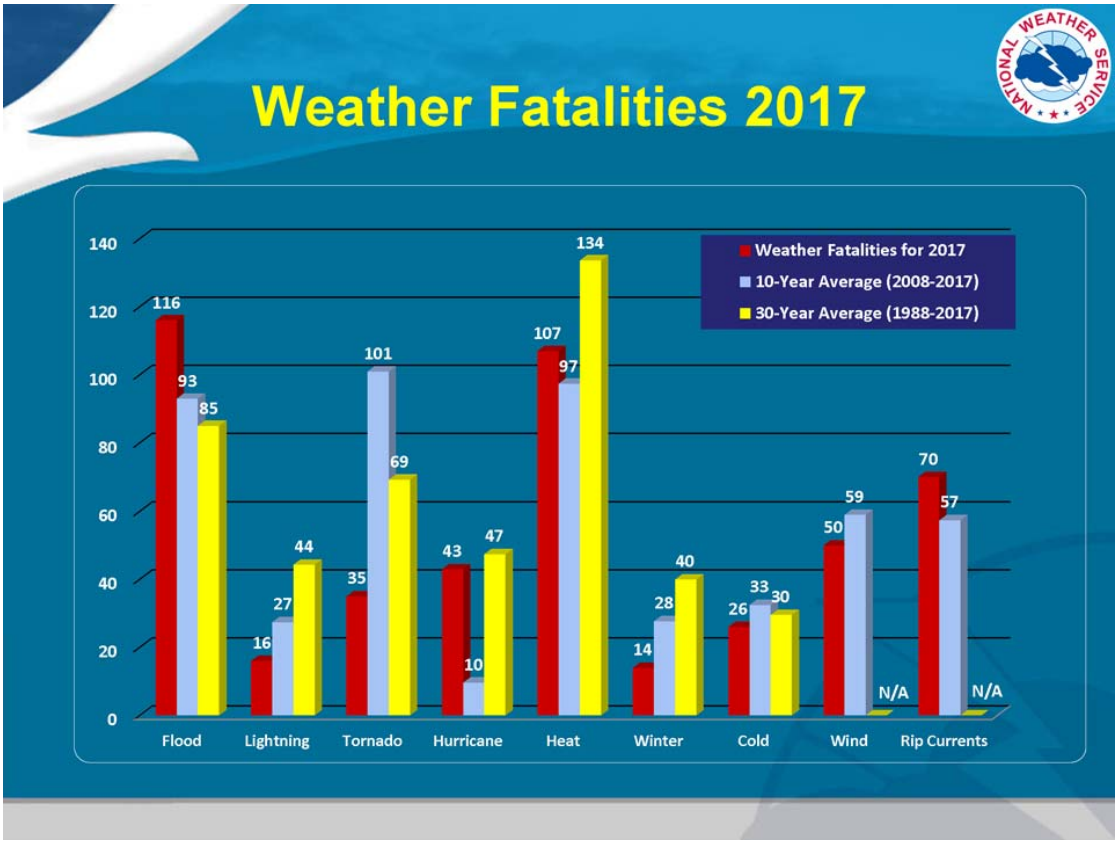
Excessive heat is especially hazardous in urban centers, where population density, the urban heat island, and building construction exacerbate the effects of high heat. A combination of high heat and humidity can lead to heat-related illness, including heat cramps, heat exhaustion, and heat stroke.

Heat-related illness can occur when the ability of the body to cool itself is challenged, or when there are insufficient levels of fluid or salt in the body due to sweating or dehydration. Heat-related illnesses increase as the combination of temperature and relative humidity increase.

Other factors include:

- age of a person
- medical conditions
- factors that amplify the heat/humidity of the environment
    - direct sun
    - being inside a hot car
    - physical exertion
    - buildings without air conditioning or electrical power.

Figure 3.4-A: Weather-Related Fatalities, 2017



Source: http://www.nws.noaa.gov/om/hazstats.shtml

Extreme Cold

There is no official or standardized definition of extreme cold. For Minnesotans, extreme cold occurs when already-cold arctic air combines with brisk winds to compound the effects of the cold temperatures. Commonly, weather forecasts during the winter season include a wind chill factor combined with the temperature. This is the temperature it feels like outside and is based on the rate of heat loss from exposed skin caused by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin temperature to drop. Warnings and advisories are issued when wind chill temperatures are potentially hazardous to people. Wind chill does not impact inanimate objects like car radiators and exposed water pipes, because these objects cannot cool below the actual air temperature.

Location

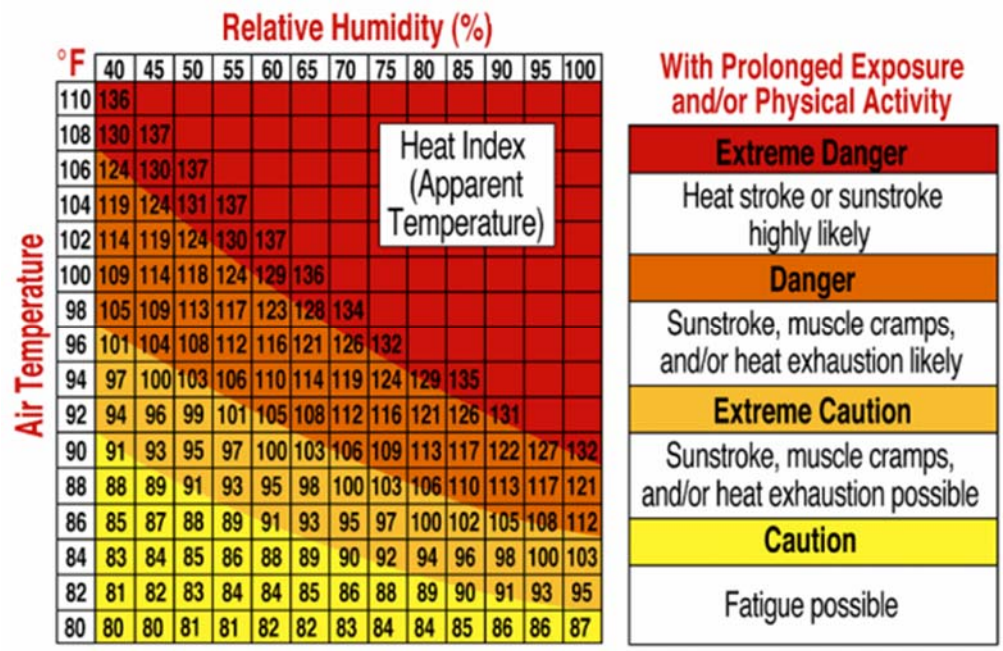
All areas within Saint Paul are susceptible to extreme heat and cold and their effects.

Extent

The City of Saint Paul experiences the extremes of summer heat and winter cold. Record temperatures for the City range from a high of 108 degrees in 1936 to a low temperature of –41 in 1888.

Extreme heat has a harmful effect on humans, which is exacerbated when relative humidity is high. The Heat Index (image below), also known as the apparent temperature, is a subjective measure of what it feels like to the human body when relative humidity is factored into the actual air temperature. Relative humidity is a measure of the amount of water in the air compared with the amount of water that air can hold at the current temperature. The body feels warmer when it's humid, and this is why relative humidity is important when considered along with high temperatures. The National Weather Service (NWS) issues a *Heat Advisory* 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.

Figure 3.4-B: Heat Index and Relative Humidity, Effects on People

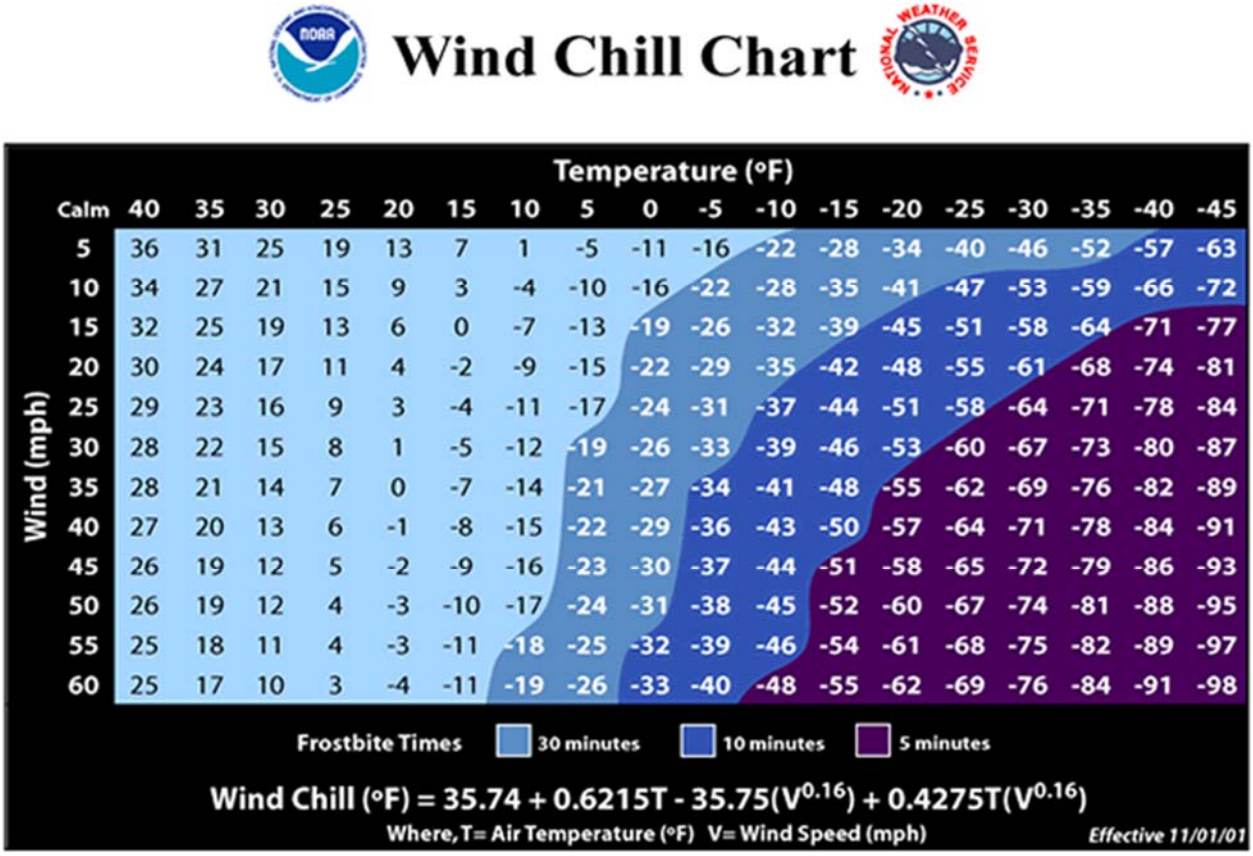


Source: National Weather Service, NOAA

During periods of extreme cold, the NWS uses the Wind Chill Temperature index depicted in the figure below to accurately calculate how cold air feels on human skin. A Wind Chill

Advisory is issued when wind chills of 35 degrees below zero with winds of at least 10 miles per hour are expected. The chart includes a frostbite indicator, showing the points where temperature, wind speed and exposure time will produce frostbite on humans. The three shaded areas of frostbite danger show how long (30, 10 and 5 minutes) a person can be exposed before frostbite develops. As an example, a temperature of 0°F and a wind speed of 15 miles per hour will produce a wind chill temperature of -19°F, which can freeze exposed skin in 30 minutes.

Figure 3.4-C: Wind Chill Chart



Source: National Weather Service. Available at: http://www.nws.noaa.gov/om/cold/resources/wind-chill-brochure.pdf

Occurrences

The Storm Events Database, National Centers for Environmental Information (NCEI), records a total of 27 events in Ramsey County related to all types of extreme heat/cold between 1950 and April 2018.

Table 3.4-1: Extreme Heat/Cold Events History, Ramsey County, 1996- 2018

Event Type(s)	Number of Occurrences	Deaths/ Injuries	Property Damage	Crop Damage
Excessive Heat/Heat	10	0	0	0
Extreme Cold/Wind Chill and Cold/Wind Chill	16	5 deaths, 2 injuries	0	0
TOTALS	**26**	**5/2**	**0**	**0**

It should be noted that the above statistics likely under-report the significance of heat and cold health impacts, as many injuries do not require hospitalization or a call to 9-1-1 (which triggers the above statistics). The statistics also do not capture heat/cold effects that result in categorizing the effects as a more serious health issue, such as heart attack or asthma attacks.

Most notable and recent extreme temperature events in Ramsey County/Saint Paul include:

Extreme Heat

- July 1999 – Heat indexes were in the 95 to 114 degrees range with overnight lows maintaining in the 80s. On July 30, the Twin Cities tied an all-time record high dew point of 81 (equaling a mark set in 1995), with the heat index climbing past 100 degrees at Minneapolis-Saint Paul Airport and many other locales.

- July - August 2001 – A persistent heat wave brought temperatures into the upper 80s and lower 90s across a large portion of central and southern Minnesota. Dew points climbing into the middle 70s to lower 80s, resulted in triple digit heat indices. The excessive heat persisted for five days and resulted in five fatalities in Minneapolis and its suburbs.

- July 18 – 22, 2016 – A large area of high pressure caused temperatures to rise into the 80s and 90s across the state, combining with very high dew points in the mid to upper 70s. This condition created heat indices between 100-115 degrees from July 20 to July 22 over portions of central and southern Minnesota, and were not

relieved with overnight temperatures falling below the upper 70s to lower 80s. The highest heat index value in Ramsey County during this event was 116 degrees.

Extreme Cold

- January, 1994 – Extreme cold related to an arctic air mass resulted in an extended period of low temperatures ranging from -20 degrees to -40 degrees across the state with daytime highs near 0 degrees. Wind accompanying the cold resulted in wind chills from -60 to -80 degrees. This resulted in closure of all schools in the state. Car exhaust froze on contact with cold pavement causing extremely icy roadways.

- January, 2009 – A pattern of significant arctic air brought temperatures below zero over a multi-day period with brisk winds causing wind chill values to drop into the -40 to -60 degrees range. Two fatalities were recorded when two elderly males were outside for an extended period of time.

- December, 2016 – A weekend snow storm and arctic high pressure brought temperatures will below normal with wind chills around -20 degrees, causing a fatality when a woman froze to death outside the apartment building where she lived in St. Paul.

- January, 2018 – The most recent fatality related to extreme cold occurred on this date when temperatures and winds dropped wind child values near -35 degrees. An individual, who apparently died from exposure to the cold weather, was found in Saint Paul.[2]

Probability of Future Events

***Saint Paul HIRA Evaluation Tool* Probability Scores: Extreme Heat/Cold – 4 (High)**

Saint Paul has experienced periodic events related to extreme heat/cold and will experience more in the future. Changes in climate conditions may have a compounding effect on the number of extreme temperature events in the future.

3.4.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Extreme temperatures occur usually in the winter months and the late summer months; however, due to the variability in Minnesota weather extreme temperatures can happen at any time. In general, Saint Paul is moderately vulnerable to extreme heat/cold that produces high heat indices when combined with high dew points,

[2] Storm Events Database, National Centers for Environmental Information, NOAA; accessed at: https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=726404

and low wind chill values when combined with arctic winds. Extreme heat/cold has the potential to cause loss of life, infrastructure damage and economic disruptions. Prolonged events have the most potential to affect the city and its citizens, as do incidents that involve loss of heating fuel or electricity to residential areas.

Life Safety (Public and Responders)

All residents of Saint Paul are potentially at risk for impacts of extreme heat/cold. When high temperatures mix with high humidity, older adults, the very young and people with chronic disease or mental illness are at the highest risk of heat-related illness and death. Even young and healthy individuals should take precautions. City dwellers are at particular risk because of elevated temperatures in cities from the "urban heat island effect" due to the magnifying effect of paved surfaces and the lack of tree cover.

Health Issues Related to Extreme Heat
- Heat Exhaustion and Heat Stroke
- Exacerbates pre-existing conditions
- Some medications make the body more susceptible to extreme heat

Extreme cold conditions are life threatening because they affect the normal functioning of the body processes and increase the risk of death. Vulnerabilities to 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 for extended periods of time or travel in extremely cold conditions are at risk. Five deaths and two injuries have been associated with extreme cold events in Saint Paul, resulting in a focus on public education related to life safety issues.

Frostbite is an injury to the body caused by the freezing of body tissue. The most susceptible areas of the body are uncovered skin and the extremities, such as hands and feet. Hypothermia, abnormally low body temperature (below 95°F) occurs when the body loses heat faster than it can produce it.

Health Issues Related to Cold[3]
- Frostbite
- Hypothermia
- Winter weather accidents

Vulnerable populations identified by the jurisdiction include people who speak limited English, the elderly, the very young, people with medical conditions exacerbated by heat/cold or the inability to control body temperatures, 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). 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.

[3] "Cold Weather Safety", National Weather Service, NOAA; accessed at https://www.weather.gov/safety/cold

The homeless/transient populations are vulnerable to any extreme weather events. Saint Paul and Ramsey County have provided shelter from extreme cold and extreme heat in facilities such as libraries, and park and recreation centers. Additional facilities and shelter plans continue to be developed. VOADs (Volunteer Organizations Active in Disasters) have also been very active in the effort to provide shelter.

First responders may be affected by extreme temperatures due to prolonged exposure during increased call volumes for accidents and medical emergencies.

Property (Facilities and Infrastructure)

Buildings or roads may be damaged due to the extreme temperatures. Utilities such as communications and electricity may be affected as well. Heavy electrical usage during extreme heat/cold may lead to prolonged power outages, causing the disruption or failure of other critical infrastructure.

A cascading event may be created when loss of heating or cooling in a building is caused by another incident such as a fire or flooding.

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. Departments would be able to run operations from sites outside or around the city. The availability of critical resources could be the most vulnerable area of operations, as transportation, buildings and people would be impacted.

Environment

Extreme heat may affect the environment if prolonged events lead to drought. Extreme cold may cause pipes to freeze and break potentially leaking hazardous materials. There is a low potential for long-term effects to the environment due to an extreme temperature event.

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. Food and supply shortages may occur if the weather disrupts transportation of resources or adversely impact individuals/families lacking adequate transportation to secure food and essential supplies. Extreme heat conditions may also result in disruption of special events that support the tourism economy in Saint Paul.

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 economic losses in the jurisdiction.

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 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.

An extreme heat or cold event has the potential to test the public's confidence in its elected leadership if critical preparedness and response information is not timely, consistent, coordinated, and accurate.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to extreme heat/cold.

Capabilities

The focus for risk reduction in relation to extreme heat/cold is generally on preparedness and response measures, which include the following:

- Disseminating public information and education relating to protective measures for individuals, families and businesses, such as sheltering-in-place, early closures, restricting outdoor activity, avoiding hazardous road conditions, the dangers of using supplemental heating systems such as space heaters, and cautions against excessive use of air conditioning systems.

- Issuing timely warnings
- Opening of emergency cooling and heating shelters within the city or the metro area.

The City of Saint Paul Emergency Management Department presents all-hazard (including extreme heat/cold) preparedness education and information to the public throughout the year. The primary focus for preparedness measures is life safety for the public and responders through timely warnings and shelter-in-place guidance, and protection of City resources.

Ramsey County's designation as a StormReady®[4] county ensures a higher level of preparedness for all severe weather events, including extreme heat/cold.

Hazardous weather preparedness information from trusted sources provides guidance for people in effective and timely ways to protect themselves from extreme heat/cold events. National Weather Service watches and warnings, issued through the media and local emergency management, generally provide lead time to make preparations and shelter in safe locations. Preparedness measures for extreme heat/cold can be accessed through a number of sources, including:

- FEMA – https://www.ready.gov/heat; https://www.fema.gov/media-library/assets/documents/117016; https://www.ready.gov/winter-weather
- National Weather Service, Weather Prediction Center - https://www.weather.gov/safety/heat; https://www.weather.gov/safety/cold
- American Red Cross - http://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies/heat-wave-safety; http://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies/winter-storm
- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for extreme heat/cold, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0** and **Appendix B**).

[4] StormReady® is a National Weather Service program designed to recognize communities that have reached a high level of severe weather preparedness. To be recognized as StormReady®, a community must meet criteria established jointly between the NWS and state and local emergency management officials related to receiving and issuing timely warning and alerts, public education, spotter training, drills and exercises, and interaction with the local NWS office.

Table 3.4-2: Summary of Risk/Vulnerability Scores for Extreme Heat/Cold

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Extreme Heat/Cold	4	4	2	3	3.0

Table 3.4-3: Summary of Consequence Scores for Extreme Heat/Cold

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements)*
Extreme Heat/Cold	4	4	3	2	3	3	3.1

Table 3.4-4: Summary of Overall Risk for Extreme Heat/Cold

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Extreme Heat/Cold	3.0	3.1	6.1	4	10.1	3

Future Population and Development Trends

Because extreme heat/cold is not limited to geographic boundaries or population groups, it is difficult to identify development and population trends that impact this hazard. Current land use and building codes incorporate standards that address and mitigate multiple hazards.

The potential for impacts of future growth and development on extreme heat/cold will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Potential Impacts of Climate Change

The Interagency Climate Adaptation Team, State of Minnesota issued the report, *Adapting to Climate Change in Minnesota*[5] in May 2017 as a tool to guide Minnesota state and local agencies in two approaches to climate change - climate adaptation and climate mitigation. Observed trends in climate change acknowledge that there is a rapid decline in severity and frequency of incidents of extreme cold. Projections for extreme heat events indicate more hot days with increases in severity, coverage, and duration. Additional information about climate change impacts are integrated throughout appropriate areas of this plan, as described in **Section 3.0.**

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to extreme heat/cold as well as other information from the *Minnesota State Hazard Mitigation Plan* updates:

- Have any extreme heat/cold events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict extreme heat/cold events or assess risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to extreme heat/cold?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to extreme heat/cold?

In addition to these factors, current scientific climate change data and adaptation measures should be closely reviewed in order to understand developing trends in extreme temperatures.

[5] *Adapting to Climate Change in Minnesota* is available online at https://www.pca.state.mn.us/sites/default/files/p-gen4-07c.pdf.

SECTION 3.5 FLOOD

2019 Plan Updates

- Hazard occurrence data has been updated to reflect recent events.
- Additional references were added to validate location, extent and risk.
- Information from the 2012 Plan was reorganized to improve plan flow.
- Enhanced impact/consequence, risk and vulnerability methodology was applied.

3.5.1 Hazard Profile

Floods are the number one natural disaster in the United States in relation to impacts and costs. From 2006 to 2015, total property damage insurance claims averaged $1.9 billion per year. Weather fatality statistics for the United States

Hazard Description

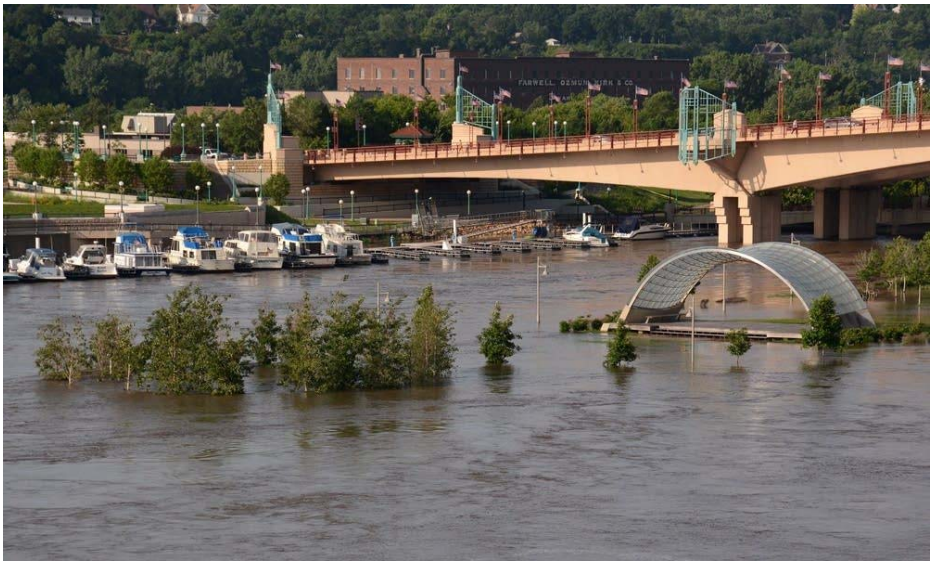
Urban flooding occurs when water overwhelms drainage systems and waterways and makes its way into the basements, backyards, and streets of homes, businesses, and other properties. It can occur as a result of heavy rainfall, rapid snowmelt, dam or levee breaks, water main breaks, or backed-up stormwater run-off. Flood depths may vary from a few inches to many feet. They can occur in a matter of minutes or over a long period of time and may last days, weeks, or longer.

As land is converted from fields or woodlands to roads or parking lots, it loses its ability to absorb rainfall. Because of this, densely populated areas are at a high risk for flash floods. The construction of buildings, highways, driveways, and parking lots increases runoff by reducing the amount of rain absorbed by the ground.

Saint Paul has a long history of flood events. Based on historical occurrences, federal disaster declarations, and analysis of impacts and consequences, flooding is one of the most frequent and costliest natural hazards impacting Saint Paul.[1] With the availability of flood mitigation assistance in recent years, large tracts of the flood-prone riverfront have been mitigated by relocating structures from repetitively flooded areas and converting areas to permanent open space and recreational sites.

Figure 3.5-A: Flooding on Raspberry Island, June 2014

[1] Federal Disaster Declarations



Source: Tim Nelson/MPR News, June 26, 2014; available at: https://www.mprnews.org/story/2014/06/26/flood-crest-st-paul

FLOOD **Assessment: Moderate Risk Hazard**	**Location** – Mississippi River floodplain (Lowertown, West Side, Hidden Falls, Crosby, Harriet Island, Lilydale Regional Park, Lambert's Landing, Pig's Eye, Battle Creek and Upper Landing Development) **Extent:** • **Duration** – Several weeks • **Speed of Onset** – Slow • **Warning Time** – Days **Seasonal Pattern** – Spring/Summer **Probability** – Moderate **Impacts** - Major damage to buildings and property **Repetitive Loss** – None	***Potential Cascading Effects*** • Power/utility outages • Traffic/roadway damage/closures • Resident/visitor safety • Increased security • Loss of essential services • Redirect of staff/equipment • Loss of revenue • Streambank erosion

Types

Two types of flooding may impact the Saint Paul area. A ***riverine flood*** occurs when water levels exceed the river banks due to persistent rain events for extended periods of time, rapid snowmelt, or an ice jam. A ***flash flood*** is typically caused by heavy rainfall within a short time period, typically less than six hours, a dam or levee break, or after a sudden release of water from a debris or ice jam.

Detection & Warning

The National Weather Service issues the following flood advisories, watches and warnings.

- ***Flood Advisory***: Thunderstorms have produced heavy rainfall that may result in ponding of water on roadways and in low-lying areas, as well as rises in small stream levels, none of which pose an immediate threat to life and property.

- ***Flash Flood Watch***: Atmospheric and hydrologic conditions are favorable for short duration flash flooding and/or dam break is possible.

- ***Flash Flood Warning***: Excessive rainfall producing thunderstorms have developed, lead to short duration flash flooding. A warning may also be issued if a dam break has occurred.

- ***Urban and Small Stream Advisory:*** This advisory alerts the public to flooding which is generally only an inconvenience (not life-threatening) to those living in the affected area. Issued when heavy rain will cause flooding of streets and low-lying places in urban areas. Also used if small rural or urban streams are expected to reach or exceed bankfull. Some damage to homes or roads could occur.

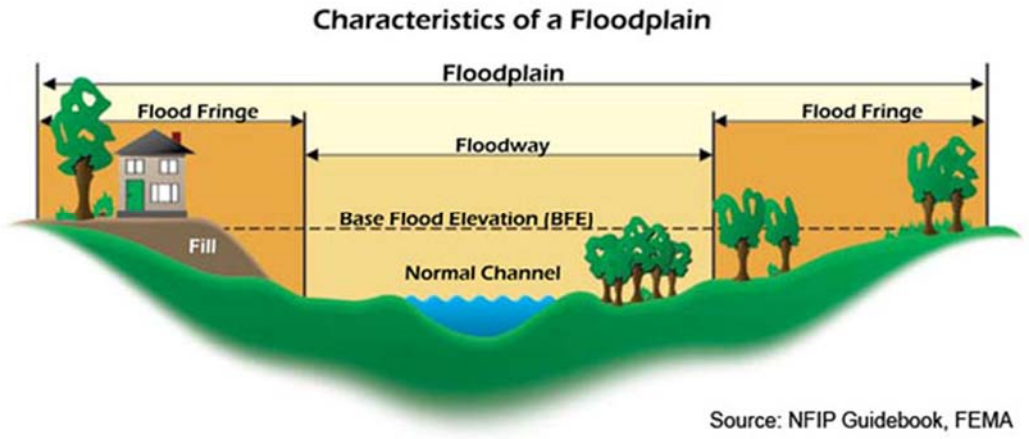
Flash Flood Indications and Forecasting

Currently, the operational method for forecasting flash floods at the National Weather Service is to utilize the Flash Flood Monitoring and Prediction software package to compare rainfall estimates with flood-induced rainfall accumulation thresholds, known as flash flood guidance values. The success of this guidance depends on both accuracy of radar-estimated rainfall rates and the flash-flood guidance values. The National Weather Service Weather Forecast Offices issues all flash-flood advisories, watches, and warnings for their respective county warning areas. The primary indicator used by forecasters to predict onset of flash flooding, is when radar-based rainfall estimates exceed flash flood guidance values over 1, 3, or 6 hours. Flash-flood guidance is defined as the threshold rainfall required to initiate flooding on small streams that respond to rainfall within a few hours.

Table 3.5-1: Flood Terms and Definitions

Term	Definition
Floodplain	The land area 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.
Floodway	This term does not reflect a recognizable geologic feature, but is defined for regulatory purposes 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 flood water downstream and is usually the area where water velocities and forces are the greatest. ***National Flood Insurance Program (N*FIP)** 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.
Flood Fringe	The land area that is outside of the stream's floodway, but is subject to periodic inundation by regular flooding; the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken.
Urban Flood	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 type of flooding does not necessarily occur within the floodplain.
Flash Flood	A rapid inundation of low-lying areas, caused by heavy rain or melting water from ice or snow. Although flash floods can occur when the volume of water in a stream, creek or river channel overtops its banks, flash floods can also occur far away from bodies of water. Outside of waterways, they typically occur when a large volume of water is unable to be absorbed into the soil or carried away by stormwater systems quickly enough.

Figure 3.5-B: Characteristics of a Floodplain



Location

The areas near the Mississippi River and Saint Paul's other bodies of water have the greatest potential for flooding and are typically designated as floodplains/Special Flood Hazard Areas through the *National Flood Insurance Program (NFIP)*. In addition to these sites, other sites are known to be flood-prone based on data and local knowledge related to past events.

Floodplains (Special Flood Hazard Areas)

In its most common usage, the floodplain most often refers to that area, (the "Special Flood Hazard Area") that is inundated by the 100-year flood, the flood that has a 1% chance in any given year of being equaled or exceeded. (During inundation, silt drops from the retreating floodwater and, trapped by vegetation, tends to build up and level the floodplain surface. Buildup is greatest near the stream, forming natural levees in areas of stable banks. Floodplain deposits may show vertical size-graded stratification (sorting), tending to be coarser near the stream. The floodplain is an integral part of the stream system and is affected by the adjustments that the system makes to its sediment load and variable flow.)

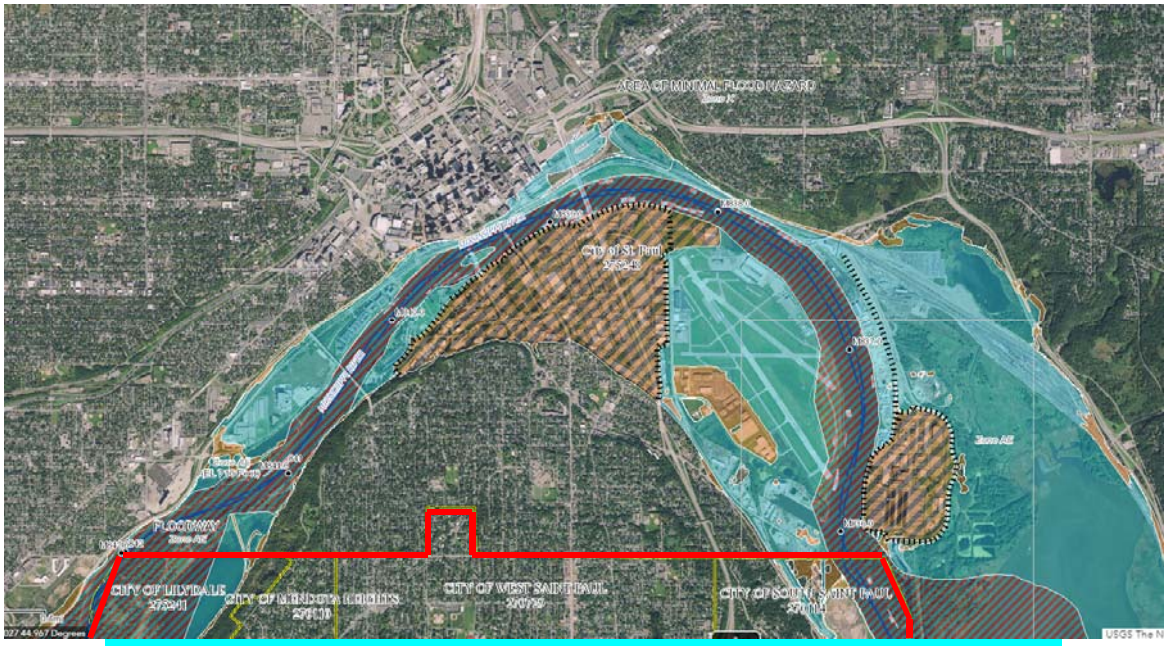
Natural floodplains have multiple functions associated with the natural or relatively undisturbed floodplain that moderate flooding, maintain water quality, recharge groundwater, reduce erosion, redistribute sand and sediment, and provide fish and wildlife habitats. The following areas are identified in relation to floodplains:

- 100-Year Flood - The flood elevation has a one 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

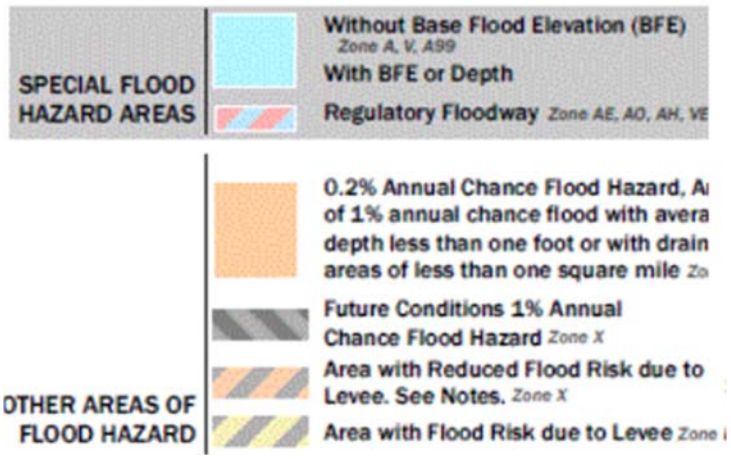
hazard area has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage.

- 500-Year Flood– The flood elevation has a 0.2 percent (1 in 500) chance percent chance of being equaled or exceeded in magnitude in any given year, and could occur more than once in a short period of time.

Figure 3.5-C: Map of Saint Paul's 100- year Floodplain



Note: All areas above the red line are located within the planning area.



Location and extend of inundation mapping reach on the Mississippi River and location of the U.S. Geological Survey streamage 05331000 at Saint Paul, Minnesota

Saint Paul has taken many steps to address localized flooding. The City's Local Surface Water Management Plan is the guiding document to identify any risks or deficiencies within the drainage system. While the State Plan and Ramsey County HAZUS can identify risk based on desktop factors, the city's Local Surface Water Management Plan is a more refined framework to inform system performance and long range capital projects at the neighborhood scale. No flood control needs are identified within the current plan. The flood inundation map is a predictive tool for illustrating regional flooding of the river corridor to help support flood response planning and communication. It remains a useful tool for outreach and coordination with property owners especially during times of flood emergency.

Flood Insurance Rate Maps (FIRMs) were developed for every jurisdiction that participates in the *NFIP*, and are updated periodically to help local jurisdictions improve planning in floodplains in order to reduce future risk. The mapping program is being enhanced through FEMA's Risk Mapping, Assessment and Planning (RiskMAP) project to provide interactive digital maps. Maps of Ramsey County and its municipalities were converted to Digital Flood Insurance Rate Maps (DFIRMs) in 2010 to provide online access to the detailed data related to the city's floodplains.

The guiding document for development in relation to the floodplain is the *City of Saint Paul Code of Ordinances, Chapter 72, Floodplain Management Overlay Districts.* Not all structures in the floodplain are at risk of flooding. However, *Chapter 72* places some restrictions on development in the floodplain with the requirements that the elevation of the lowest floor of a structure, including basements, be at least two feet above the 100-year flood elevation, or the ordinary high-water mark. There are also setback requirements from the high water mark. The *Saint Paul Zoning Code* establishes the city's floodplain management policy and requirements to assist in controlling excessive sedimentation and erosion.

Because of Saint Paul's topography, the potential for flooding exists in multiple areas of the city that may not be located within designated flood zones. Primarily, sloped streets and other areas that act as drainage channels during heavy rainfall are highly susceptible to flash flooding. In these locations, stormwater run-off may exceed the capabilities of the design limits of drainage systems, leading to increased water depth and velocity. Overland flow erodes ravines, accelerates head-cutting and steepens side slopes. Steep hillsides that have been cut to accommodate roads are especially susceptible to these conditions.

Extent

The 10-year national average of recent flood damages is about $20 billion. However, some years have run as high as $40 billion.

- Deadliest Flash Flood (Dam Collapse): 1889, Johnstown Pennsylvania : 2,200 people died
- Deadliest torrential rain flood: July 31, 1976 Big Thompson Canyon, Colorado: 143 people died
- Longest duration: 1993 61 days; The Great Midwest Flood
- Greatest Cost of Damages (U.S. Dollars): $12 Billion 1993; The Great Midwest Flood

The strength or magnitude of flooding varies greatly depending on multiple meteorological, environmental, and geological features such as latitude, altitude, topography and atmospheric conditions. In addition, there is seasonal variation in severe weather events which influence a storm's characteristics, warning time, speed of onset, and duration. Most floods are preceded by a warning period of variable length which allows for some level of preparedness, and duration can last from minutes, to hours, or even to multiple days in extreme events.

The term "stage" refers to the height of a river, or any other body of water, above a locally defined elevation. As with most rivers in the United States, the Mississippi River in the City of Saint Paul has 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. Below is a table referencing the associated stages for the Mississippi River.

Table 3.5-2: Defined Flood-Impact Levels, Mississippi River in the City of Saint Paul

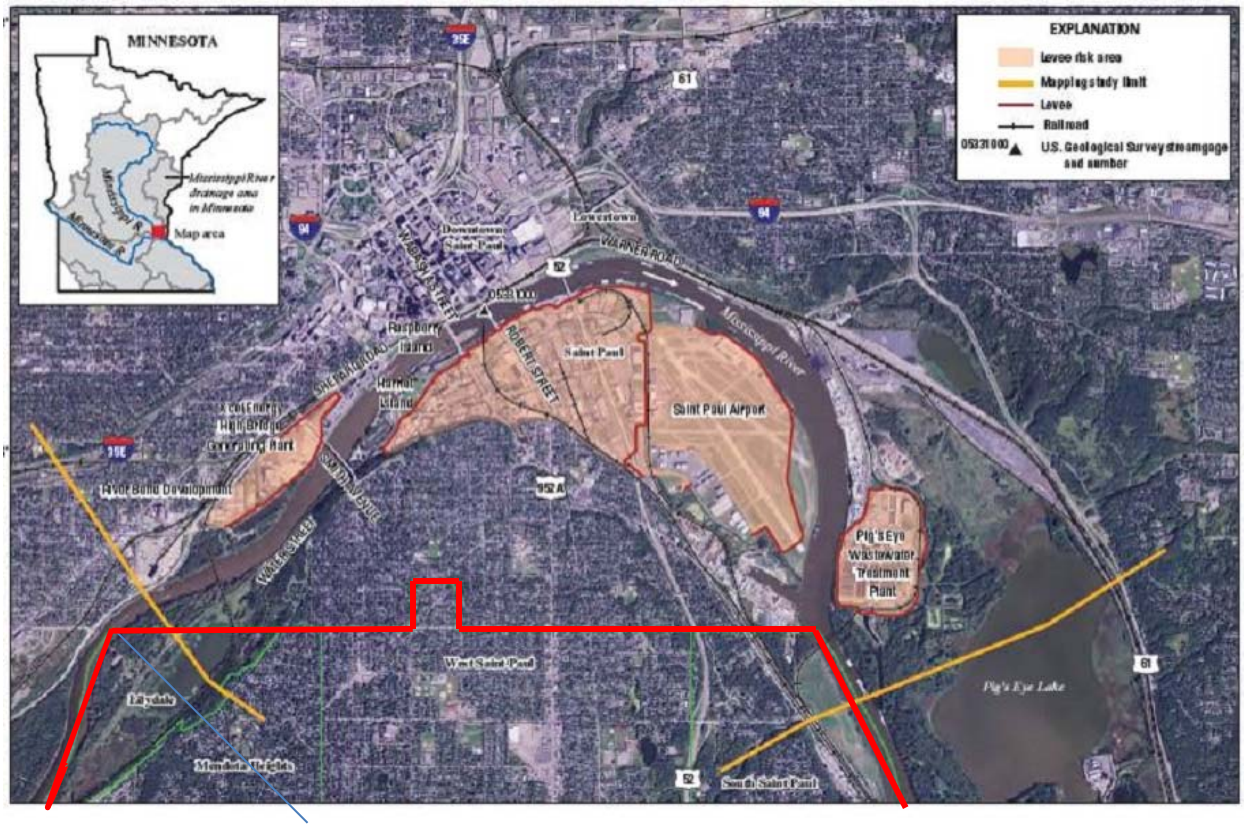
Monitoring Stage	Greater than 9 feet
Action Stage	Greater than 10 feet
Flood Stage	Greater than 14 feet
Moderate Flood Stage	Greater than 15 feet
Major Flood Stage	Greater than 17 feet

A 2014 report by the *United States Geological Survey (USGS*) in cooperation with the U.S. Army Corps of Engineers presented flood profiles computed for the 6.3-mile reach of the Mississippi River in Saint Paul.[2] This multi-agency initiative used hydraulic models to determine 25 water-surface profiles for flood stages at one (1) foot intervals ranging from approximately bankfull stage to greater than the highest recorded stage. These simulated profiles were then combined with geographic information system (GIS) digital elevation models to delineate potential areas flooded and to determine the water depths within the

[2] Czuba, C.R., Fallon, J.D., Lewis, C.R., and Cooper, D.F., 2014, Development of flood-inundation maps for the Mississippi River in Saint Paul, Minnesota: U.S. Geological Survey Scientific Investigations Report 2014–5079, 24 p., *http://dx.doi.org/10.3133/sir20145079*.
ISSN 2328-0328 (online)

inundated areas. These maps, used in combination with current stream gauge data and forecasts provide enhanced flood warning and visualization of the potential effects of a forecasted flood for the City and its residents.

Figure 3.5-D: Flood Inundation Map, Mississippi River at Saint Paul, MN



Note: All areas above the red line are located within the planning area

Location and extent of inundation mapping reach on the Mississippi River and location of the U.S Geological Survey streamage 05331000 at Saint Paul, Minnesota.

The *Minnesota State Hazard Mitigation Plan 2014*, p. 65, provides a visualization of the potential for economic loss for 100-year flood. Ramsey County, including the City of Saint Paul, is indicated in a range from $200-$500 million in economic losses due to lost jobs, business interruptions, and repair and reconstruction costs.[3]

The City of Saint Paul has spent considerable efforts towards flood mitigation and flood related issues. There have been numerous flood protection plans, engineering studies and construction projects done since 2007. Recently there have been flood mitigation studies

[3] *Brief Analysis of Flooding in Minnesota*, Minnesota Board of Water & Soil Resources, March 2011.

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) between 2007 and 2018.

Table 3.5-3: Flood Protection Activities Since 2012

East Side and Lowertown Projects:
• 2011 Sibley (Kellogg to Shepard): Reconstruction of a storm sewer system, including the addition of a slide gate.
• 2011 Jackson Pump Station: Installation of a manual transfer switch and generator plug for secondary power at storm pump station.
• 2011 Flood Barrier: Purchase of temporary flood barrier systems (Hesco and Big Bag)
• 2012 Broadway-Kellogg: Reconstruction of a storm sewer system, including replacement of a slide gate, to create separated regional and local storm sewer systems.
• 2013 Fourth, Willius, Lafayette, & John: Installation of storm sewer system to alleviate temporary pumping at Broadway-Kellogg.
• 2014 Fourth Street: Reconstruction of storm sewer system in Fourth Street, east of Willius, including the addition of a slide gate.
• 2016 Jackson-Second: Installation of slide gate on storm sewer.
• 2018 Broadway-Kellogg: Reconstruction of Broadway sanitary pump station, installation of Broadway storm pump station, including installation of permanent generator for secondary power to both sanitary and storm pump stations.
• **East Side and Lowertown Engineering Studies and Grant Applications:**
• 2010 Lowertown Flood Mitigation Study: Engineering study completed to identify and evaluate conceptual alternatives and costs for constructing a permanent flood protection system in Lowertown.
• 2010 Temporary Berm Construction Details: Plans to install a temporary earthen berm in various areas of Lowertown to mitigate rising flood waters.
• 2010 Analysis of United State Post Office Floodwall: Analysis performed of failure mechanisms for existing floodwall located in Lowertown.
• 2011 DNR Flood Damage Reduction Grant Assistance Application: Application for a DNR Grant for the design and construction of Lowertown flood mitigation improvements identified in the 2010 study.
• 2012 State Bonding Bill Application: Application for inclusion within the State Bonding Bill for the design and construction of Lowertown flood mitigation identified in the 2010 study.
• 2013 Seepage Analysis: Analysis if groundwater and floodwater seepage into Lowertown during a river flood event to aid in potential design enhancements to 2010 study.
• 2014 Mississippi River Flood Inundation Mapping: Analysis of river flood inundation on Saint Paul.
• 2014 Jackson Pump Station Analysis: Engineering analysis of the Jackson Pump Station and the intended performance during a river flood condition.
• 2014 Jackson Storm Sewer Analysis: Engineering analysis of hydrologic and hydraulic function of the gravity storm sewer system conveyed through Jackson outfall.
• 2014 Temporary Big Bag Construction Details: Plans to install a temporary Big Bag barrier in various areas of Lowertown to mitigate rising flood waters.
• 2015 State Bonding Bill Application: Application for inclusion within the State Bonding Bill for the design and construction of Lowertown flood mitigation identified in the 2010 study.

• 2016 State Bonding Bill Application: Application for inclusion within the State Bonding Bill for the design and construction of Lowertown flood mitigation identified in the 2010 study.
• 2017 Downtown Storm Sewer Analysis: Development of a comprehensive hydrologic and hydraulic model of the storm sewer system in the Downtown area.
• 2018 State Bonding Bill Application: Application for inclusion within the State Bonding Bill for the design and construction of Lowertown flood mitigation identified in the 2010 study.
• 2018 Lowertown Flood Fight Plan Update: Updating a comprehensive flood response plan for Lowertown that incorporates previous enhancements and studies.
West Side (Levee System and Flood Fringe):
• Levee System Annual Maintenance: Typical annual maintenance includes: vegetation removal/maintenance, vibration and electrical testing, painting and graffiti removal.
• 2009 & 2011 Power Pole Relocation: Power poles and fencing within the Levee easement were relocated to comply with USACE guidelines.
• 2011 Closure 8 Modifications: Concrete sill at Levee Closure 8 raised to reduce the frequency at which rail service is interrupted for flood response.
• 2013 Closure 4 Modifications: Concrete sill at Levee Closure 4 raised to reduce the frequency at which impacts to Upper River Services occur. Also included installation of a sanitary service for Upper River Services through the sill.
• 2013-2014 Water Street Reconstruction: Multiphase reconstruction of Water Street in Saint Paul. Project included raising elevation of the street, and relocation of the street further inland.
• 2017 Pump Station Roof Repair: Roof repair occurred at Custer and Moses Pump Station.
• 2017 Robie Pump Station: Reconstruction of Robie sanitary pump station including installation of redundant forcemains, and permanent generator for secondary power to the sanitary pump station.
• 2018 Vegetation Removal Contract: Contract developed to remove unwanted vegetation within the Levee easement. Work to include: tree and brush removal, stump removal, and turf restoration.
• 2018 Relief Well Testing/Maintenance: Contract developed to test Levee System relief wells.
West Side (Levee System and Flood Fringe) Engineering Studies:
• 2011-ongoing FEMA Levee Certification Project: Levee documentation and calculations 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).
• 2011 Levee System O&M Manual Update: Revisions made to the operation and maintenance manual for the Levee System.
• 2011 Levee Easement Mapping: Creation of an Easement/Ownership Map identifying land control along the Levee Alignment.
• 2012-ongoing Levee Site Plan Review: Review and documentation of proposed developments along the Levee Alignment. Projects include: buildings, utility crossings, etc.
• 2014 Levee System O&M Manual Update: Revisions made to the operation and maintenance manual for the Levee System.
Documentation of Flood Flight Materials
• An inventory of flood fight materials/equipment is housed within Public Works. A draft Levee/Floodwall Operations and Manual was submitted to USACE in 2014. Plans are developed for temporary measures in Lowertown, and are updated based on flood improvements and developments (CHS Field, Union Depot, etc.). Emergency Management requires flood response plans from private properties in the floodplain (Union Depot, Childs Road Properties, Upper Landing, etc.).

Previous Occurrences

Flood records are available through the Storm Events Database, maintained by the NOAA, National Centers for Environmental Information (NCEI), formerly the National Climatic Data Center (NCDC). The database documents weather hazards between 1950 and December 2018[4]. Flood incidents are reported by date, type and impacts to life safety, property and agricultural crops. Flooding, as an event type, were first tracked in 1996. Previous to that only tornados, thunderstorm wind, and hail were tracked in this system.

There are ten (10) flood events documented in the Storm Events Database for St. Paul (or countywide) between 1997 and 2018, which resulted in a total of one (1) death, one (1) injury and $4.5 million in property damage.

Table 3.5-4: Previous Flood Events in Saint Paul, 1997 – 2019

Incident Date(s)	Flood Type	Death	Injuries	Prop Damage ($)
7/1/1997	Flash Flood	0	1	Unknown
4/1/2001	Flood	0	0	0
6/25/2003	Flash Flood	0	0	0
9/20/2007	Flash Flood	1	0	200,000
3/20/2010	Flood	0	0	2.4 mill
6/26/2010	Flash Flood	0	0	0
6/21/2013	Flash Flood	0	0	0
6/18/2014	Flood	0	0	1.9 mill
9/17/2015	Flash Flood	0	0	0
4/23/2018	Flood	0	0	0
3/21/2019	Flood	0	0	TBD

Source: Storm Events Database, NOAA, NCEI.

The City of Saint Paul was granted a Presidential Disaster Declaration seven (7) times since 1997. Of those declarations, four (4) involved river flood events, and one involved flash flood in the Northeast part of the City (the Hoyt Avenue event of July 1997).

Table 3.5-5: Significant Historic Flood Events in Saint Paul, 1965 - 2019

Date(s)	Description and Impacts
1965	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

[4] Data maintained through December 2018, as of March 2019.

	loss of 16 lives, and property damages estimated at $181 million. It was the highest flood in Saint Paul history. (Figure **3.5-E**: Below shows flood impact.)
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
1987	Severe storms, bringing heavy rainfall and tornadoes, resulted in major flash flooding throughout the metropolitan area. Damages exceeded $12 million and resulted in Presidential Disaster Declaration #797.
April 1997	The Mississippi River crested at its fifth 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.
July 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.
2001	Flooding closed the Saint Paul Downtown Airport (Holman Field) for eleven weeks. The City subsequently approved building a floodwall, despite opposition.
June 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 Lexington.
June 2014	An exceptional amount of rainfall combined with spring thaw caused the Mississippi to crest six feet above flood stage, the sixth highest of all time. Impact to the city was minor. The impound lot was relocated.
April 2018	The flood event occurred when the Mississippi crested near downtown Saint Paul with minor flooding, primarily in boat accesses, parklands and riverside bike paths. The flooding was projected to reach a stage about 18 inches below what is considered major flood stage. The anticipated flooding prompted City officials to close streets prone to flooding.[5]
July 2018	This event required the closure of Water Street.
March-June 2019	Snowmelt derived flood event occurred from March-June of 2019. The flood event required the closure of many streets and parkland. Preliminary values from NOAA indicate a crest of 20.19 ft., making the 2019 flood event the seventh highest flood on record.

The National Weather Service, Advanced Hydrologic Prediction Service maintains an interactive map that illustrates multiple inundation levels based on the flood stage at Saint Paul, which is available at:
https://water.weather.gov/ahps2/inundation/index.php?gage=stpm5

[5] "Minnesota flood warnings include Mississippi River in St. Paul", Matt McKinney, Star Tribune, April 25, 2018.

Table 3.5-6: Historic Crests, Mississippi River at Saint Paul

Incident Date(s)	Crest
4/16/1951	17.90 ft.
4/16/1952	21.90 ft.
6/29/1957	15.46 ft.
4/16/1965	26.40 ft.
4/15/1969	25.00 ft.
5/4/1975	15.45 ft.
4/26/1979	13.98 ft.
6/26/1984	14.07 ft.
5/16/1986	16.30 ft.
5/13/1991	10.83 ft.
6/26/1993	19.65 ft.
4/10/1994	15.10 ft.
4/13/1997	22.90 ft.
4/18/2001	23.76 ft.
4/30/2001	23.60 ft.
6/23/2001	14.51 ft.
6/29/2002	9.52 ft.
7/3/2003	8.35 ft.
6/16/2004	9.94 ft.
6/17/2005	9.99 ft.
4/13/2006	12.41 ft.
4/7/2007	10.28 ft.
5/11/2008	10.01 ft.
3/31/2009	12.67 ft.
3/24/2010	18.38 ft.
10/2/2010	16.97 ft.
3/29/2011	19.01 ft.
4/10/2011	18.71 ft.
6/26/2014	20.13 ft.
2019	20.19

Source: National Climatic Data Center

Figure 3.5-E: April 13, 1965 Flooding - Kellogg Boulevard, Downtown Saint Paul

Source: Minnesota Historical Society, available at:
http://climateapps.dnr.state.mn.us/doc/journal/top5/numberfive.htm

Figure 3.5-F: Saint Paul Downtown Airport, 2001

Source: David Brewster, Star Tribune, http://www.startribune.com/neighbors-reach-a-truce-with-st-paul-s-downtown-airport/169118226/

Probability of Future Events

Saint Paul HIRA Evaluation Tool Probability Scores – Flood: 4 (High)

Urban flooding is a naturally-occurring hazard that affects cities and regions around the world, and is expected to become even more problematic in the future based on scientific predictions related to climate change. Damages from floods are also increasing as are the number of people who are affected by them.

Multiple methodologies are used for various hazards to attempt to predict the probability of future events. These methodologies support and enhance the probability findings based on historical frequencies. Using the statistical data provided by the Storm Events Database, a return interval can be calculated by dividing the number of documented events (10) by the number of years of record (22) which results in a return interval of 0.45 percent.

Human-induced land cover change and climate change are important factors in urban flooding. Rapid population growth and increasing migration from rural areas to cities lead to intense urbanization, which often increases flood risk. According to recent studies, the urban heat island effect and aerosol composition can alter the climate mechanism, which plays an important role in the storm evolution of urbanized regions. Global warming, the other main cause of hydrologic regime change, can induce the acceleration of the water cycle,

which can consequently affect the frequency and intensity of future storm events. Research has shown that in the future we may not necessarily see more rainfall, but more rainfall on less days. That is to say that if the monthly average total rainfall is four inches over eight different days, we would now see that four inches come on three or four days. So same amount of rain, just coming more at one time.

The National Weather Service, Advanced Hydrologic Prediction Service maintains an interactive model that is a probabilistic forecast issued by the North Central River Forecast Center. This model presents a graphic illustration of the weekly chance of the Mississippi River exceeding river stage at Saint Paul over a three-month period, available at: https://water.weather.gov/ahps2/probability_information.php?wfo=mpx&gage=stpm5 .

3.5.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Although Saint Paul's previous flood mitigation projects have reduced the impacts of flooding along the Mississippi River, the area's topography continues to make it prone to flooding and flash flooding during significant rain events.

Floods often cause damage to homes and businesses if they are placed in natural flood plains of rivers. Floods can result in partial or complete loss of facilities. Flooding events may also result in a temporary loss of power and/or phone service lasting from a few hours to several days. Results of these impacts often complicate communications with responders, which could affect availability of personnel and the ability to continue operations at acceptable levels.

Urban density is considered to be a vulnerability for 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 flash floods.

Life Safety (Public and Responders)

It is apparent that residents of the Planning Area are potentially at risk for impacts from this hazard. 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 are considered to be at a lower risk. The density of downtown is a vulnerable aspect in the event of a major flooding event for both residents, visitors, and responders as flooding is dangerous to navigate in and around. The number of individuals living in the Special Flood Hazard Area (100-year floodplain) has not been calculated for this update; however, a proposed action will inventory actual structures within the floodplain and this statistic will be added to the plan once it's calculated.

Health risks accompany flooding due to pooling of 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.

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).

Public safety responders may be affected if search and rescue efforts are required to evacuate populations or locate missing residents as a result of a flood incident.

Property (Facilities and Infrastructure)

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. Most property losses occur to residential structures which would cause an economic hardship for people who do not have flood insurance. The following data related to vulnerable properties within 100-and 500-year floodplains was provided for this Plan update:

Table 3.5-7: Vulnerable Properties within the 100- and 500-Year Floodplains

Use Type	Residential		Commercial & Industrial		Critical (Priority 1) Facilities
	Properties (#)	*Total Estimated Market Value*	*Properties (#)*	*Total Estimated Market Value*	*Properties (#)*
100-year	766	$284,331,900	60	$196,515,200	7
500-year	13	$60,072,800	188	$35,862,300	3

Source: City of Saint Paul GIS, Ramsey County Dataset

Note: The ten facilities noted in the table above located within the 100 and 500-Year Flood Plains fall into the following 2018 Disaster Response and Recovery Act Critical Lifeline Sectors:

- Transportation (Railway)
- Hazardous Materials (Facilities)
- Food, Water, Sheltering (Water Infrastructure)

Facilities within the special flood hazard area are generally reflective of industrial land

uses. This includes a mix of offices, shops/garages, and accessory structures as well as transfer, storage, and processing facilities.

There are also several bridges, communication facilities, and utilities (electricity, water, and sewer) located throughout the city. The communication systems throughout the city such as voice, internet and emergency services are an issue if damaged. Of critical concern is the potential for flooding to impact health and human services infrastructure, such as hospitals, nursing homes and other residential care facilities. Depending on the location and the intensity of the flooding the areas of concern are varied.

While the City of Saint Paul's zoning and land development codes regulate development in designated flood zones, some of the city's open land and roadways are lined with steep slopes that are typically excluded from these regulations. As climate change leads to more extreme rain events, these vulnerable areas will likely continue to be prone to an increased volume of water run-off leading to more frequent and severe flash flooding.

The City of Saint Paul has adopted the 2015 Minnesota State Building Code. Sections of the code that address disaster mitigation for high risk hazards include:

- 1335 Flood Proofing Regulations (The "1972 Flood Proofing Regulations" as promulgated by the Office of the Chief Engineers, U.S. Army, is incorporated by reference and made a part of the State Building Code , as amended.)

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 operations 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 impacted locations and access) and would be less vulnerable to loss of services and resources if the flood event impacted multiple areas in the City. In addition to transportation infrastructure, resources such as facilities, vehicles, equipment, and supplies could be the most vulnerable element of operations if flooding impacts or restricts access to City operational sites.

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.

Economic Conditions

The City of Saint Paul, as the capital 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.

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 as well as mitigation.

The City of Saint Paul has considered the level of public confidence in governance through various methods, including a past survey that had broad distribution to key community stakeholders as well as members of the public. The outcome of the previous survey is considered to still be valid for this plan update.

A flood event may test the public's confidence in its elected leadership if critical preparedness and response information is not presented in a timely, consistent, coordinated, and accurate manner.

National Flood Insurance Program (NFIP) and Repetitive Losses

As a participant in the NFIP, the City takes a proactive role in monitoring the number of flood policies and claims within the jurisdiction, especially noting losses to insured properties. The following data summarizes NFIP participation in the City of Saint Paul since 1978.

Table 3.5-8: NFIP Status for Insured Properties within the City of Saint Paul.

City of St. Paul (#275248)	
Initial FIRM Identified	02/09/73
Current Effective Map Date	09/16/15
Total Premiums	$137,419
Insurance in Force	$51,173,200
Total Number of Close Paid Losses	44
$ of Closed Paid Losses	$1,067,007

Occupancy	# of Policies	Premium	Insurance in Force	# of Closed Paid Losses	$ of Closed Paid Losses
Single Family	62	$21,891	$15,477,000	16	$64,974.82
2-4 Family	1	$373	$350,000	$0	$0
All Other Residential	68	$34,852	$17,570,5000	3	$160,525.91
Non-Residential	29	$80,303	$17,775,700	25	$841,506.91
TOTAL	**160**	**$137,419**	**$51,173,200**	**44**	**$1,067,007.13**

Source: State Floodplain (NFIP) Manager, Minnesota Department of Natural Resources (as of 07/31/2018)

[EMAP 4.2.4(2)] Repetitive loss structures are those structures which have sustained damages on two or more separate occasions within a 10-year time span for which the cost of repairs at the time of the flood meets or exceeds 25 percent of the market value of the structure before the damage occurred.

Table: 3.5-9: Repetitive Loss Status

Category	AE, A1-30, AO, AH, A Zones	VE, V1-30, V Zones	B, C, X Zones	TOTAL
Repetitive Loss Buildings (Total)	1	0	1	2
Repetitive Loss Payments (Total)	$37,970.85	$0	$4,470.88	$42,441.73
Repetitive Loss Payments (Building)	$37,970.85	$0	$4,470.88	$42,441.73
Repetitive Loss Payments (Contents)	$0	$0	$0	$0

Source: State Floodplain (NFIP) Manager, Minnesota Department of Natural Resources (as of 07/31/2018)

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. (See **Table 3.5-3** above.)

There are currently three (3) NFIP-insured properties with substantial damage losses in the City of Saint Paul. The City of Saint Paul will continue to be a member of the National Flood Insurance Program and promote only appropriate floodplain building and development.

Flood Capabilities

The City has assessed all Federal, State and Local authorities, policies, programs, resources, and capabilities as documented in Section 4.

Significant mitigation actions for flood have been implemented in Saint Paul over a number of years. The City's zoning, land use and floodplain management regulatory framework supports the continuation of these efforts. In addition, the City's continued focus on mitigation of, preparedness for, and response to future flood events includes maintaining

plans, equipment, exercises, training, public awareness and funding sources that focus on the flood hazard and its related impacts.

The levee/floodwall system protecting the West Side of Saint Paul is owned by the City of Saint Paul. The City operates and maintains the levee/floodwall system in accordance with guidance provided by the Army Corps of Engineers.

The City's capabilities in regard to flooding are further described in **Section 3.1: Dam/Levee Failure**. Additional information related to NFIP participation is provided in **Section 4.2.**

The public information and education focus for risk reduction in relation to flood includes preparedness and mitigation actions, which include the following:

- Preparedness measures for homes and businesses, such as flood-proofing structures and moving building contents to higher floors or higher ground
- Protective measures for individuals, families and businesses, such as avoiding high risk areas and hazardous road conditions
- Heeding timely warnings to evacuate or seek shelter

Saint Paul Emergency Management makes all-hazard (including flood) preparedness education and information to the public available throughout the year. The primary focus for preparedness measures is life safety for the public and responders through timely warnings and situational awareness; and protection of private property and City assets and resources.

Hazard preparedness information from trusted sources provides guidance for people in effective and timely ways to protect themselves from flood events. Alerts and warnings, issued through the media and local emergency management, generally provide lead time to make appropriate preparations. Preparedness measures for flood can be accessed through a number of sources, including:

- FEMA – https://www.ready.gov/flood/preparedness; https://www.fema.gov/media-library-data/1409002852888-3c5d1f64f12df02aa801901cc7c311ca/how_to_prepare_flood_033014_508.pdf
- National Safety Council (NSC) - https://www.nsc.org/home-safety/safety-topics/emergency-preparedness/flood
- American Red Cross - http://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies/flood
- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management/flood-preparations

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for flood, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0**.)

Table 3.5-10: Summary of Risk/Vulnerability Scores for Flood

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Flood	2	3	2	3	2.5

Table 3.5-11: Summary of Consequence Scores for Flood

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction's governance	Consequence Score (*Average of all Consequence elements)*
Flood	3	3	4	4	2	4	3	3.3

Table 3.5-12: Summary of Overall Risk for Flood

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Flood	2.5	3.3	5.8	4	9.8	3

Potential Impacts of Climate Change

As noted in *Adapting to Climate Change in Minnesota, 2017 Report of the Interagency Climate Adaptation Team (ICAT)*, dated May 2017, trends in the changing climate are already being felt in the state. Although science is unclear about the future trends in the frequency and severity of damaging thunderstorms in Minnesota, there is an extremely high level of confidence in the prediction of more frequent and larger extreme rainfall events, contributing to increased chances of flooding. Scientific data indicates that one-inch rainfall events in Minnesota have been up to 26 percent more frequent during the past 40 years than the 1916-1960 average. The effects of this change are seen in detrimental impacts on the increased potential for severe storms and flash flooding. Additional information related to climate change is provided in **Section 3.0**.

Future Population and Development Trends

Because flood typically occurs in identifiable geographic locations, it is more readily addressed than some other natural hazards through land development, zoning and building regulations and codes that reduce the potential for impacts. The potential for future impacts will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could continue to reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to flood as well as other information from the Minnesota State Hazard Mitigation Plan updates:

- Have any flood events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict flood failure events or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to flood?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to flood?

In addition to these factors, current scientific climate change data and adaptation measures should be closely reviewed in order to understand trends that could increase the incidence and severity of flood events in the future.

SECTION 3.6 HUMAN INFECTIOUS DISEASE

2019 Plan Updates
This hazard section has been added in this planning cycle.

3.6.1 Hazard Profile

Infectious disease outbreaks, or epidemics, occur worldwide and are one of the leading causes of death. The cause, nature, and treatment of each disease differs, but all create increased demand on health and medical resources that could potentially impact the safety and security of the jurisdiction.

The spread of infectious disease is impacted by changes in human behavior, including land use patterns; increased trade and travel; and inappropriate use of antibiotics.

One such event, the influenza pandemic of 1918 to 1919 (known as the Spanish Flu or "La Grippe") resulted in an estimated 20 to 40 million fatalities worldwide. It also killed more people than the bubonic plague (Black Death) between the years 1347 and 1351. Although studies of the Spanish Flu tell us how viruses spread and how they can be controlled, the potential for epidemics and pandemics is greater today than in past years, given the extent of world travel. Emerging diseases create new challenges for and demands on the country's healthcare system.

> *The 1918 Spanish Flu infected 28% of all Americans. An estimated 675,000 Americans died of influenza, ten times as many as in World War 1.* (*The Influenza Pandemic of 1918,* Stanford University, https://virus.stanford.edu/uda/)

Hazard Description

Epidemics strain the healthcare system over a widespread area, resulting in limited access to medical care; reduced inventories of critical medications and medical supplies; and the need for countermeasures, such as isolation, quarantine, and vaccination. The medical community may be challenged by the need to provide adequate care for many people while conducting public education campaigns to share timely preventive information.

A pandemic occurs when a new virus emerges and spreads. The word "novel" is the medical term for a new strain or previously unidentified disease. Viruses can emerge directly from animal reservoirs or result from mutations in a previously circulating virus.

Table 3.6-1: Infectious Disease Assessment

HUMAN INFECTIOUS DISEASE Assessment: Medium Risk Hazard	**Location**: Citywide **Extent** – • **Duration** – Several weeks to several months • **Speed of Onset** – Slow and may occur in multiple cycles • **Warning Time** – Days **Seasonal pattern** – None (except influenza during Fall/Winter) **Probability** – Moderate **Impacts** - Sickness in humans and/or animals, quarantine and possible death. May result in lost time for employees **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Overwhelmed health and medical resources • Closure of facilities • Loss of revenue • Loss of resources (animal death) • Quarantine (humans or animals) • Decreased available workforce • Loss of employment • Widespread economic impact

Type

Outbreaks may erupt at any time in pockets of the population. The following three terms are commonly used to classify infectious disease impacts:

- Endemic – present at all times at a low frequency
- Epidemic – sudden, severe outbreak of disease which may expand quickly, simultaneously affecting many individuals in the community
- Pandemic – an epidemic that becomes very widespread and affects a whole region, continent or the world.

An epidemic can result from illnesses including, but not limited to influenza, meningitis, measles, and tuberculosis. An epidemic does not have to be a contagious disease. Conditions such as cancer, West Nile fever, and obesity are epidemic if they affect many of the population at the same time. There are two main sources of infectious disease epidemics, and some epidemics have characteristics that are common to both:

- **Common Source Outbreak:** Affected individuals are exposed to a common agent. The exposure can be singular, meaning that all affected individuals develop a disease following a single exposure and incubation course, also called a point source

outbreak; or exposure may be continuous and variable with multiple, intermittent exposures to the source.

- **Propagated outbreak:** Disease is spread person-to-person, and affected individuals may become independent reservoirs that lead to further exposure.

Over twenty well-known diseases – including tuberculosis (TB), malaria, and cholera – have reemerged or broadened geographically since 1973, sometimes in more potent and drug-resistant forms. At least 30 previously unknown disease agents have been identified since 1973, including HIV/AIDS, Ebola, Hepatitis C, and Nipah virus, for which no cures are currently available. Of the seven (7) prevalent killers worldwide TB, malaria, and hepatitis, continue to surge, with TB and HIV/AIDS likely to account for the overwhelming majority of deaths from infectious diseases in developing countries by 2020.

Zoonotic diseases originate with animals but are transmitted to humans. Examples are Ebola virus, influenza (bird or swine flu), bacteria, fungi, and parasites. Of 1,415 pathogens known to infect humans, 61percent are zoonotic.

Emerging diseases may be transmitted by an infectious agent or microbial toxin. These include the Ebola virus, enterovirus D68, Middle East Respiratory Syndrome (MERS), legionella, and Zika virus. Transmission of infectious diseases occurs by the following primary modes:

- Airborne transmission (inhalation)
- Biological transmission (ingestion)
- Contact transmission (through skin/fluids)

Studies of the transmission patterns of the Spanish Flu of 1918 and 1919 linked outbreaks to soldiers returning from the war who brought the initial wave of influenza to military camps throughout the U.S. The path of the infection followed trade routes and shipping lanes. It was thought to be more severe in humid climates, such as those found in southern port cities. Studies of the Spanish Flu and other epidemics prompted development of the preventive health methods integral to the current public health system.

Public health and medical systems track the emergence of infectious diseases, as well as chronic conditions that may lead to mortality, such as tobacco use and obesity.

Location

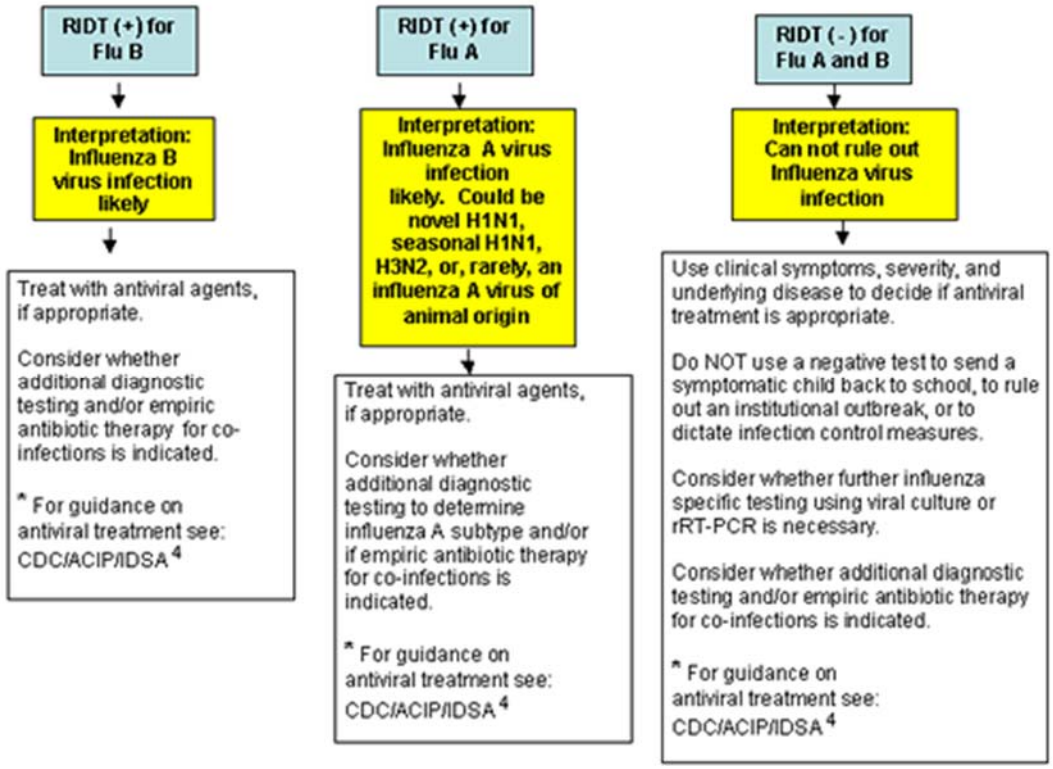
All areas of the City of Saint Paul are susceptible to infectious disease outbreaks. Because of the potential for contact with global infectious diseases through increased travel, the

Minneapolis-Saint Paul International Airport is one place where disease from other parts of the world could be introduced.

Extent

Public health and medical systems have established monitoring thresholds, surveillance procedures and treatment regimens based on the characteristics of each infectious disease. These approaches incorporate the most recent medical evidence around etiology and transmission. They are specific to geography, climate, availability of medical care, and social practices. **Figure 3.6-A** illustrates a model in use for the rapid detection of influenza.

Figure 3.6-A: Algorithm to Assist in Interpretation of Rapid Influenza Diagnostic Test (RIDT)3



Source: Interim Guidance for the Detection of Novel Influenza a Virus Using Rapid Influenza Diagnostic Tests, CDC, August 10, 2009 https://www.cdc.gov/h1n1flu/guidance/rapid_testing.htm

The public health system functions at all government levels and in collaboration with private sector partnerships. Federal, state and county-level public health agencies communicate and coordinate efforts to identify health threats. They also share information about outbreaks, new practices and protocols, and preventive measures.

The system uses multiple control activities to reduce transmission of infectious disease. **Table 3.6-1** provides a general overview of the steps involved in identifying an outbreak, preventing additional exposure, and providing treatment. Other steps may be incorporated into this process depending on the type of outbreak and available resources.

Table 3.6-2: Communicable Disease Monitoring and Containment

Measure	Description
Disease Surveillance Systems	• Maintained by health epidemiology officials and staff, supported by healthcare facilities and providers • Require reporting of specific communicable diseases by medical providers, schools, healthcare facilities, residential facilities, and sometimes the general public • Aid in quickly identifying potential outbreaks, and establishing medical countermeasures to prevent widespread transmission • Implement contact tracing and investigation to identify paths of transmission
Protective Actions, including Public Education and Information	• Public notification, when appropriate • Dissemination of appropriate measures to prevent exposure/illness • Expedited public information to manage perceptions and reduce fear • Isolation (separation from other persons when an individual may have infectious disease) • Quarantine (prohibiting non-medical staff from entering or leaving premises where a case of a communicable disease is receiving treatment)
Medical Countermeasures	• Mass prophylaxis (medication/vaccination) • Mass distribution of personal protective equipment (PPE) • Deployment of mass patient care system/Alternate care sites to reduce medical surge • Deployment of Strategic National Stockpile (SNS) assets as needed. Pre-packaged, strategically located Federal repository of antibiotics, vaccines, chemical antidotes, antitoxins, and other critical medical equipment and supplies

The Minnesota Department of Health (MDH) and Saint Paul-Ramsey County Public Health collect information on infectious diseases for the purposes of assessing trends in disease occurrence, prioritizing control efforts, and evaluating prevention strategies. Prompt reporting allows outbreaks to be recognized in a timely fashion when control measures are most likely to be effective in preventing additional cases. [1]

[1] http://www.health.state.mn.us/divs/idepc/newsletters/dcn/sum16/2016dcn.pdf

Figure 3.6-B: Strategic National Stockpile Warehouse

Source: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services: Accessed at www.cdc.gov/phpr/stockpile/index.htm

Saint Paul-Ramsey County Public Health is the lead agency for preparedness, response, recovery, and mitigation of events that affect community health or medical needs. The *Saint Paul Emergency Operations Plan (EOP)*, dated December 21, 2015, outlines the role of public health, including surveillance/detection, activation, response operations, and recovery.

The EOP outlines the mitigation function in relation to public health incidents as the following activities:

- Identify mitigation measures to reduce the impact of the emergency on the city's critical infrastructure and key resources.
- Assess the impact of the emergency on the ability of the city to perform required services and the extent of damage to community health and medical infrastructure and population.
- Develop an After Action Report (AAR) to identify actions taken, or how preventive measures and response measures could be improved in the next emergency.

Previous Occurrences

Laws that protect private medical information may constrain disease-related data-sharing. But local and state health officials maintain records documenting outbreaks, and the prevention and containment actions taken.

Although it did not reach epidemic proportions in the United States, the Ebola outbreak in 2014 illustrates how an infectious disease outbreak on another continent can impact the United States' health and medical system.

Initial Outbreak	The Centers for Disease Control (CDC) issued an initial announcement in March 2014 on the Ebola outbreak originating in Guinea, Liberia and Sierra Leone in West Africa. The first American, a government official in Liberia, died in July 2014. Several additional American health care and aid workers contracted the virus in this time period and the CDC elevated its warning level, recommending that U.S. residents avoid nonessential travel to the impacted countries. In early August 2014, an American doctor overseeing Ebola patients at a hospital in Sierra Leone was flown to a military base in Georgia and driven by ambulance to Emory Hospital in Atlanta. Within days, the World Health Organization declared the Ebola epidemic an international health emergency that required a coordinated global approach, describing it as the worst outbreak in the four-decade history of tracking the disease. [2]
Method of Infection	Ebola is extremely infectious but not extremely contagious as the virus is not transmitted through the air. Humans can be infected by other humans if they come in contact with body fluids from an infected person or contaminated objects. Unprotected health care workers are susceptible to infection because of their close contact with patients during treatment.
1st Person to Contract Ebola on American Soil	In October 2014, a nurse who cared for the Ebola patient hospitalized in Texas tests positive for the virus, followed closely by a second nurse at the hospital.
New Medical Care Guidelines Issued	In late October 2014, the CDC updated medical care guidance for Ebola patients that stressed the use of personal protective equipment as well as training and supervision around "donning and doffing" procedures. In addition, new protocols mandated quarantine for any individual, including medical personnel, who traveled to the U.S. after having direct contact with individuals infected with Ebola in West Africa. This protocol shifted the responsibility for monitoring quarantine up to 21 days to state and local health departments.
2015	Additional Ebola cases in the U.S. are monitored, treated and released. The World Health Organization declares an end to the Ebola outbreak in Liberia. More than 4,000 died from the virus. In November 2015, three newly-confirmed cases emerge in Liberia.
January 14, 2016	The United Nations releases a statement declaring that all known chains of transmission in West Africa have been stopped and no new cases reported since November 2015. The following day, a new case of Ebola, in which the patient died, was confirmed in Sierra Leone.

[2] Ebola Fast Facts , CNN Library, https://www.cnn.com/2014/04/11/health/ebola-fast-facts/index.html

December 22, 2016	A British medical journal publishes a story about a new Ebola vaccine that tested 100% effective during trials of the drug in Guinea with more than 11,000 people.
May 2018	The Democratic Republic of Congo (DRC) declares an Ebola outbreak, with a total of 58 cases and 27 deaths.
February 2019	As of February 2019, the DRC reports more than 500 deaths related to the outbreak, but notes that additional deaths have been averted because of mass vaccine distribution.

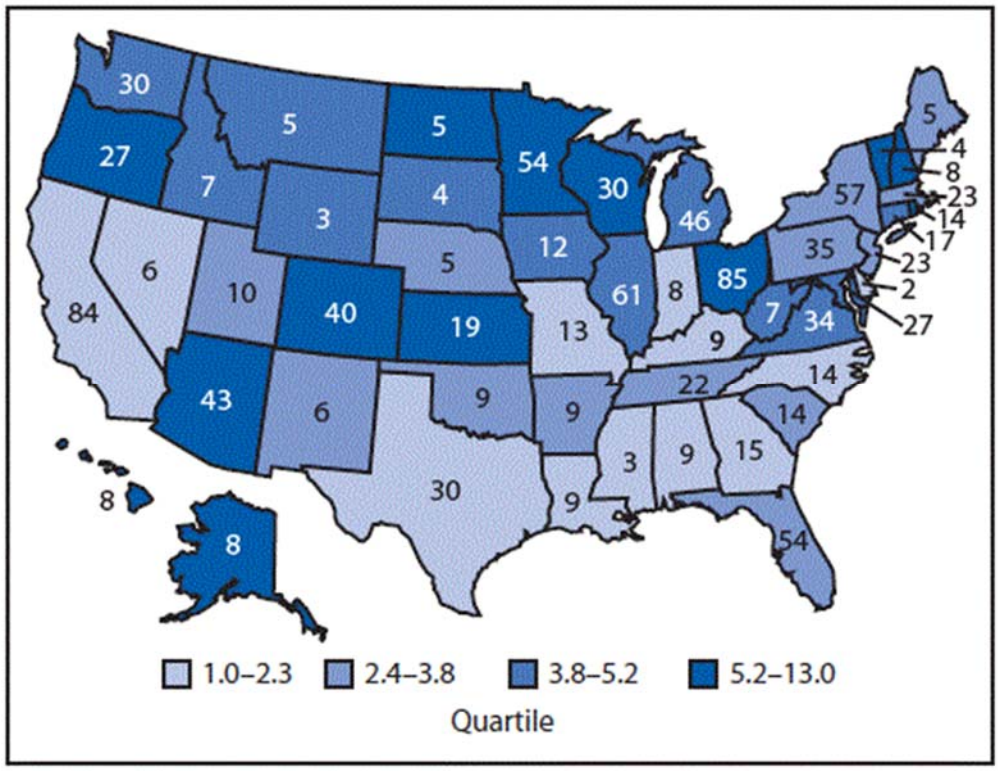
Although there were only a few confirmed Ebola cases within the U.S., efforts to monitor and contain the initial outbreak and progression of the virus led to substantial impacts on state and local health systems, in part due to the need for personal protective equipment, medical supplies, and services to support quarantined individuals.

The Saint Paul Ramsey County Public Health monitors diseases using a variety of surveillance systems and methods, including:

- The federal BioWatch Program, which actively monitors air for specific Category A bioagents.
- The federal Health Alert Network (HAN), which disseminates messages around health threats across state and local health departments to local healthcare facilities and hospital systems.
- Multiple hospital- and laboratory-based surveillance, systems. For more on the Communicable Disease rules in Minnesota, click here.

An example of CDC's disease surveillance activities is illustrated in **Figure 3.6-C** below, which shows 54 foodborne and waterborne disease outbreaks in Minnesota between 1971 and 2012.

Figure 3.6-C: Foodborne and Waterborne Disease Outbreaks



Source: Foodborne and Waterborne Disease Outbreaks – United States, 1971 – 2012, October 23, 2015; available at https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6254a7.htm

Probability of Future Events

Saint Paul HIRA Evaluation Tool Probability Scores Human Infectious Disease: 3 (Medium)

Multiple methodologies are used to attempt to predict and control future human infectious disease outbreaks. The World Health Organization (WHO) monitors disease events globally, coordinating closely with the United Nations. The CDC oversees monitoring potential public health outbreaks in the U.S. and also participates in global health security by monitoring and responding to disease outbreaks around the world. The Saint Paul Ramsey County Public Health coordinates with state and federal health and medical resources to monitor outbreaks and initiate preparedness, prevention and response measures should they occur.

3.6.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] 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 increase the vulnerability level of Saint Paul.

Human infectious disease outbreaks may have significant impact on people and infrastructure.

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

The level of risk and vulnerability of people to infectious disease differs widely based on age, gender, profession, living conditions, environment, social and cultural traditions, and other characteristics.

Life Safety (Public and Responders)

All residents of Saint Paul are potentially at risk for human infectious disease impacts.

A pandemic or serious infectious disease outbreak would result in the health care system being overwhelmed, critical workers not being able to perform their jobs and potentially an increased need for mortuary services. Impacted professions include medical personnel, public safety personnel, and critical services (communications, transportation, electric, water, gas, etc.) staff.

Vulnerable populations identified by Ramsey County include people who speak limited English, the elderly, individuals living in poverty, persons who experience disabilities (physical and mental) and people who do not have access to traditional methods of communication. Individuals without linkage to healthcare (including preventative immunizations), who live or work in congregate settings (such as schools, nursing homes, healthcare and correctional facilities) are also at risk.

[EMAP 4.2.1(1)] The city has developed the *City of Saint Paul Closed Point of Dispensing (CPOD) Plan* in conjunction with Saint Paul-Ramsey County Public Health in an effort to be better prepared in a public health emergency.

Property (Facilities and Infrastructure)

A pandemic would not directly destroy property; however, property could be damaged by lack of maintenance because of inadequate staff. Transportation services, medical services, and other critical infrastructure service facilities would likely also be impacted.

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 program operations in the event of resource shortfalls such as personnel or services. Each city department is also required to draft and maintain a COOP. Saint Paul-Ramsey County Public Health Department would be able to assist direct operations from a pre-designated site, should that be required. Available personnel for response agencies could be the most vulnerable element of operations, as disease outbreaks may impact fire rescue and law enforcement personnel who respond to 9-1-1 calls.

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.

Contaminated medical waste has the potential to impact the environment if not disposed of properly. Guidelines for appropriate elimination and disposal are typically released by public health officials in real-time events and are disease-specific. The County's Mass Fatality Plan may be initiated to address disposal of remains.

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 disease outbreak could create severe disruption of government and commercial activity, resulting in short- to long-term direct as well as indirect economic losses to the jurisdiction.

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[3] as well as mitigation.

An infectious disease outbreak has the potential to test the public's confidence in its elected leadership if critical information is not timely, consistent, coordinated, and accurate. Epidemics and long-term disease outbreaks will require intense public education and information efforts over an extended period of time to assure residents that City officials are efficiently and effectively directing the situation.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to infectious diseases.

Capabilities

The City of Saint Paul Emergency Management Office coordinates with Saint Paul Ramsey County Public Health on a regular basis to monitor public health threats and hazards, and present all-hazard public education and information throughout the year. The primary focus for public education for infectious disease is prevention through timely information, and appropriate control measures.

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for human infectious disease, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in Section 3.0 and Appendix B).

Table 3.6-3: Summary of Risk/Vulnerability Scores for Human Infectious Disease

Hazard	Risks & Vulnerability - People	Risks & Vulnerability - Property	Risks & Vulnerability - Environment	Risks & Vulnerability - Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Human Infectious Disease	4	2	2	4	3.0

[33] 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 3.6-4: Summary of Consequence Scores for Human Infectious Disease

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements*)
Human Infectious Disease	4	4	4	2	2	4	4	3.4

Table 3.6-5: Summary of Overall Risk for Human Infectious Disease

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Human Infectious Disease	3.0	3.4	6.4	3	9.4	4

Impacts of Climate Change

Climate change studies have noted the potential for significant impacts to public health as a result of changes in the climate. Impacts to agriculture could lead to the disruption of the growth cycle for food products, and increased heat levels can cause exacerbation of medical conditions in vulnerable populations such as children, elderly and individuals with certain chronic illnesses. Additional information related to climate change is provided in **Section 3.0**.

Future Population Trends

Although the total population of Saint Paul has varied over the years, experiencing a drop between 1970 and 2016, the population trend over the next 25 years indicates steady growth projected to exceed the 1970 population of 309,866 and reaching 344,100 by 2040. Changes in economic development and land use could impact population growth or decline. Trends in population will be monitored and evaluated in the next planning cycle.

Future Development Trends

Prospective re-development in the Downtown area and along rail corridors presents opportunities for residential and commercial growth in the city core. This trend could result in increases in population which could have elevated susceptibility to infectious disease outbreak.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and update of this plan should consider the following factors related to human infectious disease as well as other information from the State HMP updates:

- Have any human infectious disease events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict human infectious disease events or assess risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to human infectious disease?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to human infectious disease?

SECTION 3.7 LANDSLIDE/SLOPE FAILURE

2019 Plan Updates
This hazard was not addressed in the 2012 plan, but has been added to this update due to its risk level in the *Saint Paul Hazard and Risk Assessment Evaluation Tool.* This is due to recent occurrences, and the potential for impact to people, property, infrastructure and the environment. This profile establishes a hazard baseline and determines overall risk for this planning cycle.

3.7.1 Hazard Profile

The United States Geological Survey (USGS) indicates that landslides occur in every state in the U.S. and kill between 25 and 50 people every year nationwide. They cause more than $1 billion in damage, making them one of the more costly natural hazards. [1] Saint Paul has had landslide/slope failure events in the past which supports further profiling of this hazard.

Hazard Description

Landslides/slope failure are the movement of rock, dirt, and debris down a slope. Major natural hazards such as extreme storm events, flooding, seismic events, and wildfire can trigger an incident. Inadequate storm drainage, or leaking water distribution systems may have the same cumulative effect as extreme storm events. The blockage of stream flow may have significant impact on flood potential in topographic settings that constrict the flow of floodwaters during high flow events. Landslides/slope failures affect access and traffic safety during these same storm events in addition to fatalities and the costs of repair to infrastructure. Landslides/slope failures in developed areas can cause significant damage to buildings and property.

LANDSLIDE/ SLOPE FAILURE Assessment: Medium Risk	**Location** – River banks, bluffs, steep slopes **Extent:** – • **Duration** – Minutes to hours • **Speed of Onset** – Fast or slow • **Warning Time** – None or some warning (May depend on availability of staff for inspections) **Seasonal Pattern** – Spring to late fall **Probability** – Medium **Impacts** - Road closures, damage to buildings and infrastructure **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Road closures • Public and responder safety • Damage to buildings and infrastructure • Streambank erosion

[1] https://landslides.usgs.gov/learn/ls101.php

Types

Landslides are occasionally referred to by other terms, such as those defined in the table below.

Table 3.7-1: Types of Landslides/Slope Failures

Term	Definition
Block Slide	A block of rock slides as a unit along a slip plane down a slope.
Creep	Slow moving landslide often only noticed through crooked trees and disturbed structures.
Debris Landslide	Predominately gravel, cobble, boulder sediments and trees move quickly down slope.
Debris Flow	Coarse sediments flow downhill and spread out over relatively flat areas.
Earth Flow	Fine grained sediments flow downhill and typically form a fan structure.
Rock Fall	Blocks of rock fall away from a bedrock unit *without* a rotational component.
Rock Topple	Blocks of rock fall away from a bedrock unit *with* a rotational component.
Rotational Slump	Blocks of fine grained sediment rotate and move down slope.
Slip Plane	A plane surface through a crystal along which slip can take place under some conditions without apparently disrupting the crystal.
Transitional Slide	Sediments move along a flat surface without a rotational component.

Landslide/slope failures in the Twin Cities area are largely due to gravitational failure of sediment and rock.

Location

Landslides can occur in areas of topographically steep slopes, and areas with highly erodible soils and slopes destabilized by natural (rainfall and channel erosion) or manmade actions such as construction activity or site grading and mining. Over time, river corridors, roadway cuts, and developing areas graded to steeper slopes are areas most prone to landslides.

Because of Saint Paul's topography, the potential for landslide/slope failure exists in multiple areas of the city. Primarily, bluffs along the Mississippi River corridor, (which expose glacial sediment), road cuts, and construction areas are the most susceptible to various types of landslide/slope failure. In these locations, shallow stormflow increases flow at seeps and springs and provides a low-friction failure plan. Overland flow erodes ravines, accelerates head-cutting and steepens side slopes. Steep valleys between Saint Paul and Minneapolis expose bedrock that is susceptible to topples.

Extent

Although landslide/slope failure is not typically considered a high risk hazard in Minnesota, there is some preliminary research and data that indicates the frequency of landslide/slope failure activity may be rising in Minnesota, possibly due to frequency and intensity of heavy rainfall events. Based on preliminary research on historic landslides/slope failures, most occur between April and September, with peaks in May, June and August, both periods of higher incidence of rains associated with convective storms.

Occurrences

The earliest record of landslide/slope failure was in 1879[2], with wet periods in the late 1890s, early 1900s, 1980s and 1990s also leading to an increase in reported slides. Significant landslides/slope failures occurred throughout southeastern Minnesota during a record-breaking storm in August 2007, impacting waterways, roads and developed areas.

There have been eleven documented occurrences of landslide/slope failure in Saint Paul since 1879. The *Historical Landslide Inventory for the Twin Cities Metropolitan Area*, 2016 (Minnesota Department of Natural Resources), documents ten (10) of these events in Saint Paul between 1892 and 2014.

Table 3.7-2: Historical Landslides in Saint Paul, 1879 - 2014[3]

Estimated Slide Date	Style	Material
5/13/1879	Unknown	Rock and sediment
7/28/1892	Unknown	Unknown
8/21/1892	Rotational	Glacial sediment
Winter 1969	Unknown	Sediment
7/24/1987	Rotational	Glacial sediment and fill
4/8/2011	Topple	Rock

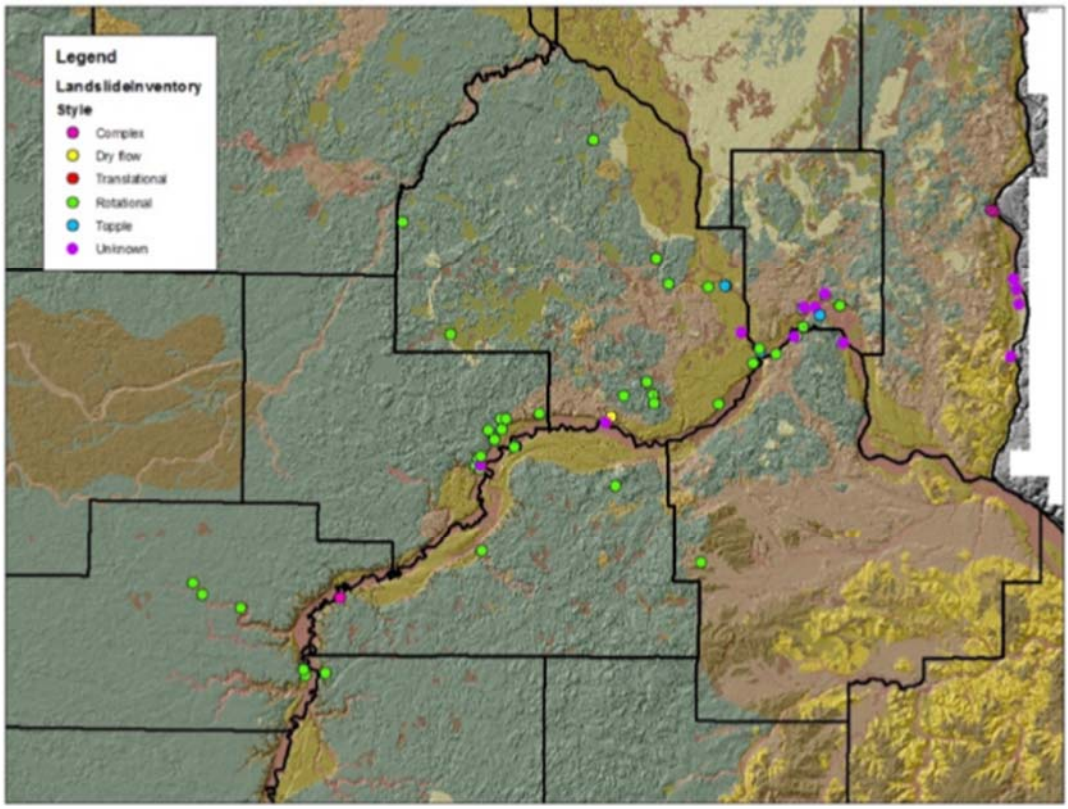
[2] Jennings, et. al., *Historical Landslide Inventory for the Twin Cities Metropolitan Area*, Minnesota Department of Natural Resources, Division of Ecological and Water Resources, 2016; page 3. Available at: https://files.dnr.state.mn.us/waters/watermgmt_section/shoreland/landslide-inventory.pdf,
[3] Ibid., page 33.

5/1/2011	Rotational	Glacial sediment and fill
5/22/2013	Complex	Rock and sediment
6/19/2014	Rotational	Glacial sediment (till)
6/19/2014	Rotational	Sediment
4/28/2018	Topple	Glacial sediment and rock

Source: https://files.dnr.state.mn.us/waters/watermgmt_section/shoreland/landslide-inventory.pdf

The increase in slides reported since 2010 may be reflected by the wetter climate, as well as enhanced availability of data through searching online records.

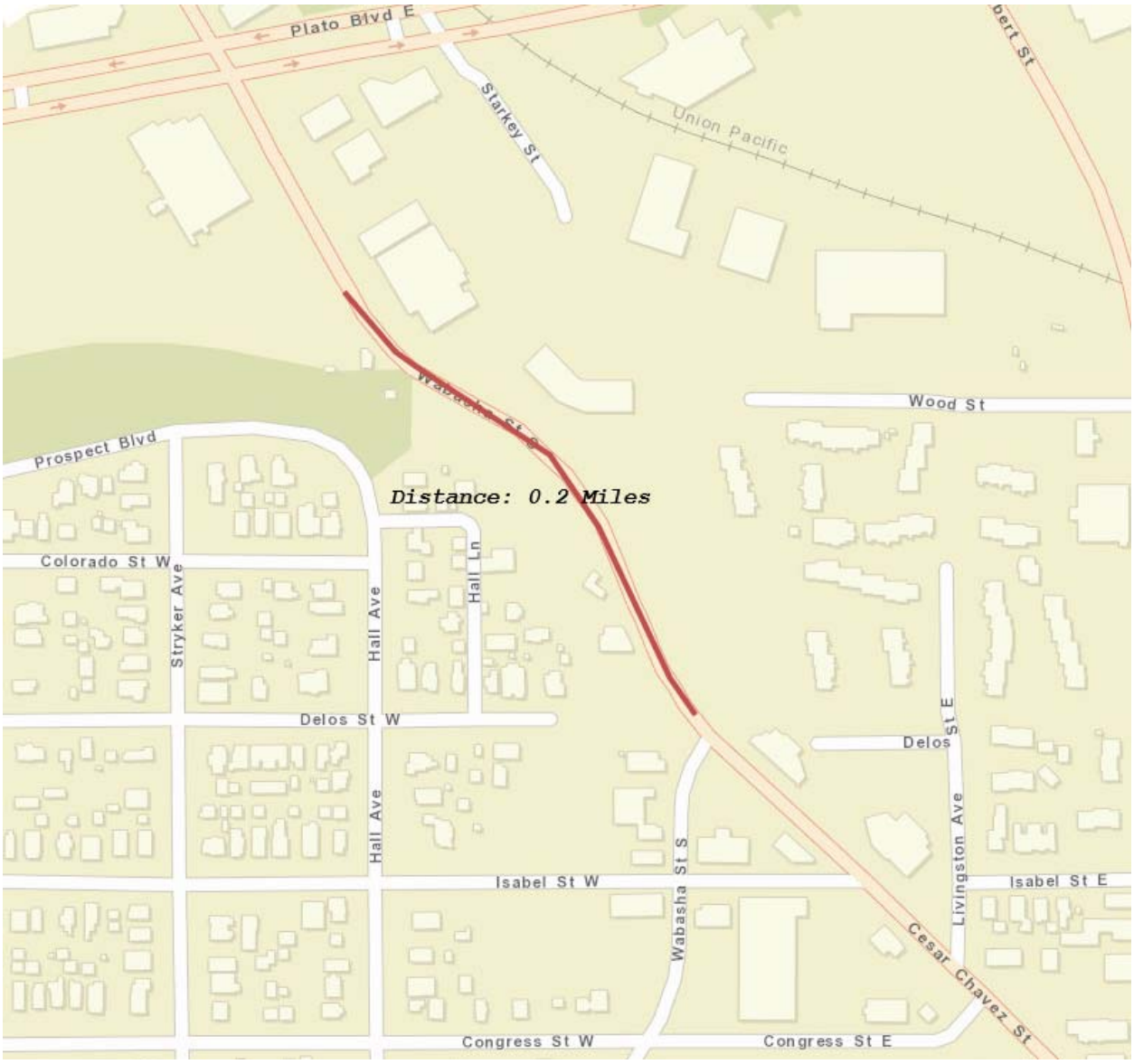
Figure 3.7-A: Slide Domain Map, *Historical Landslide Inventory for the Twin Cities Metropolitan Area*, 2016 (DNR)



Source: https://files.dnr.state.mn.us/waters/watermgmt_section/shoreland/landslide-inventory.pdf

The most recent landslide/slope failure event occurred on April 28, 2018 on Wabasha Street, resulting in a declaration of a local state of emergency by St Paul, Ramsey County, and the State of Minnesota. No injuries or damages resulted from this landslide.

Figure 3.7-B: Wabasha Street Rock Topple, April 28, 2018



Source: City of Saint Paul

This incident led to the development of a mitigation plan to help prevent future slides in that location. St Paul constructed a 250-foot gabion wall, twelve feet high and nine feet wide.

Figure 3.7-C: Wabasha Street Mitigation Project, 2018

Source: City of Saint Paul

Two fatalities associated with a previous landslide/slope failure event occurred on May 22, 2013, at Lilydale Regional Park, following a period of heavy rainfall. Two children who were in the park on a field trip died as a result.

Mitigation actions have led to improvements at the Lilydale Park since the event.

- Location identification signs
- Designation of the National Geodetic Survey (NGS) as a location tool
- Education of responders and Emergency Coordinating Committee (ECC) personnel
- Mapping of Lilydale areas of concern

Based on previous research in the Twin Cities area, the greatest number of slope failures were at a 40% grade, however, slopes began to fail at lower grades.

Probability of Future Events

***Saint Paul HIRA Evaluation Tool* Probability Scores – Landslide/Slope Failure: 3 (Medium)**

Statistical data that tracked past landslide/slope failure events in Ramsey County has only been recently developed. The *Historical Landslide Inventory for the Twin Cities Metropolitan Area*, dated 2016[4], provides substantial data that documents historical events and links increased landslide/slope failure activity to a higher incidence of precipitation.

While Saint Paul's zoning and land development codes regulate development on steep slopes and establish site grading standards, the network of steep slopes along city waterways are typically not actively managed landscapes. As climate change leads to more extreme rain events, these vulnerable areas will likely continue to be prone to failure and erosion.

3.7.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Landslides and slope failures pose threats to the population, buildings and infrastructure, and the environment. Continued attention to grading standards, construction practices, and channel erosion will help preserve the natural, human, and built environments.

Life Safety (Public and Responders)

Two fatalities have resulted from a previous landslide/slope failure event in 2013. For this reason, it is apparent that residents of Saint Paul are potentially at risk for impacts from this hazard.

The vulnerable population lives, works, or transits below the bluff areas of the city.

Public safety responders may be affected if search and rescue efforts are required to locate residents missing following a landslide or slope failure incident.

Property (Facilities and Infrastructure)

Property is vulnerable due to buildings or roads being damaged by falling rocks or if sediment failure occurs beneath a structure's foundation. Incidents occurring along roadways may cause damage to or loss of critical infrastructure such as roads and power or communication lines. Road closures may cause delayed response times for emergency responders.

[4] Jennings, et. al., *Historical Landslide Inventory for the Twin Cities Metropolitan Area*, Minnesota Department of Natural Resources, Division of Ecological and Water Resources, 2016; available at: https://files.dnr.state.mn.us/waters/watermgmt_section/shoreland/landslide-inventory.pdf

Continuity of Operations and Continued Delivery of Services

The City of Saint Paul Emergency Management has an all hazards Continuity of Operations Plan (COOP) that addresses alternate locations during an event potentially impacting a critical operational site. The Emergency Management Department and primary Emergency Operations Center (EOC) is not located in an area susceptible to landslide/slope failure and is not expected to be impacted by this hazard.

Each City department is required to draft and maintain a COOP plan as well. If any City department or agency is impacted by this hazard, the COOP plans provide operational guidance at alternate locations, whether inside or outside of the city. These provisions ensure that city services would be less vulnerable to the consequences of landslide/slope failure, if primary operational locations are impacted. Restricted access to sites and resources could be the most vulnerable area of operations, as landslide/slope failure may result in closure of main roads.

Environment

Landslide/slope failure may affect the environment if it occurs at critical locations and leads to consequences such as increased silting of waterways during periods of heavy rainfall; thereby contributing to higher levels of flooding and degradation of the quality of rivers and streams. Long-term effects to the environment due to a landslide/slope failure event are considered to be low.

Economic Conditions

While a landslide/slope failure may cause short-term economic impacts due to property and infrastructure damage, road closures, restricting access to homes and businesses, it is unlikely to cause long-term direct or indirect economic effects.

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 as well as mitigation.

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

stakeholders as well as members of the public. The outcome of the previous survey is considered to still be valid for this plan update.

A landslide/slope failure event is unlikely to test the public's confidence in its elected leadership if critical preparedness and response information is timely, consistent, coordinated, and accurate.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to landslide/slope failure events.

Capabilities

The focus for risk reduction in relation to landslide/slope failure is generally on preparedness and response measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, such as avoiding or restricting access to high risk areas, and avoiding hazardous road conditions
- Issuing timely warnings

The City of Saint Paul Emergency Management Office presents all-hazard (including landslide/slope failure) preparedness education and information to the public throughout the year. The primary focus for preparedness measures is life safety for the public and responders through timely warnings, situational awareness, and protection of City resources.

Hazard preparedness information from trusted sources provides guidance for people in effective and timely ways to protect themselves from extreme heat/cold events. Alerts and warnings, issued through the media and local emergency management, generally provide lead time to make appropriate preparations. Preparedness measures for landslide/slope failure can be accessed through a number of sources, including:

- FEMA (all-hazard individual and family preparedness) – https://www.ready.gov/
- United States Geological Survey (USGS) - https://www.usgs.gov/natural-hazards/landslide-hazards
- U.S. Army Corps of Engineers
- Minnesota Department of Natural Resources
- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for landslide/slope failure, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0** and **Appendix B**).

Table 3.7-3: Summary of Risk/Vulnerability Scores for Landslide/Slope Failure

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Landslide/Slope Failure	4	3	3	2	3.0

Table 3.7-4: Summary of Consequence Scores for Landslide/Slope Failure

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economic	Consequence– Public Confidence in Jurisdiction government	Consequence Score (*Average of all consequence elements)*
Landslide/Slope Failure	4	4	2	3	3	2	4	3.1

Table 3.7-5: Summary of Overall Risk for Landslide/Slope Failure

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability	RISK SCORE (V+F)	Impact on Lifeline Sectors
Landslide/Slope Failure	3.0	3.1	6.1	3	9.1	2

Impacts of Climate Change

Increases in precipitation can result in the increased incident or scale of landslides/slope failures due to stormwater runoff. Additional information related to climate change is provided in **Section 3.0**.

Future Population and Development Trends

Because landslide/slope failure typically occurs in identifiable geographic locations, it is more readily addressed through land development, zoning and building regulations and codes that reduce the potential for impacts.

The potential for impacts of future growth and development on landslide/slope failure will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to landslide/slope failure as well as other information from the Minnesota SHMP updates:

- Have any landslide/slope failure events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict landslide/slope failure events or assessing risk and vulnerability? Is it financially feasible?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to landslide/slope failure?

- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to landslide/slope failure?

In addition to these factors, current scientific climate change data and adaptation measures should be closely reviewed in order to understand trends that could increase the incidence and severity of landslide/slope failure events in the future.

SECTION 3.8 SEVERE WINTER STORM

2019 Plan Updates
• The hazard section title has been redefined as "Severe Winter Storm", which includes the "Blizzard/Ice Storm" Section from the 2012 Plan, and is consistent with the *Minnesota State Hazard Mitigation Plan 2014 (SHMP)*. • Updated statistical data and general information related to Severe Winter Storm has been added. • Table of previous occurrences has been updated to add significant severe winter weather events since 1995.

3.8.1 Hazard Profile

Winter Storms vary in type, strength and size and include heavy snowstorms, severe winter storms, freezing rain, sleet, and ice storms with blowing and drifting snow conditions. These weather conditions often occur in combination. They can be disruptive to critical infrastructure such as transportation and telecommunications, as well as cause power and supply chain disruptions. Populations isolated from assistance or services may face life safety issues.

Minnesota is highly susceptible to severe winter storms due to its relatively high latitude, climate, and region. The City of Saint Paul experiences significant impacts from winter storms, including severe winter storms and ice storms.

Hazard Description

Severe Winter Storm is defined as a prolonged event that includes one or more of the following conditions: snow, ice, high winds, blizzard conditions, and other wintry conditions. Severe winter storms generally occur between late October and mid-April, with February having the greatest average snowfall.

Warning Products		*Remarks*
Blizzard Warning	Sustained wind or frequent gusts greater than or equal to 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to less than 1/4 mile for three hours or more.	*A major life safety hazard is ongoing or imminent. Danger is greatest for those traveling or caught outdoors. May be issued 2-4 times per year in open areas of far southern and western Minnesota.*
Winter Storm Warning	Snow, ice, or sleet equaling or exceeding 5 inches in 12 hours and/or 7 inches in 24 hours, or a combination of snow, ice, or sleet and blowing snow with at least one of the precipitation elements meeting or exceeding warning criteria.	*This product spans a large range, from heavy snow events with little or no wind, to major wind-driven events that produce near-blizzard conditions.*
Watch Product Name		***Remarks***

Blizzard Watch	Conditions are favorable for a blizzard event to meet or exceed Blizzard Warning criteria	*Potential exists for major life safety hazard, but uncertainties preclude a Warning at this time.*
Winter Storm Watch	A Winter Storm Watch is issued when there is the potential for significant and hazardous winter weather within 48 hours. It does not mean that significant and hazardous winter weather will occur...	*As certainty about an event approaches, may be "upgraded" to a warning. Many become lower-standing Advisories, and about 1/10 Watches end up with no Warning or Advisory product.*
Advisory Product Name		***Remarks***
Winter Weather Advisory	A Winter Weather Advisory will be issued for any amount of freezing rain, or when 2 to 4 inches of snow (alone or in combination with sleet and freezing rain), is expected to cause a significant inconvenience, but not serious enough to warrant a warning.	

SEVERE WINTER STORM Assessment: High Risk Hazard	**Location** – Citywide **Extent** – • **Duration** – 1 to 3 days • **Speed of Onset** – Rapid • **Warning Time** – 12 to 36 hours **Seasonal Pattern** – Winter **Probability** –Moderately high **Impacts –** Shut down of daily operations, damage to buildings and exterior equipment **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Power/utility outages (No heat) • Traffic/roadway inaccessibility • Safety/security • Frozen pipes in facilities • Animal/plant protection • Vehicle fleet could be unusable • Communication breakdown • Downed trees & power lines

Types

Although severe winter storm conditions can include heavy snowfall, freezing rain, sleet and other elements, blizzard conditions and ice storms are the conditions with the highest potential to impact or disrupt the population, property, resources/services, and economy in the city. For this reason, severe winter storms and ice storms will be the focus of this section.

Blizzards

Blizzards represent the most dangerous class of winter storms, combining strong winds with falling or freshly fallen snow to reduce visibility dramatically. Technically, they are defined as three hours or more of sustained winds or frequent gusts in excess of 35 mph in falling or blowing snow, visibilities reduced to 1/4 mile or less. The strong winds create deadly whiteout conditions that bring traffic to a standstill, enabling the wind-driven snow to form enormous drifts that are impossible for many vehicles to penetrate. In addition, the strong

winds are often accompanied by falling temperatures and low wind chills, subjecting stranded motorists to life-threatening conditions that may persist for 24 hours or more. Lastly, the strong winds of blizzards exert additional stress upon structures if they were already straining under the load of heavy snow.

Cars in Twin Cities Metro after 1940 "Armistice Day Blizzard."
Courtesy MN Historical Society

All winter storms have some combination of cold air, moisture, and lifting mechanisms that turn the moisture into precipitation. The vast majority of winter storms affecting Ramsey County are associated with extratropical cyclones (low-pressure systems). Typically, the heaviest snow and blizzard conditions are found on the left side of the path of the storm system.

Blizzards are not consistently tracked and are difficult to diagnose retroactively. Moreover, the vast majority of major winter storms in Ramsey County have not prompted blizzard warnings. In fact, there were no NWS-issued Blizzard Warnings in Ramsey County since record keeping began in 1950 until the April 2018 blizzard. Parts of the Twin Cities had a declared blizzard on November 1-2, 1991, during the infamous Halloween Blizzard. (Source NOAA Storm Events Database); however, many winter storms have produced blizzard warnings in neighboring counties, along with winds in Ramsey County that significantly compounded the impacts from accumulating snow. Therefore, to avoid confusion and the misattribution of impacts, in this report, *a blizzard is any accumulating snow event known to have a significant wind-driven and blowing snow component*.

Ice Storms

Ice storms are major winter weather events that produce accumulations of ice, either from rain falling in sub-freezing surface temperatures, or from heavy sleet.

Significant ice storm damage in southwestern Minnesota in April 2013. *Courtesy MPR.*

In Minnesota and Ramsey County, ice storms form most commonly ahead of a warm front, resulting in warm air being lifted over colder air in place, producing precipitation that is warm enough for rain but then freezes on contact with sub-freezing objects. When the front is associated with strong low pressure, the precipitation can be quite heavy, with rapid ice accumulations. With weaker systems or when the front is stationary, it may produce sustained light to moderate precipitation for many hours. Either situation can lead to ice-related impacts.

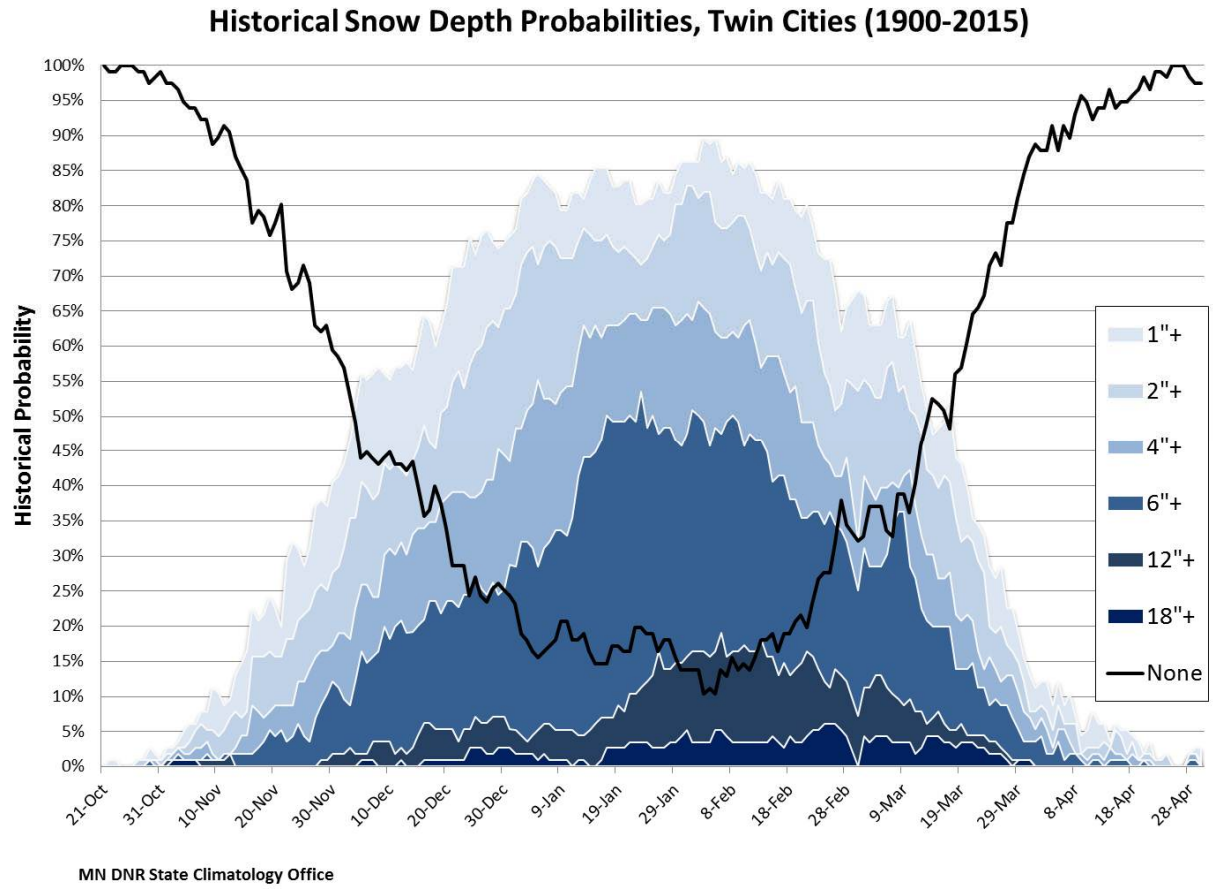
If the layer of freezing air near the surface is deep enough, the precipitation will fall as sleet instead of freezing rain. The granular nature of sleet generally makes it less of a damage and safety hazard than freezing rain, but sleet is nevertheless often a part of major ice storms.

Magnitude of ice accumulation is rarely measured, and most accounts are purely anecdotal. Severe ice storms in Minnesota have been reported to leave a glaze up to 3 inches thick.

Extent

Statistical data that determines the climate *normal* (average of a variable over a continuous three-decade period) snowfall average throughout the state illustrates that most of Ramsey County, including the City of Saint Paul, receives approximately 50 to 55 inches annually. The figure below shows the historical snow depth probabilities in the Twin Cities area between 1900 and 2015.

Figure 3.8-A: Historical Snow Depth Probabilities, Twin Cities (1900 – 2015)



Source: State Climatology Office, Minnesota Department of Natural Resources; accessed 03/04/2019 at https://images.dnr.state.mn.us/natural_resources/climate/journal/151221_snow_depth_twin_cities.jpg

The NOAA, National Centers for Environmental Information (NCEI) produces the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, similar to the Enhanced Fujita scale for tornadoes; however, the RSI scale differs in that it includes population. The RSI value is based on the spatial extent of the storm, amount of snowfall, and juxtaposition of these elements with population (currently 2010 U.S. Census) which also ties the index to societal impacts. Minnesota is included in the Upper Midwest (East North Central) climate region, as defined by the NCEI.

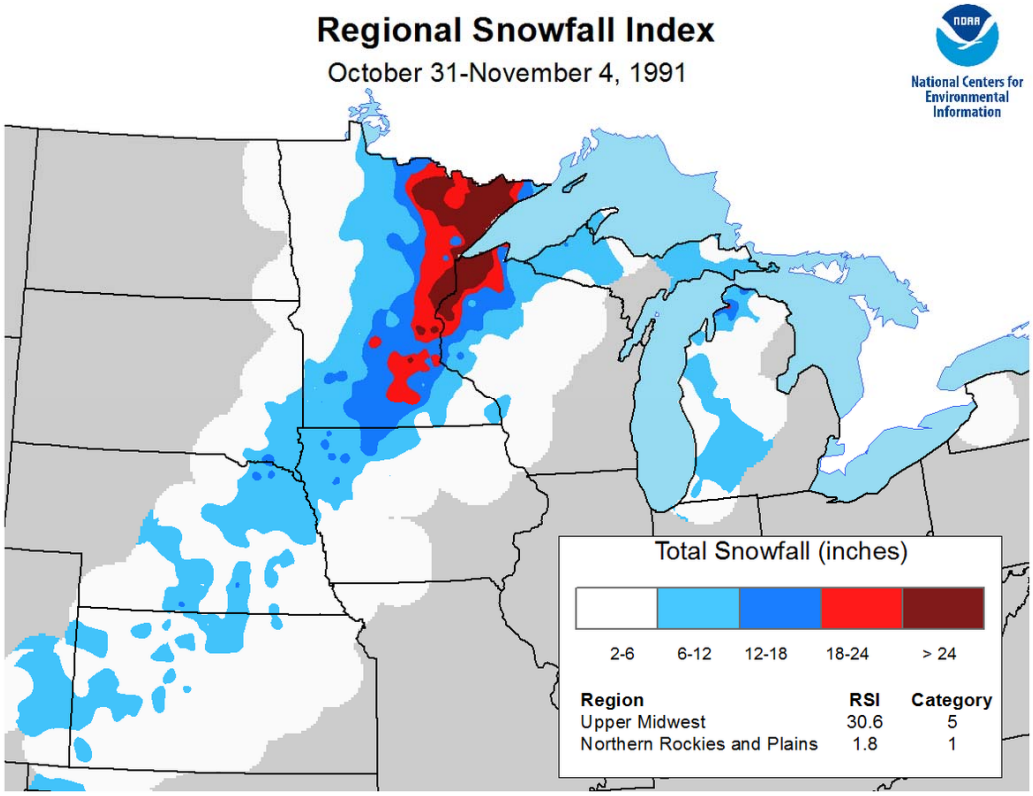
Table 3.8-1 Regional Snowfall Index (RSI)

CATEGORY	RSI VALUE	DESCRIPTION
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18.0+	Extreme

Source: NOAA, National Centers for Environmental Information; https://www.ncdc.noaa.gov/snow-and-ice/rsi/

An example of the RSI maps of the extent of a previous snowfall event is illustrated below for the winter storm known as the "Halloween Blizzard of 1991".

Figure 3.8-B: Regional Snowfall Index, Upper Midwest Region, Halloween Blizzard of 1991



Source: https://www.ncei.noaa.gov/news/halloween-blizzard-1991

Historical Data Previous Occurrences

The Twin Cities has had dozens of major winter storms since the late 19th century, with 25 calendar-day snowfalls of 10 inches or greater, and 26 two-day totals of at least 12 inches

Table 3.8-2: Historical 2-day snowfall totals of 12" or greater in the Twin Cities

Date ending	Total (in.)	Date ending	Total (in.)
11/17/1886	**13.0**	**1/21/1982**	**17.4**
3/12/1899	**12.0**	**1/23/1982**	**20.0**
3/1/1907	**12.0**	**12/28/1982**	**16.5**
4/28/1907	**13.0**	**4/14/1983**	**13.6**
12/17/1908	**12.8**	**11/28/1983**	**12.2**
1/22/1917	**16.0**	**3/4/1985**	**16.7**
3/29/1924	**12.0**	**3/31/1985**	**14.7**
3/13/1940	**15.6**	**12/1/1985**	**15.9**
11/12/1940	**16.7**	**11/1/1991**	**26.7**
3/23/1952	**14.1**	**11/30/1991**	**14.3**
3/12/1962	**12.7**	**3/9/1999**	**16.0**
3/18/1965	**12.2**	**12/11/2010**	**17.1**
3/23/1966	**13.6**	**2/21/2011**	**13.8**
		4/14/2018	**15.7**

Notable Severe Storms in Minnesota

- Armistice Day Storm in November 1940 in which there were forty-nine deaths
- The Storm of the Century in January 1975 in which there were fourteen deaths
- Back to Back Record Breakers in 1982 broke two record-breaking snowfall in three days
- The Wall of White blizzard in February 1984 in which there were sixteen deaths. Severe wind to 80 mph caused a wall of white, even though snowfall totals were only a few inches
- The Thanksgiving Weekend Blizzard of 1985
- Halloween Blizzard of 1991 which did not result in any deaths, but set staggering snowfall records.
- The Snowfall Events of 2010, specifically December 10-11, 2010, set records for the 5th largest snowstorm for the Twin Cities since 1981. During this event, the roof of

the 64,000 seat Metrodome in Minneapolis collapsed due to the weight of the snow accumulation.

- February 2019 Snowfall Record: In the Twin Cities, this was the fourth all-time snowiest month on record with 39.0 inches and the seventh snowiest meteorological winter (December through February) with 52.5 inches, which is in excess of the normal snowfall for the entire season. *(Source: https://www.weather.gov/mpx/snowymonth)*

Probability of Future Events

***Saint Paul HIRA Evaluation Tool* Probability Score – Severe Winter Storm: 2 (low)**

Research on the future of winter storms in Minnesota is lacking, but recent trends indicate a tendency towards increases in the size of the largest snowfall events. However, this increase is not yet statistically significant.

Climate change on one hand is causing a rapid warming of winter, and on another hand is putting more water vapor into the atmosphere. However, using data from the Twin cities and Minnesota, there is no evidence that seasonal snowfall is decreasing, even though significant winter warming is well underway.

Using the Twin Cities snowfall record from 1900-2015[1], a daily snowfall of just of six inches can be expected annually. The 10-year snowfall amount for a calendar day is just over 12 inches. These values can be analyzed for durations of up to 7 days and return periods of up to 100 years.

Using the same data somewhat differently, the expected frequency with which a daily snowfall total at a point in Ramsey County will equal or exceed a given amount can be assessed. This analysis shows that approximately six to eight inches of snowfall can be expected every one to two years, and 16 inches or more every 19 years.

3.8.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1In general, the City of Saint Paul is vulnerable to severe winter storms that produce freezing rain, significant snowfall, blowing snow, 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 and its citizens.

Life Safety (Public and Responders)

All residents of the City of Saint Paul are potentially at risk for impacts of severe winter storms. The hazards created by blizzards and ice storms create significant danger to life,

[11] Data obtained from the Minnesota Department of Natural Resources, updated every ten years.

travel and employment conditions.

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, especially if more than one weather element is present (such as heavy snowfall and ice at the same time). Storm effects can lead to accidents on icy roads, heart attacks while shoveling snow and hypothermia due to prolonged exposure to the cold. In addition, the safety of emergency responders may be at risk during outside operations that require prolonged exposure or when icy conditions are present.

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).

Property (Facilities and Infrastructure)

In the City of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also numerous 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 winter storm 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 severe winter storms, primarily due to utility interruptions and improper use of alternative heating sources (e.g., fireplaces, gas or propane heaters). Fires during these events also present a greater danger because water supplies may freeze and impede firefighting efforts.

By far the greatest and most common impacts from winter storms in Ramsey County are to the transportation infrastructure, but there is no strict threshold above which heavy snow is guaranteed to produce a particular impact. Stranded vehicles and snow removal costs increase with greater accumulations, but accidents and spinouts are often a function of prior road conditions, driver preparedness and awareness, and the consistency of the accumulating snow. For instance, from January 31- February 2, 2004, a well-forecast series of winter storms produced widespread 8-11" snowfall totals across the Twin Cities, but a relatively small impact, owing to preparedness, and the generally fluffy nature of the snow. By contrast, a much smaller event on March 8 that same year, produced only 1-3 inches, but

did so unexpectedly and within a 2-hour window. This "surprise" event caused hundreds of spinouts and accidents, and forced the closure of the I-94 exit at 280.

The NWS estimates that 70% of winter storm related casualties result from vehicular accidents. Heavy snow impedes traffic, creates hazardous travel conditions, and requires plowing and surface treatment to keep roads passable. It also significantly reduces visibilities, which compromises driver reaction times. In severe winter conditions, the effect of wind further restricts visibilities, often to zero, and can easily disorient drivers. Stranded drivers and those forced to leave their vehicles because of accidents are often directly exposed to the harsh conditions outside their vehicles, and can quickly find themselves in a life-threatening situation.

Airports frequently experience significant delays, and it is common for all runways to close for a time during major winter storms.

Continuity of Operations and Continued Delivery of Services

Heavy snow and ice can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical 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 coordinate operations from sites outside the city and would be less vulnerable to loss of services and resources if the storm caused damage to multiple areas within the city.

Environment

The environmental vulnerabilities due to a severe winter storm include water contamination and/or pollution, soil damage from chemical spills, and natural gas leaks, which can happen due to heavy snow and snow melt in the spring.

Economic Conditions

The cost of snow removal, repairing damages, and loss of business could have a significant economic impact on the city. The effects of a severe winter storm would be felt on infrastructure 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 winter storm 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.

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[2] as well as mitigation.

A severe winter storm event has the potential to test the public's confidence in its elected leadership if critical preparedness and response information is not timely, consistent, coordinated, and accurate.

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.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to severe winter storms.

Capabilities

The focus for risk reduction in relation to severe winter storms is generally on preparedness, response and recovery measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, such as sheltering-in-place, early closures, restricting outdoor activity, and avoiding hazardous road conditions

- Issuing timely warnings

[2] "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.

- Pre-staging snow removal equipment and other resources in order to initiate an immediate response to protect or restore critical infrastructure

- Coordination with other agencies for special equipment use and one-sided perking bans to facilitate safe travel.

The City of Saint Paul Emergency Management Office presents all-hazard (including severe winter storm) preparedness education and information to the public throughout the year. The primary focus for preparedness measures is life safety for the public and responders through timely warnings and shelter-in-place guidance, and protection of City resources.

In addition, Ramsey County's designation as a StormReady®[3] county ensures a higher level of preparedness for all severe weather events, including blizzards and ice storms.

Hazardous weather preparedness information from trusted sources provides guidance for people in effective and timely ways to protect themselves from severe winter storm events. National Weather Service watches and warnings, issued through the media and local emergency management, generally provide lead time to make preparations and shelter in safe locations. Preparedness measures for severe winter storms can be accessed through a number of sources, including:

- FEMA – https://www.ready.gov/winter-weather
- National Weather Service, Weather Prediction Center - http://www.wpc.ncep.noaa.gov/wwd/about.shtml
- American Red Cross - http://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies/winter-storm
- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management

Recovery

Recovery from a major snow event can take days, or even weeks if it is complicated by a combination of cold weather, power outages, fallen trees, ice, or snow. In addition to power outages, persistent wind loading on structures has at times caused gas line ruptures.

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for severe winter storm, and provide numerical risk/vulnerability

[3] StormReady® is a National Weather Service program designed to recognize communities that have reached a high level of severe weather preparedness. To be recognized as StormReady®, a community must meet criteria established jointly between the NWS and state and local emergency management officials related to receiving and issuing timely warning and alerts, public education, spotter training, drills and exercises, and interaction with the local NWS office.

(impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in Section 3.0.)

Table 3.8-3: Summary of Risk/Vulnerability Scores for Severe Winter Storm

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Severe Winter Storm	4	4	2	4	3.5

Table 3.8-4: Summary of Consequence Scores for Severe Winter Storm

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction governance	Consequence Score *(Average of all consequence elements)*
Severe Winter Storm	4	4	4	3	2	3	4	3.1

Table 3.8-5: Summary of Overall Risk for Severe Winter Storm

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Severe Winter Storm	3.5	3.1	6.6	2	8.6	4

Future Population and Development Trends

Because severe winter storms are not limited to geographic boundaries or population groups, it is difficult to identify development and population trends that impact this hazard. Current land use and building codes incorporate standards that address and mitigate snow accumulation.

The potential for impacts of future growth and development on severe winter storms will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Potential Impacts of Climate Change

As noted in *Adapting to Climate Change in Minnesota, 2017 Report of the Interagency Climate Adaptation Team (ICAT)*, dated May 2017, trends in the changing climate are already being felt in the state. The ICAT report notes, "Both the science summarized in the National Climate Assessment and high-quality climate data show that in Minnesota and the Midwest, rising temperatures have been driven by a dramatic warming of winter and also night, with both the frequency and the severity of extreme cold conditions declining rapidly. Annual precipitation increases have been punctuated by more frequent and more intense heavy rainfall events. The heaviest snowstorms have also become larger, even as winter has warmed. "(*ICAT Report*, p. 12) This "cold weather warming" trend is affecting the lowest temperatures of each season, and has already produced detrimental impacts on natural resources and availability of popular winter recreational activities such as ice fishing and skiing. Total temperature change of the winter lows in the lower- to mid-region of the state have increased by 3.4 to 4.0 degrees F. between 1895 and 2015, while summer highs have decreased from -1.4 to -0.2 degrees F. Overall, the annual temperature change has increased by 1 to 2 degrees F. Additional information related to the impacts of climate change impacts for this hazard is provided in **Section 3.0.**

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to severe winter storm as well as other information from the Minnesota SHMP updates:

- Have any severe winter storm events occurred since adoption of this plan?
- What lessons were learned from the severe winter storm events?
- Has any new scientific research or methodology changed the ability to predict severe winter storm events or assess risk and vulnerability?
- How can new research/methodology be applied?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to severe winter storm?

- How should our planning or operations change to reflect significant change?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to severe winter storm?
- How should our planning or operations change to reflect climate change?

SECTION 3.9 TORNADO

2019 Plan Updates
• Updated statistical data and general information related to Tornado has been added. • All hazard incidents were reviewed to determine if any tornado events have occurred since the 2012 Plan was adopted.

3.9.1 Hazard Profile

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, 1,253 tornadoes are reported. These result in an average of almost 70 deaths, over 1,500 injuries, and more than $400 million in damage. (*U.S. Tornado Climatology, National Centers for Environmental Information)*

Source: Stormaware

Nearly three-quarters of all tornadoes in Minnesota have occurred during the three months of May (15%), **June** (37%), and July (25%). The most probable danger period in Minnesota, therefore, is late spring and early summer, between 2:00 PM and 9:00 PM. However, tornadoes can and do occur at any time of the day or night. *(MN Tornado History and Statistics, Minnesota Department of Natural Resources)*

The number of average deaths per year in the United States was higher before improved forecasting and warning systems were put into place. The focus for risk reduction in relation to tornadoes is generally on preparedness measures, which include the following:

- Public information and education relating to protective measures for individuals and families, such as sheltering-in-place, and construction of tornado safe areas/rooms
- Issuing timely warnings

Hazard Description

Tornadoes are a hazard associated with severe weather conditions that can affect the Saint Paul, primarily during the early spring and summer, when severe storms are more prevalent.

TORNADO Assessment: High Risk Hazard	**Location -** Citywide **Extent:** • **Duration** – Minutes to an hour • **Speed of Onset** – Rapid • **Warning Time** – Minimal (minutes) for actual tornado; hours/days for accompanying storm pattern **Seasonal pattern** – Spring/Summer/Fall **Probability** – Moderate **Impacts -** The results could be devastating towards human, property, business, and the environment. **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Power/utility outages • Traffic/roadway damage • Visitor/staff safety • Medical attention for residents/visitors/staff • Animal escape (Como Zoo) • Vehicle fleet could be unusable • Communication breakdown

Type

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.

Location

Minnesota has a long-recorded history of tornadoes impacting various locations within the state. Based on the National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center, the State of Minnesota has an average of 28.2 tornadoes annually. Additional NOAA data places the City of Saint Paul in a region that has approximately one to five major tornado strikes (per 1,000 square miles) per year.

Table 3.9-1: Minnesota Tornado Statistics

1950 - 2018	Totals	Annual Average
Tornadoes	1,940	28.2 (1950 to 2018)
Tornado Deaths (last death was 2011)	99	1.46
Tornado Injuries	1,983	29.2

Source: https://www.dnr.state.mn.us/climate/summaries_and_publications/tornadoes.html

Extent

Practically speaking, it is nearly impossible to measure the actual wind speed inside tornadoes, as they can destroy almost any unprotected weather instruments in their path. For this reason, the *Fujita Scale* was devised in 1971 as a system for estimating the intensity of tornadoes based upon the type and severity of damage produced by the tornado. The Fujita Scale ranged from F0 to F5, with the higher number being more severe. In recent years, increased knowledge of wind forces and their effects on buildings determined that the original scale wind speeds were too high for categories F3 and higher, and the original scale was revised in 2007 to the *Enhanced Fujita Tornado Intensity Scale*. 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 scale 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 3.9-1** below. These estimates vary with height and exposure.

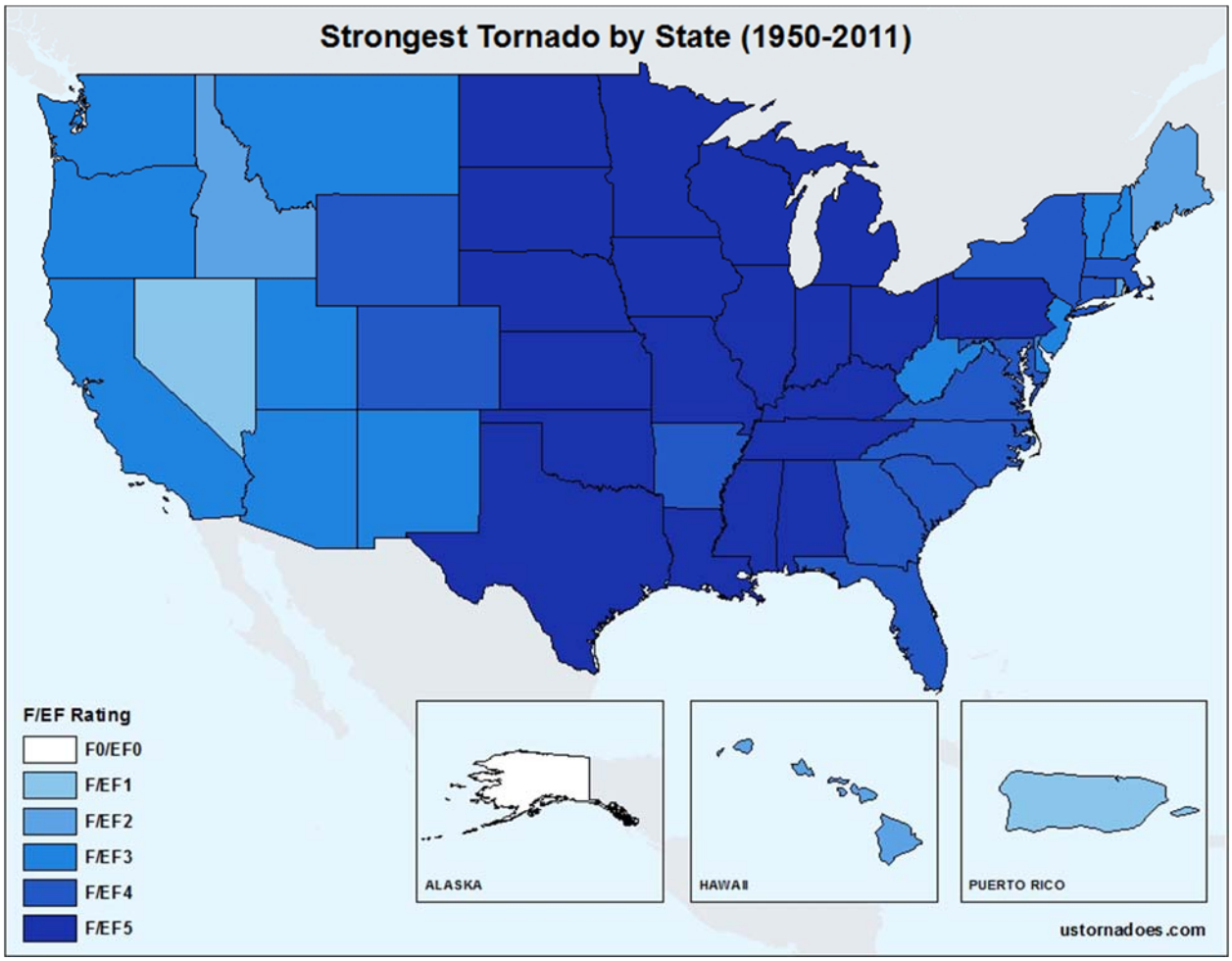
Table 3.9-2: Enhanced Fujita Scale (adopted February 1, 2007)

EF Rating	Wind Speeds	Expected Damage	
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.	
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.	
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.	
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.	
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.	
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.	

Source: Storm Prediction Center, National Weather Service, and http://whyfiles.org/2014/tornadoes-strike-again-how-do-they-work/

The figure below illustrates the strongest tornadoes by state, territory and district in the United States for the period 1950-2011.[1] Minnesota has experienced EF 5 tornadoes three times.

Figure 3.9-A: Tornado Strength, By State (1950-2011)

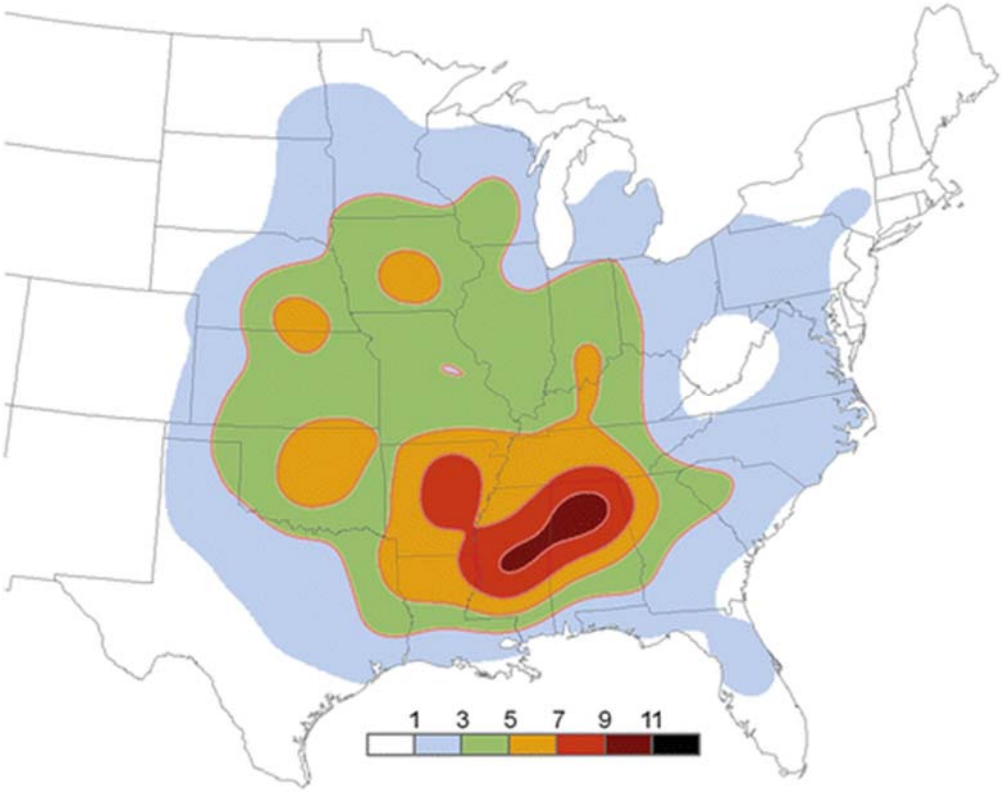


Source: http://www.ustornadoes.com/2012/10/19/strongest-tornadoes-by-state-territory-and-district-in-the-u-s/

The following figure shows the average annual path length (by miles) of all significant (F2-F5) tornadoes passing within 25 miles of a point, 1973 – 2011. This graphic illustrates that Saint Paul is in an area where the path length could range from one (1) to three (3) miles.

[1] Livingston, I., "Strongest Tornadoes by State, Territory and District in the U.S", Tornado Climatology, October 19, 2012.

Figure 3.9-B: Average Annual Tornado Path length, by miles (1973 – 2011)



Source: Coleman, T. & Dixon, P. "An Objective Analysis of Tornado Risk in the United States", American Meteorological Society, Published Online: April 10, 2014. *https://journals.ametsoc.org/doi/10.1175/WAF-D-13-00057.1*

No tornado above the EF-3 category has been recorded within the Planning Area, although loss of life, injuries and property damage from previous tornadoes has been experienced in other areas of the state and the potential for similar impacts within Saint Paul. In the City of Saint Paul, most wind damage in the past ten years has been limited to downed trees and power lines, blocked roads, and interruption of electrical power.

Previous Occurrences

When compared to other states by the frequency per square mile, Minnesota ranks 29 out of the 50 states for frequency of tornadoes, 22 for number of tornado-related deaths, 26 for Injuries and 11 for cost of damages.[2] The average annual number of tornadoes in Minnesota averages 28.2 for the period 1950 to 2018.

[2] Disaster Center Risk of Tornado by State, Statistical data based on storm information from 1950-1995. http://www.disastercenter.com/tornado/rank.htm

The table below describes historic tornado occurrences in the State of Minnesota with comments relating to impact and magnitude. As a note, Minnesota had an historic year in regards to tornadoes in 2010 with 113 tornadoes reported (four (4) rated at the EF-4 level, four (4) rated at the EF-3 level, eight (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 (3) deaths and 46 injuries (all of which were on June 17 except one injury on August 13).

Table 3.9-3: Historic Tornado Occurrences in the State of Minnesota

Date	Location	Comment
September 20, 2018	South Central and SE MN	MN's 3rd most prolific day with 24 tornadoes (48 on 6/17/10, 27 on 6/16/92)
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 area 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.

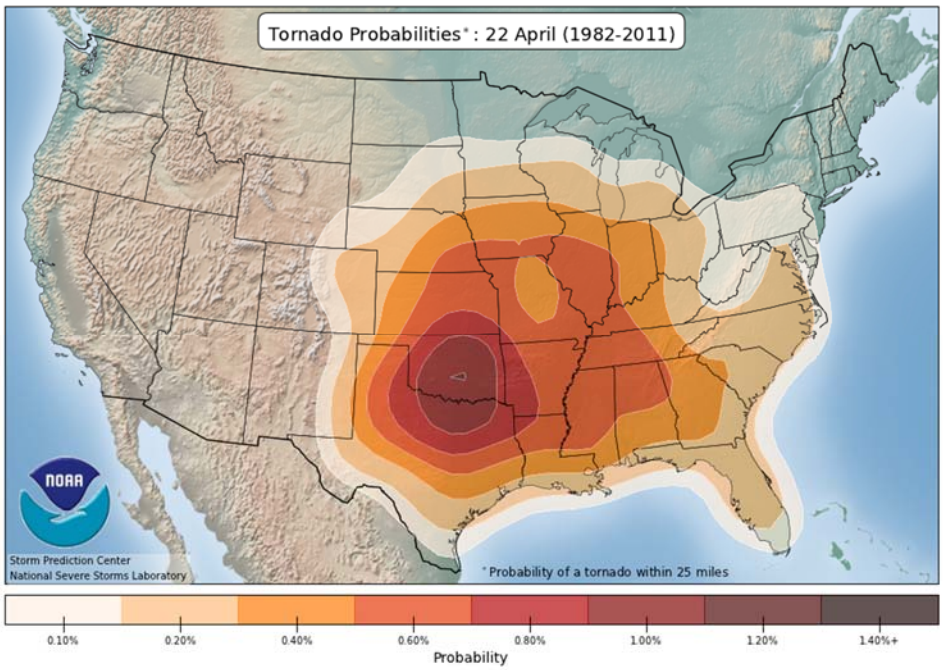
Based on historical and statistical records, Ramsey County has been impacted by 5 tornadoes between 1965 and 2018. These were assessed to be between F1/EF1 and stronger, based on the Fujita/Enhanced Fujita Scale for damage. There was one fatality and 168 injuries documented in the storm statistics. (NOAA, National Centers for Environmental Information)

Probability of Future Events

***Saint Paul HIRA Evaluation Tool* Probability Score - Tornado: 1 (unlikely)**

Multiple methodologies are used to attempt to predict the probability of future tornado events. One such method used by the NOAA Storm Prediction Center (SPC) determines the average annual number of tornadoes based on analysis of previous tornado event frequency. The figure below illustrates an example the application of the SPC data in one such format; however, it does not provide a level of detail in its current form to determine whether St. Paul is within the .2% area or the .4% probability area.

Figure 3.9-C: Tornado Probabilities 1982-2011



Source: https://www.spc.noaa.gov/new/SVRclimo/climo.php?parm=allTorn

The probability values presented in the figure above were estimated from the 30-year period of severe weather reports from 1982-2011.

3.9.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] 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.

More heavily populated areas are the most vulnerable, while sparsely populated and uninhabited areas are less vulnerable. There is some potential for impacts to the natural environment and the Planning Area's economy through direct and indirect consequences described in the primary and secondary impact descriptions below.

Life Safety (Public and Responders)

Serious injuries or fatalities from tornado events do not typically occur in Saint Paul, but there are 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 may be at risk during search and rescue operations following impact or in response to fires or hazardous material spills caused by the tornado.

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).

All residents of the Planning Area are potentially at risk from tornado impacts.

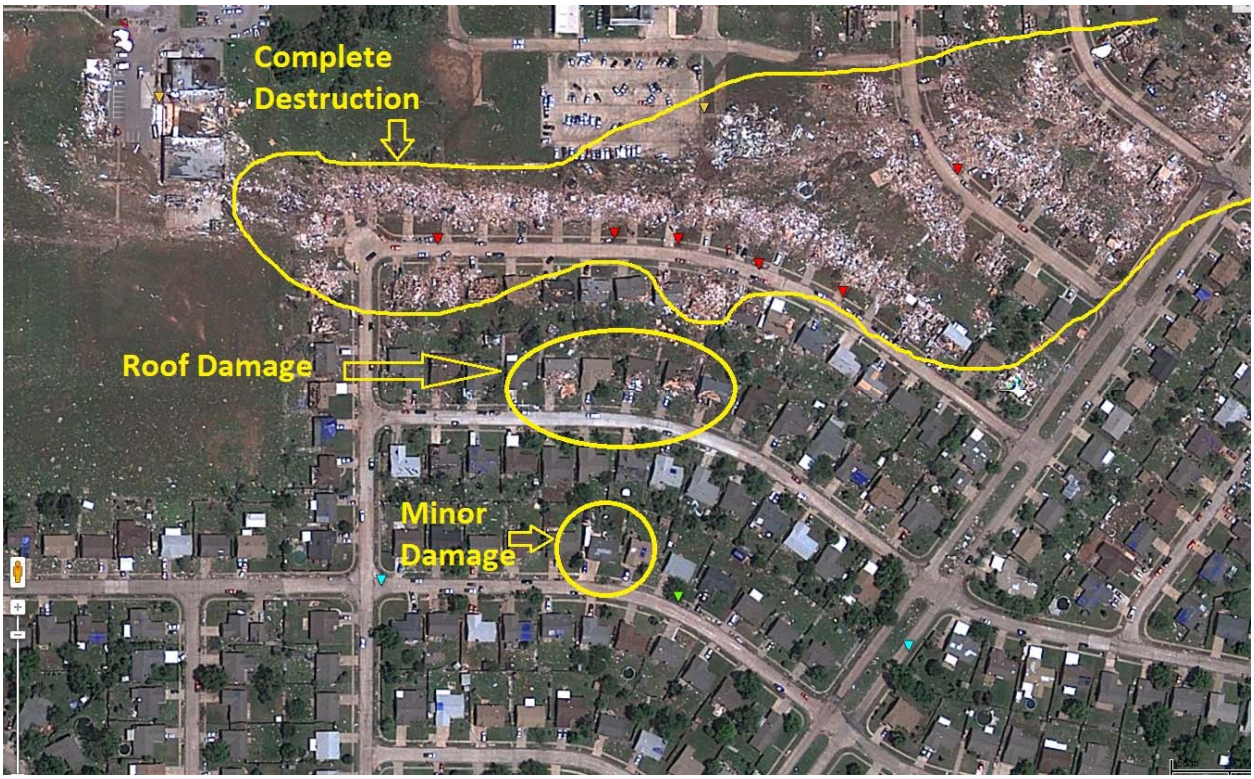
Property (Facilities and Infrastructure)

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. In the most extreme events with direct catastrophic impact on a community, almost no structure is capable of withstanding the force of tornadic winds.

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.

Although part of a building could be hardened into a tornado safe room capable of surviving an F5 tornado, the construction of homes and businesses that are impervious to tornado damage is often cost-prohibitive, and current building codes do not include wind-load design to protect against the levels of wind generated by tornadoes. The figure below depicts the damage patterns from an EF5 tornado that caused severe damage to homes in a Moore, Oklahoma neighborhood in May 2013.

Figure 3.9-D: Tornado Damage Patterns



Source: http://wane.com/blog/2013/05/23/google-crisis-map-moore-tornado-damage/

As the above figure illustrates, structures within the actual storm path are the most vulnerable to tornado winds that could cause the most significant damage. Structures on the periphery of the storm path are more likely to receive moderate to minimal damage, although by the nature of the storm conditions, flying debris could cause serious damage outside the storm path.

The City of Saint Paul has adopted the 2015 Minnesota State Building Code. Sections of the code that address disaster mitigation for high risk hazards include:

- 1335 Flood Proofing Regulations (The "1972 Flood Proofing Regulations" as promulgated by the Office of the Chief Engineers, U.S. Army, is incorporated by reference and made a part of the State Building Code, as amended.)
- 1370 Storm Shelters – Manufactured Home Park Storm Shelter Design (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/codes15.asp

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 in the event 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.

Environment

The environmental vulnerabilities due to a tornado include widespread debris, 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.

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.

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[3] as well as mitigation.

A previously-conducted survey that attempted to identify the level of public confidence in governance related to mitigation was described in the 2012 Plan. This survey found that

[33] "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.

94% of survey responders believed that mitigation planning was vitally important or very important. Because it was felt that these survey results are still valid, a new survey was not conducted for this planning cycle.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to tornadoes.

Capabilities

The City of Saint Paul Emergency Management Office presents all-hazard (including tornado) preparedness education and information to the public throughout the year. The primary focus for preparedness measures for tornadoes is life safety for the public and responders through timely warnings, safe-room construction, and shelter-in-place guidance.

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for tornadoes, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0** and **Appendix B**).

Table 3.9-4: Summary of Risk/Vulnerability Scores for Tornado

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Tornado	3	3	3	4	3.3

Table 3.9-5: Summary of Consequence Scores for Tornado

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Environment	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements)*
Tornado	4	4	4	3	2	4	5	3.6

Table 3.9-6: Summary of Overall Risk for Tornado

Hazard(	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability	RISK SCORE (V+F)	Impact on Lifeline Sectors
Damaging Wind/ Thunderstorm	3.3	3.6	6.9	3	9.9	4

Future Population Trends

Although the total population of Saint Paul has varied over the years, experiencing a drop between 1970 and 2016, the population trend over the next 25 years indicates steady growth projected to exceed the 1970 population of 309,866 and reach 344,100 by 2040. Changes in economic development and land use could impact population growth or decline. Trends in population will be monitored and evaluated in the next planning cycle.

Future Development Trends

Although the population of Saint Paul has maintained a fairly steady rate of decline and increase since 1970, prospective re-development in the Downtown area and along rail corridors presents opportunities for residential and commercial growth in the city. This trend could result in development of new multi-story residential buildings which could have some increased susceptibility to tornadic winds. Integration of mitigation initiatives into land use planning will help to ensure that future urban development will address potential mitigation opportunities.

Potential Impacts of Climate Change

Tornadoes, along with straight-line winds, large hail and other characteristics of severe thunderstorms are a regular part of Minnesota's warm-season climate, and do not appear to be worsening in response to climate change; however, extensive study of trends among these hazards is limited by inconsistent tracking and measurement over time. As noted in *Adapting to Climate Change in Minnesota, 2017 Report of the Interagency Climate Adaptation Team (ICAT)*, dated May 2017, trends in the changing climate are already being felt in the state. Although science is unclear about future trends in the frequency and severity of tornadoes in Minnesota, tornadoes and damaging thunderstorm hazards may become more concentrated on fewer days, indicating the potential for more "outbreaks", even major ones. The effects of this change are seen in potential threat to public safety and property, including critical infrastructure. Additional information related to the impacts of climate change are provided in **Section 3.0**.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to tornado as well as other information from NYS HMP updates:

- Have any tornado events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict tornado events or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to tornado?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to tornado?

SECTION 3.10 URBAN FIRE/WILDLAND FIRE

2019 Plan Updates

- Updated general information related to Urban Fire/Wildland Fire has been added.
- Table of previous occurrences, has been updated to add significant urban/natural fire events since 2012.

3.10.1 Hazard Profile

The fire problem in the United States, on a per capita basis, is one of the worse 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.

Fire statistics for Minnesota in 2017 indicate that 84% of deaths, and 61% of injuries due to fire occur in structure fires. In 2018, there were 22 home fire fatalities.[1] For the period 2014-2018 in Saint Paul, all except one fire fatality have occurred in residential structures or in private dwelling areas of commercial structures.

Table 3.10-1 Fire Fatalities in Saint Paul

Year	Number
1998	5
1999	5
2000	5
2001	2
2002	3
2003	5
2004	2
2005	4
2006	3
2007	3
2008	1
2009	0
2010	3

[1] https://www.nfpa.org/~/media/FD0144A044C84FC5BAF90C05C04890B7.ashx

2011	5
2012	4
2013	5
2014	2
2015	5
2016	3
2017	6
2018	3

Source: Saint Paul Fire Department

Hazard Description

The leading causes of all fires nationally are arson, open flame, and cooking. Nationally, 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 age 55 and older are most at risk. The most recent data now shows that older adults are at a much higher risk of dying in a fire than any other group. Between 2010 and 2017, 45% of all fire fatalities in MN were age 60+. (*Source Fire in Minnesota 2017*.)

A report[2] issued by the National Fire Protection Association (NFPA), entitled "Fire Loss in the United States in 2017, reported that there were 1,319,500 reported fires in the nation in 2017; 38% occurring in structures. Those fires resulted in nearly 15,000 reported injuries and 3,400 civilian fire deaths, of which 77% occurred in the home. In Minnesota, 60% of fires occur in the home, resulting in 90% of the injuries.[2] During the last 20 years in Saint Paul, 42% of fires occurred in the home. Over that time there have been 60 fatal fires in the city, more than 90% of them occurring in home or in areas used as sleeping quarters in commercial structures or outbuildings.

To a large extent, statistics at the national, state, and local level reveal that the urban fire problem is centered on the home, and that the sources of the most deadly and damaging home fires are smoking and cooking. Locally, the leading causes of fire in the city are cooking, smoking, heating equipment, and candles. Most fire deaths in the city are the result of smoking. For the purpose of this Plan, major urban fires are those structure fires in the City of Saint Paul that are greater than or equal to two alarms.

Due to the extensive urban development within the jurisdictional boundaries of the city, large-scale, natural wildland fires are not considered to be a significant factor. Consequently, wildland fire is profiled in this section, but a comprehensive vulnerability analysis is not indicated in this planning cycle.

[2] U.S. Fire Administration; available at: https://www.usfa.fema.gov/data/statistics/states/minnesota.html

URBAN FIRE/ WILDLAND FIRE Assessment: Moderate Risk Hazard	**Location** – Citywide **Extent:** • **Duration** – Several hours to days • **Speed of Onset** – Rapid • **Warning Time** – Minimal **Seasonal Pattern** – Primarily late summer/fall **Probability** – Moderate **Impacts** - Damage to property and buildings; life safety issues **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Loss of service(s) • Evacuation of residents, visitors or staff • Medical and public health impacts • Traffic/roadway closures • Increased security/policing

Types

Urban Fire/Wildland Fire can start from numerous causes such as untended cooking, cigarettes, or fireworks, but often occur as the result of other hazards such as lightning, transportation accidents, electrical equipment malfunction, or arson.

Urban Fire

For the purposes of this Plan, any structure fire in the City is considered significant, since any fire can injure or kill civilians or responders. Response to a "working" structure fire also consumes a major portion of available fire and Emergency Medical Services (EMS) assets in the city. (A full assignment of fire/EMS crews to even a single-family residential fire uses roughly one-third of all fire/EMS units in the city, one-third of on-duty staffing, and half of on-duty chief officers). Based on past National Fire Data Center statistics, cooking fires account for nearly two thirds of all residential structure fires in urban areas. According to the National Fire Protection Association, intentional fire rates and arson fire rates are highest in large cities.[3]

Wildland Fire

A wildland fire 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.

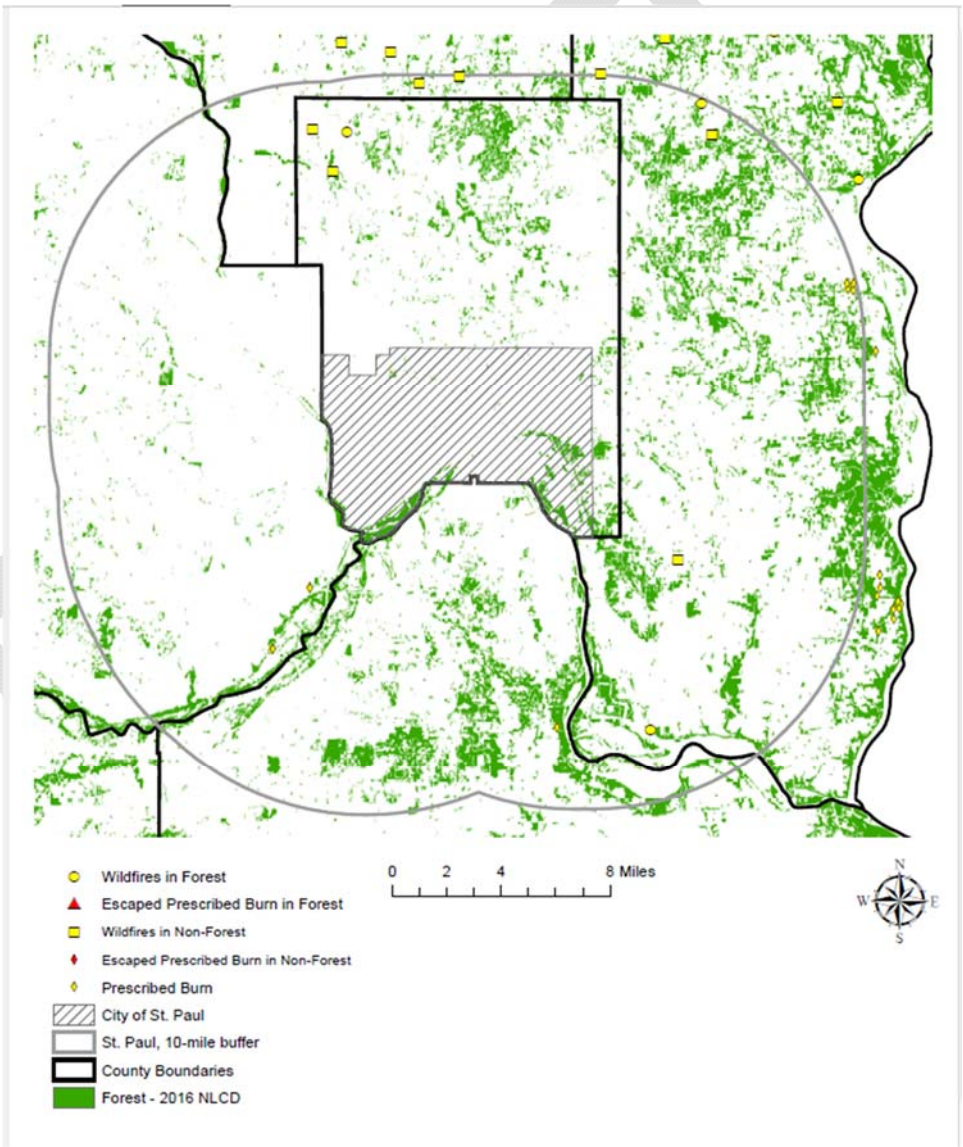
Wildland fires often begin unnoticed. They spread quickly, igniting brush, trees, and homes. Human-caused fires, such as arson and carelessness, make up four out of every five wildfires. As a natural hazard, wildland fires are caused as a result of lightning. The

[3] https://www.nfpa.org/Public-Education/By-topic/People-at-risk/Urban-fire-safety

destruction of timber, property, wildlife, and loss of human life are the most frequent dangers from wildfires.

Location

All areas within Saint Paul's jurisdictional boundaries are susceptible to Urban Fires/Wildland Fires and their effects. Urban fires may happen anywhere in the city where there are several buildings in close proximity. In the City, wildland fires are most likely to occur in areas near railroad tracks, brush piles and in park settings along the Mississippi River, and may spread as long the conditions allow and there is fuel for the fire to burn.



Source: Minnesota Department of Revenue Firewise Program

Extent

The severity or magnitude of an urban fire/wildland fire depends on multiple factors including the fire's cause, source of fuels, weather conditions, internal suppression systems, ease of access by response personnel and equipment, and additional dynamics. Many dangerous fires begin in the winter. Conventional and alternative heating appliances, electrical problems, and holiday decorations contribute to the winter months being the peak season for fires. Many deadly fires occur at night due to unattended heating appliances or discarded smoking materials. These fires often may also be undetected due to night time conditions which often result in a blaze too large to escape. This delay in fire detection and occupant response often results in larger blazes, more injuries and deaths, and delayed emergency response.

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, wildland fires can create dangerous situations if the conditions are conducive. Wildland fires 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 wildland fires is the buildup of grass, leaves and twigs in a pile. This accumulation of dead matter can create heat through decomposition, enough in some instances to spontaneously combust and ignite the surrounding area. The potential for threat of wildland fires is dependent upon topography and slope, surface fuel characteristics, recent climate conditions, current meteorological conditions, and fire behavior. Once a large-scale wildland fire threatens a community, it is often too late to protect nearby structures, and populations have to be evacuated for their own safety.

Occurrences

The following table provides the history and annual statistical report of urban fire/wildland fire in Saint Paul.

Table 3.10-2: Annual Fire Statistics for Saint Paul, 1998 - 2017

Year	Number of Structure Fires	Property Damage	Total Loss
1998	468	4,936,703	5,857,494
1999	451	7,262,148	8,493,197

2000	395	11,914,854	15,280,988
2001	643	8,554,469	9,194,919
2002	634	7,513,472	8,278,262
2003	695	4,998,720	5,765,430
2004	782	8,504,383	9,291,248
2005	708	9,348,701	10,426,742
2006	716	8,482,067	9,579,927
2007	681	6,595,060	7,363,240
2008	799	6,824,242	7,481,439
2009	886	7,901,193	8,516,583
2010	799	6,536,199	6,932,061
2011	794	5,958,509	6,421,184
2012	826	6,398,058	7,316,374
2013	796	4,568,874	5,140,247
2014	819	9,976,223	10,620,223
2015	934	13,092,532	14,091,442
2016	908	6,183,553	6,955,523
2017	895	7,750,986	8,190,628

Source: Saint Paul Fire Department

Table 3.10-3 Wildfire, grass, natural vegetation and brush fire calls in Saint Paul

Year	Total	Acres burned
1998	174	

1999	254	
2000	210	
2001	116	
2002	101	
2003	143	
2004	104	
2005	74	
2006	88	
2007	133	
2008	70	
2009	126	
2010	67	
2011	78	8
2012	134	10
2013	56	23
2014	62	1
2015	90	10
2016	75	2
2017	85	8

Source: Saint Paul Fire Department

Probability of Future Events

Saint Paul HIRA Evaluation Tool Probability Score – Urban/Wildland Fire: 3 (medium)

The probability of an urban fire occurring in Saint Paul is relatively high; however, the impacts of the fire depend greatly on its location, fire conditions, and magnitude. Most urban fires are quickly contained and cause only localized damage due to the proximity and rapid response time of emergency services personnel. The probability of a fire occurring has increased with population growth.

While the city has not suffered extensive damage from wildland fires, there still remains a low probability that one could occur. Wildland fire susceptibility is greater during drought conditions. With Saint Paul having a high frequency of thunderstorms, especially in the summer months, the potential exists for lightning to start wildland fires.

3.10.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] According to the Minnesota State Fire Marshal report, *2017 Fire in Minnesota*,[34] in 2017, residential fires accounted for 75 percent of all structure fires, 53 percent of total dollar loss, and 98 percent of all fire deaths in structures. These statistics continue to identify the home as the most dangerous place to be. A consistent factor in Saint Paul fires for more than a decade, is that 100% of fatal fires have occurred in the home.

Urban fires often occur in heavily populated and developed areas. Although the overall trend in fire fatalities has declined in the past thirty-five years, the potential vulnerability is still significant. The potential increases when alternate heating sources are in use during cold weather, building density increases, and due to the flammability of modern construction materials and furnishings.

High-rise buildings are a notable hazard, as any structure beyond 7 stories tall is beyond the reach of aerial fire apparatus, and the logistical and manpower needs to fight such a fire will require the assistance of multiple city departments and most likely mutual aid fire departments. Most commercial high rises in the City are protected by automatic fire sprinkler systems, but some of the high rises are only partially sprinklered, and two major residential high rises have no fire sprinkler system installed. Saint Paul Fire Department maintains an inventory of sprinklered, un-sprinklered and partially sprinklered high rise structures. The table below provides a listing of the un-sprinklered/partially sprinklered high rises in the City.

City officials should work diligently to encourage the retrofitting of these buildings with automatic fire sprinkler systems.

Life Safety (Public and Responders)

While all residents of Saint Paul are potentially at risk for impacts of urban fire, the higher density living conditions within the urban core present the greatest risk. There is a possibility of great loss of life if the city is affected by a major fire in a large residential structure, a high-rise building, or when more than one structure is involved.

Effects of the fire can lead to traffic accidents on surrounding roadways due to dense smoke, or health issues from breathing smoke. In addition, the safety of emergency responders could be at risk during intense operations that require prolonged exposure to fire conditions, or extraordinary rescue efforts. In any fire incident involving multiple

[3] https://dps.mn.gov/divisions/sfm/mfirs/Documents/Fire%20in%20Minnesota/Fire-in-Minnesota-2017.pdf

fatalities, responders may require critical incident stress debriefing assistance to deal with the situation.

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). Members of these populations often live in conditions that are more prone to fire due to aging structures and infrastructure, and lack of fire suppression systems.

In general, wildland fires pose less of a threat to the public as they tend to occur in less densely populated areas.

Property (Facilities and Infrastructure)

The highest risk to property would be those homes built prior to current building codes, buildings not being maintained to State Fire Code standards (where structures are not sufficiently separated to avoid exposure from an adjacent building), and in those structures that lack sufficient smoke and fire alarms or automatic fire sprinkler systems. One problematic area is within private dwellings: mandatory fire code inspections are not conducted in private dwellings except on a "complaint basis," so when violations do occur, they remain largely undetected. One solution is the Fire Department's 2018 "Project Safe Haven" – a courtesy home inspection program offered for owner-occupied dwellings and one to four-unit rental occupancies.

In the city of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also numerous bridges, communication facilities, and utility infrastructures (electricity, water, and sewer) 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 by an urban fire.

An extensive wildland fire occurring within any area of Saint Paul would likely cause damage to property, especially if it occurs in an area where structures are close together and access by fire apparatus may be constricted. The area most likely to experience a wildland fire in the City is along the river bottomland along the Mississippi River. A portion of these areas are not provided with a fire hydrant system for supplying fire suppression water. While hard-suction hose is available on some apparatus, due to the City's general response methods, training on drafting is rarely conducted.

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 or wildland 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, including personnel, apparatus and water supplies, could be the most vulnerable area of operations, as transportation, buildings and people would be impacted.

Environment

The environmental vulnerabilities due to a 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 urban fire/wildland fire is low.

An urban fire may also lead to less immediate and obvious adverse consequences to the natural environment, such as air contamination, contamination of water runoff containing toxic products, and other environmental discharges or releases from burned materials.

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 wildland) 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.

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[5] as well as mitigation.

An urban/wildland fire event has the potential to test the public's confidence in its elected leadership if critical prevention measures are not in place, and preparedness and response information is not timely, consistent, coordinated, and accurate.

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. In 2017, Saint Paul was awarded a Public Protection Classification of "2" (representing the highest level of fire prevention/suppression readiness ever awarded in the State of Minnesota) by the Insurance Services Office (ISO).

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to urban fire/wildland fire.

Capabilities

The City has assessed all-hazard authorities, policies, programs and resources, as documented in **Section 4** of this plan. In addition to the broad assessment of capabilities, the city maintains the following capabilities to prevent and/or respond to urban fires.

The Saint Paul Fire Department operates out of 15 Fire Stations, located throughout the city in three Districts, under the command of three District Chiefs and a Deputy Chief, per shift. The department currently operates a fire apparatus fleet of 15 Engines, seven Ladders, three Rescue Squads, 15 Paramedic Ambulances, one Arson Unit and numerous other special, support, and reserve units. In addition, the City operates two Hazardous Materials Units, a technical rescue/collapsed structure team as part of MN Task Force One, MN Aviation Rescue Team which is a an a helicopter rescue team (partnership with the Minnesota State Patrol), and two major fire/rescue boats.

Minimum staffing is four personnel (typically two firefighter/paramedics and two firefighter/Emergency Medical Technicians) for engine and ladder companies and five personnel for rescue squads. There are three "supermedic" companies (Ladder 7/Medic 7, Engine/Medic 8, and Engine/Medic 9); which are staffed with two dedicated personnel on the medic and four dedicated personnel on the engine. The 12 remaining Medic units are

[55] "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.

cross staffed with the four personnel assigned to the engine from their respective stations. In addition to these internal resources, the City is a signatory to the Minnesota Intrastate Mutual Aid Plan which provides access to large quantities of fire service resources that may be needed in a major fire, disaster or other major emergency.

There are significant, on-going efforts for public education in relation to risk reduction for urban/wildland fires which is heavily focused on prevention measures, including the following:

- Public information and education for individuals, families and businesses, such as fire safety plans, fire prevention and reduction systems, and appropriate preparedness measures such as building evacuation plans
- Building codes that require fire alarms and suppression systems in commercial structures and multi-family housing
- Dedicated fire personnel who coordinate the on-going city-wide fire prevention program

The City of Saint Paul presents fire prevention and preparedness education and information to the public throughout the year through multiple departments, including Fire, Safety and Inspections, and Emergency Management. Although the Fire Prevention and Public Education staff in the Fire Department provide on-going public education and information to a broad range of audiences, the number of personnel has been scaled back by two thirds over the last several years, and the erosion of this capability is concerning.

The primary focus for preparedness measures is life safety for the public and responders and protection of City resources.

Fire prevention information from trusted sources provides guidance for people in effective and timely ways to protect themselves from urban/natural fire events. Prevention measures for fire can be accessed through a number of sources, including:

- FEMA – https://www.ready.gov/wildfires
- National Fire Protection Association, Community Risk Reduction Standard - https://www.nfpa.org/-/media/Files/Public-Education/By-topic/Urban/Urban-Task-Force/UrbanPaper2016.ashx?la=en
- U.S. Fire Academy - https://www.usfa.fema.gov/prevention/
- American Red Cross - http://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies/fire
- Saint Paul Fire Department - https://www.stpaul.gov/departments/fire-paramedics/fire-prevention; https://www.stpaul.gov/news/make-your-home-safe-haven

- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management
- Minnesota's Department of Public Safety, State Fire Marshal Division
- Vision 20/20 - https://strategicfire.org/

In addition to the public education focus to individuals, families and businesses, jurisdictions frequently focus on community involvement in fire prevention and safety planning to reduce risk. The NFPA guide, *Public Fire Education Planning for Urban Communities*, defines the following process and provides detailed guidance in developing and implementing community risk reduction plans.

Figure 3.10-A: NFPA Community Risk Reduction Plan Development Model

Source: "Community Risk Reduction: Doing More with More", National Fire Protection Association, June 2016. Available at: https://www.nfpa.org/-/media/Files/Public-Education/By-topic/Urban/Urban-Task-Force/UrbanPaper2016.ashx?la=en

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for urban fire/wildland fire, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0** and **Appendix B**). This hazard was ranked by the jurisdiction as the **highest hazard**, based on risk and vulnerability, as illustrated in the *Saint Paul Hazard Identification and Risk Analysis*, dated November 2015 (**Appendix B**).

Table 3.10-5: Summary of Risk/Vulnerability Scores for Urban Fire/Wildland Fire

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Urban/Wildland Fire	4	4	3	2	3.3

Table 3.10-6: Summary of Consequence Scores for Urban/Natural Fire

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements)*
Urban/Wildland Fire	4	4	4	3	3	4	2	3.4

Table 3.10-7: Summary of Overall Risk for Urban Fire/Wildland Fire

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Urban/Wildland Fire	3.3	3.4	6.7	5	11.7	2

Future Population and Development Trends

As Urban fire/wildland fire is typically limited to geographic boundaries, it is possible to identify development and population trends that may impact this hazard. Current land use and building codes incorporate standards that address and mitigate fire prevention methods, systems and materials.

A major trend in Saint Paul and the surrounding metropolitan area is to emphasize the availability and affordability of low-income housing. These structures house some of the populations most at risk for fire. People in lower income brackets are at greater risk for fire injuries and death, and they often lack access to fire prevention equipment and information. Renovations and new developments for low-income residents should include automatic fire detection and suppression systems as part of the initial design considerations and final building results for all residential low-income housing projects.

The potential for impacts of future growth and development on urban fire/wildland fire will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Potential Impacts of Climate Change

As noted in *Adapting to Climate Change in Minnesota, 2017 Report of the Interagency Climate Adaptation Team (ICAT)*, dated May 2017, trends in the changing climate are already being felt in the state. Observed trends in precipitation demonstrate that rainfall events in Minnesota have been up to 26 percent more frequent during the past 40 years than the 1916-1960 average. In addition, there is a high level of confidence that the overall numbers of severe thunderstorms will be more frequent and larger in the coming decades.

Damaging thunderstorm hazards may become more concentrated on fewer days, indicating the potential for more "outbreaks", even major ones. Science is less clear about trends related to drought, extreme heat and general weather conditions that exacerbate the risks of urban fire or wildland fire. The ICAT report notes that while the current trend indicates that the overall numbers of severe thunderstorms are not changing, there is a tendency toward more "outbreaks" and severe weather systems that carry frequent lightning which could ignite fires. The detrimental effects of this change are seen in impacts for the increased potential for fires caused by lightning or damaging winds.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to urban fire/wildland fire as well as other information from the Minnesota SHMP updates:

- Have any urban fire/wildland fire events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict urban fire/wildland fire events or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to urban fire/wildland fire?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to urban fire/wildland fire?

Summary of Mitigation Strategies for this Section:

Most Saint Paul fires occur in the home and specifically in the kitchen. The following proven mitigation strategies should continue to be funded and prioritized:

a) Ensure smoke alarms are installed in sufficient numbers and placed according to NFPA 1 through programs like the Fire Department's Project Safe Haven courtesy inspection program.

b) Emphasize the use of automatic, maintenance-free stovetop fire extinguishers for cooking surfaces in all residential units

c) Expand the use of heat-limiting technology for all electric stovetop installations, especially in new residential developments or in major remodeling efforts in multi-unit residential structures.

d) Expand the use of automatic residential fire sprinkler systems to the maximum extent allowable under state law and the state fire code. This includes designing

incentive-based programs for owner-occupied homes and residential property owners. Specific focused attention should be directed toward efforts leading to retrofitting high rise buildings with automatic fire sprinkler systems. In relation to this initiative:

- Saint Paul Fire, DSI, and Emergency Management officials should make use of State and Federal Hazard Mitigation Grant Program (HMPG) to retrofit municipal buildings and publicly-owned housing with automatic fire sprinklers.

- Public education and outreach efforts should include information regarding the recent changes in tax law that provides tax relief of up to $1 million for small business owners who retrofit their buildings with fire sprinklers. (Ref: Tax Cuts and Jobs Act, Section 179 of Public Law 115-97).

e) Continue a robust public education campaign that addresses all common causes of home fires. This campaign should include the use of multi-language written materials and spoken presentations, and dramatic live fire demonstrations like the Kitchen Fire Demonstration Trailer and the Side-by-Side Sprinkler Demonstration Trailer used by the Fire Department.

f) Continue a robust public education campaign within the school systems to educate future residents on the importance of fire prevention

g) Expand education initiatives and programing for older adults.

h) Continue a robust fire code inspection and enforcement program focused on the fire code and life safety items.

Although the wildland fire problem in the city is less prevalent than the urban fire threat, the areas along the railroad lines and along the Mississippi River bottomlands remain a notable threat. This threat is exacerbated by the lack of fire hydrants in areas in Lilydale Park, Cosby Park/Hidden Falls Park, and in areas along Point Douglas Road/Battle Creek Park. Mitigation strategies that should be incorporated to address wildland fire include:

a) Fire Department mutual aid agreements and training with other Ramsey County Fire Departments regarding the use of hard-suction water supplies and tender operations to establish continuous water supplies for fire suppression activities in areas not protected by hydrants.

b) Expand the fire hydrant systems to areas of the city not currently equipped with them.

SECTION 4 MITIGATION STRATEGY

44 CFR, Part 201.6 Requirements:
• **§201.6 (c) (3)**: [The Plan documents] each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs. • **§201.6 (c) (3) (ii)**: [The Plan addresses] each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate. • **§201.6 (c) (3) (i):** [The Plan includes] goals to reduce/avoid long-term vulnerabilities to the identified hazards. • **§201.6 (c)(3)(ii):** [The Plan identifies and analyzes] a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure. • **§201.6 (c) (3) (iv); §201.6 (c) (3) (iii):** [The Plan contains] an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction. • **§201.6 (c)(4)(ii):** [The Plan describes] a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate.

2019 Update:
• This Section was reorganized for consistency with the review criteria. • Mitigation goals and objectives were redefined and restructured to provide a more distinct alignment with hazard risks and actions; "Mitigation Action Steps" were removed from the Goals and Objectives section and re-evaluated for inclusion in the Mitigation Actions Table in this update. • A new format for developing mitigation actions was utilized. • A new methodology for prioritizing mitigation actions was initiated.

4.0 Overview

This section discusses goals, objectives, existing capabilities, and potential remedies for the gaps discovered during the mitigation planning process. Many of the goals, objectives and action steps came directly from an analysis of capabilities and gaps in the city's ability to mitigate specific hazards. Others came directly from stakeholder and community input and through hazard surveys. Finally, some goals, objectives, and action steps came from Mitigation Planning Team members through awareness of inherent deficiencies in the jurisdiction's critical infrastructure or mitigation efforts. This corporate knowledge contributed to a large extent in the preparation of this section.

The combined steps of the planning process, along with the diligent work of the Stakeholder Working Group (SWG), subject matter experts, and other planning partners, resulted in a comprehensive mitigation strategy and action plan for implementation. The scope of this section includes:

4.1 Mitigation Goals and Objectives
4.2 Mitigation Capabilities
4.3 Mitigation Actions
4.4 Action Plan for Implementation

- **Prioritization of Mitigation Actions**
- **Implementation Tools and Integration with Existing Programs, Plans and Procedures**
- **Potential Funding and Resources**

In addition to the information provided in this section of the Base Plan, the following associated appendices contain detailed information that supports the mitigation strategy process, development and prioritization of mitigation actions, and the implementation plan described in this section:

Appendix C-1	**Mitigation Action Worksheet**
Appendix C-2	**Mitigation Prioritization Criteria and Ranked Projects List**
Appendix C-3	**Implementation Tools for Mitigation Actions**
Appendix C-4:	**Mitigation Action Ranking Criteria and Worksheet**

4.1 Mitigation Goals and Objectives

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. Objectives provide more specific direction to accomplish the goals. Taken as a whole, the mitigation goals and objectives provide the overall framework for the city's mitigation strategy.

The goal-setting process for the 2018 Plan update was initiated following the Kick-Off Meeting on February 27, 2018 through a series of methods. In the months that followed this meeting, Saint Paul Emergency Management (EM) staff conducted a series of one-on-one meetings with stakeholder and subject matter expert departments, agencies and organizations (documented in **Section 2**) to capture overall priorities and initiatives that support mitigation. In addition, these meetings provided the opportunity to gather updated hazard and risk data; ascertain the current level of mitigation capabilities; and assess achievements in implementing the strategy of the 2012 Plan, which all serve to evaluate the status of previously identified goals and objectives.

The next step in goal-setting was conducted by the Saint Paul Emergency Management (EM) staff with a review of the 2012 Plan goals and objectives. This list was compared with information gleaned from the agency meetings and modified and condensed to reflect new risk reduction priorities and opportunities and to provide a more cohesive scope. The revised and updated goals and objectives were distributed through email to the Stakeholder Working Group for review, and input from this process resulted in a final set of goals and objectives that were approved on May 28, 2019.

Table 4-1: Mitigation Goals and Objectives, 2019

GOAL 1: Protect public health and safety	
Objective 1.1	Implement mitigation activities that will assist in protecting lives by making homes, businesses, infrastructure, and critical facilities more resistant to hazards.
Objective 1.2	Identify and reduce the impacts of hazards on vulnerable populations
Objective 1.3	Improve and promote systems that provide early warning and emergency communications
Objective 1.4	Train emergency responders on hazard-specific plans and procedures
Objective 1.5	Reduce public health risk from natural and non-natural hazards
Objective 1.6	Increase social resiliency by improving knowledge about climate-related hazards and their impacts, and promoting adaptive mitigation strategies to protect health and safety
GOAL 2: Preserve property	
Objective 2.1	Strengthen state and local building and health code enforcement
Objective 2.2	Consider known hazards when identifying a site for new facilities and systems
Objective 2.3	Implement mitigation programs that protect critical facilities and services and promote reliability of lifeline systems to minimize impacts from hazards, maintain operations, and expedite recovery from an emergency
Objective 2.4	Promote appropriate mitigation actions for all public and privately-owned property within the City's jurisdiction including, but not limited to, residential units, commercial structures, educational institutions, healthcare facilities, cultural facilities, and infrastructure systems
Objective 2.5	Adopt and enforce public policies to minimize negative impacts of development and enhance safe construction in high-hazard areas
Objective 2.6	Create redundancies for critical networks such as transportation, 5.4water, sewer, digital data, power and communications
Objective 2.7	Integrate new hazard and risk information into building codes and land use planning mechanisms
Objective 2.8	Incorporate effective mitigation strategies into capital improvement projects within the city
Objective 2.9	Encourage the development and incorporation of innovative technological solutions without compromising neighborhood or building character
Objective 2.10	Continue and enhance participation in the NFIP by pursuing CRS designation, and identifying and implementing mitigation actions for flood-prone properties.
GOAL 3: Promote a sustainable economy	
Objective 3.1	Prevent spring runoff (river) flood damage to property
Objective 3.2	Promote post-disaster mitigation as part of restoration and recovery
Objective 3.3	Develop feasible plans to continue critical business operations post-disaster
Objective 3.4	Partner with the private sector to promote business continuity efforts that include employee/employer education about disaster preparedness and mitigation at work and at home
GOAL 4: Promote and sustain a healthy environment	
Objective 4.1	Develop hazard mitigation policies that protect the environment
Objective 4.2	Advance understanding of the relationship between climate change and natural hazards

Objective 4.3	Promote climate change adaptation strategies that protect against long-term effects on the environment
Objective 4.4	Form partnerships to leverage and share resources
GOAL 5: Encourage public preparedness for disasters	
Objective 5.1	Improve community engagement and outreach by organizations and agencies that provide services to vulnerable populations with medical, access, and functional needs
Objective 5.2	Improve public outreach and access to hazard information, data, and maps to enhance understanding of natural hazards and the risks they pose
Objective 5.3	Enhance technology to collect and analyze hazard information, including databases and maps, by using the latest available data and scientific analysis about hazards and vulnerabilities
Objective 5.4	Improve public knowledge of protective measures so individuals are able to appropriately prepare and respond during hazard events

4.2 Mitigation Capabilities

[EMAP 4.2.2, 4.2.43] Building on the identified hazards and associated threats to and vulnerability of the Planning Area described in **Section 3**, it is necessary to assess what loss prevention mechanisms are already in place within the Planning Area. By examining various capabilities related to the roles and responsibilities of the governing body in protecting the community, the mitigation goals, objectives and proposed actions can be more accurately focused on the greatest opportunities for loss reduction.

Throughout the planning process the SWG reviewed various City and area plans, documents, historical records, and other information. City departments and agencies active in mitigation, preparedness, response and recovery activities contributed to the capabilities assessment by informing Saint Paul EM planning staff of historical data, plans, studies, programs, projects, personnel and other resources that support implementation of the 2019 Plan.

The SWG used a two-step approach in conducting this assessment. First, a compilation of summary information related to existing policies, studies and plans noted in the 2012 plan was prepared by the Saint Paul EM planning staff and reviewed with the SWG agencies and organizations during face-to-face agency meetings. While significant progress in flood mitigation has been achieved in previous years, the review also included information collected during the 2018-2019 planning process that focused on the broad range of all hazards. The second step of the process involved updating the capabilities worksheet and National Flood Insurance Program (NFIP) survey form based on new data and information collected during the agency meetings and through additional research.

Specific capabilities noted in the department/agency meetings include:

- First responders, emergency service personnel, and city leadership were involved in extensive preparation for the 2018 Super Bowl LII held in Minneapolis
- Frequent response to severe weather events such as flooding and extreme winter weather
- The City maintains the *City of Saint Paul Comprehensive Emergency Management Plan* and related plans and procedures
- Comprehensive hazard identification, risk assessment and consequence analysis reviewed and maintained annually in the *Saint Paul Hazard and Risk Assessment (HIRA) Evaluation Tool*
- Accreditation of Saint Paul Emergency Management Program by the Emergency Management Accreditation Program (EMAP)
- Accreditation of Ramsey County Emergency Management Program by EMAP
- Accreditation of Saint Paul-Ramsey County Public Health by the Public Health Accreditation Board (PHAB)

The Capabilities Assessment Worksheet was utilized to assess the following areas:

- Planning and Regulatory
- Administrative and Technical
- Safe Growth
- Financial
- Education and Outreach

The planning team considered both internal and external capabilities. Because the City is a large urban area and the State Capital, there are many internal capabilities and capacities for specific functions performed by employees or staff, and other services provided through contractual arrangements or agreements in coordination with other jurisdictions, outside agencies, or vendors. In addition, support for some capabilities is gained through technical assistance from county, state or federal agencies.

Table 4.2: Summary of Mitigation Capabilities, by Function

Planning and Regulatory Capabilities
• 2040 Comprehensive Plan [update of 2030 Plan] • City of Saint Paul, Title VI – Building and Housing • City of Saint Paul, Title VII – Fire Code • City of Saint Paul, Title VIII – Zoning Code • City of Saint Paul, Title IX – City Planning/Chapter 72-Floodplain Management Overlay Districts • Capital Improvement Plan (5-year) • Economic Development Strategy • Stormwater Management Program • Transportation Plan • Housing Plan • Water Resources Management Plan

- Historic Preservation Plan
- Consolidated Plan (5-year) (planning guide for housing/community development needs to access grant programs such as CDBG)
- EPA Brownfields Redevelopment Showcase Community (1998)

Analysis:

- City departments and stakeholder agencies maintain robust planning regulations and programs that involve multiple local, regional and state partners
- City zoning, land use, subdivision and building codes and regulations address potential hazard-related conditions such as floodplains, urban fire and steep slopes
- The City's planning and regulatory capabilities are sufficient to support appropriate mitigation goals, objectives and actions.

Administrative and Technical Capabilities

- 21-member Planning Commission
- Mitigation Stakeholder Working Group
- Public Works maintenance programs (stormwater drainage, tree trimming, etc.)
- Mutual Aid agreements (police, fire, public health, public works)
- Administrative staff includes emergency building official, floodplain administrator, emergency manager, community planner, civil engineer, GIS coordinator, grants manager)
- Warning systems and services (outdoor warning signals)

Analysis:

[EMAP 4.2.4(1)] City departments, and stakeholder agencies and organizations have capabilities to support on-going administrative and technical needs related to building codes and ordinance, floodplain and stormwater management, fire codes and ordinances, public health, and mitigation project development and management. In addition, technical information and assistance is provided by the jurisdiction's staff, much of which is available through online resources, such as:

- Building Code and Ordinances:
  - Sustainable Power Zoning Code [amendments pending as of March 6, 2019]
  - Erosion and Sediment Control: https://www.stpaul.gov/sites/default/files/Media%20Root/Safety%20%26%20Inspections/DSI.Bldg_ErosionSedimentControl.pdf
- Fire Inspection: https://www.stpaul.gov/departments/safety-inspections/fire-inspections
- Flood-related Information and Resources for Business Owners: https://www.stpaul.gov/sites/default/files/Media%20Root/Safety%20%26%20Inspections/DSI.Biz_Flood_Prep_%26_Cleanup.pdf
- 2019 Flood Season in Saint Paul - Flood preparedness and protection measures: https://www.stpaul.gov/departments/emergency-management/flood-preparations
- Additional resources for technical assistance: https://www.stpaul.gov/departments/emergency-management/additional-resources

Safe Growth Capabilities
• City plans and policies address land use, zoning, subdivisions, transportation, public safety and environmental management • The zoning ordinance contains floodplain overlay zones that limit zoning changes that allow greater intensity or density of use
Analysis: • Floodplains are clearly identified and development is prevented or controlled within these hazard-prone areas • Additional analysis is required to determine that: o Land use policies discourage development or redevelopment within other natural hazard areas o Environmental systems that protect development from hazards are identified and mapped o Subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas, and provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources

Financial Capabilities
• Capital Improvement Budget • Authority to levy taxes for specific purposes • Fees for water, sewer and gas services • Impact fees for new development • Storm Sewer System Charge/Utility Fee • General obligation bonds or special tax bonds • Community Development Block Grant • Other federal and state funding programs
Analysis: The City of Saint Paul has a broad capability to access and manage multiple funding resources to implement mitigation activities.

Education and Outreach Capabilities
• On -going public education and information program presented by multiple departments and disciplines, including public-private partnerships (fire prevention and safety, public health, natural hazards, environmental) • Multiple departments and agencies maintain staff trained and/or certified in public information • Ramsey County is StormReady certified • All-hazard information is available online through multiple departments and agencies to provide education and information day-to-day as well as during emergencies
Analysis: The City of Saint Paul has a broad capability to provide public education and information to residents and tourists through multiple methods and venues.

The analyses presented above demonstrate the City's existing authorities and policies,

programs, and resources including potential funding for mitigation-related projects support implementation of mitigation actions linked to the broad range of hazards identified by the SWG.

National Flood Insurance Program Assessment and Continued Compliance

The City of Saint Paul is a participant in the National Flood Insurance Program (NFIP). The function of the NFIP is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost. In exchange, the City agrees 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.

As a step in the capability assessment, a review of the City's NFIP participation was recorded on the Survey Form, indicating the current status of participation in the program. *(Specific data related to NFIP insured properties, premiums, claims and repetitive loss properties since 1978 is provided in **Section 3.5, Tables 3.5-7** and **3.5-8**.)*

Table 4.3: NFIP Survey Results

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	160
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	44 claims 3 claims for substantial damage
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	[Inventory project identified as 2019 Mitigation Action.]
Describe any areas of flood risk with limited NFIP policy coverage	Community FPA	None identified
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	No
Is floodplain management an auxiliary function?	Community FPA	Yes/ in coordination with DNR State Floodplain Manager

Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Floodplain Management Overlay Districts have provisions for building and development standards, including permitting and inspections. The City maintains the following web page for NFIP information: https://www.stpaul.gov/departments/emergency-management/flood-preparations/preparing-flooding
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	None at this time.
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Are there any outstanding compliance issues (i.e., current violations)?	Community FPA	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	Community FPA	November 6, 2015

The City of Saint Paul is committed to maintaining compliance with the National Flood Insurance Program. This is exhibited through multiple measures and processes documented in the capability assessments, NFIP survey form, Goal 2 - Objective 2.10, action plans for implementation, and the 2019 Plan maintenance process and schedule. In addition, multiple mitigation actions identified by the planning team build on flood mitigation and resulting risk reduction.

Development permits for all new building construction or substantial improvements are required by the City in all A, AO, AH, and A-numbered Zones. Flood insurance purchase may be required in flood zones A, AO, AH, and 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 (FEMA) and is required to be maintained by communities participating in the NFIP. According to the NFIP, local governments will maintain records of elevations for all new construction or substantial improvements in floodplains and keep the certificates on file. There are two (2) Repetitive Loss Properties in the City of Saint Paul at the time of the 2019 Plan update.

NFIP compliance measures demonstrated by the City include:

- Maintaining regulatory requirements of the floodplain management program through enforcement
    - Municipal floodplain codes and ordinances

- Monitoring storm water plans and practices for consistency with floodplain regulations
- Considering enhancement of floodplain management through voluntary Community Rating System (CRS) participation
- Implementing flood mitigation actions
- Identifying opportunities for flood mitigation education and outreach
- Annual monitoring and evaluation of the Saint Paul Hazard Mitigation Plan
- Maintenance of the City's NFIP policies
- Adoption of the State Building Code requirement for base flood elevation plus 2 feet
- Maintaining the City of Saint Paul Flood Insurance Study (FIS) and Digital Flood Insurance Rate Maps (DFIRM)
- Monitoring future land use planning and review and update of Comprehensive Plans

These measures, in addition to continually involving the public in mitigation planning, will maintain a high priority and commitment to flood mitigation in the Planning Area.

4.3 Mitigation Actions

The mitigation strategy must identify the actions and/or projects to reduce the impacts of hazards prioritized in the risk assessment that the City intends to implement. In addition, the process of developing actions involves analysis of multiple factors that may contribute to an action's effectiveness and feasibility. The following procedure summarizes the multi-step process for submitting, accepting, and prioritizing potential mitigation actions:

Table 4.4: Procedure for Submitting, Approving, and Prioritizing Mitigation Actions

Procedure for Submitting, Approving, and Prioritizing Mitigation Actions		
Submitting a potential mitigation action	**Step 1:** Identify the issue or problem	Base information on documented post-disaster reports, after-action plans, studies, reports, risk assessments, previously – submitted actions, and other statistics or data
	Step 2: Identify and develop a potential solution or action, including alternatives, to address the issue or problem	Complete an **Action Worksheet**: Provide the Title; develop a description of the problem and potential solution, including alternatives; 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
	Step 3: Submit the action for consideration	Send **Action Worksheet** to Saint Paul Emergency Management.
	Step 4: Saint Paul EM provides technical review	Is it consistent with the Mitigation Strategy? Does it address a priority hazard? Is it feasible? Is it potentially cost effective?
Approving the action	**Step 5:** Action is submitted to Stakeholder Work Group for approval	Saint Paul EM coordinates the submission and approval process.
	Step 6: Approved action is added to the mitigation list	Saint Paul EM is responsible for maintaining the comprehensive list of mitigation actions
Prioritizing the action	**Step 7:** Approved action is prioritized based on the criteria provided in this plan	Saint Paul EM coordinates the prioritization process using the criteria described in the Mitigation Plan.
	Step 8: Prioritized action is monitored, and positioned for implementation	Can the responsible entity implement the action through existing planning processes? What is the funding source? Is it an eligible project under current grant funding criteria? Has a detailed Benefit-Cost Analysis (BCA) been performed to confirm that the action is cost-effective?

Mitigation Actions are practical, specific actions that can be taken by City Departments, partners in industry, state and local governments, business and private sector organizations, and other partners assigned to complete remediation, mitigation, prevention, and preparedness activities. The starting point for identifying appropriate mitigation actions for the 2019 Plan update was to evaluate progress made in completing previously-identified actions and identify conditions that may prevent an action from being carried out in the future. This evaluation resulted in the determination of the current

status for the 2012 mitigation actions, as described in the summary in Table 4-5. The 2012 Mitigation Action Status Worksheet with detailed information is provided in **Appendix C-2**.

Table 4-5: Status Update of 2012 Mitigation Actions

2012 Status	Number of Actions
Total Mitigation Actions	64
Total Completed since 2012	11
Actions Removed – response oriented	9
Actions Removed – no update	22
Total Actions retained in 2019 Plan	**22**

Following the status update of the 2012 mitigation actions, the Stakeholder Working Group and Saint Paul EM planning staff reviewed the updated risk assessment to identify the highest hazards of concern and greatest opportunities to reduce risk based on the hazard priorities. Mitigation actions previously identified in the 2012 Plan that were retained in the 2019 update were aligned with updated goals and objectives. Due to the amount of time that has passed since the 2012 list was developed, it was determined that each sponsoring entity of a previous project would reconsider all actions deemed to still be relevant and confirm or revise action descriptions to submit for the current plan. (*Following adoption of this plan, all future actions will be submitted on a **Mitigation Action Worksheet,** which is provided in **Appendix C-1**.*) This process is consistent with FEMA guidance for local hazard mitigation planning, which also supports plan implementation by:

- Defining the scope of the action in relation to addressing the hazard issue
- Identifying potential alternative actions
- Identifying a responsible agency(is) to sponsor each action
- Identifying potential resources, such as funding, technical assistance and materials
- Establishing an estimated timeframe in which the action will be implemented

4.4 Action Plan for Implementation

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and community-based planning. The Action Plan lays the groundwork for implementation by describing how the mitigation actions will be prioritized, implemented and administered by the City or the appropriate sponsor, and how the mitigation plan will be incorporated into existing planning mechanisms. Saint Paul EM and other project sponsors continuously seek to identify resources to support the

identified action steps, including mitigation grants, City budget funds, capital improvement funds, public/private partnerships, corporate and non-profit donations, and other sources.

Implementation will be accomplished by adhering to the process and schedules identified for each action and through continuous and vigilant efforts to highlight the multi-objective benefits of the mitigation program by the City of Saint Paul and its stakeholders. This effort is achieved through routinely monitoring agendas, attending meetings, capitalizing on existing planning efforts and funding opportunities, and promoting a safe, sustainable community. At every opportunity, the coordination of the goals and objectives common to the mitigation plan and other plans and policies will help to integrate the mitigation actions into existing programs and to leverage and implement some of the more costly recommended actions.

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities, including special pre- and post-disaster funds, state and federal earmarked funds, and other grant programs including those that can serve or support multi-objective applications. Assessment of potential benefits in relation to costs during the action-development process will help to position each action for possible funding when it becomes available.

The SWG adopted a mitigation action evaluation, prioritization and implementation methodology that established the Action Plan, as described in the figure below**.**

Figure 4-A: Mitigation Action Plan Methodology

The following steps highlight this methodology through the components of the Action Plan for Implementation.

Component 1: **Review of 2012 Actions and Action Worksheets**
The **review** provided the opportunity to identify progress in risk reduction by identifying completed projects as well as those that are still relevant to carry forward in the updated plan. The Action Worksheets present a consistent template for development of information related to each action, and analysis of alternatives to address the identified issues.

Upon review of the 2012 actions, each sponsoring entity had the opportunity to obtain technical assistance from Saint Paul EM Mitigation staff to assist in developing new, viable and actionable projects. This step in the process supported the Action Plan for Implementation by:

- Evaluating potential alternatives to address hazard issues
- Assigning a responsible agency(is) to sponsor each action
- Identifying potential resources, such as funding, technical assistance and materials
- Establishing an estimated timeframe in which the action will be implemented

Although **Action Worksheets** were not used in this plan update, they will be utilized from this point forward as a means of ensuring that sufficient information is provided when actions are submitted. The Action Worksheet form is provided in **Appendix C-1.**

A total of **31** mitigation actions were submitted for this plan update. The actions summarized in **Table 4-6** below are linked to the mitigating hazard, responsible agency/individual, funding options, timeline, and supporting mitigation goals and objectives. The actions cover a range of project types, including:

- Local Plans and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Program

In addition, some projects that address emergency response measures, such as operational plans and training, are included to ensure that these actions are maintained for risk reduction of the related hazards.

***Component 2:* Ranking System for Prioritization**
The SWG and Saint Paul EM planning staff evaluated and prioritized the mitigation actions, which resulted in a comprehensive list of prioritized actions that address all hazards.

The City's approach to prioritizing identified mitigation actions and projects is to assign relative scores to the actions based on qualitative factors. By also considering costs and benefits, this method clearly emphasizes the Benefit-Cost Review. Additional criteria, commonly provided the framework to determine a ranked order for all mitigation actions based on social, technical, administrative, political, legal, economic and environmental factors.

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 five years given the resources available
- 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.

Assessment of Benefits and Costs

DMA 2000 mandates an emphasis on Benefit-Cost Review as part of the prioritization process. There are many ways of determining whether potential actions are cost-effective. The full Benefit-Cost Analysis process is costly to carry out for all actions; 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 at the time that funding opportunities become available for individual actions that are determined to be feasible and eligible for funding, but a general assessment of benefit-cost is incorporated in the prioritization criteria.

Benefit-Cost Analysis data related to specific projects is maintained by the responsible entity for implementing the action.

Ranking Criteria

The ranking criteria used to prioritize mitigation actions for this Plan includes consideration of:

- Life safety/property protection
- Funding availability
- Probability of matching funds
- Benefit cost review
- Environmental benefit
- Technical feasibility
- Timeframe of implementation

The scoring format used a range of 0 to 4 points, with related criteria (see **Prioritization Worksheet** in **Appendix C-3**. Total points were determined with the final score indicating a **low**, **medium** or **high** priority.

The table below provides a summary listing of the **2019 Mitigation Actions** and the prioritized rank for each action. The comprehensive list of actions, with responsible agency/individual, potential funding source, timeline, supporting mitigation goals and objectives, 2012 status, anticipated completion timeframe and hazard addressed is provided in **Appendix C-3.**

Table 4-6: 2019 Prioritized Mitigation Actions

2019 Action #	Action Step	Priority High Medium Low
1	Extreme Temperature Shelters - Coordinate with the Department of Parks & Recreation (P & R) to identify procures, supplies and plans for implementation.	**M**
2	Public Education Awareness Campaigns - General; Promote the use of Family Emergency Plans, NOAA Weather radios, and Severe Weather Awareness activities... Winter; Promote use of home and auto survival kits and urge public to heed winter weather warnings... Summer; Coordinate with Libraries and Parks & Rec for cooling sites, and urge public to heed winter weather warnings...Terrorism; Educate and disseminate info on "See Something, Say Something campaign, common sense terrorism & CBRNE awareness... EOP and ESF's; Community Outreach Education, Planning Discussions... Economic Development; Educate citizens on low interest loans for improving structural ability of homes & businesses	**H**
3	Disaster Exercise Development - Develop flood recovery and mitigation scenarios and integrate into disaster exercises	**H**
4	Infrastructure Hardening - Conduct study to identify eligible projects and build capacity by mitigating key infrastructure nodes to harden against terrorism and other hazards	**L**
5	Public Health Exercise - Conduct Isolation & Quarantine Tabletop Exercise	**H**
6	Assist businesses in developing business continuity plans and resources to minimize hazard impacts.	**M**
7	Develop Bridge Infrastructure Failure response plans	**M**
8	Riverfront Fire Hydrant Gaps (Southport Industrial Study Item)	**M**
9	Downtown Evacuation Plan - Develop & Complete	**H**
10	Bridge Post-Failure Plans - Alternate transportation plan post-failure	**M**
11	Incident Response Plans for Large event venues - pedestrian/traffic hazards, signage/cameras, patrol, personnel requirements	**H**
12	Water Street - Raising the street in low area(s)…	M
13	Wabasha Hill/Street Stabilization Plan - Develop and Complete	**M**
14	Raspberry Island - Bridge Deflector Project	**M**
15	Raspberry Island - Debris Deflector for tip of island	**M**

16	City House Building - Utility Protection & Sewage Ejector Relocation	**M**
17	Chestnut Plaza - Feature Fountain Pump Pit Relocation	**M**
18	Upper Landing Feature Fountains (4) Pump Pit Relocation	**M**
19	Hidden Falls Park - Pathway Removal/Realignment Near Low Spot Along River	**M**
20	Harriet Island Public Dock - Add more structural support related to debris entanglement to reduce repetitive costs for contract debris and dredging	**M**
21	Watergate Marina - Define and develop new facility electrical and fueling station systems to protect against annual flooding	**M**
22	Crosby Bog Walk - Build New Structure	**M**
23	Flood Plain Structure Inventory Project - Inventory all structures that are at flood risk within the Mississippi River flood plain at Saint Paul. Determine individual Risk Assessments for existing structures. Includes: inventorying (marrying-up with Conditional Use Permits), developing Key Contacts Lists, facilitate accomplishment of Flood Response Plans and the creation of maps.	**M**
24	Community Rating System Project – This voluntary program recognizes and encourages community floodplain management activities exceeding the minimum National Flood Insurance Program standards. This action tailors Saint Paul's own particular hazards, character, and goals. The city implementing standards in turn ultimately leads to discounted premiums rates.	**M**
25	Localized NOAA Atlas 14 Map Assessment Update Project - Utilize current data and provide updated assessment for Saint Paul flood plain.	**M**
26	West Levee - Determine FEMA re-certification and PAL status	**M**
27	Localized NOAA Atlas 14 Map Assessment Update - Utilize current data and provide updated assessment for Saint Paul flood plain.	**M**
28	West Levee Re-Certification Project - Determine future FEMA re-certification and PAL	**M**
29	Enact Combined Enhanced Fire Safety Ordinances - Automatic Fire Sprinkler Mitigation Initiatives	**M**
30	Incorporating Fire Sprinkler Technology in New and Existing Buildings - Automatic Fire Sprinkler Mitigation Initiatives	**M**
31	Smoke Detector Education Program - Continue to implement smoke detector education and giveaway program	**M**

Component 3: **Integration into Existing Plans and Procedures**
There is a wide variety of steps that can be taken to integrate mitigation goals, objectives and actions into existing plans, procedures and programs. The actions selected are consistent with the City's capabilities and demonstrate how mitigation planning and the Action Plan can be integrated into existing programs, plans and procedures.

The following table describes how the strategy may be integrated into the identified plan, procedure or program.

Table 4-7: Steps to Integrate Mitigation Planning into Existing Plans and Procedures

Plan, Procedure or Program	Implementation Action
Comprehensive Plan	Integrate mitigation goals into Comprehensive plan at next plan revision cycle.
Land Use/Development Regulations	Review land development regulations to ensure that mitigation goals are addressed and thereby potentially minimizing development in identified hazard areas.
Building/Zoning Codes	Review building and zoning codes to ensure that mitigation goals are addressed. The adoption and enforcement of building codes relates the design and construction of structures to standards established for withstanding a variety of forces. Zoning can keep inappropriate development out of hazard-prone areas and can designate certain areas for such things as conservation, public use, or agriculture.
Subdivision Regulations	Review subdivision regulations to ensure that storm water drainage issues don't contribute to urban flooding as a result of building residential or commercial developments. These regulations have the potential to reduce the impact of urban flooding on a community.
NFIP	Monitor NFIP requirements to ensure that mitigation goals, objectives and actions adequately address flood risk issues.
Floodplain Management	Integrate Community Rating System activities with the mitigation planning process.
Economic Development	Review economic development plans to ensure that mitigation goals are addressed.
Public Involvement	Identify and carry out opportunities for public involvement in mitigation planning and actions.
Education and Outreach	Present public education and information related to mitigation goals and activities on an on-going basis

Emergency Management Plans & Procedures	Ensure that mitigation is integrated into hazard response and recovery plans and programs, including procedures to review mitigation opportunities post-disaster.
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.
Funding Programs	Monitor potential funding programs and sources to identify opportunities for implementing actions.
Resiliency/Sustainability Plans & Programs	Review resiliency and sustainability plans and programs to ensure that mitigation supports common goals.
Local Government Policy	Monitor proposed laws, ordinance, and regulations to ensure they are consistent with mitigation goals and actions.
Climate Change Studies, Plans and Adaptation Measures	Participate in the City's climate change planning committees to ensure that mitigation risk, vulnerability and strategy are consistent with climate change data and recommended adaptation measures. Leverage funding opportunities that merge similar objectives for resiliency, adaptation and mitigation.

Programs, Plans, Studies and Reports that Inform and Implement Mitigation Actions

In addition to prioritizing and assigning responsibilities for implementation, opportunities for integrating mitigation actions within current planning efforts will put them in motion. The plans, studies, programs and other resources listed in the tables below are a broad representation of mitigation-related resources and tools that can be used to implement this plan.

Various elements of information from these programs and documents are also integrated into appropriate sections of this plan.

Table 4-8: Summary of Programs, Plans, Studies and Reports

Program, Plan, Study or Report	How it Informs/Implements Mitigation Actions
Emergency Management Program Strategic Plan	The annual review cycle includes review of: • Hazard priorities (based on frequency and level of risk/vulnerability • Mitigation goals, objectives and actions steps • Available or potential funding sources • Disaster events that have occurred since the last update
City of Saint Paul 2040 Comprehensive Planning Process (Current plan adopted 2010; Draft of updated plan released in March 2018)	The annual review cycle includes review of: • Major trends in comprehensive plan policy, including climate change • Opportunities related to growth and density, economic development, and climate change mitigation, adaptation and resiliency that could impact hazard risks and vulnerabilities • Resiliency and sustainability goals and objectives that are consistent with the mitigation strategy • Proposed future development and land use changes to ensure there are no negative impacts on hazard risk and vulnerability
City of Saint Paul Comprehensive Emergency Management Plan (CEMP)and Associated Operational Plans	The mitigation plan provides the all-hazard foundation for the jurisdiction's preparedness, prevention, response and recovery plans by identifying hazards of highest concern and their associated risks and vulnerability. The CEMP addresses operational concepts and procedures and integrates mitigation into the recovery phase. Associated plans align with the hazards, risks and vulnerabilities associated with the mitigation plan and identify roles, responsibilities, resources and operational procedures.
City of Saint Paul Continuity of Government and Continuity of Operations Plans	The City's Continuity of Government Plan ensures that the elected leadership will be able to maintain essential government services during a widespread disaster. Continuity of Operations Plans have been developed by City departments/agencies to address essential services and resources.

Strategic Framework for Community Resiliency (Draft, May 22, 2016; Final report projected May 2016)	This initiative engaged stakeholders to examine areas of potential hazards, exposures and vulnerability related to climate change, with the objective of developing a strategy to incorporate climate change adaptation into relevant local and regional plans and projects. The on-going planning process will identify resiliency strategies and procedures to prepare the City to respond and adapt to the changing climate. Information in this report informed sections on climate change found in this plan update. In August 2018, Saint Paul EM staff was invited to participate on the Steering Committee for this initiative. The planning process will include researching, assessing, organizing, planning, and documenting data and information related to climate change impacts and adaptation.
City of Saint Paul, Minnesota Consolidated Plan, 2015-2019 (2018 Draft Action Plan)	This five-year plan is submitted to the U.S. Department of Housing and Urban Development with an annual Action Plan that guides housing and community development programs. Priority needs identified in the plan address common goals with mitigation including acquisition, demolition and clearance of property, public infrastructure, and community outreach. Funding sources such as CDBG provide an opportunity to implement actions that meet joint goals and objectives through partnerships.
Climate Action and Resilience Draft Plan; A Framework for Our Community to Address the Impact of Climate Change, City of Saint Paul, Mayor Melvin Carter (April 2019)	This draft report was released in April 2019 and is included in this plan as a reference to ensure that Saint Paul EM staff monitor progress of adopting and implementing the Climate Action Plan. Risk and vulnerability data presented in the Climate Action Plan will be taken into consideration during the annual hazard mitigation risk and vulnerability analysis to determine whether significant changes in hazards, risks or vulnerabilities have occurred that could result in changes in mitigation priorities, goals and actions. In addition, adaptation measures will help to inform potential mitigation actions.

Implementation Resources

The following table provides a comprehensive listing of federal, state, local and other entities that may provide programs, funding, technical assistance or other types of resources that can support mitigation actions. It is not intended to be a comprehensive list of agencies and organizations, but serves as a starting point for additional research.

Table 4-9: Federal, State and Local Funding and Assistance Resources

Federal, State and Local Mitigation Funding and Assistance						
Program	**Description**	**Lead Agency**	**Link**	**Regulatory**	**Technical**	**Financial**
Federal Grant and Assistance Programs for Governments	Catalog of federal disaster assistance and hazard-related grants and assistance	FEMA	*[Temporary IP address]* https://beta.sam.gov/?s=program&mode=list&tab=list		x	x
Grants.gov	Searchable catalog of federal grant opportunities in health and human services	U.S. Department of Health and Human Services (HHS)	http://www.grants.gov/web/grants/home.html	x	x	x
National Earthquake Hazards Reduction Program	Program research to advance understanding earthquakes occurrence and impact	National Institute of Science and Technology (NIST)	http://www.nehrp.gov/index.htm		x	
Decision, Risk and Management Science Program	Scientific research directed at increasing the understanding and effectiveness of decision making by individuals, groups, organizations, and society	National Science Foundation (NSF)	http://www.nsf.gov/funding/pgm_summ.jsp?pims_id_5423		x	
Societal Dimensions of Engineering, Science, and Technology Program	Proposals benefiting the study of interactions of engineering, science, technology, and society	NSF	http://nsf.gov/funding/pgm_summ.jsp?pims_id=5323&org=SES		x	
Aquatic Ecosystem Restoration	Direct support for carrying out aquatic ecosystem restoration projects, such as wetlands, repairing and other floodplain and aquatic systems, that will improve the quality of the environment; Regulatory and adaptation planning initiatives for Climate Change	U.S. Army Corps of Engineers (USACE)	http://www.nae.usace.army.mil/Missions/Public-Services/Ecosystem-Restoration-Authorities/	x	x	x
Beneficial Uses of Dredged Materials	Direct assistance for projects that protect, restore, and create aquatic and ecological habitats, including connection with dredging in authorized Federal wetlands, in navigation projects	Environmental Protection Agency (EPA)	https://www.epa.gov/cwa-404/beneficial-use-dredged-material	x	x	x

Federal, State and Local Mitigation Funding and Assistance

Program	Description	Lead Agency	Link	Regulatory	Technical	Financial
Water Grants	A variety of grants related to water and wastewater infrastructure projects, including a catalog of federal funding for watershed protection projects	EPA	https://www.epa.gov/nps/watershed-funding		x	x
Urban Waters Small Grants Program	Protect and restore urban waters by improving water quality through activities that also support community revitalization and other local priorities	EPA	http://www2.epa.gov/urbanwaters		x	x
Community Development Block Grant (CDBG)	Grants to states and local governments to develop viable communities (e.g., housing, suitable living environment, expanded economic opportunities) and recover from federally declared disasters; principally for low- and moderate-income areas	U.S. Department of Housing and Urban Development (HUD)	http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs	x	x	x
Disaster Housing Assistance Program	Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage and rental assistance	U.S. Dept. of Housing and Urban Development (HUD)	https://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/publications/dhap			x
HOME Investment Partnerships Program	Grants to state and local government and consortia for permanent and transitional housing (including financial support for property acquisition and rehabilitation for low-income persons)	HUD	https://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/affordablehousing/programs/home/			x
HUD Disaster Resources	Grants and a variety of disaster assistance related to housing, including mortgage assistance	HUD	https://portal.hud.gov/hudportal/HUD?src=/info/disasterresources			x

Federal, State and Local Mitigation Funding and Assistance						
Program	**Description**	**Lead Agency**	**Link**	**Regulatory**	**Technical**	**Financial**
Section 108 Loan Guarantee	Offers states and local governments a source of financing for certain community development activities, such as housing rehabilitation, economic development, and large-scale physical development projects.	HUD	https://portal.hud.gov/hudportal/HUD?src=/hudprograms/section108			x
National Flood Insurance Program	Formula grants to States to assist FEMA communities to comply with NFIP floodplain management requirements (Community Assistance Program)	FEMA	https://www.fema.gov/national-flood-insurance-program	x		
Hazard Mitigation Assistance (HMA)	Grants to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages – ***[includes FMA, HMGP, PDM, below]***	FEMA	http://www.fema.gov/hazard-mitigation-assistance		x	x
Flood Mitigation Assistance (FMA) Program	Grants to states and communities for pre-disaster mitigation planning and projects to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program	FEMA	http://www.fema.gov/flood-mitigation-assistance-program		x	x
Hazard Mitigation Grant Program (HMGP)	Grants to states and communities for planning and projects providing long-term hazard mitigation measures following a major disaster declaration	FEMA	http://www.fema.gov/hazard-mitigation-grant-program		x	x
Pre-Disaster Mitigation (PDM) Competitive Grant Program	Grants to states and communities for planning and projects that provide long-term hazard pre-disaster mitigation measures	FEMA	http://www.fema.gov/pre-disaster-mitigation-grant-program		x	x

Federal, State and Local Mitigation Funding and Assistance						
Program	**Description**	**Lead Agency**	**Link**	**Regulatory**	**Technical**	**Financial**
Public Assistance: Hazard Mitigation Funding under Section 406	9526.1 Hazard mitigation discretionary funding available under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act following a federally-declared disaster	FEMA	https://www.fema.gov/95261-hazard-mitigation-funding-under-section-406-stafford-act			x
Assistance to Firefighters Grant Program	Assists in local funding for fire equipment, staffing, facility construction and emergency response costs	FEMA	https://www.fema.gov/welcome-assistance-firefighters-grant-program			x
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats	U.S. Fish and Wildlife Service (USFWS)	https://www.fws.gov/partners/resourceBenefits.html		x	x
National Trust Preservation Funds (NTPF)	Funding awarded to nonprofit organizations and public agencies for planning and education projects	National Trust for Historic Preservation (NTHP)	https://savingplaces.org/stories/how-to-apply-for-grants-from-the-national-trust-preservation-fund#.W3ifqtQrLs0		x	x
Historic Preservation Financial Assistance - General	Federal financial assistance specifically for historic preservation. Initiatives include sustainability and climate resilience, and community revitalization and economic benefits.	Advisory Council on Historic Preservation	https://www.achp.gov/initiatives		x	x
FHWA Emergency Relief Program	Funding for the repair or reconstruction of Federal-aid highways that have suffered serious damage as a result of (1) natural disasters, or (2) catastrophic failures from an external cause	U.S. Department of Transportation (USDOT)	http://www.fhwa.dot.gov/programadmin/erelief.cfm			x

Federal, State and Local Mitigation Funding and Assistance						
Program	**Description**	**Lead Agency**	**Link**	**Regulatory**	**Technical**	**Financial**
Transportation Investment Generating Economic Recovery (BUILD)	Investing in surface transportation infrastructure for roads, bridges, transit, rail, ports or intermodal transportation. *[Replaces previous TIGER program]*	USDOT	https://www.transportation.gov/BUILDgrants		x	x
Emergency Loan Program	USDA's Farm Service Agency (FSA) provides emergency loans to help producers recovery from production and physical losses due to drought, flooding, other natural disasters or quarantine	USDA	https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/			x
Emergency Watershed Protection (WP) Program	Provides assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences	National Resources Conservation Service (NRCS)	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/		x	x
Financial Assistance	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/		x	x
Homeland Security Grant Program	Supports efforts to build and sustain core capabilities across the five mission areas of Prevention, Protection, Mitigation, Response, and Recovery based on allowable costs.	U.S. Department of Homeland Security (DHS)	https://www.fema.gov/homeland-security-grant-program		x	x
Emergency Management Performance Grant (EMPG) Program	Assists local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities	DHS	https://www.fema.gov/emergency-management-performance-grant-program		x	x

Federal, State and Local Mitigation Funding and Assistance						
Program	**Description**	**Lead Agency**	**Link**	**Regulatory**	**Technical**	**Financial**
Land & Water Conservation Fund	Funding allows 4 federal agencies to acquire and develop private lands for public outdoor recreation areas and facilities; and congressional appropriate for matching funds for state and local government land acquisition projects	U.S. Bureau of Land Management, Forestry Service, Fish & Wildlife Service and National Park Service	http://www.lwcfcoalition.org/		x	x
Missions and Appropriations	Federal budget and funding to support USACE missions including research, feasibility studies, construction and disaster relief	USACE	https://www.usace.army.mil/Missions/	x	x	x
Flood Risk Management Program	The program objective is to foster public understanding of the options for dealing with flood hazards and to promote prudent use and management of the Nation's flood plains. Types of assistance: 1) General Technical Services, and 2) General Planning Guidance	USACE	https://www.iwr.usace.army.mil/Missions/Flood-Risk-Management/Flood-Risk-Management-Program/		x	
Economic Injury Disaster Loans	Low-interest disaster loans to businesses of all sizes, private non-profit organizations, homeowners, and renters. SBA disaster loans can be used to repair or replace the following damaged property, equipment, inventory or other business assets.	Small Business Administration (SBA)	https://www.sba.gov/loans-grants/see-what-sba-offers/sba-loan-programs/disaster-loans			x
State Mitigation Funding and Assistance						
Minnesota Grant Opportunities	Centralized listing of funding programs & grant opportunities	State of Minnesota	https://mn.gov/grants/		x	x
HSEM Grant Programs	Centralized listing of various Homeland Security and Emergency Management grant programs	Minnesota Homeland Security and Emergency Management (HSEM)	https://dps.mn.gov/divisions/hsem/grants/Pages/default.aspx		x	x

Federal, State and Local Mitigation Funding and Assistance

Program	Description	Lead Agency	Link	Regulatory	Technical	Financial
Grant & Bid Opportunities	Grant opportunities related to land and water management and conservation	Minnesota Department of Natural Resources	https://www.dnr.state.mn.us/grants/index.html		x	x
State Resources for Homeowners and Renters impacted by Disasters	General resource information for homeowners and renters related to disaster clean-up and recovery	Minnesota HSEM	https://dps.mn.gov/divisions/hsem/disaster-recovery/Pages/homeowners-renters.aspx		x	x
Rural Fire Department Assistance	Assistance to rural fire departments for low-cost equipment, matching grants, technical assistance and wildland fire training.	Minnesota DNR	https://www.dnr.state.mn.us/grants/ruralfire/index.html			x
Climate Change Program	Studies and plans related to the impacts of climate change in Minnesota	Minnesota Pollution Control Agency	https://www.pca.state.mn.us/featured/adapting-climate-change-minnesota	x	x	
Minnesota Historic Structure State Tax Credit Grant Program)	This program officer a 20% state tax credit for qualified historic rehabilitations. Only income-producing properties are eligible for this incentive program.	Minnesota Historical Society (MHS)/Minnesota State Historic Preservation Office (SHPO)	http://archive.mnpreservation.org/state-level-funding-sources/			x
Minnesota State Capital Projects Grants-in-Aid Program	Matching grants for historic preservation capital projects awarded to public entities, including county and local jurisdictions.	MHS/SHPO	http://archive.mnpreservation.org/state-level-funding-sources/			x
Conservation Improvement Program	The Conservation Improvement Program (CIP) helps Minnesota households and businesses use electricity and natural gas more efficiently --conserving energy, reducing carbon dioxide emissions, and lessening the	**Minnesota Commerce Department**	https://mn.gov/commerce/industries/energy/utilities/cip/		x	x

Federal, State and Local Mitigation Funding and Assistance						
Program	**Description**	**Lead Agency**	**Link**	**Regulatory**	**Technical**	**Financial**
	need for new utility infrastructure. CIP is funded by ratepayers and administered by electricity and natural gas utilities.					
Minnesota Stormwater Manual - Funding	This site provides information on funding sources and funding opportunities for storm water projects, as well as a list of currently funded and previously funded projects.	Minnesota Pollution Control Agency (MPCA)	https://stormwater.pca.state.mn.us/index.php?title=Funding			x
Financial Assistance for Water Projects	Financial assistance is offered for surface-water, wastewater and storm water related financial assessment and monitoring projects. Applicant must be a local government. Involves building new or improving, rehabilitating, expanding, or replacing existing wastewater collection or treatment facilities.	MPCA	https://www.pca.state.mn.us/water/financial-assistance-water-projects; https://www.pca.state.mn.us/water/wastewater-and-stormwater-financial-assistance			x
Local Mitigation Funding and Assistance						
Community Emergency Response Team (CERT)	Nine-week citizen training program for disaster preparedness and basic disaster response skills for individuals, families, neighborhoods, community organizations, and businesses	Ramsey County Sheriff's Office	https://www.ramseycounty.us/your-government/leadership/sheriffs-office/sheriffs-office-divisions/public-safety-services/volunteer/community-emergency-response-team		x	
Non-Profit Organizations (NPOs) Mitigation Funding and Assistance						
ARC Minnesota	Support services for vulnerable populations - assistance with social services, healthcare, housing, family support,	The ARC Minnesota	https://arcminnesota.org/regions/greater-twin-cities-region/		x	x

Federal, State and Local Mitigation Funding and Assistance						
Program	**Description**	**Lead Agency**	**Link**	**Regulatory**	**Technical**	**Financial**
	education and government benefits.					
American Red Cross	Shelter, food, support, supplies, and direct assistance to populations impacted by disaster	American Red Cross, Minnesota Region	https://www.redcross.org/local/minnesota/about-us/locations/twin-cities.html		x	x
100 Resilient Cities Program	Grants and technical assistance to support initiatives that help cities become more resilient to physical, social, and economic shocks and stresses, including disasters. Support includes financial and logistical guidance to establish a new position in government for a Chief Resilience Officer.	Rockefeller Foundation	https://www.rockefellerfoundation.org/our-work/initiatives/100-resilient-cities/		x	x
The Nature Conservancy	Conservation organization partnering with communities, business, government, and other non-profits to protect ecologically important lands and waters for nature and people	The Nature Conservancy	http://www.nature.org		x	x
The Trust for Public Land	Assistance to state and local governments including land conservation transactions, conservation finance, park design & development	The Trust for Public Land	http://www.tpl.org/services/conservation-finance		x	x
Public Health Programs	Provides funding, expertise, information, leadership and/or connections to specific groups of people for projects addressing priority public health challenges	CDC Foundation	http://www.cdcfoundation.org		x	x

Implementation Roles and Responsibilities

Implementation of this plan is the joint responsibility of the Saint Paul Emergency Management Office and the Stakeholder Work Group (SWG).

The SWG (under the leadership of the Saint Paul Mitigation Coordinator) will:

- Act as a forum for hazard mitigation issues
- Identify existing mechanisms to institute mitigation goals, objectives and strategies
- Disseminate hazard mitigation ideas and activities to all participants
- Pursue the implementation of high-priority, low/no-cost recommended actions
- Ensure hazard mitigation remains a consideration for community decision makers
- Maintain regular monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists
- Monitor and assist in implementation and update of this strategy
- Report plan progress and recommended changes to the various governing bodies
- Inform and solicit input from the public

With adoption of this plan, the City accepts responsibility for plan implementation. To ensure that the plan is successfully carried out, Saint Paul EM will:

- Coordinate with the SWG and subject matter experts to identify existing mechanisms to institute mitigation goals, objectives and actions
- Report to the City leadership and the public on the status of the plan and mitigation opportunities
- Review and promote mitigation proposals, considering stakeholder concerns about hazard mitigation
- Post relevant information on the City's website (and others, as appropriate)
- Conduct ongoing public education promoting the benefits of hazard mitigation

Mitigation goals, objectives and actions described in this section are dynamic and change with disaster priorities, timing, available resources and funding opportunities. The timeline of implementation of individual actions 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.

SECTION 5 PLAN MAINTENANCE

Requirements
• **§201.6(c) (4) (i):** There is a] description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle.) • **§201.6(c) (4) (iii):** [The plan discusses] how the community will continue public participation in the plan maintenance process.

2019 Update
• Section 5 was expanded to address more detail related to the method and schedule for monitoring, evaluating, and updating the plan.

Overview

[EMAP 4,1,3, 4.2.5] The mitigation plan is a living document that guides action over time. As conditions change, new information becomes available, or actions progress, adjustments may be necessary to maintain its relevance and effectiveness.

Implementation and maintenance of the plan work in parallel to ensure success of the mitigation strategy. **Section 4** included a discussion of the process Saint Paul will follow to integrate the requirements of the mitigation plan into other planning mechanisms. This section provides the overall strategy for plan maintenance and outlines the method and schedule for monitoring, evaluating, and updating the plan. The implementation and maintenance processes will serve to periodically assess project status, identify benchmarks, make appropriate adjustments (if needed), and generally ensure that the planning process is ongoing and that progress in risk reduction is being made. The scope of this section includes the following plan maintenance steps:

5.1 Monitoring the Plan

5.2 Evaluating the Plan

5.3 Updating the Plan

Stakeholder Working Group members were given the opportunity to review the process, provide comments, and make modifications.

The procedures for each step described in this Plan:

- Assign responsibility

- Identify the schedule
- Describe how information will be collected, analyzed and reported

5.1 Monitoring the Plan

This plan maintenance step tracks implementation of the plan over time.

Plan Monitoring Roles and Responsibilities	
City of Saint Paul Emergency Management Planning Coordinator	• Coordinate and facilitate the monitoring process • Maintain schedule of monitoring activities • Collect data and disseminate reports • Maintain records and documentation of all monitoring activities
Stakeholder Working Group - Department/Agency Representatives and Key Stakeholders	• Participate in the monitoring process as requested by the planning coordinator • Assist in collecting and analyzing data • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input • Promote the mitigation planning process with the public and solicit public input
Stakeholder Working Group - Subject Matter Stakeholders	• Represent the agency/discipline during the monitoring process • Collect, analyze and report data to the Stakeholder Working Group and planning coordinator • Maintain records and documentation of monitoring activities • Assist in disseminating reports to agency/discipline • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input

Continued Public Input

As noted in the table above, members of the Stakeholder Working Group, including department/agency representatives, key stakeholders and subject matter stakeholders, are

charged with the responsibility to continue promoting mitigation planning with the public, assisting in disseminating information and reports to the public, and soliciting input from the public. This will be accomplished during the monitoring process through, but not limited to, the following methods:

- Maintaining access to the City's Hazard Mitigation Plan on the Emergency Management website
- Distributing mitigation educational materials and progress reports to citizen groups and at public venues
- Utilizing post-disaster situations to highlight successful past mitigation efforts and promote opportunities to develop and implement mitigation actions that reduce the impacts of hazards in the future

Monitoring Procedure and Schedule: The following steps describe how the City of Saint Paul will monitor mitigation progress annually and/or following major disaster(s) to monitor progress of mitigation actions
Step 1: Planning Coordinator – Initiate Monitoring Process

• Notify Stakeholder Working Group members of the annual/post-disaster review
  o Disseminate Mitigation Action Progress Report Form* for mitigation action updates to Project Leads/Representatives, along with the current list of mitigation actions in the plan
  o Disseminate *Mitigation Action Worksheet Form* to representatives of agencies with potential new mitigation actions

Step 2: Planning Coordinator and Stakeholder Working Group – Collect and assess Status of Actions (current and new)

• Assess progress in current actions, including implemented and funded actions, and any new opportunities for mitigation actions
  o Are there different or additional resources now available?
  o Are mitigation actions being implemented and monitored?
  o Have new mitigation actions been identified?
  o Have any mitigation actions been completed?

Step 3: Planning Coordinator, Stakeholder Working Group and the Public – Solicit input and Assess New Opportunities for Mitigation
• Has a major disaster occurred that presents opportunities for mitigation? • How have mitigation goals, objectives, and actions been incorporated into existing planning mechanisms or information • Is there a new initiative, agency priority, existing planning mechanism or information that is not represented in the current actions?
Step 4: Planning Coordinator and Stakeholder Working Group – Prepare and Disseminate Status Report to all Plan stakeholders, including elected officials and the public.
• Status of current and implemented actions

• Proposed new actions* • Potential funding sources • New opportunities for mitigation (actions in development, new programs, etc.)
**The City may, annually or following a major disaster, add new mitigation actions to the current list of prioritized actions by using the Action Worksheets and Ranking System for Prioritizing Actions.*

The Mitigation Action Progress Report Form is provided as **Attachment 5a** to this Section.

5.2 Evaluating the Plan

This plan maintenance step assesses the effectiveness of the plan at achieving its stated purpose and goals.

The planning coordinator and Stakeholder Working Group are responsible for evaluating the effectiveness of the plan at achieving its purpose and goals during the planning cycle.

Plan Evaluation Roles and Responsibilities	
City of Saint Paul Emergency Management Planning Coordinator	• Coordinate and facilitate the evaluation process • Maintain schedule of evaluation activities • Collect data and disseminate reports • Maintain records and documentation of all evaluation activities
Stakeholder Working Group - Department/Agency Representatives and Key Stakeholders	• Participate in the evaluation process, as requested by the Planning Coordinator • Assist in collecting and disseminating information • Assist in disseminating reports to stakeholders and the public • Promote the mitigation planning process with the public and solicit public input
Stakeholder Working Group - Subject Matter Stakeholders	• Represent the agency/discipline during the evaluation process • Collect and report data to the Stakeholder Working Group and planning coordinator • Maintain records and documentation of all jurisdictional evaluation activities

Continued Public Input

As noted in the table above, members of the Stakeholder Working Group, including department/agency representatives, key stakeholders and subject matter stakeholders, are charged with the responsibility to continue promoting mitigation planning with the public,

assisting in disseminating information and reports to the public, and soliciting input from the public. This will be accomplished during the evaluation process through, but not limited to, the following methods:

- Maintaining access to the City's Hazard Mitigation Plan on the Emergency Management website and highlighting successful mitigation actions when completed
- Distributing mitigation educational materials and evaluation reports to citizen groups and at public venues
- Utilizing post-disaster situations to highlight successful past mitigation efforts and promote opportunities to develop and implement mitigation actions that reduce the impacts of hazards in the future

Evaluation Procedure and Schedule: The following process describes the steps that the City of Saint Paul will take annually and/or following major disaster(s) to evaluate the effectiveness of the plan.

Action	Responsible Party	Tasks	Deliverable/Outcome
Initiate Annual Review	Planning Coordinator	Notify Stakeholder Working Group members to facilitate annual evaluation	Work plan, schedule, and assigned resources to implement plan review process
Stakeholder Working Group and Key Stakeholders	Planning Coordinator (or designee)	Invite Stakeholder Working Group members and key stakeholders, and new agency representatives to participate in the plan monitoring and evaluation process	List of invited current and new stakeholders and other key planning partners invitation to participate
Review Policies and Regulations	Planning Coordinator (or designee)	Research new or updated laws, policies, regulations, initiatives, and studies that contribute to the hazard risk assessment or identified mitigation actions	Status report: current and new policies, regulations, initiatives and/or studies
Review Programs	Planning Coordinator (or designee)	Assess changes in city, county and state programs, new grant programs or areas of focus, integration into existing planning mechanisms	Status report: current and new stakeholders, programs, grant programs, planning mechanisms, and/or new areas of focus
Hazards [EMAP 4.1.3]	Planning Coordinator (or designee)	Research new or updated data and information that contributes to the risk	Status report: recent disasters, hazard impacts and losses, lessons learned,

		assessments, loss estimates, or vulnerabilities in assets, by jurisdiction	status of jurisdictional facilities and infrastructure; ***update Plan annually to reflect new risk assessment and capability data gathered from review of hazard events and impacts***
Mitigation Actions	Planning Coordinator (or designee)	Assess progress in previously implemented actions that reduce vulnerability and losses, and any new opportunities for mitigation actions	Status report: Completed actions, pending actions, implementation status of actions *[collected through monitoring procedure]*
Outcomes	Planning Coordinator (or designee)	Maintain and complete documentation of the plan review process, including any needed plan updates, and prepare summary report	Summary report: Mitigation Strategy Annual Update (incorporating results of annual monitoring and evaluation process)

5.3 Updating the Plan

This plan maintenance step reviews and revises the plan on an established schedule to reflect changes in development, progress in local mitigation efforts, and changes in priorities.

The end date for completion of the current planning cycle will be five years from the date the plan is adopted by the City of Saint Paul (See **Section 6**.)

Plan Update Roles and Responsibilities	
City of Saint Paul Emergency Management Planning Coordinator	• Coordinate and facilitate the plan review, revision and update process • Maintain schedule of all plan update activities • Collect data and disseminate reports • Maintain records and documentation of all evaluation activities • Identify and implement opportunities for public participation and input in the planning process, including review of the revised draft plan

Stakeholder Working Group - Department/Agency Representatives and Key Stakeholders	• Participate in the plan review, revision and update process, as requested by the Planning Coordinator • Assist in collecting and disseminating information • Assist in disseminating reports to stakeholders and the public • Promote the mitigation planning process with stakeholders and the public and solicit public input
Stakeholder Working Group - Subject Matter Stakeholders	• Represent the agency/discipline during the planning cycle, including plan review, revision and update process • Collect and report data to the Stakeholder Working Group and Planning Coordinator • Maintain records and documentation of plan review and revision activities • Assist in disseminating information and reports to stakeholders and the public

Continued Public Input

As noted in the table above, members of the Stakeholder Working Group, including department/agency representatives, key stakeholders and subject matter stakeholders, are charged with the responsibility to continue promoting mitigation planning with the public, assisting in disseminating information and reports to the public, and soliciting input from the public. This will be accomplished during the plan update process through, but not limited to, the following methods:

- Identifying key representatives from citizen boards and committees, and neighborhood organizations to be invited to participate in the update process
- Incorporating public participation in the Stakeholder Working Group
- Providing opportunities to the public to contribute hazard risk, impact and consequence information
- Establishing an online hazard mitigation public forum for questions, discussion and status updates
- Distributing sections of the draft plan to identified public participants to solicit comments, questions and relevant information

The plan update process and schedule are designed to focus on various components of the plan throughout the five-year cycle. Based on the schedule described, all parts of the plan will have been reviewed at the end of the five-year cycle, potentially reducing the time and

resource burden in the final planning year. Adherence to the monitoring, evaluation and update process schedule will ensure that the plan is kept current throughout its five-year cycle.

Five-Year Plan Update Process and Schedule	
Monitoring and Evaluation Activities – *Ongoing throughout the five-year planning cycle*	• Monitoring and evaluation results, meeting documentation, and other pertinent documents will be collected throughout the five year life cycle of the plan and used in the next Plan update • Multiple meetings with elected officials, Emergency Management Council, Stakeholder Working Group, state and federal agencies, and interested parties will be conducted • Activities, meetings, and interactions will be tracked and documented throughout the planning cycle • The annual evaluation review will be conducted using the most recent update of the plan as the basis.
Update Risk Assessment – *Conducted in the 1st Quarter of the fifth year of the planning cycle*	• Planning Coordinator/designee and Stakeholder Working Group representatives will identify key stakeholders to contribute to the updated risk assessment • Monitoring and evaluation results will be incorporated • Changes since the previous plan approval will be identified • Each hazard will be assessed and updated to include new data since the date of plan adoption • New hazard occurrences and potential changes in low-ranked hazards will be identified and assessed • Any significant changes in the jurisdictional risk assessment will be noted during plan review and integrated into the updated Plan
Review and Update Goals and Objectives – *Conducted in the 2nd Quarter of the fifth year of the planning cycle*	• Planning Coordinator/designee will coordinate with Stakeholder Working Group and key partners to assess the status of current Plan goals and objectives for potential revision • Assess how have mitigation goals and objectives been integrated with existing planning mechanisms • Any significant changes in mitigation goals, especially those that are not consistent with the current Plan goals, will be assessed and incorporated as appropriate in the updated HMP • Monitoring and evaluation results will be utilized to modify the goals and objectives and describe achievements
Review and Update Mitigation Actions – *Conducted in the 3rd Quarter of the fifth year of the planning cycle*	• Planning Coordinator/designee will coordinate with Stakeholder Working Group and key partners to obtain an update on the current status of actions • Monitoring and evaluation results will be utilized to assess the effectiveness of mitigation actions in meeting the goals and reducing risks • Assess jurisdictional mitigation actions implemented since the plan was last adopted and how they have contributed to the achievement of goals and objectives • Management and maintenance data from the implemented activities will be used to describe progress in the previous five years

Compile and Review *Conducted in the 3rd Quarter of the fifth year of the planning cycle*	• Planning Coordinator/designee and Stakeholder Working Group will compile the data and develop the updated Plan • Draft will be made available for stakeholder review and input • Draft will be made available for public review and comment • All comments and suggestions will be incorporated and the final draft completed
Conducted in the 4th Quarter of the fifth year of the planning cycle	• State review of plan update • FEMA review of plan update
Adopt Plan *Conducted in 4th Quarter - Fifth year of planning cycle*	• Updated plan will be adopted prior to the plan expiration date **(Date TBD, 2024)**

Incorporating the Plan in Existing Planning Mechanisms

An ongoing responsibility of Stakeholder Working Group members is to identify additional stakeholders and existing planning mechanisms that can assist in integrating mitigation planning into short- and long-term community development and resiliency planning. This involves establishing hazard mitigation as a community planning priority that can be supported through the same community capabilities defined in **Section 4.2.**

- Planning and Regulatory
- Administrative and Technical
- Safe Growth
- Fiscal and Resources
- Education and Outreach

Each step in the planning cycle includes ongoing opportunities to identify existing planning processes that provide a platform for integration of hazard mitigation planning. Each annual review of the plan will include an analysis of how the mitigation plan has been incorporated into existing planning mechanisms.

Continued Public Involvement

A critical focus of plan maintenance is continuing to identify and provide opportunities for stakeholder and public involvement in the planning process and plan implementation. References to opportunities for stakeholder and public involvement, and how these will be implemented, are addressed in plan maintenance steps described above.

ATTACHMENT 5a: Mitigation Action Progress Report Form

As a step in the monitoring process for the plan, the following form will be used to collect current information related to mitigation actions included in the current plan.

Mitigation Action Progress Report Form

Progress Report Period	**From Date:**	**To Date:**
Action/Project Title		
Responsible Agency		
Contact Name		
Contact Phone/Email		
Project Status	☐ Project Completed ☐ Project deleted ☐ Project in progress ☐ Anticipated completion date _____ ☐Project delayed Explain: _____	

Summary of Progress on Current Project for this Report Period

1. What was accomplished for this project during this reporting period?

2. What obstacles, problems or delays did the project encounter?

3. If uncompleted, is the project still relevant? Should the project be changed or revised?

4. Other comments

SECTION 6 PLAN ADOPTION

Requirement
• **§201.6(c) (5):** [The] plan includes documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan has documented formal plan adoption.

2019 Update
This section was expanded to include a draft Adoption Resolution.

Plan Approval

[EMAP 4.2.1] The process for finalizing the Saint Paul All-Hazard Mitigation Plan (SPHMP) includes approval by the Stakeholder Working Group and the Emergency Management Council, prior to 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 provides the final level of approval of the plan prior to adoption by the City.

Formal Adoption

The adoption of this plan by the City's governing body completes a step of the planning process, in accordance with the requirements of the Disaster Mitigation Act of 2000 and Part 44 Cord of Federal Regulations (CFR), part 201.6(c)(5). 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 authorized 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 in 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 All-Hazard Mitigation Plan* after FEMA determines the plan to be "Approvable Pending Adoption" (APA). The Adoption Resolution, signed by the Mayor of Saint Paul [to be included when fully executed] will follow the Executive Summary of this plan. The adoption of this plan is a clear statement of the intent of citywide implementation.

The mitigation actions described in this plan are dynamic and subject to change with disaster priorities, timing, available resources and funding opportunities. The timeline of implementation of this plan is also dependent on availability of funding and other

resources from sponsoring departments, agencies and organizations tasked with carrying out specific actions. Consequently, periodic review and update of sections of this plan will not require re-adoption of the plan, but will be addressed as administrative or technical updates.

City of Saint Paul All-Hazard Mitigation Plan Adoption – SAMPLE RESOLUTION

Resolution # _____

Adopting the

CITY OF SAINT PAUL ALL-HAZARD MITIGATION PLAN - 2019

***Whereas**, the City of Saint Paul recognizes the threat that natural hazards pose to people and property within our community: and*

***Whereas**, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and*

***Whereas**, an adopted Local Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and*

***Whereas**, City of Saint Paul resides within the Planning Area, and fully participated in the mitigation planning process to prepare this Local Hazard Mitigation Plan; and*

***Whereas**, the Minnesota Department of Homeland Security and Emergency Management and Federal Emergency Management Agency, Region V, officials have reviewed the City of Saint Paull All-Hazard Mitigation Plan and approved it contingent upon this official adoption of the participating governing body; and*

***Now, therefore, be it resolved**, that the City of Saint Paul hereby adopts the City of Saint Paul All-Hazard Mitigation Plan, 2019 as an official plan; and*

***Be it further resolved**, Saint Paul Department of Emergency Management will submit this Adoption Resolution to the Minnesota Department of Homeland Security and Emergency Management and the Federal Emergency Management Agency, Region V, officials to enable the Plan's final approval.*

Passed: ____(date)____

_____

[Certifying Official (printed)

_____

Certifying Official (signature)

APPENDIX A: PLANNING PROCESS DOCUMENTATION

Attachment A-1 Outreach Strategy
Attachment A-2 Participation in the Planning Process
Attachment A-3 Meeting and Outreach Documentation

Appendix A: Planning Process Documentation

Appendix A-1: *Outreach Strategy*

The following information describes the outreach efforts conducted during the planning process for the 2019 Saint Paul All-Hazard Mitigation Plan.

CITY OF SAINT PAUL HAZARD MITIGATION PLAN 2019

OUTREACH STRATEGY

Purpose:

- Required by 44 CFR Part 201.6
- Develop on-going support for the plan and its goals
- Enhance "buy-in" from working group, stakeholders and the public, resulting in greater success in implementing mitigation actions and projects to reduce risk
- Integrate mitigation planning into community planning and resiliency practices
- Provide an on-going opportunity for public agencies, non-governmental and community-based organizations, private sector, and residents to participate in and support mitigation planning, activities and initiatives

Three Tiers of Participation:

The organizational components that will design, implement and/or participate in the 2019 Plan update process are the Project Team, Stakeholder Working Group, Subject Matter Experts, and the Public, as described in the table below.

Tier/Role	Responsibilities	Participation Level	Key Milestones
Project Team *(Saint Paul Emergency Management, Consultant)*	Design and implement the planning process; coordinate Stakeholder Working Group; conduct meetings; collect and analyze data; write the plan update; coordinate plan review and plan adoption	Participation begins with project initiation and continues throughout the planning process, plan review and plan adoption	• Project design • Contractor agreement • Kick-Off meeting • Hazard and risk assessment • Capabilities assessment • Mitigation strategy • Initial Draft for review by State • Plan review by FEMA • Plan Adoption • Plan Approval
Stakeholder Working Group (SWG) *Core oversight group that will provide input in the planning process and agree upon the final contents of the plan.* • *Elected Officials* • *Lead Staff Contacts* • *Department & Agency representatives* • *Floodplain Manager* • *MN Homeland Security and Emergency Management* • *Contractors*	Participate in all planning activities; assist in identifying and collecting information and data; identify and assist in development of projects; coordinate with local jurisdiction; review and approve plan drafts and final plan; participate in plan maintenance	Participation begins with Kick-Off meeting and continues throughout the plan maintenance cycle.	• Hazard and Risk Analysis • Capabilities Assessment • Mitigation Strategy (goals, objectives, projects) • Draft Plans • Final Plan • Adoption of Plan

Subject Matter Experts: *Person, Group or institution that can affect or be affected by a course of action identified in the mitigation plan:* • *Local elected officials and local agencies* • *Special Districts and Authorities* • *Non-Governmental Organizations* • *Regional, State and Federal Agencies* • *Educational Institutions* • *Major Employers* • *Land Use and Development Agencies* • *Professional Associations* • *Neighboring Jurisdictions* • *Neighborhood groups* • *Cultural institutions* • *Access and functional needs agencies*	Inform the Stakeholder Working Group on specific topics or provide input from specific points of view • Provide technical assistance and expertise • Participate in outreach activities • Provide input on the draft mitigation plan	• Invited to Kick-Off Meeting • Outreach activities (requests for information and/or participation) • Project development and plan support (resources, partnerships and technical expertise) • Plan review - comments and input • Plan Maintenance (provide updated information as requested)	• Hazard and Risk Analysis • Capabilities Assessment • Mitigation Strategy (goals, objectives, projects) • Draft Plans • Final Plan
Public	Involvement in the planning process through information sharing and opportunities to provide input.	Respond to invitations for participation, review and input through multiple venues • Media releases • Surveys • Community meetings • Presentations	• Information/media releases • Educational Publications • Surveys • Draft Plans • Final Plan

OUTREACH METHOD AND SCHEDULE

Stakeholder Working Group

Method and Schedule	Outcome
Organize Stakeholder Working Group	Project Team identified key stakeholder agencies and issued invitations to participate in the planning process. **Invited:** 40 people from 22 departments or agencies

Kick-Off Meeting	Conducted February 27, 2018 to describe the planning process, purpose and expectations for participation. **Attended:** 26 people
Hazard Survey	Conducted survey at the Kick-Off meeting to solicit input from key stakeholders related to hazard risks and vulnerability. **Completed Survey:** 17 (Saint Paul EM staff did not complete survey. 8 people)
One-on-One Meetings (Emergency Management and Stakeholder representatives)	Between February 2018 and June 2019, conducted approximately 50 selective subject matter expert meetings to discuss agency capabilities and programs, and completed current and planned actions. (1) Schedule one-on-one meetings with departments, agencies, organizations and subject matter experts (2) Follow-up emails and phone calls to non-responding stakeholders (3) Distribute Mitigation Planning flyer through SWG and subject matter experts (4) Provided opportunities to collect specific data and information related to hazards, risks, vulnerabilities, goals and objectives, capabilities, programs and projects, and are integrated into the appropriate sections of the plan.
Mitigation Strategy Survey	Provided to stakeholders through email to collect specific data and information related to goals and objectives, capabilities, programs and projects, and are integrated into the appropriate sections of the plan.
Draft Plan Review and Comment Period	Email notification to stakeholders of plan posting for review and input; weblink provided - https://www.stpaul.gov/departments/emergency-management/mitigation/hazard-mitigation
Meeting for Approval of Draft Plan	Stakeholder meeting conducted on May 28, 2019, prior to submission to State for review
Public Announcement – Adoption by Jurisdiction	TBD Media Release – Plan adoption by Jurisdiction
Plan Maintenance Cycle	(1) Annual meetings, at a minimum (2) Email Plan updates, notification of funding availability; conduct hazard updates, progress updates; implement plan evaluation and update process; ensure integration with other planning processes

Subject Matter Experts

Method and Schedule	Outcome
Identify Subject Matter Experts	Project Team identified subject matter experts and issued invitations to participate in the planning process. . Invited: 11 people from 9 departments or agencies
Kick-Off Meeting	Conducted February 27, 2018 to describe the planning process, purpose and expectations for participation. Attended: 6 people
Hazard Survey	Conducted survey at the Kick-Off meeting to solicit input from subject matter experts related to hazard risks and vulnerability. Completed survey: 6 people
One-on-One Meetings (Emergency Management and Subject Matter Experts)	Between February 2018 and June 2019, conducted approximately 50 selective subject matter expert meetings to discuss agency capabilities and programs, and completed current and planned actions. (1) Schedule one-on-one meetings with departments, agencies, organizations and subject matter experts (2) Follow-up emails and phone calls to non-responding stakeholders (3) Distribute Mitigation Planning flyer through SWG and subject matter experts (4) Provided opportunities to collect specific data and information related to hazards, risks, vulnerabilities, goals and objectives, capabilities, programs and projects, and are integrated into the appropriate sections of the plan.
Draft Plan Review and Comment Period	Email notification to subject matter experts of plan posting for review and input; weblink provided - https://www.stpaul.gov/departments/emergency-management/mitigation/hazard-mitigation

Public

Outreach must include an opportunity to comment on the plan during the drafting stage and prior to plan approval. Other activities and methods ensure public participation and on-going support for implementing mitigation measures.

Method and Schedule	Outcome
Information/Media Release	5/14/19 Notification of Mitigation Plan Update Process posted to website at: https://www.stpaul.gov/departments/emergency-management/mitigation/hazard-mitigation

Public Announcement – Draft Plan Review and Comment Period -Open	5/14/19 Media release - Draft Plan Opening of Review and Comment Period. Released through 6/14/19.
Public Announcement – Draft Plan Review and Comment Period - Closed	5/14/19 Media release - Draft Plan End of Review and Comment Period. Released through 6/14/19.
Public Announcement – Adoption by Jurisdiction	[DATE] Media Release – Plan adoption by Jurisdiction. Released through

At the completion of the 2012 plan, a public meeting was planned and publicized for review and comments. Time and resources were expended in preparation of the event. No members of the public attended the event. In light of this outcome, and the current prevalence of social media, requests for comments from the public were done electronically. The following comments were received in response to the request for public input. A link to the following press release was sent out on Twitter, posted on Nextdoor (54,447 households) and available to followers of the City of Saint Paul Website.

News Release

FOR IMMEDIATE RELEASE
May 15, 2019

Mike Lovas
City of Saint Paul, Emergency Management Department
651-266-5497 (office)
mike.lovas@ci.stpaul.mn.us

Saint Paul Invites Public Review and Comments for the Updated All-Hazard Mitigation Plan

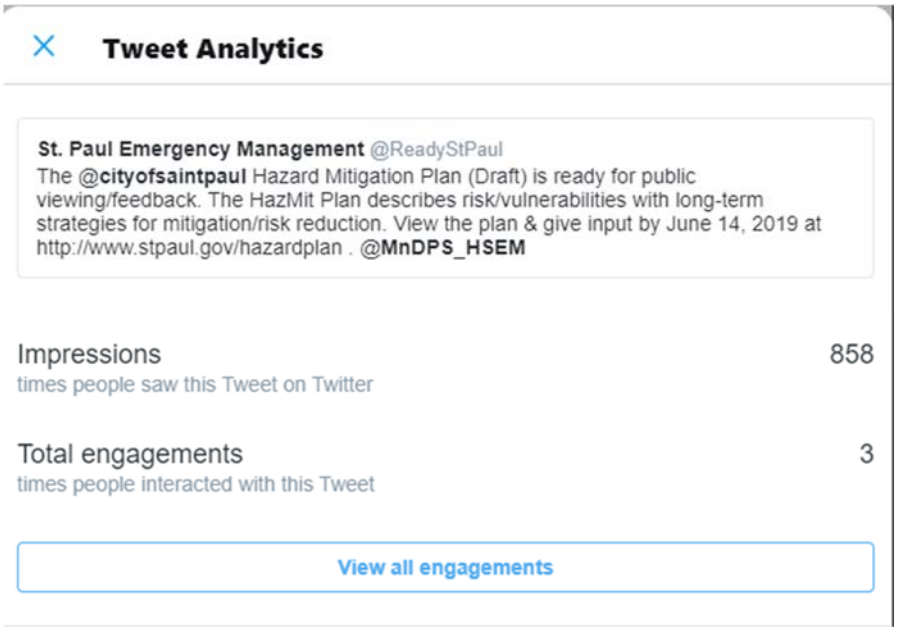
SAINT PAUL – The City of Saint Paul has completed an updated draft of the "All-Hazard Mitigation Plan" as required by the Federal Disaster Mitigation Act of 2000. Local jurisdictions are required to update the plan every five years to remain eligible for pre-disaster and post-disaster mitigation grant programs. The All-Hazard Mitigation Plan identifies risks and vulnerabilities in the City of Saint Paul, and develops mitigation strategies to reduce or eliminate long-term risks.

The plan update was completed under the direction of Saint Paul's Department of Emergency Management, in partnership with an outside hazard mitigation technical expert and input from multiple city, county, state, and federal departments and agencies.

"The planning team worked together to identify cost-effective and sustainable actions to reduce or eliminate long-term risks to human life or property from hazards" said Rick Schute, Director of Emergency Management. "Some examples of these mitigation efforts include the improvement of roads or parks facilities that experience repetitive flooding, the creation of flood plains, or levee projects. We will take all necessary and appropriate action to protect the people and infrastructure in Saint Paul, and this plan helps us identify those needs and efforts."

Community involvement and feedback are vital to the success of the plan. Saint Paul invites public review and feedback of the draft plan which will be reviewed and approved by the State of Minnesota and the Federal Emergency Management Agency (FEMA).

The plan review and comment period will be open until June 14, 2019. A copy of the draft plan and a feedback form is available online at https://www.stpaul.gov/hazardplan


Tweet Analytics
St. Paul Emergency Management @ReadyStPaul
The @cityofsaintpaul Hazard Mitigation Plan (Draft) is ready for public viewing/feedback. The HazMit Plan describes risk/vulnerabilities with long-term strategies for mitigation/risk reduction. View the plan & give input by June 14, 2019 at http://www.stpaul.gov/hazardplan . @MnDPS_HSEM
Impressions
858
times people saw this Tweet on Twitter
Total engagements
3
times people interacted with this Tweet
View all engagements

Ready St. Paul, St. Paul Emergency Management AGENCY

Saint Paul Invites Public Review and Comments for the Updated All-Hazard Mitigation Plan

The City of Saint Paul has completed an updated draft of the All-Hazard Mitigation Plan, as required by the Federal Disaster Mitigation Act of 2000. Community involvement and feedback are vital to the success of the plan. Saint Paul invites public review and feedback of the draft plan by June 14, 2019. The plan will be reviewed and approved by the State of Minnesota and the Federal Emergency Management Agency (FEMA).

The All-Hazard Mitigation Plan identifies risks and vulnerabilities in the City of Saint Paul, and develops mitigation strategies to reduce or eliminate long-term risks. Local jurisdictions are required to update the plan every five years to remain eligible for pre-disaster and post-disaster mitigation grant programs. The plan update was completed under the direction of the Saint Paul Department of Emergency Management, in partnership with an outside hazard mitigation technical expert and input from multiple city, county, state, and federal departments and agencies.

The plan review and comment period will be open until June 14, 2019. A copy of the draft plan and a feedback form is available online at https://www.stpaul.gov/hazardplan

Hazard Mitigation
2019 All-Hazard Mitigation Plan (Draft) The 2012 City of Saint Paul All-Hazard Mitigation Plan has
STPAUL.GOV

15 May · Subscribers of St. Paul Emergency Management

Reply 2 7· 6605 Impressions

Corey P., South Como
Dear nameless, faceless, "EM Specialist Ready St. Paul, St Paul Emergency Management" ... person(?), Suggestion: Instead of spending other people's $ on coming up w/ a "mitigation"... See more
16 May Thank Reply 1

Regina P., Macalester Groveland
This is a joke, right?
16 May Thank Reply

Corey P., South Como
No. St Paul DOES have a Chief "Resilience" Officer! Not sure if "Chief" denotes that there's asst. chiefs, lieutenants, etc. or, is a respectful yet culturally appropriating, nod,... See more
Edited 16 May Thank Reply

Corey P., South Como
Or were you referring to the, mere, 341 page draft?
16 May Thank Reply

Carrie K., South Como
Is there a disaster plan for the oil cars going through our neighborhoods? I don't see one.
16 May Thank Reply 2

Carol M. N., Hope
Oil cars on trains is one of the potential hazards going through our neighborhoods. Am I correct on my belief that train companies (Burlington Northern , etc) do not have to notify... See more
16 May Thank Reply 5

Vu D., Hamline Midway - East
I gotta admit, the section in Tornadoes has cool maps and statistics. As a kid I was scared of them, but it looks like the number of deaths in history are in the ones and twos... See more
16 May Thank Reply 1

Discussion closed on 19 Jul. Learn more »

Appendix A: Planning Process Documentation

Appendix A-2: Participation in the Planning Process

The following table provides a summary of the individuals (by name and position), departments, agencies and organizations that were invited to participate in the planning process, and who attended meetings and/or provided data, information, input, feedback or other assistance during the process.

Department or Agency	First Name	Last Name	Position/Title	Invited to Kickoff Meeting	Attended Kickoff Meeting	Completed Hazard Survey	Requested to provide information	Meeting with HM Planner(s)	Discussion with EM Director	Provided Resource Material	Provided information	Reviewed Prior Mitigation Project	Submitted New Mitigation Project	Technical Expert for Hazard	St Paul EM Director	Invited to Review Draft	Invited to Review Plan	Attended Plan Review	Commented on plan
Anoka County Emergency Management																			
	Stalzman	Terry	Director													x			
Capitol Regional Watershed District																			
	Eleria	Anna	Planning, Projects & Grants Division Manager	x	x	x	x									x	x		
	Zuanich	Nate	Water Resource Project Manager														x	x	
Children's Hospitals																			
	Camby	Ken	Emergency Preparedness Program Manager	x	x	x	x			x						x	x		
Dakota County Sheriff's Office																			
	Illiff	James	Sergeant													x			
Hennepin County EM																			
	Kelli	Bruce	Planning Coordinator				x			x									
	Waage	Eric	Director													x			
Metropolitan Council																			
	Fehr	Erik	Technology Security Officer	x			x				x					x	x		
Metro Transit																			
	Tuveson	Greg	Street Operations				x				x					x	x	x	
Minneapolis Emergency Management																			
	Gustafson	Eric														x	x	x	
	Lane	Barret	Director													x			
MN Department of Health																			
	Raab	Kristin	HIA and Climate Change Project Director	x			x									x	x		
MN Department of Natural Resources																			
	Strauss	Cail	State Floodplain Manager	x			x				x					x	x		
MN State Patrol																			
	Kane	Jenny	Emergency Manager	x			x									x	x		
MN Homeland Security Emergency Management																			
	Braun	Angie	Coordinator						x		x					x	x		
	Hirte	Bill	Administrator Principal/Public Assistance Officer													x	x		
	Nelson	Jennifer	Planner	x	x	x	x	x	x	x	x					x	x		x
	Peterson	Gary	Regional Program Coordinator-Metro	x			x		x										
MN State Climate Office																			
	Blumenfeld	Kenny	Senior Climatologist	x	x	x	x	x		x	x					x	x		
National Weather Service																			
	Krause	Todd	Warning Coordination Meteorologist	x			x									x	x		
Ramsey County Emergency Communications Ctr																			
	Carbone	Cathe	Supervisor	x			x									x	x		
Ramsey County Emergency Management Homeland Security																			
	Freed	Judd	Director	x					x							x	x		
	Meyer	Bryan	Coordinator	x	x	x	x			x	x					x	x		
Ramsey Washington Metro Watershed District																			
	Courtney	Tina	Administrator	x			x									x	x		
Rochester, MN Emergency Management																			

Department or Agency	First Name	Last Name	Position/Title	Invite d to Kickoff Meeting	Attended Kickoff Meeting	Completed Hazard Survey	Requested to provide Information or	Meeting with HM Planner(s)	Discuss with EM Director	Provided Resource Material	Provided information	Reviewed Prior Mitigation Project	Submitted New Mitigation Project	Technical Expert for Hazard	St Paul EM Director	Invited to Review Draft	Invited to Review Plan	Attended Plan Review	Commented on plan
	Hamilton	Patrick	Director of Global Change Initiative	x	x	x	x									x	x		
St Paul Airport																			
	Harris	Joe	Manager	x												x	x		
Visit St Paul																			
	Johnson	Adam	Vice President of Marketing				x				x					x	x		
St Paul City Attorney Office																			
	Voith	Lisa	Attorney						x							x	x	x	
St Paul City Council																			
	Moermond	Marcia	Legislative Hearing Officer & Sr. Policy Analyst	x			x		x							x	x		
	Stark	Russ	Council President	x	x	x	x		x							x			
St Paul Emergency Management																			
	Anderson	Jared	Coordinator	x	x		x	x		x	x	x		x		x	x		
	Angelo	Lucy	1/22/19	x	x		x	x	x		x	x		x		x	x		
	Bauer	Kelly	Executive Assistant	x	x		x				x					x	x		
	Larkin	Rick	Director thru 12/31/17				x	x		x	x						x		
	Lavar	Mike	Specialist	x	x		x	x		x	x						x		
	Phillips	Barry	Specialist	x	x		x	x		x	x	x		x			x	x	
	Sand	Mike	Coordinator	x	x		x	x			x	x					x		
	Schute	Rick	Director as of 1/28/19					x			x	x					x	x	
	Sieben	Terry	Coordinator	x	x		x	x	x	x	x	x		x			x	x	
	Yang	Rue	Specialist	x	x		x	x			x	x					x	x	
St Paul Financial Services																			
	Hurley	Todd	Director						x										
St Paul Fire Dept																			
	Butler	Tim	Chief	x	x	x	x	x		x	x	x	x	x					
	Gaede	Mike	Assistant Fire Chief	x			x												
	Simpson	Matt	Assistant Fire Chief	x			x	x			x	x				x	x		
St Paul Office of Technology and Communications																			
	Gaetzler	Linda	Officer						x							x	x		
St Paul HR/Risk Mgmt																			
	Bodenstein	Sandra	Claims Manager	x			x									x	x		
St Paul Human Rights & Equal Economic Opportunity																			
	Audette	Tiffany	Buyer, Contract & Analyst	x			x									x	x		
	Brakeu	Jazzica	Deputy Director	x			x									x	x		
	McKeown	Lisa	Senior Consultant								x					x	x		
	Satterberg	Sarah	Administrative Manager								x					x	x		
St Paul Libraries																			
	Williamson	Lee	Facilities Manager-Rhanda	x	x	x	x									x	x	x	
	Yang	Tony	Administration	x	x	x	x									x	x		
St Paul Mayor's Office																			
	Rider	Chris	Scheduler						x							x	x		
	Tincher	Jamie	Deputy Mayor						x							x	x		
St Paul Parks and Recreation																			
	Hagel	Tom	Building Trades Supervisor	x	x	x	x	2		x	x	x	9	x		x	x		
	Karum	Gary	Manager	x			x	2			x	x	x	x		x	x		

Department or Agency	First Name	Last Name	Position/Title	Invited to Kick off Meeting	Attended Kick off Meeting	Completed Hazard Survey	Requested to provide Information or	Meeting with HM Planner(s)	Discuss with EM Director	Provided Resource Material	Provided information	Reviewed Prior Mitigation Project	Submitted New Mitigation Project	Technical Expert for Hazard	St Paul EM Director	Invited to Review Draft	Invited to Review Revised Plan	Attended Plan Review	Commented on plan
St Paul Planning and Economic Development																			
	Agustini	Vergi	GIS and Research Intern							x	x								
	Dermody	Bill	Senior City Planner								x						x		
	Schieckel	Martin	Director								x						x		
	Schultz	Kurt	Manager														x		
	Spaulding	Bob	Research Analyst III							x	x						x		
	Tantaran	Allan	Principal City Planner	x			x										x		
St Paul Police																			
	Carcaran	Jennifer	Safe Streets	x	x	x	x									x	x		
	Hallstrom	Kurt	Special Operations	x	x	x	x	x			x	x	x			x	x	x	
St Paul Port Authority																			
	Sarnecki	Kathryn	Harbor Management	x	x	x	x									x	x	x	
St Paul Public Schools																			
	Hegenderf	Shaun	Digital Editor								x					x	x		
	Lyden	Trent	Manager, Security & Emergency Management								x					x	x		
	Olsen	Laura	Director, Security & Emergency Management	x			x									x	x		
St Paul Public Works																			
	Christenson	Brent	Bridges								x	x	x	x		x	x		
	Elder	Bruce	Assistant City Engineer	x	x	x	x	5		x	x	x	4	x		x	x	x	x
	Farraher	Beverly	Operations Manager	x	x	x	x	3			x	x	x	x		x	x	x	x
	Murphy	Pat	Civil Engineer III	x	x	x	x	4			x			x		x	x	x	x
	Weeks	Jim	Supervisor - Paving Office								x			x		x	x		
St Paul Regional Water Services																			
	Heidelberg	Hayley	Emergency Planning and Security Supervisor	x	x	x	x	2		x	x	x	x	x		x	x		
St Paul Safety and Inspections																			
	Noir	Adrian	Fire Safety Inspector	x	x	x	x	x			x	x				x	x		
	Sanders-Pe	Wer	Water Resource Manager				x	4		x	x	x	6	x		x	x		
	Wiere	Angie	Fire Safety Manager	x	x	x	x	x		x	x	x				x	x	x	
St. Paul-Ramsey County Public Health																			
	Anderzen	Laura	Manager, Health Protection	x	x	x	x	3			x	x		x		x	x	x	
	McIntyre	Arthur	Emergency Preparedness Planner					x				x				x	x		
U of M Geology Department																			
	Feinberg	Joshua	Associate Professor, Earth Science	x	x	x	x	x		x	x					x	x		
U.S Army Corps of Engineers				x															
	Alberico	Teri	EOC Manager	x	x	x	x			x	x					x	x		
	Zien	Terry	Senior Program Manager	x	x	x	x									x	x		
Washington County Emergency Management																			
	Matzek	Kelli	EM Planner							x									
	Berglund	Doug	Director													x			

Appendix A-3: Meeting and Outreach Documentation

The following documentation presents the meeting invitations, agendas and presentations materials; and summary of information received through emails and other methods during the planning process.

Kickoff Meeting

Text of email invitation for Kickoff Meeting:

> We request your participation as we start the process of updating the City of St. Paul All-Hazard Mitigation Plan. The City is required by law to update the plan every five years. This will be the first of two meetings at the St. Paul Emergency Operations Center. If you are unable to attend or if additional individual meetings are needed, we will meet with you at your office. We look forward to working with you on this critical plan.
>
> Your participation is crucial to creating a functional and useful plan. Please contact me with any questions or concerns.
>
> Thank you.

27 Feb 18 - Kick-off Hazard Mit Mtg Attendees

NAME		DEPARTMENT	SIGNATURE
Anderson	Jerod	St. Paul Emergency Management	
Anderson	Laura	St. Paul-Ramsey Cty Community Health Public	
Angelis	Lucy	St. Paul Emergency Management	
Audette	Tiffany	HREEO	
Bauer	Kelly	St. Paul Emergency Management	
Blumenfeld	Ken	MN State Climate Office	
Bodensteiner	Sandra	HR/Risk Mgmt	
Brokaw	Jesssica	HREEO	
Butler	Tim	St. Paul Emergency Management	
Carbone	Cathe	Ramsey Cty Emergency Communications Ctr	
Carstens	Tina	Ramsey Washington Metro Watershed District	
Combs	Ken	~~St. Paul Emergency Management~~ Chi Hieu Ho	
Corcoran	Jennifer	St Paul Police Dept	
Doneux	Mark	Capitol Regional Watershed District	
Elder	Bruce	Public Works	
Eleria	Anna	Capitol Regional Watershed District	
Farraher	Beverly	Public Works	
Feinberg	Joshua	U of M Geology Department	
Felter	Erik	Metropolitan Council	
Freeman	Nancy	Consultant	
Gaede	Mike	St Paul Fire Dept	
Graupman	Jim	Regional Water	
Hagel	Tom	Parks and Recreation	
Hallstrom	Kurt	St Paul Police Dept	
Hamilton	Patrick	Science Museum of Minnesota	
Harris	Joe	Manager of DT St. Paul Airport	
Heidelberg	Hayley	Regional Water	
Kane	Jenny	MN DPS/ Capital	
Korum	Gary	Parks and Recreation	
Krause	Todd	NWS	
Lovas	Mike	St. Paul Emergency Management	OUT
Mayer	Bryan	Ramsey County EMHS	
Moermond	Marcia	City Council	
Murphy	Pat	Public Works	
Nels	AJ	Safety and Inspections (DSI)	
Nelson	Jennifer	MN HSEM	
Olson	Laura	St Paul Public Schools	
Peterson	Gary	MN HSEM	
Raab	Kristin	Minnesota Department of Health	
Sand	Mike	St. Paul Emergency Management	
Sarnecki	Kathryn	St Paul Port Authority	
Sieben	Terry	St. Paul Emergency Management	
Simpson	Matt	St Paul Fire Dept	
Stark	Russ	Mayor's Office	
Strauss	Ceil	MN DNR	

NAME		DEPARTMENT	SIGNATURE
Torstenson	Allan	Planning and Economic Development (PED)	
Vang	Xue	St. Paul Emergency Management	
Wiese	Angie	Safety and Inspections (DSI)	
Williamson	Lee	St. Paul Libraries	
Yang	Tony	St. Paul Libraries	
Zien	Terry	Army Corps of Engineers	
Alberico	Teri	US Army Corps of Engineers	

City of Saint Paul, MN
LOCAL HAZARD MITIGATION PLAN (LHMP) - PROCESS CHART

PROCESS AND ORGANIZATION	**1. Determine Planning Area and Resources**	
	• Single Jurisdictional Plan • Lead Contact for Planning Process	Document Planning Process - Meetings, Minutes, Sign-ins
	2. Planning Team	
	• Identify Planning Team Members o Multi-agency • Engage Leadership • Promote Participation and Buy-in • Initial Steps for Planning Team	Document Planning Process - Planning Team Roles, Engagement, and Input
	3. Outreach Strategy - Update	
	• Strategy Framework • Conduct Outreach • Continue Public Outreach over Time	Document Planning Process - Stakeholder and Public Involvement
ANALYSIS AND DECISION MAKING	**4. Review Community Capabilities - Update**	
	• Review and Update Capability Assessment • Review and Update Types of Capabilities • National Flood Insurance Program (NFIP)	Document - Community Capabilities
	5. Conduct Risk Assessment - Update	
	• Review and Update Risk Assessment • Document Risk Assessment	Document - Hazards and Risk Assessment
	6. Develop Mitigation Strategy – Update	
	• Review and Update Goals and Objectives • Review and Update Actions • Revise Action Plan for Implementation • Update Mitigation Strategy • Communicate Mitigation Action Plan	Document - Update and Development Process for Mitigation Strategy, Goals, Objectives, and Actions, including Alternatives
	7. Keep Plan Current [Maintenance] - Update	
	• Review and Update Plan Maintenance Procedures • Continue Public Involvement	Document - Plan Maintenance Procedures and Schedule
	8. Review and Adopt the Plan	
	• Local Plan Review • State and EMA Plan Review • Local Adoption of the Plan • Additional Considerations • Celebrate Success	Document - Adoption Process - Jurisdiction, Date, and Method of Adoption (minutes, signed resolutions, etc.)
RESOURCES	**9. Create Safe and Resilient Community**	
	• Implementation of the Action Plan • Challenges to Achieving Mitigation Goals • Recommendations for Success • Funding and Assistance	Appendices to LHMP

DEPARTMENT OF EMERGENCY MANAGEMENT
Lucy Angelis, Interim Director

CITY OF SAINT PAUL
Melvin Carter, Mayor

367 Grove Street, 5th Floor Telephone: 651-266-5494
St. Paul, Minnesota 55101 Facsimile: 651-266-5493

March 6, 2018

TO: Attendees, Saint Paul All-Hazard Mitigation Plan Update Working Group

FROM: Department of Emergency Management – Planning Coordinator

SUBJECT: All-Hazard Mitigation Plan Update Kick-Off Meeting Minutes – February 27, 2018

1. Location and Attendees

- The meeting was held at the Wellstone Center from 1-3pm. Please see attached Sign-In Roster for the names of participants.

2. Welcome and Introductions

- Interim Director Lucy Angelis welcomed the group and thanked them for their participation. Saint Paul Department of Emergency Management, Hazardous Mitigation Planner Betsy Phillips and Hazard Mitigation Consultant Nancy Freeman were introduced, and they then conducted the rest of meeting and presented slides on the topic. (Please see the attached meeting slides.)

3. Meeting Purpose and Overview

- An overview of the 2012 plan was briefly discussed and the goals for the meeting were shared.

3. Hazard Mitigation Planning Process Overview

- The group was informed on the process for the plan revision and given an overview of the what Mitigation is all about, specifically for the city of Saint Paul.

4. Planning Organization

- An overview of the planning organization was shared along with the formal Federal Emergency Management Agency process, some expected participation needs, anticipated phases, key sectors and time-lines for plan completion.

5. Hazard Validation

- Definitions of standard terms were discussed. The city-wide 2012 Hazards were reviewed along with the updated 2017 Hazards. Finally, a Hazard Risk Survey was discussed with scoring criteria.

6. Outreach Strategy

AA-ADA-EEO Employer

- The methods, anticipated schedule and potential participants were discussed.

7. Next Steps

- Future meetings, interviews along with communication and coordination methods were discussed.

8. Implementation of the Plan & Adjournment

- A discussion of the new plan's implementation process was shared, and questions were answered from the group.

TERRANCE A. SIEBEN
Coordinator – Plans
Department of Emergency Management

Attachments:
Meeting Attendee Sign-In Sheet, February 27, 2018
Meeting Slides, February 27, 2018

City of Saint Paul
All-Hazard Mitigation Plan Update

KICK-OFF & HAZARD VALIDATION MEETING
FEBRUARY 27, 2018

EMAP Accredited

Welcome & Introductions

- Name
- Position and Agency/Jurisdiction
- Level of involvement in previous and/or current mitigation planning efforts, activities and projects

Hazard Mitigation Planning

- Lucy Angelis, Interim Director
  St. Paul Department of Emergency Management
- Betsy Phillips, Hazard Mitigation Planner
  St. Paul Department of Emergency Management

Today's Goals

- Describe the mitigation planning process
  - Federal and other planning requirements
- Discuss the Working Group organization, roles and responsibilities
- Review and validate St. Paul Hazard Identification and Risk Analysis Evaluation Tool
- Questions and Answers

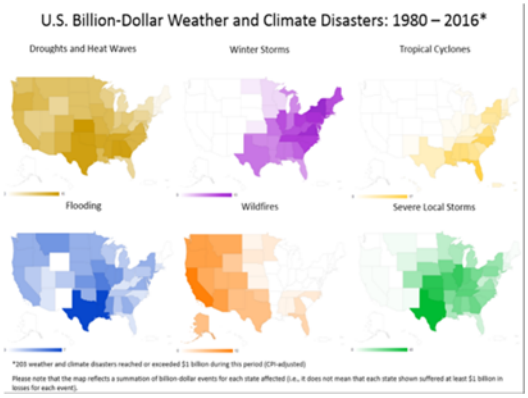
Hazard Mitigation Planning

- Nancy Freeman
  Hazard Mitigation Consultant

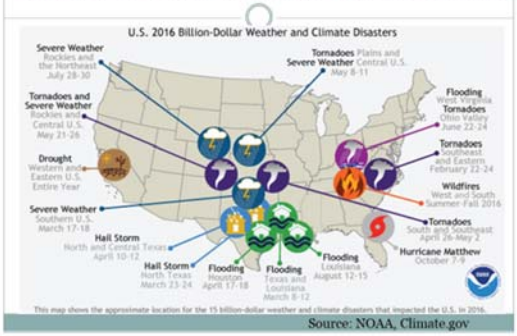
U.S. Natural Disasters by the Numbers

- *Most frequent types:*
  - *Severe Storm (83)*
  - *Tropical Cyclone (35)*
  - *Flooding (26)*
  - *Drought (24)*
  - *Wildfire (14)*
  - *Winter Storm (14)*
  - *Freeze (7)*

- Since 1980 - 2013 weather and climate disasters with overall damage costs reaching or exceeding $1 billion
  - Cumulative costs exceed $1.1 trillion
- 2016 – 15 weather and climate events with losses (exceeding $1 billion each), with total losses:
  - 138 Fatalities
  - $46 billion total (direct costs)
  - 2nd highest annual number of U.S. billion-dollar disasters behind 16 events that occurred in 2011



2016 Billion-Dollar Weather and Climate Disasters



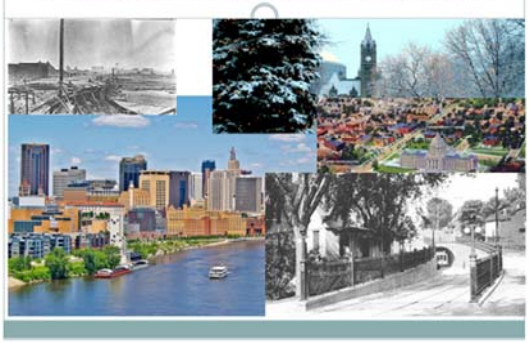
Source: NOAA, Climate.gov

Federal Disaster Declarations (1964-2014)

Source: *Minnesota State Hazard Mitigation Plan 2014*

Disaster Costs in Saint Paul

What Makes St. Paul a desirable place to live?



Hazard Mitigation Planning

- Update 2012 St. Paul All-Hazard Mitigation Plan
- Inclusive process involving broad range of stakeholders
- Review and update and hazards, risks, and vulnerability analysis
- Meet Federal requirements of 44 CFR Part 201.6 for natural hazard mitigation plan *(natural hazards)*
- Meet criteria of the Emergency Management Accreditation Standard *(all-hazards)*
- Fulfill requirements for public review and input

Mitigation Planning Process – By the Book

- Determine Planning Area and Resources
- Build the Planning Team
- Create an Outreach Strategy
- Review Community Capabilities
- Conduct Risk Assessment
- Develop Mitigation Strategy
- Keep the Plan Current
- Review and Adopt the Plan
- Implement the Plan

Project Planning Phases and Timeline

- **Phase I: Initiate Planning Process *(January-February)***
  - Project Organization and Timeline
  - Kick-Off /Hazard Validation Meeting
  - 2012 Plan Review
- **Phase II: Capabilities Assessment, Risk Assessment, and Outreach *(March)***
  - Capabilities Assessment (Existing policies, studies, plans, programs, etc.)
  - Outreach Strategy
  - Data Review and Collection
  - Community Infrastructure
  - Community Vulnerabilities

Statistical analysis provides a foundation for sound judgment, but remember... nature continually defies statistics!

Planning Phases

- **Phase III: Develop Mitigation Strategies *(April)***
  - Project Briefing to Emergency Management Council
  - Public Input
  - Mitigation Goals, Objectives and Actions
  - Plan Maintenance
- **Phase IV: First Draft *(May)***
  - Planning Team Review and Input
- **Phase V: Final Plan Review, Approval and Adoption *(June-July)***
  - Review and approval by Planning Team
  - State Review and approval
  - FEMA Review and APA determination
  - Adoption by jurisdiction
  - Final adopted plan approved by FEMA

Planning Organization

Working Group (Key Departments, Agencies and Organizations)

Technical Stakeholders/ Subject Matter Experts

Emergency Management Council

Elected Officials

Community Groups

Adjacent Jurisdictions

Public

Key Sectors in the Planning Process

- Emergency Management
- Economic Development
- Land Use and Development
- Housing
- Health and Social Services
- Infrastructure
- Natural and Cultural Resources

Look closely at the present you are constructing.
It should look like the future you are dreaming.
–Alice Walker

St. Paul All-Hazard Mitigation Plan Planning Team

- **Working Group**
  - Emergency Management (City, County, State)
  - Floodplain Managers
  - Code Enforcement/Building Inspectors
  - Health and Human Services
  - Fire
  - Contractor
- **Stakeholders**
  - Local, Regional, State and Federal Agencies
  - Special Districts and Authorities
  - NGO's
  - Educational Institutions
  - Major Employers
  - Cultural Institutions
  - Land Use and Development Agencies
  - Professional Associations
  - Neighboring Jurisdictions
  - Access and functional needs agencies
- **Public**

Hazard Validation Process

- **Step 1** • Identify and Describe Hazards
- **Step 2** • Identify Community Assets
- **Step 3** • Analyze Risk
- **Step 4** • Summarize Vulnerability

Definitions

- **Natural Hazard** - source of harm or difficulty created by a meteorological, environmental, or geological event
- **Technological Hazard** – results from accident or the failure of systems and structures
- **Human-Caused Incident or Threat** – results from intentional actions of an adversary
- **Community assets** – the people, structures, facilities and systems that have value to the community

Definitions

- **Impact** – The consequences or effects of the hazard on the community and its assets
- **Risk** - The potential for damage, loss, or other impacts created by the interaction of natural hazards with community assets
  - Exposure of:
    - People
    - Built Environment
    - Natural Environment
    - Economy

Definitions

- **Vulnerability** - characteristics of community assets that make them susceptible to damage or impact from a given hazard
  - ***Measures of vulnerability***
    - ***Quantitative – assigns values to measure the potential losses to the assets at risk.*** *(i.e.,* types, number, and total value of existing buildings, infrastructure and critical facilities in a hazard area)
    - ***Qualitative*** – description of the types of impacts that might occur during a hazard event

Definitions

- **At-Risk Populations**
  - Individuals who may need additional assistance before, during or after a disaster in order to maintain or stabilize functional needs or activities of daily living (special medical needs, vision-impaired, dialysis-dependent, etc.)
- **Vulnerable Populations**
  - Individuals who, due to increased risk in their living situations may be more severely impacted by the effects of a disaster (residents in flood-zones, sub-standard housing, transient, migrant workers, transportation-dependent, etc.)

Definitions

- **Risk Assessment** – product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making

A Risk Assessment is the process of measuring the potential loss of life, personal injury, economic injury, property damage, and environmental impact resulting from hazards.

Step 1. Describe Hazards

- **Type**
- **Location**
  - Geographic area affected by the hazard
  - Maps and/or narratives
- **Extent** – characteristics of magnitude or strength
  - Scientific measurement system, such as the Enhanced Fujita Scale (tornado), or Richter Scale (earthquake)
  - Water depth
  - Wind speed
  - Speed of onset (warning time)
  - Duration (the longer the duration, the greater the extent)

Step 1. Describe Hazard

- **Previous Occurrences**
  - Historical Data
  - Multiple sources
  - Helps to estimate the likelihood of future events
  - Predicts potential impacts
- **Likelihood of Future Events**
  - Historical Frequencies
  - Statistical probabilities
  - General descriptions or rankings

St. Paul Natural Hazards – 2012 Plan

Hazards Prioritized by Risk Score:

- Vulnerability (V) (impacts + consequences)
- Probability (P)
- Risk (R): V+P=R

1. Damaging Winds/Thunderstorms
2. Tornado
3. Blizzard/Ice Storm
4. Flood
5. Infectious Disease
6. Extreme Heat/Cold
7. Dam/Levee Failure
8. Natural Fire
9. Karsts, Tunnels and Caves
10. Drought
11. Invasive Species
12. Earthquake

Technological and Human-Caused Hazards – 2012 Plan

Threat and Hazard Identification and Risk Assessment Methodology (THIRA)

1. Infrastructure Failure
2. Animal Escape
3. Major Community Events
4. Large Scale Threats of Violence
5. Terrorism (CBRNE)
   1. Chemical
   2. Biological
   3. Radiological
   4. Nuclear
   5. Explosive

Hazard Risk Survey

- Review the list of natural, technological and human-caused hazards
- For each hazard, use the definitions and ranking criteria provided on the handout to assign a number for location; probability of future occurrences; magnitude/severity; and significance
- Determine the "Overall Risk Score" by adding the numbers in the previous four columns

St. Paul Technological and Human-Caused Hazards - 2017

Risk Score = Consequence Score + Risk/Vulnerability Impact Score + Frequency/ Probability Score

Additional Score: Impact on Lifeline Sectors

1. Urban Fire
2. Oil by Rail Incident
3. Transportation Incidents
4. CBRNE Incident/Terrorism
5. Cyber Attack
6. CIKR Lifeline Sectors Failure
7. Active Shooter
8. Major Community Event Disruption
9. Hazardous Material Incident
10. Critical Supply Chain Disruption
11. Sabotage/Theft
12. Civil Disorder
13. Airplane Crash
14. Maritime Attach
15. Arson/Incendiary Attack
16. Animal Escape
17. Aircraft as Weapon
18. Communication Systems Failure
19. (REP)/Ingestion Pathway Planning Zone

Next Step: Hazard Validation

- Determine average Overall Risk Score for each hazard based on the Hazard and Risk Survey
- Merge survey results with the *St. Paul Hazard Identification and Risk Analysis Evaluation Tool*
- Disseminate final hazard list for Working Group validation

Is the Climate changing?

- Rising number of events that cause significant amounts of damage
- Increasing potential and costs in damage due to increases in population and material wealth
- Increasing number of heavy rainfall events *(related to warming trends that increase water vapor in the atmosphere?)*
- Higher frequency of drought and wildfire
- Fewer cold wave/crop freeze events
- More record high vs. record low temperatures
  - Trends in winter storm event intensity – subject to more uncertainty than only temperature

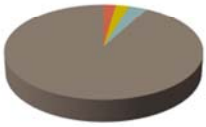
Outreach Strategy

Methods

Schedule

Participants

How many people have thought about mitigation in relation to these hazards?



- Flood
- Winter Storm
- Fire
- Zombie Apocalypse

Future Meetings*

- Capability Assessment
  - Planning and Regulatory
  - Administrative and Technical
  - Financial
  - Education and Outreach
  - Safe Growth Audit
  - National Flood Insurance Program
- Mitigation Strategy Session
  - Vulnerability Analysis
  - Goals and Objectives
- Project Workshop
  - Project Updates and Status
  - New Projects
- Draft Plan Review
- Final Plan Review and Approval

**Meetings will be a combination of individual agency and group meetings*

Communication and Coordination

- Planning Worksheets
- Calls for Information
- Review and Development of Mitigation Actions
- Outreach Materials
- Review and Feedback

Implementation of the Plan

Plan Implementation through Adoption....

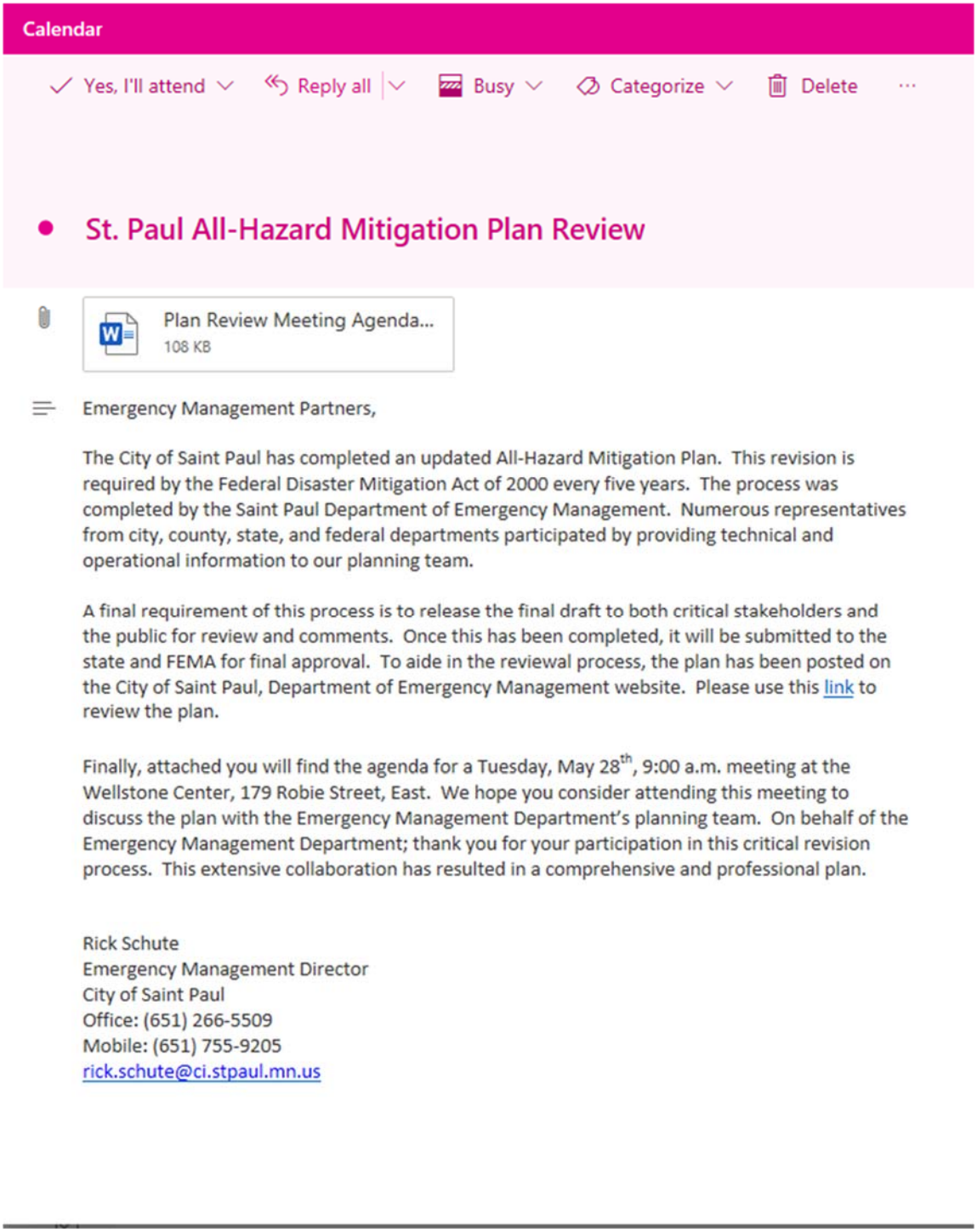
"Enough with all the strategic planning. Get out there and kill something."

- Implementation Plan
- Integration with Existing Planning Processes
- Funding and Other Resources
- Five-Year Plan Maintenance Cycle
  - Monitoring
  - Evaluation
  - Revision

Question and Comments?

Contact: Betsy Phillips
Phone: 651-274-9367
Email: Betsy.Phillips@ci.stpaul.mn.us

Draft Review Meeting



Calendar

Yes, I'll attend | Reply all | Busy | Categorize | Delete | ...

St. Paul All-Hazard Mitigation Plan Review

Plan Review Meeting Agenda...
108 KB

Emergency Management Partners,

The City of Saint Paul has completed an updated All-Hazard Mitigation Plan. This revision is required by the Federal Disaster Mitigation Act of 2000 every five years. The process was completed by the Saint Paul Department of Emergency Management. Numerous representatives from city, county, state, and federal departments participated by providing technical and operational information to our planning team.

A final requirement of this process is to release the final draft to both critical stakeholders and the public for review and comments. Once this has been completed, it will be submitted to the state and FEMA for final approval. To aide in the reviewal process, the plan has been posted on the City of Saint Paul, Department of Emergency Management website. Please use this link to review the plan.

Finally, attached you will find the agenda for a Tuesday, May 28th, 9:00 a.m. meeting at the Wellstone Center, 179 Robie Street, East. We hope you consider attending this meeting to discuss the plan with the Emergency Management Department's planning team. On behalf of the Emergency Management Department; thank you for your participation in this critical revision process. This extensive collaboration has resulted in a comprehensive and professional plan.

Rick Schute
Emergency Management Director
City of Saint Paul
Office: (651) 266-5509
Mobile: (651) 755-9205
rick.schute@ci.stpaul.mn.us

Saint Paul All-Hazard Mitigation Plan – 2019 Update

Plan Review Meeting

May 28, 2019

9:00am
Wellstone Center
Room 212
179 Robie Street East
St. Paul

SAINT PAUL
The Most Livable City in America

AGENDA

- Welcome and Introductions
  - Meeting Purpose and Overview
- Plan Presentation
  - Overview
  - Plan Format
  - Section Summaries
  - Mitigation Actions
- Discussion and Comments – Approve Initial Draft
  - Stakeholder Input
  - Public Review and Comment Period
- Plan Review Schedule
  - State
  - FEMA
- Plan Approval Process
- Next Steps
  - Approvable Pending Adoption (APA)
  - Adoption of the Plan
- Plan Implementation
  - Mitigation Actions
  - Monitoring and Evaluation
  - Integration into Existing Planning Processes
- Adjournment

* Initial By Name Please *

Sign-In List

All-Hazard Mitigation Plan Meeting – 28 May 2019

Schute, Rick (CI-StPaul)	Meeting Organizer	None	RTS
anna@capitolregionwd.org	Required Attendee	Accepted	Nate Zwonitzer nate@capitolregionwd.org
ken.combs@childrensmn.org	Required Attendee	Accepted	
bruce.kelli@hennepin.us	Required Attendee	None	
eirik.felter@metc.state.mn.us	Required Attendee	None	
Greg.Tuveson@metrotransit.org	Required Attendee	Accepted	
kristin.raab@state.mn.us	Required Attendee	None	
ceil.strauss@state.mn.us	Required Attendee	None	
angela.d.brown@state.mn.us	Required Attendee	None	
bill.hirte@state.mn.us	Required Attendee	None	
jennifer.e.nelson@state.mn.us	Required Attendee	None	
kenneth.blumenfeld@state.mn.us	Required Attendee	Tentative	
todd.krause@noaa.gov	Required Attendee	None	
Cathe Carbone (ECC)	Required Attendee	None	
Freed, Judd	Required Attendee	None	
bryan.mayer@CO.RAMSEY.MN.US	Required Attendee	None	
tina.carstens@rwmwd.org	Required Attendee	Tentative	
hamilton@smm.org	Required Attendee	None	
joe.harris@mspmac.org	Required Attendee	None	
ajohnson@visitsaintpaul.com	Required Attendee	None	
Veith, Lisa (CI-StPaul)	Required Attendee	Accepted	
Moermond, Marcia (CI-StPaul)	Required Attendee	None	
Anderson, Jerod (CI-StPaul)	Required Attendee	None	
Angelis, Lucy (CI-StPaul)	Required Attendee	Accepted	
Lovas, Mike (CI-StPaul)	Required Attendee	None	
Phillips, Betsy (CI-StPaul)	Required Attendee	Accepted	
Sand, Mike (CI-StPaul)	Required Attendee	Accepted	
Sieben, Terry (CI-StPaul)	Required Attendee	Accepted	
Vang, Xue (CI-StPaul)	Required Attendee	Accepted	
Linda Goettler	Required Attendee	None	
Bodensteiner, Sandra (CI-StPaul)	Required Attendee	Accepted	
Satterberg, Sarah (CI-StPaul)	Required Attendee	None	
Williamson, Lee (CI-StPaul)	Required Attendee	Accepted	
Rider, Chris (CI-StPaul)	Required Attendee	None	
Tincher, Jaime (CI-StPaul)	Required Attendee	None	
Hagel, Tom (CI-StPaul)	Required Attendee	None	
Korum, Gary (CI-StPaul)	Required Attendee	None	
Dermody, Bill (CI-StPaul)	Required Attendee	None	
Schieckel, Martin (CI-StPaul)	Required Attendee	None	
Corcoran, Jennifer (CI-StPaul)	Required Attendee	None	
Hallstrom, Kurt (CI-StPaul)	Required Attendee	Accepted	
Kathryn L. Sarnecki	Required Attendee	Accepted	
Trenton Lyden (SPPS)	Required Attendee	Accepted	
shawn.hogendorf@spps.org	Required Attendee	None	
Christensen, Brent (CI-StPaul)	Required Attendee	None	
Elder, Bruce (CI-StPaul)	Required Attendee	None	
Farraher, Beverly (CI-StPaul)	Required Attendee	Accepted	
Murphy, Patrick G (CI-StPaul)	Required Attendee	None	
Weeks, James (CI-StPaul)	Required Attendee	None	
Heidelberg, Hayley (CI-StPaul)	Required Attendee	Accepted	
Neis, Adrian (CI-StPaul)	Required Attendee	Accepted	
Wiese, Angie (CI-StPaul)	Required Attendee	None	
Saunders-Pearce, Wes (CI-StPaul)	Required Attendee	None	
feinberg@umn.edu	Required Attendee	Accepted	
teri.alberico@usace.army.mil	Required Attendee	Accepted	
terry.r.zien@usace.army.mil	Required Attendee	None	
eric.waage@hennepin.us	Required Attendee	None	
james.illiff@co.dakota.mn.us	Required Attendee	None	
barret.lane@minneapolismn.gov	Required Attendee	None	
~~nancy.freeman@mn.com~~	~~Required Attendee~~	~~None~~	
nancyinop@yahoo.com	Required Attendee	None	
Andersen, Laura	Required Attendee	None	LEA
Gustafson, Eric	Optional Attendee	None	– Eric Kvaalen from
Nate Zwonitzer	Optional Attendee	Accepted	
jenny.kane@state.mn.us	Required Attendee	Declined	
Simpson, Matthew (CI-StPaul)	Required Attendee	Declined	
McKeown, Lisa (CI-StPaul)	Required Attendee	Declined	
Schultz, Kurt (CI-StPaul)	Required Attendee	Declined	
Spaulding, Bob (CI-StPaul)	Required Attendee	Declined	
Torstenson, Allan (CI-StPaul)	Required Attendee	Declined	
laura.olson@spps.org	Required Attendee	Declined	
douglas.berglund (washco)	Required Attendee	Declined	
terry.stoltzman (anokaco)	Required Attendee	Declined	

2

DEPARTMENT OF EMERGENCY MANAGEMENT
Rick Schute, Director

CITY OF SAINT PAUL
Melvin Carter, Mayor

367 Grove Street, 3rd Floor Telephone: 651-266-5404
St. Paul, Minnesota 55101 Facsimile: 651-266-5493

May 30, 2019

TO: Attendees, Saint Paul 2019 All-Hazard Mitigation Plan Review Meeting

FROM: Department of Emergency Management – Planning Coordinator

SUBJECT: All-Hazard Mitigation Plan Draft Review Meeting Minutes – May 28, 2019

1. Location and Attendees

- The meeting was held at the Wellstone Center from 9-10:30am. Please see attached Meeting Sign-In Roster for the names and departments/agencies of participants. Also attached is a copy of the meeting agenda and the slides presented.

2. Welcome and Introductions

- Terry Sieben started the meeting by introducing Emergency Management Director Rick Schute who welcomed the group and thanked them for their participation today and throughout the entire plan revision process. Hazardous Mitigation Planner, Betsy Phillips and Hazard Mitigation Consultant Nancy Freeman were introduced, along with the department's Critical Infrastructure & Key Resource Coordinator, Jerod Anderson. Sieben, Anderson and Freeman then conducted the rest of meeting and presented slides (attached) on the 2019 draft plan.

3. Plan Presentation

- An overview of the 2019 plan was provided focusing on its two major parts; Base Plan (with six sections) and Appendices (with 4 sections). The plan format, section summaries and mitigation actions were reviewed.

4. Discussion and Comments

- The group approved the plan and the public comment period closes June 14th.

5. Plan Review Schedule

- Simultaneously, the Stakeholder Working Group Review & Input Period and the Public Review & Comment Period occur 5/16/19 - 6/14/19. Minor adjustments to the plan's formatting and other corrections will be completed during this time and will incorporate any public comments if applicable. The State Hazard Mitigation Officer at the MN Department of Homeland Security & Emergency Management (MN HSEM) should receive the final draft on or about 18 June. Once approved there, it will be forwarded on to the Federal Emergency Management Agency for final approval.

AA-ADA-EEO Employer

6. Plan Approval Process, Next Steps & Implementation

- Discussion occurred on these subjects. Upon the approval of the plan from both the FEMA and MN HSEM, the plan will be formally "Approvable Pending Adoption" and the Department of Emergency Management will coordinate with the Mayor's Office to request adoption by resolution with the City Council. Following adoption, the plan will be made available to all stakeholders and the public. At this time it will be fully implemented.

7. Adjournment

- The meeting was completed at approximately 10:30am.

TERRANCE A. SIEBEN
Coordinator – Plans
Department of Emergency Management

Attachments:
Meeting Attendee Sign-In Sheet, May 28, 2019
Meeting Agenda, May 28, 2019
Meeting Slides, May 28, 2019

City of Saint Paul All- Hazard Mitigation Plan

Plan Review Meeting

May 28, 2019

Prepared for the City of Saint Paul, Minnesota
May 2019 [DRAFT]

EMAP Accredited

2019 City of Saint Paul All-Hazard Mitigation Plan

Today's Objectives

- Review Plan format and contents
- Provide opportunity for feedback
- Discuss Plan review process and schedule
- Discuss Plan Implementation
- Approve Initial Draft to release for public comment
- Discuss methods of disseminating the Adopted Plan

Plan Organization

- **Base Plan** – Executive Summary and 6 Sections
- **Appendices** – Supporting Data and Information

Base Plan

- Executive Summary
- Section 1: Introduction
- Section 2: Planning Process
- Section 3: Hazard Identification and Risk Assessment
- Section 4: Mitigation Strategy
- Section 5: Plan Maintenance
- Section 6: Plan Adoption

Executive Summary

- Provides a broad overview for elected officials and others of why the Plan was developed
  - Reducing the risk from the impacts of natural, technological and human-caused hazards
- Benefits
  - Every $1 of mitigation funding spent, can save the nation $6 in future disaster costs (study of the *National Institute of Building Sciences*)
- Plan Promulgation Documentation (Adoption Resolution, Record of Distribution, Record of Changes)

Section 1: Introduction

- Purpose, Background and Scope
- Plan Organization
- Authorities and References
- City of Saint Paul Profile
  - History, Geography/climate, Topography, Transportation, Economy, Education, Government, Demographics, Special Features, Environment, Cultural & Historical Assets, Population Trends and Projections, Special Populations at Risk, Future Growth and Development

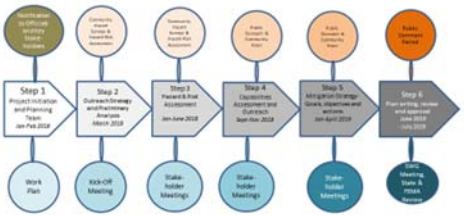
Section 2: Planning Process

- Overview – Background and Approach
- 6-Step Planning Process
- Planning Organization – Project Team and Stakeholder Working Group (SWG) *(Emergency Management Council, Subject Matter Experts, and other planning partners)*
- Roles, Responsibilities & Participation

Section 2: Planning Process (Cont.)

- Group and One-on-One Meetings
  - Collect, analyze and update data and information
  - Obtain input related to hazard risks and vulnerabilities, impacts and consequences
  - Update 2012 Mitigation Actions and Develop new Actions for the 2019 Plan
- Public Involvement and Input
- Review and Integrate key data from Community Plans and Studies
  - Growth Management
  - Emergency Management
  - Economic Development
  - Sustainability and Resiliency

Six-Step Planning Process and Timeline
January 2018 to July 2019



Section 3.0: Hazard Identification & Risk Assessment

- Overview and Methodology
  - Process, hazards considered, hazards omitted
  - Impacts and Consequences Summary
  - 10 Hazards of Highest Concern
  - Assets at Risk
  - Critical Facilities/Infrastructure Summary
  - Risk Assessment Summary
  - Vulnerability Analysis Summary
  - Future Growth and Development
  - Impacts of Climate Change

Top 10 Hazards – Natural

- Urban Fire/Wildland Fire
- Damaging Wind/Severe Thunderstorm (Hail)
- Extreme Heat/Cold
- Severe Winter Storm
- Tornado
- Flood
- Human Infectious Disease
- Landslide/Slope Failure
- Dam/Levee Failure
- Drought

Hazard Subsections – Technological & Human-Caused

- **CIKR Lifeline Sectors Failure**
  - Communications Systems
  - Cyber-Attack
  - Transportation Systems Incident
  - Water Supply Contamination
- **Critical Supply Chain Commodity Disruption**
  - Large Scale Fuel Shortage
  - Food Supply
  - Health and Medical Supply
- **Terrorism (Intentional threat or attack)**
  - Chemical, Biological, Radiological, Nuclear, Explosive
- **Hazardous Materials (Accidental)**
  - Explosives, flammable and combustible substances, poisons and radioactive materials
    - Chemical leak/spill
    - Natural Gas
- **Criminal Acts**
  - Active Shooter
  - Arson/Incendiary Attack
- **Civil Disorder**
  - Major Community Event
  - Demonstrations and Riots
  - Labor Strike

Technological and Human-Caused Hazards are addressed in Appendix B

Sections 3.1 to 3.10: Hazard Subsections

Hazard Profile	*Vulnerability Assessment*
Problem/Description	Vulnerability Summary
Type	Population
Location	Built Environment & Critical infrastructure
Extent	Natural Environment
Previous Occurrences	Economy
Probability of Future Events	Future Population Growth and Development
Impacts and Consequences	Impacts of Climate Change
Analysis of Risk	Factors for Consideration in the Next Planning Cycle

Section 4: Mitigation Strategy

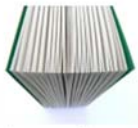
- Mitigation Goals and Objectives
- Mitigation Capabilities
- Mitigation Actions
- Action Plan for Implementation
  - Integrate mitigation planning into existing planning mechanisms
  - Potential Funding and Resources

Mitigation Goals

- Goal 1: Protect public health and safety
- Goal 2: Preserve property
- Goal 3: Promote a sustainable economy
- Goal 4: Promote and sustain a healthy environment
- Goal 5: Encourage public preparedness for disasters

Mitigation Capabilities

- Summary and Analysis:
  - Planning and Regulatory
  - Administrative and Technical
  - Safe Growth
  - Financial
  - Education and Outreach



- Discusses how capabilities have been enhanced since 2012 and how gaps may be addressed in the next planning cycle
- NFIP Assessment and Continued Compliance

Mitigation Actions

- Progress on 2012 Mitigation Actions
  - 64 Actions:
    - 11 Completed
    - 9 Removed – preparedness or response action
    - 22 Removed – no update or other resolution
    - 22 Retained in 2019 Plan
- 2019 Mitigation Actions
  - 31 Actions
    - 22 from 2012 Plan
    - 9 New actions
    - Hazards addressed: Flood (18), Extreme Heat/Cold (1), Fire (4), Human Infectious Disease (1), Landslide/Slope (1), Technological/Human-Caused (2), Infrastructure (1), All (3)

Mitigation Actions (Cont.)

- Action Plan for Implementation
  - Roles and Responsibilities
    - EM Planning Coordinator
    - Stakeholder Working Group
  - Implementation Components
    - Responsible agency, resources, timeline
    - Prioritization (Ranking System)
      - 6 Ranked as High Priorities
      - 24 Ranked as Medium Priorities
      - 1 Ranked as Low Priority
    - Integration into Existing Plans and Procedures
      - Other planning efforts and opportunities
  - Funding and Resources

Current Mitigation Projects

- Extreme Temperature supplies in shelters
- Urge public to heed winter weather warnings
- Expand Severe Weather Awareness activities
- Seek funding for smoke detector education and giveaway program
- Examine existing levees and identify areas of additional levee constructions so as to reduce need for repetitive and time-consuming sandbag levee construction
- Promote the use of Family Emergency Plans
- Info dissemination on NOAA Weather radios
- Alert, Sheltering & Transportation issues for heat emergencies
- Insert flood recovery and mitigation scenario in disaster exercise schedule
- Disseminate info on common sense terrorism & CBRNE awareness
- Discourage the public from video-taping severe weather

- Harden infrastructure and build capacity to mitigate, prepare for, respond to, and recover from terrorism at key infrastructure nodes
- Conduct Isolation & Quarantine Tabletop Exercise
- Promote use of winter survival kits
- Educate Public on disease precautions
- Community Outreach Education/Planning Discussions on EOP and subsequent ESF's
- Educate citizens on low interest loans for improving structural ability of homes/businesses
- Gather heat-related information
- Develop bridge infrastructure failure plans
- Coordinate the gathering and dissemination of commonsense directions for terrorism prevention, preparation, response, recovery actions.
- Create partnership to disseminate info on use of emergency generators

Section 5: Plan Maintenance

- Plan Maintenance Steps:
  - Monitoring
  - Evaluating
  - Updating

- Roles and Responsibilities
- Procedures and Schedules
- Continued Public Involvement

Monitoring the Plan

- Annually and/or following major disaster(s)
- Mitigation Action Progress Report Form (Section 5, Attachment 5A)
- Status of current actions
- Assess progress in funding and implementing actions
- Identify new opportunities for mitigation actions
- Identify new funding, resources, agency priorities, and planning mechanisms

Evaluating the Plan

- Annually and/or following major disaster(s)
- Assess effectiveness of the plan in achieving purpose and goals
  - Annual Plan Review
  - Stakeholder Participation
  - Review Polices and Regulations
  - Review Programs
  - Review Hazards, Risks and Vulnerabilities
  - Review Annual Monitoring Report
- Produce Summary Report – Mitigation Strategy Annual Update

Updating the Plan: 5-Year Cycle

- Years 1 – 4:
  - Monitor and Evaluate
  - Administrative changes
  - Revise plan to maintain progress
  - Public Input
- Year 5:
  - Update Risk Assessment *(1st qtr.)*
  - Review and Update Goals and Objectives (2nd qtr.)
  - Review and Update Mitigation Actions *(3rd qtr.)*
  - Public Input *(3rd qtr.)*
  - Revise Plan *(3rd qtr.)*
  - State Review and FEMA Approval Pending Adoption *(4th qtr.)*
  - Adopt Revised Plan *(4th qtr.)*

Section 6: Plan Adoption

- Purpose of Adopting the Plan
- Sample Resolution to Adopt the Plan
  - Instructions to incorporate fully executed Resolution into the Final Plan
- Signed Adoption Resolution, when fully executed, will be added to the Executive Summary Section with Promulgation documentation

Appendices

- Appendix A: Planning Process
  - Outreach Strategy
  - Participation
  - Documentation of Planning meetings and activities
- Appendix B: Hazard Identification and Risk Assessment
  - Saint Paul Hazard Identification and Risk Assessment Evaluation Tool *[included by reference]*
- Appendix C: Mitigation Strategy
  - Mitigation Actions & Prioritization Ranking Sheet
  - Action Worksheet *(for submitting new Mitigation Actions)*
- Appendix D: [Reserved]

Plan Review Schedule

- SWG Review and Input – 5/14/19 to 6/14/19
- Public Review and Comment Period – 5/14/19 to 6/14/19
- Initial State Review *5/08/19*
- FEMA Review and "Approval Pending Adoption" – *[Date TBD]*

Today's Requested Action

- Approve release of initial draft for state review and public review and
  - Draft plan posted on: https://www.stpaul.gov/departments/emergency-management
    - Provide Comment Form
  - Disseminate to neighboring jurisdictions
  - Return all comments by June 14, 2019

Next Step – Coordinate with State Hazard Mitigation Office for Review/Revision

- Incorporate stakeholder feedback and public comments, as applicable
- Coordinate with State Hazard Mitigation Office for State and FEMA review/revision
- Incorporate required/suggested changes from State and/or FEMA

Upon FEMA determination that the Plan is ***Approvable Pending Adoption***, Saint Paul Emergency Management will coordinate with the Mayor's Office to request adoption by resolution. Following adoption, the Plan will be available to all stakeholders and the public.

CITY OF SAINT PAUL NEWS RELEASE
May 10, 2019

Public Review and Feedback Invited for
City of Saint Paul 2019 All-Hazard Mitigation Plan

Saint Paul has completed an updated draft of the All-Hazard Mitigation Plan as required by the Federal Disaster Mitigation Act of 2000 (DMA 2000). Local jurisdictions are required to update the plan every five years to remain eligible for pre-disaster and post-disaster mitigation grant programs.

Community involvement and feedback are vital to the success of the plan. Saint Paul invites public review and feedback of the draft plan which will be reviewed and approved by the State of Minnesota and the Federal Emergency Management Agency (FEMA). A copy of the draft plan and a survey for public feedback is available online at https://www.stpaul.gov/departments/emergency-management. The plan review and comment period will be open until May 31, 2019.

About the Plan

Saint Paul is vulnerable to a variety of potential natural disasters, which threaten the loss of life and property in the county. The plan addresses how to mitigate against hazards such as:

- Dam/Levee/Floodwall Failure
- Damaging Winds/Thunderstorms
- Drought
- Extreme Heat/Cold
- Flood
- Human Infectious Disease
- Landslide/Slope Failure
- Severe Winter Storm
- Tornado
- Urban Fire/Wildfire

The update of the plan has been under direction of Saint Paul Emergency Management in cooperation with Nancy Freeman, a Florida-based hazard mitigation technical expert and multiple city, state, and federal departments and agencies.

Together, the planning team worked to identify cost-effective and sustainable actions to reduce or eliminate the long-term risk to human life or property from natural hazards. Some examples include the improvement of roads that experience repetitive flooding; parks and recreation improvements, the creation of a flood plain structure inventory, and levee projects.

The Benefits of Hazard Mitigation Planning

Hazard mitigation planning ultimately helps us protect Saint Paul residents. By working with city, state, and federal departments and agencies, we can identify vulnerabilities and develop strategies to reduce or eliminate the effects of a potential hazard. In addition, increasing public awareness of local hazards and disaster preparedness helps to create a community that is resilient to disaster, and breaks the cycle of response and recovery. Update of the plan will further allow the county and its jurisdictions to apply for eligible projects under future Hazard Mitigation Assistance (HMA) grant funding from FEMA for projects that are cost-effective and will help to reduce or eliminate impacts of future natural disaster events.

Contact:
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City of Saint Paul Emergency Management Planning Coordinator
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Email: EmerMgmtDept-Correspondence@ci.stpaul.mn.us

APPENDIX B: HAZARD IDENTIFICATION AND RISK ASSESSMENT

Appendix B-1: Saint Paul Hazard Identification and Risk Assessment Evaluation Tool
Appendix B-2: Hazard Survey Summary (February 2018)
Appendix B-3: Technological and Human-Caused Hazards Annex
Appendix B-4: Summary - *Climate Change Action and Resilience Draft Plan*, April 2019

Appendix B-1: Saint Paul Hazard Identification and Risk Assessment Evaluation Tool

This document contains sensitive information and has not been published in this plan. If you have a valid reason to review this evaluation tool please contact the Saint Paul Department of Emergency Management with your request.

EmerMgmtDept-Correspondence@ci.stpaul.mn.us

Appendix B: Hazard Identification and Risk Assessment

Appendix B-2: Hazard Survey Summary (February 2018)

See next page.

Department or Agency	Representatives	Blizzard / Ice Storm	Dam / Levee Failure	Damaging Winds / Thunderstorm	Drought	Earthquake	Extreme Heat / Cold	River Flood	Hail	Human Infectious Disease	Animal Infectious Disease-	Invasive Species	Karst Regions	Landslides/Slope Failures	Natural Fire - Wildland	Tornado
Results are listed with 1 as Highest Overall Risk Score.																
Capitol Regional Watershed District																
	One	1		3	3		2									
Children's Hospitals																
	One	2		1			3		2							
MN Homeland Security Emergency Management																
	One			1			3			2						1
MN State Climate Office																
	One	1		3	2		1				3					
Ramsey County Emergency Management Homeland Security																
	One	2		1					3							2
Science Museum Of MN																
	One	1			2		3			3		2				
St Paul City Council																
	One	3		1			2		3	3		3				3
St Paul Fire Dept																
	One	2		1			2		3	3						1
St Paul Libraries																
	One	2		1			3		3							
	Two	3					3			2						1
St Paul Parks and Recreation																
	One	1		2				1					2	2		
	Two	1		2				1					2	2		
St Paul Police																
	One	1					2	3		2	2					
	Two	1					2	3		2	2					
St Paul Port Authority																
	One	1		1			3	2								2
St Paul Public Works																
	One	1		1			2	3		2	2					
	Two	1		1			3	3	1							2
	Three	1		1					1							2
St Paul Regional Water Services																
	One	3		2			2		2							1
St Paul Safety and Inspections																
	One	2		1			1									1
	Two	1		2			1	2								2
St. Paul-Ramsey County Public Health																
	One	1					2	3		2	2					
U of M Geology Department																
	One	2		2			1									
U.S Army Corps of Engineers																
	One	1								2				3		3
	Two	1							2	2				3		3
TOTAL																
		36	0	27	7	0	41	21	20	25	11	5	4	10	0	24

Appendix B: Hazard Identification and Risk Assessment

Appendix B-3: Technological and Human-Caused Hazards Annex

APPENDIX B-3: TECHNOLOGICAL AND HUMAN/CAUSED HAZARDS

2019 Plan Update
Although Title 44 CFR, Part 201.6 requires that the plan must address only ***natural*** hazards, plans may include other hazards but these will not be reviewed to meet the requirements for natural hazards.[1] ***Technological*** and ***human-caused*** hazards are addressed in this appendix in a format consistent with the natural hazard sections. These sections provide a baseline for monitoring during the planning cycle and reconsideration of their impacts and consequences in the next plan update. Specific changes to this section since the 2012 Plan include: • Infrastructure Failure has been redefined as CIKR (Critical Infrastructure and Key Resources) Lifeline Sectors Failure. • All technological and human-caused hazards addressed in this section have been reorganized and all hazards have been grouped within six categories: CIKR Lifeline Sectors Failure, Critical Supply Chain Commodity Disruption, Terrorism, HAZMAT, Criminal Act and Civil Disorder. • Where data was not available for this update, the potential sources for future development of the hazard profile is noted.

The technological and human-caused hazards addressed in this section have been identified as a risk to the City of Saint Paul, due to either previous incidents in the city or risks that are known through other identification processes, such as the Threat and Hazard Identification and Risk Assessment (THIRA) process.

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".

Human-caused hazards are those hazards caused by direct human intervention that create a potential threat to the health, safety, and welfare of citizens.

[1] FEMA, *Local Mitigation Plan Review Guide*, October 1, 2011, p. 19

The technological/human-caused hazards discussed in this section have been reorganized for the 2018 Plan and are grouped within six categories that incorporate individual hazards with similar causes, impacts and/or consequences. Some of the individual hazards were previously identified in the 2012 plan; others are presented as new hazards because they were considered and ranked on the *Saint Paul Hazard and Risk Assessment (HIRA) Evaluation Tool,* dated November 2015. These hazard categories and individual hazards are:

1. **Critical Infrastructure and Key Resources (CIKR) Lifeline Sectors Failure**
   - Communication Systems Failure
   - Cyber-Attack (identified as "Computer Virus/Hacker" in the 2012 Plan)
   - Transportation Systems Incident (Interstate, Air, Marine, Rail, LRT)
   - Water Supply Contamination

2. **Civil Disorder**
   - Major Community Event
   - Demonstration and Riot
   - Labor Strike

3. **Critical Supply Chain/Commodity Disruption**
   - Large Scale Fuel Shortage
   - Food Supply
   - Health and Medical Supply

4. **Criminal Acts**
   - Active Shooter/Hostile Incident
   - Arson/Incendiary Attack

5. **Hazardous Materials**
   - Explosives, Flammable and Combustible Substances, Poisons and Radioactive Materials
     - Chemical Leak/Spill
     - Natural Gas Leak

6. **Terrorism (**Intentional threat or attack)
   - Chemical, Biological, Radiological, Nuclear, Explosive (CBRNE)
   - Aircraft as weapon

Information on each type of disaster has been reviewed and updated from the previous mitigation plan (2012), the State of Minnesota mitigation plan (2014), and other relevant data and information sources.

Some technological/human-caused hazards either involve actions that the city can do little to mitigate against. Others are more of a cascade effect from other hazards that do not impact the city by themselves. These could potentially cause serious indirect impacts or consequences to the city's resources, services or infrastructure.

B-3.1: CRITICAL INFRASTRUCTRE AND KEY RESOURCES (CIKR) LIFELINE SECTORS FAILURE

2019 Updates
• Redefined "Infrastructure Failure" from the 2012 Plan as "CIKR Lifeline Sectors Failure" and incorporated Communication Systems Failure, Cyber Attack, Transportation Systems Incident and Water Supply Contamination in a combined hazard profile and risk assessment.

B-3.1.1Hazard Profile

Critical Infrastructure and Key Resources (CIKR) is an umbrella term developed by the U.S. Department of Homeland Security to describe those critical assets and essential services that are the backbone of the nation's economy, security and health. Overall, there are sixteen (16) critical infrastructure sectors that compose assets, systems, and networks, whether physical or virtual, so vital to the United States that their incapacitation or destruction would have a debilitating effect on the nation and its citizens. Presidential Policy Directive 21 (PDD-21) was established as the national policy for Critical Infrastructure Security and Resilience.

For the purpose of this plan, the City of Saint Paul has identified the following specific critical infrastructure hazards and threats incorporated in the CIKR category:

- Communication Systems Failure
- Cyber-Attack (identified as "Computer Virus/Hacker" in the 2012 Plan)
- Transportation Systems Incident (Interstate, Air, Marine, Rail)
- Water Supply Contamination

Additional CIKR assets and services that may be considered in future planning cycles include critical manufacturing, energy, financial services, and government facilities.

Hazard Description

CIKR Infrastructure failure results when an event or events either stop the use of or create an interruption of a known infrastructure system. Infrastructure failure may result from natural hazards, technological hazards, human error, man-made occurrences, simple equipment failure, or poor maintenance. The risks of CIKR failure can be significant.

Disruption of any critical infrastructure or resources may cause public safety and health impacts to the city's residents as well as emergency responders and the health and medical system. Failure of the public safety communications systems can cause delays in emergency fire, law enforcement, and medical response. A cyber-attack could lead to

disruption or failure of the electric grid. Water supply contamination has the potential to lead to widespread public health 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 daily occurrences, transportation accidents with impacts to local commerce or resulting in transportation diversions are fairly rare. The major issue surrounding transportation systems revolves around incidents that create a temporary shut-down of transportation mechanisms.

Due to aging transportation 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 within the City of Saint Paul, it happened in a neighboring jurisdiction and affected residents of the city and the region. 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 validates why mitigating against future failures is extremely important.

Types

Communication Failure

Telecommunication networks are a vitally important component of the city's basic infrastructure and essential to public safety. Multiple companies provide voice, data, and video services using a variety of technologies. The local systems in day-to-day usage are generally reliable but are vulnerable to the impacts of multiple types of hazards, either natural or technological/human-caused.

Communication failure may be an indirect result of a major electrical power failure, 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 jurisdiction. 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 the entire population. Emergency generators are critical to maintain public safety communication systems during an extended power failure.

COMMUNICATION FAILURE Assessment: Moderate Risk Hazard	**Location –** Citywide **Extent –** Loss of service(s), reduced response time **Probability** - low to moderate **Duration –** Unknown **Seasonal pattern** – None **Speed of Onset –**Rapid **Warning time –** Minimal **Repetitive Loss-** N/A	***Potential Cascading Effects*** • Major redirect of staff/equipment • Loss of deliverable services • Resident, visitor and staff safety • Increased security • Loss of revenue • Need for alternative communication systems and methods

Cyber Attack (identified as "Computer Virus/Hacker" in the 2012 Plan)

Although the cause of cyber-attacks can be intentional or unintentional, the vulnerability of computer systems and structures has never been more apparent than what has been revealed by the investigations into cyber attacks during the 2016 U.S. elections.

To date, unintentional threats caused by publicly released worms/viruses, accidents and intentional incidents caused by disgruntled or former employees or customers and others have generally been the most common threat agents to computer system failure; however, there have been documented intentional cyber-attack incidents on critical infrastructure networks. More importantly, any disruption in communication and information technology infrastructure, including the Internet and telecommunication networks can result in a significant impact on the operation of critical systems.

CYBER ATTACK Assessment: Moderate Risk Hazard	**Location –** Citywide, but also variable. Primary Targets: Downtown, Como Campus, Central Service Facility **Extent –** Damage to/loss of computer network and data **Probability** - Moderate to high **Duration –** Extended periods **Seasonal pattern** – None **Speed of Onset –**Slow to rapid **Warning time –** Minimal **Repetitive Loss-** N/A	***Potential Cascading Effects*** • Protection of systems • Network security • Criminal investigation, if crime suspected • Loss of service(s) if attack affects network systems, hardware or software • Activation of continuity plans, including redirect of staff/resources • Alternate methods of public information

Transportation Systems Incident

Transportation accidents occur in multiple modes and conditions. Within the Planning Area, transportation modes include highway/road, rail, air and water. Although this plan defines a transportation "incident" as a single hazard, almost all transportation accidents

are related to potential natural and man-made threats and hazards that lead to accidents. Natural hazards that may cause transportation accidents include:

- Extreme weather events
- Geophysical events (earthquake)
- Geomagnetic storms

Man-made hazard events with the potential to cause transportation accidents or impact infrastructure include:

- Technical failures or human errors
- Infrastructure failure (deferred maintenance, improper management, design flows or exceeding design capacities)

Many of the related hazards noted above can be considered rare events within the city or would have only indirect effects on the transportation system. For the purpose of this plan, types of transportation accidents considered as the focus of this profile and risk assessment are those related to the following potential impacts or consequences to the City and its residents:

- Mass casualty incident
- Hazardous material spill or release
- Loss of critical infrastructure

Depending on the hazard cause and conditions, a transportation accident can have multiple interrelated impacts or consequences. An accident that results in a hazardous material spill or release can also result in mass casualties and/or the loss of critical infrastructure. Hazardous material incidents are separately addressed within a single category for this Plan.

Significant freight, consisting of known and unknown chemicals, is moved through the city along interstate highways and other state roads. The major rail lines running through the Twin Cities area also carry large numbers of commodities. In addition, commercial boat and barge traffic passes through the Mississippi River; however, for the purpose of this plan this is considered a low threat for major transportation accidents.

TRANSPORTATION SYSTEMS INCIDENT Assessment: Moderate Risk Hazard	**Location –** Variable, linked to transportation networks: Rail lines and stations, river ports/terminals, roads and bridges, airport **Extent –** Damage to system or components; loss of use or access	***Potential Cascading Effects*** • Limited use or access, constricting traffic flow • Need for increased security • Criminal investigation, if crime suspected

	Probability – Low to moderate **Duration –** Few hours to few days or longer **Seasonal pattern** – None **Speed of Onset –**Rapid **Warning time –** Minimal **Repetitive Loss-** N/A	• Activation of continuity plans, including redirection of staff/resources • Increased need for public information

Water Supply Contamination

In general, the United States has one of the safest public drinking water supplies in the world. The U.S. Environmental Protection Agency (EPA) regulates drinking water quality in public water systems and sets maximum concentration levels for water chemicals and pollutants. 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 in aquifers. Most City residents get their tap water from the community water system.

Contamination of drinking water supplies can occur in the source water as well as in the distribution system after water treatment has already occurred. There are many sources of water contamination, including naturally occurring chemical and minerals (for example, arsenic, radon, uranium), local land use practices (fertilizers, pesticides, concentrated feeding operations) manufacturing processes, and sewer overflows or wastewater releases. There is a potential for intentional tampering to introduce contaminants into water storage and distribution systems; however, the Public Health Security and Bioterrorism and Response Act, passed by the federal government in June 2002, requires that all community public water systems serving 3,300 people or more conduct a vulnerability assessment and prepare or revise an emergency response plan to address threats to drinking water security and safety from terrorism or other intentional acts.

		Potential Cascading Effects
WATER SUPPLY CONTAMINATION Assessment: Medium Risk Hazard	**Location –** Citywide **Extent –** Risk to life and industrial processes **Probability** – Low to moderate **Duration –** Several hours to a few days **Seasonal pattern** – None **Speed of Onset –**Rapid **Warning time –** Minimal **Repetitive Loss-** N/A	• Illness and epidemics in both humans and animals • Business losses due to decreased productivity • Decreased work periods/decreased pay • Public unrest • Potential for loss of fire suppression sources • Potential for relocation of population (universities, hospitals, residential facilities, day care centers etc.)

Location

Because the definition of critical infrastructure and key resources encompasses a broad range of facilities, as well as systems and functions, it is nearly impossible to identify specific locations within the city that could be impacted by these hazards. For this reason, facility and system security is a primary component of CIKR policies and plans.

In general, computer networks managed by government agencies and major employers may be at the highest risk for intentional attack. It is possible that intelligence and other information sources can identify potential targets which assist in determining the need to increase levels of security to prevent or minimize potential threats and attacks. These events can happen on a large or small scale, but can regardless cause serious problems due to the everyday needs of the community. In addition, each infrastructure system may be dependent on another infrastructure system, which in turn makes each vulnerable to failure.

Transportation systems are more easily linked to specific locations, including highway corridors (segments of Interstates 35E and 94, U.S. Highways 52, 10/61, and State roads); major waterways and ports (Mississippi River and Port of Saint Paul); passenger and commercial railways (Amtrak, Union Pacific, Canadian Pacific, BNSF, and Minnesota Commercial Railway); and airports (Saint Paul Downtown Airport). In addition, the Light Rail Transit provides service that connects Saint Paul to other areas within the Twin Cities.

Extent

Infrastructure failure has the potential to cause significant impacts to the citizens of Saint Paul, as well as create a ripple effect throughout the region. In addition, a catastrophic loss of one component may have devastating cascading effects, multiplying the number of people affected.

The severity or magnitude of a CIKR incident depends on many factors including the facility, system or function that has been impacted, whether the incident is intentional or unintentional, weather conditions, internal control and prevention systems, ease of access by response personnel and equipment, and additional dynamics. The extent of communications failure, cyber-attack or transportation system failure is dependent upon the specific incident and cascading impacts and consequences.

Assessing the extent of water supply contamination incidents is linked to the public health surveillance systems that are in place. Typically, the top ten causes of public health outbreaks in public water systems are linked to:

- Giardia
- Legionella
- Norovirus
- Shigella
- Campylobacter
- Copper
- Salmonella
- Hepatitis A
- Cryptosporidium
- E. coli
- Excess fluoride

In addition to these unintentional threats to public health within water systems, intentional contamination caused by chemicals and biological contaminants introduced into public water systems could lead to significant impacts to the public.

Occurrences

Serious infrastructure failure is a rare occurrence in Saint Paul. There are many safeguards in place to ensure that the infrastructure is secure and works as intended. In the event of a natural disaster the chances of infrastructure failure increases as a result of the disaster. The City does not currently have a process that tracks these types of incidents.

Probability of Future Events

The probability of some type of a CIKR incident occurring in Saint Paul is high, considering the City's status as the State Capital and an important economic center. The scope and function of critical infrastructure and interdependencies of systems that maintain operational capabilities, such as electric power, transportation systems, supply chain distribution, and internet connectivity, make CIKR incidents even more likely in the future. Because of these linkages, there is also a high level of probability that the failure of one infrastructure system could have a cascading effect on other infrastructure. A highly probable scenario of cyber failure or attack has the potential to lead to failures in communication, transportation (air, rail and marine) and utilities. The probability of a CIKR event has grown with increased reliance on common systems.

Because of the broad scope and controlled nature of critical infrastructure, and the likelihood that some level of security may prohibit full disclosure to the public, a return interval for CIKR incidents cannot be calculated.

B-3.1.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Infrastructure failure is especially vulnerable to not only human error but also intentional attacks. Heavily populated and developed areas such as the City of Saint Paul have all types of critical infrastructure that support day to day activities as well as in times of peril. Although increased vigilance and security in recent years has generally decreased the likelihood of some types of CIKR events on a national level, the potential vulnerability is still significant due to widespread reliance on computer and communication networks, system interdependencies and changing technology. Incidents unintentionally initiated may be difficult to prevent or mitigate. This risk increases when intentionally triggered. The population density (residents and visitors) of downtown is an aspect of the city's vulnerability.

Life Safety (Public and Responders)

Infrastructure failure can pose an immediate threat to the public and responders due to the reliance on critical systems in daily life. While all residents of the Planning Area are potentially at risk for impacts of CIKR failure, the higher density living conditions within the urban core present the greatest risk, and there is a possibility of significant loss of life if the city is affected by a widespread loss of critical systems and services.

Effects of a CIKR attack or failure, especially a cyber-attack, can lead to loss of the electric grid, fires, traffic accidents on surrounding roadways due to signal failure, or public health issues due to lack of access to heating or cooling systems. If public communication systems are impacted, alternative messaging must be implemented to allay fears and calm the population. In addition, the safety of emergency responders may be especially at risk if the attack is intentional and public safety communication systems are impacted. In a high-impact incident that could involve multiple fatalities, responders may require critical incident stress debriefing assistance to deal with the situation.

The presence of contaminants in water can lead to adverse health effects, including gastrointestinal illness, reproductive problems, and neurological disorders. Infants, young children, pregnant women, the elderly, and people whose immune systems are compromised because of AIDS, chemotherapy or transplant medications, may be especially susceptible to illness from some contaminants. The public health system in the United States, of which Saint Paul-Ramsey County Public Health is a component, has a robust surveillance and monitoring system that can quickly identify potential public health outbreaks and investigate and contain sources, thus lowering the risk of widespread outbreak.

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). Members of these populations often live in conditions that are more prone to loss of critical systems

and services due to aging structures and infrastructure and lack of mobility to evacuate impacted areas.

Property (Facilities and Infrastructure)

Property and facilities operations can be affected due to an infrastructure disruption or failure, depending on the level of impact and duration. This could lead to temporary relocation of populations due to property damage and lack of energy resources.

In the city of Saint Paul there is a mix of residential, commercial and governmental buildings. There are also numerous 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 impacted by a CIKR event.

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 CIKR event that could result in limited resources and operations. 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 impacts and consequences to specific infrastructure). Failure of some infrastructure, such as communication systems, would result in the need to identify alternate means of communication within City departments and agencies, and with the public. An event resulting in the loss or unavailability of resources such as personnel or equipment could be the most vulnerable area of operations, possibly impacting transportation, water supply and communications as well.

Environment

The environmental vulnerabilities due to a CIKR event may be specifically related to 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 CIKR event is low.

Economic Conditions

The City of Saint Paul, as the State Capitol, 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 CIKR 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.

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[2] as well as mitigation.

A CIKR event has the potential to test the public's confidence in its elected leadership if critical prevention measures are not in place, and preparedness and response information is not timely, consistent, coordinated, and accurate.

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.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to CIKR events.

Capabilities

The City has assessed all-hazard authorities, policies, programs and resources, as documented in **Section 4**. In addition to the broad assessment of capabilities, the City maintains the following capabilities to prevent and/or respond to CIKR events:

- An all- hazard planning program that provides the foundation for risk-based preparedness, training and exercises;

- An accredited Emergency Management Program that operates within a well-coordinated multi-agency system for preparedness, prevention, response, recovery, and mitigation;

[22] "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.

- Mutual aid agreements that ensure intra- and inter-jurisdictional resources from local, regional and state entities; and

- A comprehensive continuity of operations program to ensure that City departments and agencies can maintain essential operations with reduced resources, or at alternate locations.

There are significant, on-going efforts for public education in relation to prevention and risk reduction for CIKR/infrastructure events which is heavily focused on prevention measures, including the following:

- Public information and education for individuals, families and businesses, such as facility security and safety plans, and prevention and reduction systems, and appropriate preparedness measures such as continuity plans and training

- Vulnerability assessments and implementation of higher levels of security systems

- Dedicated intelligence personnel who continually monitor potential threats and notify appropriate agencies to take protective measures, if indicated

The City of Saint Paul presents all-hazard prevention and preparedness education and information to the public throughout the year. The primary focus for preparedness measures is life safety for the public and responders and protection of City resources.

Information from trusted sources provides guidance for people in effective and timely ways to protect themselves from CIKR events. Prevention and preparedness measures can be accessed through a number of sources, including:

- FEMA, National Preparedness Resource Library – https://www.fema.gov/national-preparedness-resource-library
- FEMA, Critical Infrastructure Security Web Site - https://www.dhs.gov/topic/critical-infrastructure-security
- American Red Cross - http://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies.html/
- Saint Paul Emergency Management Office - https://www.stpaul.gov/departments/emergency-management

In addition to the public education focus to individuals, families and businesses, publicly and privately-owned infrastructure focus on CIKR prevention and safety planning based on vulnerability assessments to reduce risk. Protective Security Advisors are available through the Department of Homeland Security, National Protection and Programs Directorate, Office of Infrastructure Protection, to facilitate local site visits to assess infrastructure assets and help develop plans identify vulnerabilities and reduce risks.

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for CIKR Infrastructure events, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in Section 3.0).

Table B-3.1-1: Summary of Risk/Vulnerability Scores for CIKR Lifeline Sectors Failure

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
CIKR Lifeline Sectors Failure	4	3	4	4	3.8

Table B-3.1-2: Summary of Consequence Scores for CIKR Lifeline Sectors Failure

Hazard	Consequence– Public	Consequence–	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, Facilities and	Consequence–	Consequence– Economy	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements)*
CIKR Lifeline Sectors Failure	4	4	4	3	4	4	4	3.9

Table B-3.1-3: Summary of Overall Risk for CIKR Lifeline Sectors Failure

Hazard	Impact Score	Consequence Score	Overall Vulnerability Score (I+C+V)	Frequency/Probability	RISK SCORE (V+F)	Impact on Lifeline Sectors
CIKR Lifeline Sectors Failure	3.8	3.9	7.6	2	9.6	5

Potential Impacts of Climate Change

Information related to the potential impacts of climate change for this hazard are addressed in **Sections 3.0.**

Future Population and Development Trends

As CIKR lifeline sector failure is typically limited to identified systems or facilities, it is possible to identify development and population trends that may impact this hazard. Current land use and building codes incorporate standards that address and mitigate some prevention methods, systems and materials.

The potential for impacts of future growth and development on CIKR lifeline sector issues will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to CIKR lifeline sector failure as well as other information from the Minnesota SHMP updates:

- Have any CIKR lifeline sector failure occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict CIKR lifeline sector failure or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to CIKR lifeline sector failure?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to CIKR lifeline sector failure?

B-3.2: Civil Disorder

2019 Updates
• Expanded "Major Community Event" from the 2012 Plan as "Civil Disorder" and incorporated Demonstration and Riot and Labor Strike in a combined hazard profile and risk assessment.

The City of Saint Paul, as State Capitol and the site of major companies, and many large public and private events every year, has the potential for events causing civil disorder.

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 available services or goods (such as extreme water, gasoline, or food rationing), or unpopular political actions.

For the purpose of the 2019 Plan, the City of Saint Paul has identified the following specific hazards and threats incorporated in the Civil Disorder category:

Civil Disorder

- Major Community Event
- Demonstration and Riot
- Labor Strike

B-3.2.1 Hazard Profile

Civil disorder is defined as any incident intended to disrupt community affairs, and threaten the public safety. Civil disorders can include riots, mobs, large acts of violence or any demonstration resulting in police intervention and arrests.

Types

Major Community Event

The City of Saint Paul is host to many large public and private 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. Major sporting events include professional hockey and soccer, amateur baseball, music concerts and Super Bowl LXII events. Each major event brings tens of thousands of people into the City at one time. Events such as the annual Saint Paul Winter Carnival, Saint Patrick's Day Parade, Festival of Nations, Cinco de Mayor Festival, Hmong Soccer Tournament, Rondo Days, Twin City Marathon and Irish Fair take place throughout the year. Numerous smaller events occur on a regular basis

throughout the City. Each event has the potential to grow and become larger than anticipated, causing problems related to crowd and traffic control; food, water and sanitary services; housing; and communications.

MAJOR COMMUNITY EVENT Assessment: Moderate Risk Hazard	**Location** – Citywide and variable **Extent** – Loss of services, reduced response time **Probability** – High frequency **Duration** – Varies **Seasonal Pattern** – All seasons, but more frequently in warmer months **Speed of Onset** – Rapid **Warning Time** – Days to weeks, or possibly minimal **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Major redirect of City resources (personnel, equipment) • Reduction of deliverable services • Traffic/roadway redirect/closures • Increased need for security • Increased threat of violence • Increased use of public safety communication systems • Increased need for public information and media support

Demonstration and Riot

A demonstration provides the lawful opportunity for people to gather in order to show support or opposition to something or someone. Demonstrations frequently target to government facilities, major employers, or religious sites. Although riots are typically unplanned and unintended, demonstrations may evolve into riots when opposing groups clash. Other aspects of large-scale violence or threats of violence related to riots are addressed under Criminal Acts.

DEMONSTRATION AND RIOT Assessment: Moderate Risk Hazard	**Location** – Citywide and variable **Extent** – Loss of services, reduced response time **Probability** – Low **Duration** – Unknown **Seasonal Pattern** – None **Speed of Onset** – Slow to rapid **Warning Time** – Days to weeks, or minimal **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Increased need for public safety resources (law enforcement, fire and EMS) • Increased need for public information and media support • Loss of revenue • Fear/paranoia of public and staff

Labor Strike

Labor strikes are planned work stoppages caused by the mass refusal of employees to work. They are generally planned to be non-violent events intended to call out demands for change in labor practices such as wages, benefits, work conditions, or other employee grievances.

LABOR STRIKE Assessment: Moderate Risk Hazard	**Location** – Citywide **Extent** – Loss of services, reduced response time, redirect of staff/equipment **Probability** – Low to moderate **Duration** – Unknown **Seasonal Pattern** – None **Speed of Onset** – Slow **Warning Time** – Weeks **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Loss of deliverable services • Increased need for public safety resources (law enforcement, fire and EMS) • Increased need for public information and media support • Facility/computer protection • Loss of revenue • Closure of facilities • Media attention

Location

Civil disorder, while possible in any area where people live, typically occurs today in areas of dense population such as Downtown Saint Paul. Major events and demonstrations may occur in any part of Saint Paul, but are most likely to take place in the downtown area at venue sites, major companies, government facilities, or religious sites. Demonstrations conducted at specific sites may escalate into a riot at any site.

Extent

Civil disorder can, in extreme cases, cause extensive public safety and social disruption, loss of jobs, fatalities and injuries, 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. Major community events and demonstrations are typically well-planned and controlled events that require public safety, public health, transportation and communication support. When a riot occurs, 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.

The ability to manage large-scale events in Saint Paul is always a concern, but the City has significant plans and procedures in place, and extensive experience to deal with potential problems.

Occurrences

There are over one hundred permitted events in the City of Saint Paul each year. The probability of a small event getting out of control is minimal. There is very little history of events becoming dangerous and unmanageable beyond the scope of normal operations. Although major community events are frequent in the City of Saint Paul, riots and labor strike occur infrequently. A comprehensive database of previous civil disorder incidents occurring in the jurisdiction has not been developed. Consideration will be given in the next planning cycle as to how these events may be documented.

Probability of Future Occurrences

Because no quantitative data related to previous incidents of civil disorder is currently available, a return interval cannot be calculated. There is a high probability that major community events will continue to occur. Demonstrations are less common, but may develop at any time in response to national or local issues and causes. The probability for future occurrences of labor strikes and riots is low.

B-3.2.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Vulnerabilities in the City of Saint Paul due to civil disorder are vast and could be significant due to large gatherings of people at notable locations and the increased need for support from the jurisdiction's resources. As the State Capitol, the City of Saint Paul has a higher level of vulnerabilities due to the governmental operations housed within the jurisdiction. This vulnerability is taken into consideration during planning and approval for major events and demonstrations.

Life Safety (Public and Responders)

There can be health risks, public safety and responder safety concerns associated with civil disorder, due to the close proximity of large crowds to roads and densely developed areas. The public safety response to an incident area could be delayed due to roadway constriction and crowds.

Property (Facilities and Infrastructure)

Civil disorder poses vulnerabilities to property such as critical facilities and infrastructure in the manner of damage or disruption if the event gets out of control. Transportation routes can become blocked making it difficult for attendees to leave the area and difficult for the emergency response personnel to arrive. This is not common in the City of Saint Paul, in fact most events take place without loss of life or damage to property.

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 a Continuity of Operations Plan (COOP) that addresses alternate locations for program operations in the event of civil disorder. Each City department is also required to draft and maintain a COOP.

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 civil disorder is low.

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 is loss of life, this could impact the economic situation of the City and its businesses.

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[3] as well as mitigation.

A civil disorder incident has the potential to test the public's confidence in its elected leadership if the public perception is that the event occurred due to a failure of government officials, and critical preparedness and response information is not timely, consistent, coordinated, and accurate.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to civil disorder.

Capabilities

[3] "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 all State and local authorities, policies, programs, and resources and the capabilities, documented in **Section 4**.

Multiple agency capabilities support the jurisdiction ability to address civil disorder capabilities and aid in reducing risk:

- Law Enforcement policies, plans and procedures
- Fire and Emergency Medical Services policies, plans and procedures
- Emergency Management policies, plans and procedures
- Mutual Aid Agreements
- Responder training and exercises
- Public Information services and media relations

The focus for risk reduction in relation to civil disorder is generally on prevention and response measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, such as evacuation routes, and safe driving in potential civil disorder situations
- Issuing timely warnings
- Ensuring that event organizers coordinate public safety resources and needs with City agencies
- Conducting multi-agency training and exercises related to appropriate prevention and response measures

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for civil disorder, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0**.)

Table B-3.2-1: Summary of Risk/Vulnerability Scores for Civil Disorder Failure

Hazard	Risks & Vulnerability – People	Risks & Vulnerability – Property	Risks & Vulnerability – Environment	Risks & Vulnerability – Program Operations	Risk/ Vulnerability Score *(Average of all R/V elements)*
Civil Disorder	3	3	2	3	2.8

Table B-3.2-2: Summary of Consequence Scores for Civil Disorder Failure

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction governance	Consequence Score (*Average of all consequence elements)*
Civil Disorder	3	4	3	2	2	4	4	3.1

Table B-3.2-3: Summary of Overall Risk for Civil Disorder Failure

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Civil Disorder	2.8	3.1	5.9	3	8.9	2

Potential Impacts of Climate Change

Information related to the potential impacts of climate change for this hazard are addressed in **Sections 3.0.**

Future Population and Development Trends

The potential for impacts of future growth and development on civil disorder will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to civil disorder as well as other information from the Minnesota SHMP updates:

- Have any civil disorder events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict civil disorder events or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to civil disorder?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to civil disorder?

B-3.3 CRIMINAL ACTS

2019 Updates
• Expanded "Large Scale Threats of Violence, Criminal Acts" from the 2012 Plan as "Criminal Acts" and incorporated Active Shooter and Arson/Incendiary Attack in a combined hazard profile and risk assessment.

A criminal act is an act committee by a person or persons that violates a law and which is punishable by the government. These acts are offenses against the public which are punishable and can be an act of omission or possession which poses a threat to the public. For the purpose of this plan, the types of criminal acts that will be considered are those that exceed the City's day-to-day capabilities and capacities and would require resources beyond normal response requirements.

The City of Saint Paul has significant capabilities and resources directed to criminal acts. Plans and procedures are in place to prepare for and respond to incidents, and extensive training is provided to responders. There are several types of gangs located in Minnesota that could potentially turn into large scale acts of violence of a criminal nature. The main enterprise for gangs is drug trafficking which can lead to situations that escalate quickly. Mitigation planning related to this hazard focuses on facility security measures that protect lives and property. Procedural, programmatic and physical security actions should be considered.

For the purpose of the 2019 Plan, the City of Saint Paul has identified the following specific hazards and threats incorporated in the Criminal Acts category:

Criminal Acts

- Active Shooter/Hostile Incident
- Arson/Incendiary Attack

B-3.3.1 Hazard Profile

Types

Active Shooter

At the forefront of human-caused hazards related to criminal acts is the potential for active shooter incidents at public venues, religious or educational facilities, or major events. Some incidents in the world have been carried out by individuals from recognized extremist organizations, while others have been implemented by individuals with personal resentments against employers, religious or cultural entities or government. In some cases,

incidents have been carried out on seemingly random targets for no apparent reason. The random and unpredictable nature of these threats present a complex challenge to local and Federal security and law enforcement agencies. Threats related to active shooters are taken extremely seriously by law enforcement officials, resulting in a high level of preparedness for all responders.

ACTIVE SHOOTER INCIDENT Assessment: Moderately High Risk Hazard	**Location** – Government, educational or religious facilities; targeted locations **Extent** – Potential Mass Casualty event **Probability** – Low frequency **Duration** – Varies **Seasonal Pattern** – None **Speed of Onset** – Rapid **Warning Time** –Minimal **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Mass casualties • Major redirect of City resources (personnel, equipment) • Traffic/roadway redirect/closures • Increased need for security • Increased threat of violence • Increased use of public safety communication systems • Increased need for public information and media support

Arson/Incendiary Attack

Arson is defined as the willful and malicious burning or charring of property. There are many types of arson crimes, including setting fire to one's own property with fraudulent intent. Typically, arson is due to vandalism, crime concealment, extremism, profit, revenge or excitement (nuisance type fires that may be escalated from a smaller act by an individual).

An incendiary attack uses weapons, devices, munitions or bombs as weapons designed to start fires or destroy sensitive equipment using fire. Materials such as napalm, thermite, magnesium powder, chlorine trifluoride or white phosphorus are used to create the fire.

The level of risk for arson and incendiary attacks may be minimized by identifying and addressing personnel and facility security issues that can be addressed through protective measures such as restricted access, physical barriers, and facility evacuation plans.

ARSON/INCENDIARY ATTACK Assessment: Moderately Low Risk Hazard	**Location** – Government, educational or religious facilities; targeted locations **Extent** – Potential Mass Casualty event **Probability** – Low frequency **Duration** – Varies **Seasonal Pattern** – None	***Potential Cascading Effects*** • Mass casualties • Major redirect of City resources (personnel, equipment) • Traffic/roadway redirect/closures

	Speed of Onset – Rapid **Warning Time** –Minimal **Repetitive Loss** – N/A	• Increased need for security • Increased threat of violence • Increased use of public safety communication systems • Increased need for public information and media support

Location

Criminal acts may occur in any part of Saint Paul, most likely where people gather or attend events, or at targeted government, educational or religious facilities, or major employers. Government facilities are especially vulnerable to potential threats of violence.

Extent

The extent of an active shooter or arson/incendiary attack could cause many cascading effects throughout the City's services. If an event is prolonged or covers a broad geographical area, it would increase issues associated with public and responder safety, property protection and fear within the population.

Occurrences

The City of Saint Paul has not had any major issues related to large-scale criminal acts related to active shooters, or arson/incendiary attacks in recent years.

Probability of Future Occurrences

The frequency of active shooter incidents has increased in recent years, and unfortunately, these events will undoubtedly continue if not increase in coming years as a reflection of societal disruption and the challenge of preventing these types of incidents.

Arson/incendiary attacks occur less frequently and typically, local incidents of arson are small in scale. There is no indication that this trend will change in the next few years.

B-3.3.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Vulnerabilities in the City of Saint Paul due to criminal acts are generally limited in scale, but could become significant due to large gatherings of people at notable locations and the increased need for support from the jurisdiction's resources. As the State Capitol, the City of Saint Paul has a higher level of vulnerabilities due to the governmental operations housed within the jurisdiction. This vulnerability is taken into consideration during facility security planning.

Life Safety (Public and Responders)

There can be health risks, public safety and responder safety concerns associated with criminal acts, due to the unpredictable and random nature of these incidents. The public safety response to an incident could require numerous external resources to address injuries and medical care.

Property (Facilities and Infrastructure)

Large-scale criminal acts pose vulnerabilities to property such as critical facilities and infrastructure in the manner of damage or disruption if the event gets out of control. Transportation routes can become blocked making it difficult for emergency response units to access and depart from the area. This is not common in the City of Saint Paul, in fact most events take place without loss of life or damage to property.

Continuity of Operations and Continued Delivery of Services

It is unlikely that the continuity of operations and continued delivery of services would be impacted by a large-scale criminal act, unless a government facility is the direct target. The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operations in the event of criminal acts. Each City department is also required to draft and maintain a COOP.

Environment

The vulnerabilities to the environment due to the results of a criminal act are minimal and have never been documented. The level of risk for long-term environmental impacts from criminal acts is low.

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 criminal act in a short period of time or there is loss of life, this could impact the economic situation of the City and its businesses.

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[4] as well as mitigation.

A criminal act has the potential to test the public's confidence in its elected leadership if the public perception is that the event occurred due to a failure of government officials, and critical preparedness and response information is not timely, consistent, coordinated, and accurate.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to criminal acts.

Capabilities

The City has assessed all State and local authorities, policies, programs, and resources and the capabilities, documented in **Section 4**.

Multiple agency capabilities support the jurisdiction ability to address capabilities in relation to criminal acts and aid in reducing risk:

- Law Enforcement policies, plans and procedures
- Fire and Emergency Medical Services policies, plans and procedures
- Emergency Management policies, plans and procedures
- Mutual Aid Agreements
- Responder training and exercises
- Public Information services and media relations

The focus for risk reduction in relation to criminal acts is generally on prevention and response measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, such as evacuation routes, and safe driving in potential criminal act situations
- Issuing timely warnings

[44] "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.

- Ensuring that facility plans address physical security and evacuation, coordinating public safety resources and needs with City agencies
- Conducting multi-agency training and exercises related to appropriate prevention and response measures

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for criminal acts, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0**.)

Table B-3.3-1: Summary of Risk/Vulnerability Scores for Criminal Acts

Hazard	Risks & Vulnerability -	Risks & Vulnerability -	Risks & Vulnerability -	Risks & Vulnerability -	Risk/ Vulnerability Score *(Average of all R/V elements)*
Active Shooter	4	3	2	4	3.3
Arson/Incendiary Attack	3	3	2	4	3.0
Combined Average - Criminal Acts					**3.2**

Table B-3.3-2: Summary of Consequence Scores for Criminal Acts

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction	Consequence Score (*Average of all consequence elements)*
Active Shooter	4	4	3	3	2	3	4	3.3
Arson/Incendiary Attack	3	4	2	3	2	2	3	2.7

Combined Average - Criminal Acts		**3.0**

Table B-3.3-3: Summary of Overall Risk for Criminal Acts

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score (I+C=V)	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Active Shooter	3.3	3.3	6.6	3	9.6	3
Arson/Incendiary Attack	2.7	3.0	5.7	2	7.7	3
Combined Average - Criminal Acts					**8.7**	**3**

Potential Impacts of Climate Change

Information related to the potential impacts of climate change for this hazard are addressed in **Sections 3.0.**

Future Population and Development Trends

The potential for impacts of future growth and development on criminal acts will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to criminal acts as well as other information from the Minnesota SHMP updates:

- Have any criminal act events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict criminal act events or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to criminal acts?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to criminal acts?

B-3.4 CRITICAL SUPPLY CHAIN/COMMODITY DISRUPTION

2019 Updates

- Expanded "Large Scale Fuel Shortage" from the 2012 Plan as "Critical Supply Chain/Commodity Disruption" and incorporated Large Scale Fuel Shortage, Food Supply and Health and Medical Supply in a combined hazard profile and risk assessment.

A supply chain disruption can be defined as any occurrence which has negative consequences for regular supply chain operations, leading to some degree of disorder or disruption of the system. A supply chain typically can be described as a series of "nodes" that connect flows of information, products and/or services.

For the purpose of the 2019 Plan, the City of Saint Paul has identified the following specific critical infrastructure hazards and threats incorporated in the CIKR category:

Critical Supply Chain/Commodity Disruption

- Large Scale Fuel Shortage
- Food Supply
- Health and Medical Supply

B-3.4.1 Hazard Profile

The cause of most disruptions can be classified as either *acts of nature* (flooding, earthquakes, hurricanes), or *acts of humans* (e.g., political instability, terrorism, quality issues). Changes in the economy, markets, and management can also bring about substantive negative consequences of supply chain/commodity disruption. The current focus on low-cost business and product supply strategies to control costs creates a fragile system for critical businesses and services that could be quickly disrupted even with relatively small-scale events. In addition, multiple studies document the fact that these disruptions can lead to substantial short- and longer-term effects. Increasing interdependencies on technology that links multiple systems together on organizational and operational levels have brought the issue to the forefront and emphasized the close dependence of community systems and services on private sector assets.

The increased emphasis in recent years, generally in response to real-world natural or human-caused disasters, on managing consequences of the supply chain disruptions through business continuity planning in private sectors provides the opportunity for developing risk-based plans to mitigate some of these potential effects.

Types

Large Scale Fuel Shortage

Minnesota has no indigenous sources of petroleum so it must import both crude oil and refined oil products for use by its residents. The state has two crude oil refineries and an extensive system of pipelines that distribute refined petroleum products throughout the state. Approximately two-thirds of Canadian crude oil imports are shipped through Minnesota, which amounts to 847 million barrels a day (2015 data).[5] Almost 30 percent of all U.S. crude oil imports flow through Minnesota.

A large-scale fuel shortage may occur when the demand for fuel (including gasoline; natural gas; and diesel, aviation and other fuels) exceeds the quantity of supply that is normally available to support the electric and transportation needs of the area. This situation may occur as a result of a natural disaster, such as a hurricane, or human-caused event such as a widespread economic crisis.

On a broader level, fuel shortages will eventually impact other critical infrastructure and services such as power generation and transportation. Access in refineries in hurricane-prone coastal states can create a temporary shortage or lack of access to gasoline to other parts of the country, and increased demand in other states could reduce availability in Minnesota.

		Potential Cascading Effects
LARGE SCALE FUEL SHORTAGE Assessment: Moderate Risk Hazard	**Location** – Citywide **Extent** – Loss of services/facility shutdown **Probability** – Low to moderate **Duration** – Unknown **Seasonal Pattern** – None **Speed of Onset** – Slow **Warning Time** –Days to weeks **Repetitive Loss** – N/A	• Major redirect of services and resources • Facility closures • Increased need for security • Increased threat of violence • Increased use of public safety communication systems • Increased need for public information and media support

[5] *U.S. Energy Information Administration, U.S. Imports by Country of Origin, www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbl_m.htm; Ibid., U.S. Imports from Canada of Crude Oil, www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrimusca1&f=a; Ibid., U.S. Field Production of Crude Oil, www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrfpus1&f=a; Government of Canada, National Energy Board, Canada's Pipeline Transportation System 2016, 2016, p. 34, www.nebone.gc.ca/nrg/ntgrtd/trnsprttn/2016/cnds-ppln-trnsprttn-systm-eng.pdf.*

Food Supply

A disruption of the food supply may be short- or long-term and may result from a number of causes. Natural disasters such as drought are one of the most common causes of food supply disruption in the world. Other contributing factors that lead to disruption of the food supply are transportation strikes and blockages, production shortages/crop failure, import disruptions, supply chain management and economic conditions.

Health and Medical Supply

Health and medical supply disruptions occur when supplies and equipment that are typically in stock or available upon demand are no longer available. These disruptions may be short- or long-term and can occur for a number of reasons including manufacturing and quality problems, transportation delays, supply chain management, rising costs, or production shortages.

Health and medical supply disruptions can impact life and safety if shortages occur in critical medications or drugs, or the delay in acquiring the supply exacerbates the patient environment and level of care. Disruption of supply routes, caused by natural disasters such as floods or hurricanes, can quickly impact the availability of medical supplies. When production is interrupted by natural disasters in other parts of the world, it can impact availability globally.

Location

Critical supply chain/commodity disruption may happen on a small- or large scale, but can regardless cause serious impacts and consequences due to the everyday needs of the community. Each supply chain system may be dependent on another system, which in turn will compound the vulnerability to failure.

Extent

Critical supply chain/commodity failure would lead to many serious effects to the citizens of Saint Paul, as well as create a ripple effect throughout the region. Commodities available day-to-day to the people who live and work in Saint Paul.

Occurrences

The City of Saint Paul has not had any major incidents related to critical supply chain/commodity disruption in recent years.

There have been some small-scale, temporary incidents that resulted in specific supplies and commodities being difficult to acquire or being temporarily unavailable. The 2009

H1N1 influenza pandemic created an increased demand for influenza test and medical treatment supplies and equipment, resulting in delays in diagnosis and care in some communities. The Centers for Disease Control reported more than 27,000 confirmed cases in the U.S., but the actual total was probably over a million, including cases that were unreported or not diagnosed.

Probability of Future Occurrences

Although critical supplies and commodities are generally available day-to-day, there is always a slight risk of critical supply chain/commodity disruption resulting from natural hazards and minimal risk based on technological and human-caused factors. Other conditions, such as severe economic downturns or depression may cause widespread disruptions linked to product availability, transportation resources, and other factors. In addition, the vulnerability of critical supply chain/commodity systems will increase, as they become more and more linked to interdependencies of networks and systems reliant on technology and other infrastructure such as communications and transportation. There is no indication that this trend will change in the next few years.

B-3.4.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Vulnerabilities in the City of Saint Paul due to critical supply chain/commodity disruption are generally limited in scale, but could become significant due to widespread conditions such as drought or economic depression. Any increase in human infectious disease outbreak could also lead to supply shortages. As the State Capitol, the City of Saint Paul has a higher level of vulnerabilities due to the governmental operations housed within the jurisdiction.

Life Safety (Public and Responders)

There can be health risks, public safety and responder safety concerns associated with critical supply chain/commodity disruption, especially if an infectious disease outbreak or drought conditions impact medical and food supplies. The public safety response to an incident could require numerous external resources to support the needs of the public.

Property (Facilities and Infrastructure)

Large-scale critical supply chain/commodity disruptions may pose vulnerabilities to property such as critical facilities and infrastructure if the event involves specific supplies or equipment that are crucial to the continued operation of the facility. Because transportation systems are key to the timely delivery of critical supplies and commodities, any disruption of one of these systems could impact a broad range of vulnerabilities. Difficulty in transporting critical supplies and commodities, especially if supplies such as critical medications that need constant refrigeration are involved.

Continuity of Operations and Continued Delivery of Services

There is a possibility that the continuity of operations and continued delivery of services would be impacted by critical supply chain/commodity disruption, especially if the supplies are vital to continuation of services provided by government entities. The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operations in the event of critical supply chain/commodity disruption. Each City department is also required to draft and maintain a COOP.

Environment

The vulnerabilities to the environment due to the results of critical supply chain/commodity disruption are minimal. The level of risk for long-term environmental impacts from critical supply chain/commodity disruption is low.

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 critical supply chain/commodity disruption within a short period of time or there is loss of life, this could impact the economic situation of the City and its businesses.

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[6] as well as mitigation.

There is a strong potential that Critical supply chain/commodity disruption would test the public's confidence in its elected leadership if the public perception is that the event occurred due to a failure of government officials, and critical preparedness and response information is not timely, consistent, coordinated, and accurate.

[66] "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.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to critical supply chain/commodity disruption.

Capabilities

The City has assessed all State and local authorities, policies, programs, and resources and the capabilities, documented in **Section 4**.

Multiple agency capabilities support the jurisdiction ability to address capabilities in relation to critical supply chain/commodity disruption and aid in reducing risk:

- High-level oversight by elected officials of critical government services and private-sector commerce
- Multi-agency policies, plans and procedures for coordination and response
- Public Health surveillance systems
- Emergency Management policies, plans and procedures
- Mutual Aid Agreements
- Public Information services and media relations

The focus for risk reduction in relation to critical supply chain/commodity disruption is generally on prevention and response measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, such as evacuation routes, and safe driving in potential critical supply chain/commodity disruption situations
- Issuing timely warnings
- Ensuring that facility plans address physical security and evacuation, coordinating public safety resources and needs with City agencies
- Conducting multi-agency training and exercises related to appropriate prevention and response measures

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for critical supply chain/commodity disruption, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0**.)

Table B-3.4-1: Summary of Risk/Vulnerability Scores for Critical Supply Chain/Commodity Disruption

Hazard	Risks & Vulnerability –	Risks & Vulnerability –	Risks & Vulnerability –	Risks & Vulnerability –	Risk/ Vulnerability Score *(Average of all R/V elements)*
Critical Supply Chain/Commodity Disruption	4	2	2	3	**2.8**

Table B-3.4-2: Summary of Consequence Scores for Critical Supply Chain/Commodity Disruption

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction	Consequence Score (*Average of all consequence elements)*
Critical Supply Chain/Commodity Disruption	4	4	3	2	2	4	4	**3.2**

Table B-3.4-3: Summary of Overall Risk for Critical Supply Chain/Commodity Disruption

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Critical Supply Chain/Commodity Disruption	2.8	3.2	6.0	3	**9.0**	**3**

Potential Impacts of Climate Change

Information related to the potential impacts of climate change for this hazard are addressed in **Sections 3.0.**

Future Population and Development Trends

The potential for impacts of future growth and development on critical supply chain/commodity disruption will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to critical supply chain/commodity disruption as well as other information from the Minnesota SHMP updates:

- Have any critical supply chain/commodity disruptions occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict critical supply chain/commodity disruption or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to critical supply chain/commodity disruption?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to critical supply chain/commodity disruption?

B-3.5: HAZARDOUS MATERIALS (HAZMAT)

2019 Updates

- Expanded "Hazardous Material Event" from the 2012 Plan as "Hazardous Materials" and incorporated Chemical Leak/Spill and Natural Gas Leak in a combined hazard profile and risk assessment.

A hazardous material incident occurs when chemicals, radioactive materials or biological materials are spilled or released inside a building or to the environment. Simple spills are typically managed by trained personnel within the City's Hazardous Material team, who are trained and familiar with the jurisdiction's spill protocols. Major spills or emergencies may have wider impacts on the population and environment.

B-3.5.1 Hazard Profile

Hazardous materials are chemical substances that, 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. Most HAZMAT releases are not intentional, but result from transportation or industrial accident or conditions that expand beyond the control of the responsible entity. Explosives, flammable and combustible substances, poisons and radioactive materials can all be classified as hazardous materials.

For the purpose of the 2019 Plan, the City of Saint Paul has identified the following specific hazards and threats are incorporated in the Hazardous Material category:

- Chemical Leak/Spill
- Natural Gas Leak

Types

Chemical Leak/Spill

Federal and state regulations[7] establish hazardous material programs in local jurisdictions, which are overseen by Local Emergency Planning Committees (LEPC). Multiple disciplines participate in the LEPC and assume responsibilities for planning and procedures to protect the public (including evacuation); providing information about hazardous chemicals and accidental releases of chemicals in the community; and assisting in the preparation of

[7] The Federal regulation is under the *Superfund Amendments and Reauthorization Act of 1986* (SARA). The free-standing law, the *Emergency Planning and Community Right to Know Act of 1986* (EPCRA) establishes state and local requirements. The state regulation is Minnesota Emergency Planning and Community Right-to-Know Act (MN Statutes, Chapter 299K), 1989.

public reports on annual release of toxic chemicals into the air, water and soil. LEPC's frequently sponsor or conduct training, exercises and other activities targeted to emergency response personnel.

The Federal Emergency Planning and Community Right to Know Act of 1986 (EPCRA) program encourages and supports emergency planning efforts at the state and local levels and provides the public and local governments with information concerning potential chemical hazards present in the community. EPCRA does not limit which chemicals can be stored, used, released, disposed, or transferred at a facility, but only requires a facility to document, notify and report specific information to LEPC's. The Environmental Protection Agency (EPA) identifies Extremely Hazardous Substances (EHS) by name, and the threshold planning quantity. Facilities with EHS equal to or in excess of the chemical's threshold planning quantity are subject to EPCRA emergency planning requirements and must notify the LEPC and the State. The facility must also appoint an emergency response coordinator who works with the LEPC and local government on developing and implementing the local emergency plan at the facility. There are specific reporting requirements for EHS chemicals.

The danger of chemical spills or releases is dependent on several factors which include, but are not limited to, nature of the spilled substance/chemical, volume, interior (within a structure) or exterior (into the air), location and conditions (pressure and temperature) of the substance.

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

Hazardous Material – Chemical Leak/Spill Assessment: Moderate Risk Hazard	**Location** – Citywide **Extent** – Damage to people, property and buildings **Probability** – Moderate to high **Duration** – Several hours to a few days **Seasonal Pattern** – None **Speed of Onset** – Rapid **Warning Time** – Minimal **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Evacuation/safety of visitors and staff • Medical attention to residents and responders • Containment and clean-up • Increased security • Notification of OSHA/Inspection • Environmental threats • Noxious fumes/gases

Natural Gas

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. Millions of

The greatest threat from a natural 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 ill.

Hazardous Material – Natural Gas Leak Assessment: Moderate Risk Hazard	**Location** – Citywide **Extent** – Damage to people, property and buildings **Probability** – Moderate to high **Duration** – Several hours to a few days **Seasonal Pattern** – None **Speed of Onset** – Rapid **Warning Time** – Minimal **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Evacuation/safety of visitors and staff • Medical attention to residents and responders • Containment and clean-up • Increased security • Notification of OSHA/Inspection • Environmental threats • Noxious fumes/gases

Location

Hazardous materials are mostly found in industrial and commercial complexes and medical facilities. Roadway, rail and marine transportation nodes are also locations where large quantities of hazard materials are present.

Extent

The severity and magnitude of hazardous material incidents is dependent on the type, quantity and conditions of the substance. Any spill, release or explosion has the potential for serious impacts and consequences to people, property and the environment. In addition, a large-scale incident could have cascading consequences that impact critical infrastructure and vital services.

Occurrences

Although hazardous material incidents occur periodically, most are small-scale and sufficiently handled by on-duty response agencies without external resources.

Probability of Future Occurrences

Large-scale hazardous material release is a rare occurrence; however, there are many safeguards in place to ensure that incidents are minimized. In the event of a natural disaster such as flood or tornado, the risk of an incident increases.

B-3.5.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Vulnerabilities in the City of Saint Paul due to hazardous material incidents are generally limited in scale, but could become significant due to factors such as population density or weather. As the State Capitol, the City of Saint Paul has a higher level of vulnerabilities due to the governmental operations housed within the jurisdiction.

Life Safety (Public and Responders)

There can be health risks, public safety and responder safety concerns associated with hazardous material incidents. Depending on the scale of the event, the public safety response to an incident could require numerous external resources to support the needs of the incident and the public.

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 chemicals and where they are stored, used and transported in order to protect the population. Everyday substances that can be found in the workplace and public areas can potentially cause a devastating release or explosion.

People who are walking, standing, or working near the site of a release or 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.

Property (Facilities and Infrastructure)

Large-scale hazardous material incident may pose vulnerabilities to property such as critical facilities and infrastructure if the event involves specific resources that are crucial to the continued operation of the facility. Because transportation systems are key to the timely delivery of critical supplies and commodities, any disruption of one of these systems due to a hazardous materials incident could impact a broad range of vulnerabilities. The challenges related to transporting hazardous materials bring a higher level of vulnerability to certain substances.

Continuity of Operations and Continued Delivery of Services

There is a possibility that the continuity of operations and continued delivery of services could be impacted by a hazardous materials incident, especially if the area of impact interferes with the continuation of services provided by government entities. The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that

addresses alternate locations for program operations in the event of a hazardous material incident. Each City department is also required to draft and maintain a COOP.

Environment

The potential for impacts to the environment due to a hazardous material incident could be catastrophic, especially if a radioactive substance is involved. The level of risk for long-term environmental impacts from hazardous material incidents is moderately high.

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 hazardous material incident within a short period of time, or there is loss of life or disruption of critical systems, this could impact the economic situation of the City and its businesses and industries.

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[8] as well as mitigation.

There is a strong potential that a large-scale hazardous material incident would test the public's confidence in its elected leadership if the public perception is that the event occurred due to a failure of government officials, and critical preparedness and response information is not timely, consistent, coordinated, and accurate.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to hazardous material incidents.

Capabilities

[8] "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 all State and local authorities, policies, programs, and resources and the capabilities, documented in **Section 4**.

Multiple agency capabilities support the jurisdiction ability to address capabilities in relation to hazardous material incidents and aid in reducing risk:

- High-level oversight by elected officials of critical government services and private-sector commerce
- Multi-agency policies, plans and procedures for coordination and response
- Fire and Hazardous Materials response plans and protocols
- Emergency Management policies, plans and procedures
- LEPC oversight of facilities storing, using, or transporting Extremely Hazardous Substances
- Mutual Aid Agreements
- Public Information services and media relations

The focus for risk reduction in relation to hazardous materials incidents is generally on prevention and response measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, such as evacuation routes, and safe driving in potential hazardous materials situations
- Issuing timely warnings
- Ensuring that facility plans address physical security and evacuation, coordinating public safety resources and needs with City agencies
- Conducting multi-agency training and exercises related to appropriate prevention and response measures

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for hazardous materials incidents, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0**.)

Table B-3.5-1: Summary of Risk/Vulnerability Scores for Hazardous Materials Incidents

Hazard	Risks & Vulnerability –	Risks & Vulnerability –	Risks & Vulnerability –	Risks & Vulnerability –	Risk/ Vulnerability Score *(Average of all R/V elements)*
Hazardous Materials Incidents	3	2	2	3	**2.5**

Table B-3.5-2: Summary of Consequence Scores for Hazardous Materials Incidents

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction	Consequence Score (*Average of all consequence elements)*
Hazardous Materials Incidents	3	4	3	2	2	3	4	**3.0**

Table B-3.5-3: Summary of Overall Risk for Hazardous Materials Incidents

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Hazardous Materials Incidents	2.5	3.0	5.5	4	**9.5**	**1**

Potential Impacts of Climate Change

Information related to the potential impacts of climate change for this hazard are addressed in **Sections 3.0.**

Future Population and Development Trends

The potential for impacts of future growth and development on hazardous material incidents will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to hazardous material incidents as well as other information from the Minnesota SHMP updates:

- Have any hazardous material incidents occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict hazardous material incidents or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to hazardous material incidents?

Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to hazardous material incidents?

B-3.6: TERRORISM (INTENTIONAL THREAT OR ATTACK)

The U.S. Code of Federal Regulations (CFR) defines terrorism as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives." (28 CFR) For the purpose of this Plan, the Federal Bureau of Investigation (FBI) classifies terrorism in one of the following categories, depending on the origin, base, and objectives of the terrorist organization:

- Domestic terrorism: Perpetrated by individuals and/or groups inspired by or associated with primarily U.S.-based movements that espouse extremist ideologies of a political, religious, social, racial, or environmental nature. *Example: June 2014 Law Vegas shooting, during which two police officers inside a restaurant were killed in an ambush-style attack, which was committed by two individuals who held anti-government views and who intended to use the shooting to start a revolution.*

- International terrorism: Perpetrated by individuals and/or groups inspired by or associated with designated foreign terrorist organizations or nations (state-sponsored*). Example: December 2015 shooting in San Bernardina, CA, that killed 14 people and wounded 22, which involved a married couple who radicalized for some time prior to the attack and were inspired by multiple extremist ideologies and foreign terrorist organizations.*

This Plan addresses the following methods of carrying out terrorist attacks:

- Chemical, Biological, Radiological, Nuclear or Explosives (CBRNE)
- Aircraft as a Weapon

B-3.6.1 Hazard Profile

Types

This section of the Plan includes information pertinent to CBRNE, regardless of whether the event was triggered for domestic or intentional purposes. CBRNE events that may be the result of natural or accidental causes are addressed in **Appendix B-3.5: Hazardous Materials**, above.

CBRNE

CRBNE materials are extremely dangerous, and can hurt many people. When used intentionally, CBRNE materials are weapons of mass destruction (WMD). The use of these materials is highly likely to result in mass casualty incidents.

Chemical agents can include: nerve agents, blister agents, blood agents, choking agents and incapacitating agents. Sarin gas was used during the 2013 Syrian Civil War.

Types of biological weapons include: bacteria (e.g., anthrax, plague), viruses (smallpox, Ebola), and toxins (e.g., ricin, botulism).

Radiological weapons spread radiation through methods such as dirty bombs, and poisoning food or water supplies.

Nuclear weapons have only been used as weapons of mass destruction twice – during World War II, when the United Stated dropped two nuclear bombs on the Japanese cities of Hiroshima and Nagasaki. Although thousands of people were killed immediately, more people later died from radiation sickness and cancer caused by the radiation.

Explosives can include regular bombs and improvised explosive devices (IEDs). Explosives were used in the 2013 Boston Marathon and the November 2015 Parris attacks

TERRORISM - CBRNE Assessment: Medium Risk Hazard	**Location** – Citywide **Extent** – Damage to people, property, and the environment **Probability** – Moderate to high **Duration** – Extended periods **Seasonal Pattern** – None **Speed of Onset** – Slow to rapid **Warning Time** – Days to weeks **Repetitive Loss** – N/A	***Potential Cascading Effects*** • Closure of facilities • Evacuation/safety of residents and visitors • Medical attention to residents and responders • Containment and clean-up • Increased security • Loss of revenue • Short- or long-term environmental impacts

Location

Although the potential for terrorist attack is higher in the heavily populated areas, such as downtown, or where large crowds gather, the man governmental and educational facilities are also high-risk targets.

Extent

A major terrorist attack in the City of Saint Paul would be devastating. The density of the population in specific areas and the large number of government agencies and global businesses located in the City increases the level of vulnerability.

Occurrences

There have been incidents of domestic threats and attacks in the Twin Cities areas documented in the 2012 Plan, and more frequent incidents that indicate the threat has increased in recent years.

One of the incidents that occurred most recently was the arrest of a young woman, Tnuza Jamal Hassan, in Saint Paul. She was initially stopped from flying to Afghanistan in September 2017 and allegedly told the FBI that she wanted to joint the jihad in fighting, but had no intention of carrying out an attack on U.S. soil. Despite this claim, she was arrested in February 2018 for allegedly setting small fires on her former college campus, St. Catherine University, Saint Paul, in January 2018. This individual case illustrates the challenge in monitoring potential threats related to terrorism and carrying out intervention to prevent an act of terrorism.

Probability of Future Occurrences

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 capability to strike anywhere in the world. When properly motivated, they may achieve their goals by any means necessary.

B-3.6.2 Risk and Vulnerability Analysis

[EMAP 4.1.1, 4.1.2, 4.2.1] Vulnerabilities in the City of Saint Paul due to terrorism incidents are generally limited in scale, but could become significant due to factors such as population density or specific targets. As the State Capitol, the City of Saint Paul has a higher level of vulnerabilities due to the governmental operations housed within the jurisdiction.

Life Safety (Public and Responders)

There can be significant health risks, public safety and responder safety concerns associated with terrorism incidents. Depending on the scale of the event, the public safety response to an incident could require numerous external resources to support the needs of the incident and the public. In addition, secondary devices and agents should be considered by all responders.

If an explosive incident occurs with large number of people, the blast may cause serious injuries or even death. It is important to understand the different types of chemical and biological agents that may be used, in addition to potential radiological materials that may be present in a “dirty bomb” in order to protect the population.

Large gatherings of people at major community events present a high target risk to terrorists, and may suffer injuries resulting from flying debris, impact injuries, burns, heat/smoke/chemical inhalation, and other trauma.

Property (Facilities and Infrastructure)

Large-scale terrorist incidents may pose vulnerabilities to property such as critical facilities and infrastructure if the facility provides crucial services or functions to the population. Because transportation systems are widely used, and any disruption to the system will cause a severe impact to the city in relation to the those who depend on mass transit, or the timely delivery of critical supplies and commodities, any disruption of one of these systems due to a terrorist incident could impact a broad range of community assets. The challenge related to ensuring that public transportation systems are physically secure brings a higher level of vulnerability to the jurisdiction.

Continuity of Operations and Continued Delivery of Services

There is a possibility that the continuity of operations and continued delivery of services could be impacted by a terrorist incident, especially if the target area interferes with the continuation of vital services provided by government entities. The City of Saint Paul Emergency Management has a Continuity of Operations Plan (COOP) that addresses alternate locations for program operations in the event of a terrorist incident. Each City department is also required to draft and maintain a COOP.

Environment

The potential for impacts to the environment due to a terrorist incident could be catastrophic, especially if a radioactive substance is involved. The level of risk for long-term environmental impacts from terrorist incidents is moderately high.

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 terrorist incident within a short period of time, or there is significant loss of life or disruption of critical systems, this could impact the economic situation of the City and its businesses and industries.

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[9] as well as mitigation.

Due to the objective of terrorism to cause public fear or panic, it is highly likely that a large-scale terrorism incident would test the public's confidence in its elected leadership if the public perception is that the event occurred due to a failure of government officials, and critical preparedness and response information is not timely, consistent, coordinated, and accurate.

Repetitive Losses

[EMAP 4.2.4(2)] Repetitive loss information has not been collected or maintained in relation to terrorism incidents.

Capabilities

The City has assessed all State and local authorities, policies, programs, and resources and the capabilities, documented in **Section 4**.

Multiple agency capabilities support the jurisdiction ability to address capabilities in relation to terrorism incidents and aid in reducing risk:

- High-level oversight by the Joint Terrorism Task Force, coordinating Federal, State and Local law enforcement
- Multi-jurisdiction and multi-agency coordination and information sharing
- Multi-agency response policies, plans and procedures
- Fire and Hazardous Materials response plans and protocols
- Emergency Management policies, plans and procedures
- Multi-jurisdictional and multi-agency training and exercises
- Mutual Aid Agreements
- Public Information services and media relations

The focus for risk reduction in relation to terrorism incidents is generally on prevention and response measures, which include the following:

- Public information and education relating to protective measures for individuals, families and businesses, such as shelter-in-place or evacuation routes, and safe driving routes in potential terrorism situations
- Issuing timely warnings

[99] "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.

- Ensuring that facility plans address physical security and evacuation, coordinating public safety resources and needs with City agencies
- Conducting multi-agency training and exercises related to appropriate prevention and response measures

Hazard Analysis Summary

The tables in this section summarize the information described above in the narrative for terrorism incidents, and provide numerical risk/vulnerability (impact), and consequence scores in addition to an overall risk rating. (The HIRA methodology is described in **Section 3.0**.)

Table B-3.6-1: Summary of Risk/Vulnerability Scores for Terrorism Incidents

Hazard	Risks & Vulnerability -	Risks & Vulnerability -	Risks & Vulnerability -	Risks & Vulnerability -	Risk/ Vulnerability Score *(Average of all R/V elements)*
Terrorism Incidents	4	4	3	4	**3.8**

Table B-3.6-2: Summary of Consequence Scores for Terrorism Incidents

Hazard	Consequence– Public	Consequence– Responders	Consequence– Continuity of Operations (including Delivery of Services)	Consequence– Property, facilities and infrastructure	Consequence– Environment	Consequence– Economy	Consequence– Public Confidence in Jurisdiction	Consequence Score (*Average of all consequence elements)*
Terrorism Incidents	4	4	4	2	3	4	5	**4.0**

Table B-3.64-3: Summary of Overall Risk for Terrorism Incidents

Hazard	Impact Score (I)	Consequence Score (C)	Overall Vulnerability Score	Frequency/Probability (F)	RISK SCORE (V+F)	Impact on Lifeline Sectors
Terrorism Incidents	3.8	4.0	7.8	2	**9.8**	**3**

Potential Impacts of Climate Change

Information related to the potential impacts of climate change for this hazard are addressed in **Sections 3.0.**

Future Population and Development Trends

The potential for impacts of future growth and development on terrorism incidents will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation and updating of this plan should consider the following factors related to terrorism incidents as well as other information from the Minnesota SHMP updates:

- Have any terrorism incidents occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict terrorism incidents or assessing risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to terrorism incidents?

Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to hazardous terrorism?

Appendix B-4: Summary - *Climate Action and Resilience Draft Plan: A Framework for Our Community to Address the Impact of Climate Change*

City of Saint Paul, Mayor Melvin Carter, dated April 2019

The following information is included in the Saint Paul All-Hazard Mitigation Plan as a summary to provide guidance for integrating hazard mitigation planning into the City's climate change action and resiliency initiatives.

Purpose

The purpose of this framework is to ensure that climate resilience strategies are ***integrated into emergency management and community planning documents and increase the community's adaptive capacity while promoting a healthy and prosperous community****. The framework identified the acute shocks and chronic stressors that were most likely to have an impact on life in Saint Paul.* (Climate Action Plan, p. 14)

The Climate Action Plan identifies the following "shock" and "stressors" related to climate change that were most likely to have an impact to residents of Saint Paul:

SHOCKS (sudden, sharp events that threaten a sector)
• Flooding (20%) • Severe Thunder Storms (11%) • Infrastructure Failure (10%) • Winter storms (9%)
STRESSORS (impacts or ongoing conditions that weaken the fabric of a city on a day-to-day or cyclical basis)
• **Aging/Overwhelmed Infrastructure (17%)** • **Insufficient Funding (15%)** • **Lack of Trained Professional**

LOCAL IMPACTS OF A CHANGING CLIMATE

The Report of the Interagency Climate Adaptation Team prepared by the Minnesota Pollution Control Agency identifies warmer summers and winters and more frequent and intense weather events as the hallmarks of climate change in Saint Paul, which can result in changes to health, livability, landscape, and the environment. The report points out that the frequency and severity of extreme cold conditions are declining rapidly, adding that the heaviest snow storms have also become larger even as winter has warmed. Heavy

downpours in Minnesota are now twice as frequent as they were a hundred years ago, and scientists expect events like these to become an increasingly common part of our daily lives. Saint Paul will become warmer and wetter as a consequence of climate change. We know that warmer temperatures are often accompanied by increased humidity, increasing the heat index and making the air feel hotter. Extreme heat events are increasing in Minnesota and can cause a variety of heat-related illnesses like heat stress and heat stroke. In April of 2016, Saint Paul Ramsey County Public Health developed a climate change vulnerability assessment, which identified populations and geographic areas that may be particularly vulnerable to climate hazards. The climate hazards included in the assessment and likely to impact Saint Paul are:

- Extreme Heat Events: Heatwaves are expected to become more common by the middle of the 21st century. Extreme heat will be exacerbated in urban areas where impervious pavement and limited vegetation result in the urban heat island effect.
- Poor Air Quality: Air pollutants, such as ozone, particulate matter, and allergens pose acute and chronic respiratory and cardiovascular threats. Rising temperatures and changes in precipitation patterns may lead to increased air pollution. Increased frequency of wildfires in the western United States and Canada have also impacted local air quality.
- Changes in Precipitation: Increased precipitation has already been observed in Minnesota and is likely to increase into the future. This increase occurs in all seasons, but spring and summer are becoming wetter at a faster rate than fall and winter. Changes in precipitation patterns will likely lead to more flash flooding.
- Ecological Changes: Vector-borne disease transmission is expected to increase due to changes in the distributions of ticks, mosquitoes, and other insect vectors as a result of warming temperatures and changing precipitation patterns. Diseases may include West Nile Virus, Lyme disease, and human anaplasmosis. The urban forest may be directly impacted by invasive species like Emerald Ash Borer, that can lead to changes in the canopy and reduce the benefits that a healthy forest provides.
- Psychological Impacts: Climate change can lead to negative mental health outcomes caused by the acute trauma of an extreme weather event or the gradual onset of climate change. Mental health issues may include anxiety, stress, depression, and PTSD. (Climate Action Plan, p. 13)

To improve resilience, the community must know what its vulnerabilities are:

Vulnerable populations, defined by

- Race and language of residents
- Age of residents
- Income and Housing
- Abilities/disabilities

- Respiratory Illness

The following table describes which vulnerable populations may be affected by specific hazard events and highlights potential impacts to those populations.

HAZARD	VULNERABLE POPULATIONS	IMPACTS
Heavy Rain Events	• Older adults, especially those living alone and/or low-income • Residents with limited English proficiency • Residents with mobility limitations (access to transportation, ambulatory difficulties) • Residents who lack property, rental, or homeowner insurance (typically low-income)	• Drowning or injury • Mold or waterborne disease • Economic loss • Property damage • Travel limitations
Extreme Weather Events	• Older • Residents with limited English proficiency • Residents with mobility limitations (access to transportation, ambulatory difficulties) • Residents who lack property, rental, or homeowner insurance (typically low-income) • Homeless and those in unstable housing	• Property damage • Injury or death • Travel limitations
Poor Air Quality Days	• Older adults • Younger children • Residents with respiratory illnesses • Those who work outside • Residents living near high-volume traffic corridors (interstates, arterial roads)	• Asthma attacks • Severe allergies • Cardiovascular health
Extreme Heat	• Older adults, especially those living alone • Younger children • Residents with respiratory illnesses • Those who work outside • Low-income residents with no or limited access to air conditioning • Homeless and those in unstable housing	• Heat stress • Heat stroke • Cardiovascular health • Dehydration

Vulnerability by location (maps included in the Climate Action Plan, pp. 18-23)

The following table describes the vulnerabilities related to geographical locations or areas of the jurisdiction likely to be affected by specific hazard events and highlights additional factors that may affect the location, magnitude and severity of impact.

CLIMATE RISK/ HAZARD	CLIMATE IMPACTS	LOCATION FACTORS
Air Quality	• More days on average with higher concentrations of air pollutants • Asthma attacks and other respiratory illnesses • Elevated risk of heart disease and stroke • Higher risk to children and older residents	• Proximity to highways with high volumes of vehicles (I-94 corridor, I-35E) • Proximity to Industrial areas
Extreme Heat	• Urban heat island effect • Higher overnight temperatures in urban areas • Elevated risk of heat stroke and heat exhaustion	• Urban areas with less dense vegetation and tree canopy cover – downtown Saint Paul, Frogtown, Greater East Side, and Dayton's Bluff, and southern edge of Highland Park neighborhood
Flooding	• Increased frequency and duration of precipitation events	• Low-lying areas with high levels of impervious surfaces, like roads and parking lots • SFHA and riverine areas • Lowertown, Childs Road, Barge Channel Road, and Harriet Island • Local factors, such as stormwater drainage capacity and disruption of runoff flow
Composite Vulnerability *(air quality, extreme heat and flooding)*	Neighborhoods identified as having the **highest combined risk** to negative impacts of climate change are largely concentrated in the northeastern and north central portions of the city: • Thomas-Dale • North End • Northern Payne-Phalen • Greater East Side The western portion of the city is comparatively **low risk**.	

Other Vulnerabilities

SECTOR	VULNERABILITY	CONSEQUENCES
Natural Infrastructure	• Urban forest [2011 canopy cover assessed to be 32.5% of land area] • Water quality and availability	• Soil erosion • Increased carbon • Increased heat island effect • Threat to wildlife habitat • Reduction of stormwater management capacities • Invasive species • Vulnerability to loss from drought and damaging winds • Contamination of drinking water resources
Built Environment	• Roads and bridges • Water distribution, stormwater, and wastewater • Energy distribution infrastructure • Critical infrastructure	• Increased scour, undermining bridge foundations and abutment slopes • Extreme heat causing road buckling and damage to rail lines • Increased repair and maintenance costs • Dangerous driving conditions • Disruption or reduction of water supply • Disruption or reduction of available power • Need to redesign or re-engineer infrastructure systems for resiliency • Increased vulnerability to electric outages and resulting impacts on healthcare system resources and services

RESILIENCE STRATEGIES

The Climate Action Plan identifies the following areas to target resilience strategies that will help residents to prepare for, withstand, and adapt to climate-related impacts.

POPULATION

ECONOMIC AND SOCIAL WELL-BEING

- Strengthen social connectedness through relationship-building among community members across age, ethnicity, income, and other demographic differences
- Build relationships with neighborhood groups and community organizations to strengthen resilience of vulnerable residents

EMERGENCY PREPAREDNESS AND RESPONSE

- Designate appropriate facilities as emergency shelters that are equipped with back-up electric generation Maintain public health and safety during extreme weather events
- Ensure all residents are prepared to respond to emergency situations
- Ensure mobility options and transportation plans are available to those most vulnerable during times of emergency
- Develop and promote educational materials on the health impacts of air pollution, extreme heat, longer allergy seasons, and vector-borne disease
- Communicate which facilities are open to the public during times of extreme weather events
- Ensure emergency communications are available in multiple languages and interpreters are available
- Coordinate with the County to plan for emergency debris management

NATURAL INFRASTRUCTURE

Protect natural infrastructure and enhance it to maximize its ability to mitigate weather and climate impacts

URBAN FOREST & WATER QUALITY

- Update the citywide urban tree canopy assessment every ten years and maintain a current street tree inventory to develop targets and goals for tree canopy cover and identify strategies to achieve them
- Accelerate tree replacement programming in neighborhoods that will be most impacted by urban heat island effect and Emerald Ash Borer
- Build relationships and trust with community members; support early maintenance and care of trees
- Promote the proactive replacement of declining ash trees with a diverse mix of species to build urban forest resiliency and maintain canopy cover
- Use vegetative cover to help stabilize slopes, reduce slope failure, and address waterbody sedimentation
- Expand and connect green spaces so they are welcoming and within walking distance of all residents, especially in underserved communities where there is a high level of impervious surfaces
- Improve the ecological functionality of and resiliency of parks and open space through green infrastructure, best practices for stormwater management, and increased plant diversity and pollinator-friendly habitat
- Encourage the use of low-impact landscaping, to reduce consumption of water in yard maintenance and improve permeability and reduce stormwater runoff
- Ensure water treatment and distribution infrastructure is resilient to potential hazards

BUILT INFRASTRUCTURE

Ensure the long-term integrity and reliability of built infrastructure systems by considering future climate impacts in long-term planning

- Include life-cycle costs when preparing asset management plans and selecting construction materials and equipment
- Incorporate resilience into the capital improvement planning process
- Pilot opportunities to test and demonstrate the value of a smart grid or microgrid, including tie-ins with electric vehicles
- Invest in cost-effective materials for road surfaces that are robust enough to withstand extreme weather events, including heavy precipitation and freeze/thaw cycles
- Reduce impervious surfaces where possible, and use lighter colored pavements and building materials to lessen the impact of urban heat island effect

CLIMATE CHANGE MITIGATION (P. 27)

The Climate Action Plan emphasizes the importance of adapting to future climate changes by looking toward alternative forms of emergency and changing human habits related to energy use and conservation. This also includes increasing the use of cleaner modes of transportation and modifying human diets.

Changes must occur at the "system" level as well as the individual level. Large producers of energy must commit to continuing to reduce carbon intensity of their generation mix with the intent of being entirely carbon-free by the year 2050. With this shift in generation, the city may have more flexibility "to focus on other areas of carbon reduction, particularly transportation, heating, and efficiency."

Several individual actions that will help to reduce the impacts of climate change are presented in the Climate Action Plan, including:

- Living car-free
- Avoiding one flight per year
- Purchasing or installing green energy
- Reducing effects of driving
- Eating a plant-based diet
- Increasing the efficiency of home energy
- Reducing food waste
- Reducing waste
- Eating local and in season

Additional methods of increasing resiliency of the city and its residents are included in the Climate Action Plan, including recommendations for the following sectors:

- Energy sector

- Transportation and Mobility
- Waste Management
- Water Conservation and Water Quality
- Emissions Reduction

The Climate Action Plan presents a number of targets and initiatives related to these sectors for the 2019-2025 timeframe, that may be taken into consideration as potential mitigation actions, as appropriate.

During the next planning cycle, the Department of Emergency Management will monitor the planning process related to the Climate Action Plan, and work with the appropriate departments, agencies and disciplines to integrate the mitigation goals, objectives and actions into the City's climate change initiatives. In addition, risk and vulnerability data presented in the Climate Action Plan will be taken into consideration during the annual hazard risk and vulnerability analysis to determine whether significant changes in hazards, risks or vulnerabilities have occurred that could result in changes in mitigation priorities, goals and actions.

APPENDIX C: MITIGATION ACTIONS AND IMPLEMENTATION

Appendix C-1: Mitigation Action Worksheet
Appendix C-2: 2012 Mitigation Action Status Worksheet [EMAP 4.2.3]
Appendix C-3: 2019 Prioritized Mitigation Actions
Appendix C-4: Mitigation Action Ranking Criteria and Worksheet

Appendix C-1: *Mitigation Action Worksheet*

The worksheet presented below provides a uniform format for development of mitigation actions which is consistent with planning requirements of 44 CFR, Part 201.6. This worksheet will be used for all Mitigation Actions submitted during the ***2019-2024*** mitigation planning cycle.

Action Worksheet			
Project Name:			
Project Number:			
Risk / Vulnerability			
Hazard(s) of Concern:			
Description of the Problem:			
Action or Project Intended for Implementation			
Description of the Solution:	•		
Is this project related to a Critical Facility?	**Yes** ☐	X	No ☐
(If the subject facility is located within the Special Flood Hazard Area (100-year floodplain), this project must intend to protect the Critical Facility to the 500-year flood event or the actual worst damage scenario, whichever is greater.)			
Level of Protection:		**Estimated Benefits (losses avoided):**	
Useful Life:			
Estimated Cost:			
Plan for Implementation			
Prioritization:		**Desired Timeframe for Implementation:**	
Estimated Project Timeline:		**Potential Funding Sources:**	
Responsible Organization:		**Local Planning Mechanisms to be Used in Implementation, if any:**	
Three Alternatives Considered (including No Action)			
Alternatives:	**Action**	**Estimated Cost**	**Evaluation**

	No Action	$0	Failure to plan _____could have a significant impact on the population, property, environment and economy in Saint Paul.
Progress Report (for plan maintenance)			
Date of Status Report:			
Report of Progress:			
Update Evaluation of the Problem and/or Solution:			

Appendix C: Mitigation Actions and Implementation Plan

Appendix C-2: 2012 Mitigation Action Status Worksheet

Color Code:

Completed Action
Removed – Not relevant to mitigation
Removed – Response oriented actions
Retained in 2019 Plan

	Action Step	Responsible Department	Potential Funding Source	Timeline	Completed? (Yes, No, or In Process)	Anticipated Completion Date mo/yr	Hazard	2012 Priority 3=High 2=Medium 1=Low	2019 Update
Natural Hazards: Tornado, Damaging Winds/Thunderstorms, Flood, Blizzard/Ice Storm, Extreme Heat/Cold, Natural or Urban Fire, Drought, Karst, Earthquake, Failure of a Dam/Levee, Infectious Disease, Invasive Species. **Technological or Human-Caused:** Infrastructure Failure, Animal Escape, Major Community Events, Terrorism/CBRNE									
1	NIMS training	Emergency Management, Fire, and Police	Annual Operating Budgets, HSEM training assistance, DHS TA visits and Training Consortium assistance	Continue to implement in 2012 and beyond	In-process	On-going	All	**19**	Removed - response
2	Continue CBRNE training of first responders	Emergency Management, Fire, and Police	Annual Operating Budgets, HSEM training assistance, DHS TA visits and Training Consortiu	Continue to implement	In-process	On-going	CBRNE	**19**	Removed - response

			m assistance						
3	Extreme Temperature supplies in shelters	Emergency Management, VOAD, and Parks and Recreation	Annual Operating Budget, various grant programs, public and private partnerships	Maintain the identification of needs and compile supply lists in 2012; continue to procure and stock supplies.	No	On-going	Extreme Heat	**19**	Retained - 2019 Action #1
4	Urge public to heed winter weather warnings	Emergency Management	Annual Operating Budget	Started in 2012 and continue thereafter	Yes	On-going	Blizzard Ice Storm, Extreme Cold	**18**	Retained - Combined with 5, 12, 13, 29, 39, 41,42, 52, 53, 61
5	Expand Severe Weather Awareness activities	Emergency Management	Annual Operating Budget and EMPG grant funding	Continue action plan in 2012, implement in 2012 and beyond	Yes	On-going	Natural Hazards	**18**	Retained - 2019 Action #2
6	Investigate water supply sharing options	Water Utility	Annual Operating Budget	Begin in 2012, analyze options in 2013, and implement options as resources become available.	No	2015	Drought	**18**	Removed – Completed
7	Ensure grant money is spent to close jurisdictional assessment	Emergency Management, Fire, Police,	Annual Operating Budget & federal	Continue this work in 2012 and beyond, especially at the time of	In-process	On-going	All	**17**	Removed – Upon further review this project is

	gaps & is compliant with UASI and State HS Strategies	DSI, and Public Works	grant funding	grant applications.					not relevant to hazard mitigation.
8	Seek funding for smoke detector education and giveaway program	Fire Department	Annual Operating Budget, various grant programs, public and private partnerships	Continue efforts in 2012 and annually thereafter	Yes	On-going	Urban Fire	**17**	Retained - Action #29
9	Standardize Electrical Connections at substations	Police Department	Annual Operating Budget & Federal Mitigation Grant	Continue as resources allow	In-process	On-going	All	**17**	Removed – The project is being addressed by the current operating budget
10	Examine existing levees and identify areas of additional levee constructions so as to reduce need for repetitive and time-consuming sandbag levee construction	Emergency Management and Public Works	Annual Operating Budget and Federal Mitigation Grants	Continue activities in 2012 and thereafter	Yes	N/A	Flood	**17**	Retained - redefined Actions #26 & 28
11	Enforce building codes for structural snow loads	Department of Safety and Inspection	Annual Operating Budget	Maintain activities and continue thereafter	In-process	On-going	All	**16**	Removed - building inspection authority

12	Promote the use of Family Emergency Plans	Emergency Management	Annual Operating Budget	Continue work in 2012 and continue thereafter.	Yes	On-going	All	**16**	Retained - merged with Action #2
13	Info dissemination on NOAA Weather radios	Emergency Management	Annual Operating Budget and EMPG funding, Private & corporate funding, and private Co-Ops	Continue information gathering and disseminatio n in 2012. Continue annually thereafter during severe weather awareness week.	Yes	On-going	Tornado, Damaging Winds, Thunderstor ms	**16**	Retained - merged with Action #2
14	Alert, Sheltering & Transportation issues for heat emergencies	Emergency Management and Superhot Task Force	Annual Operating Budget, Private & public partnershi ps like Superhot Task Force, and private Co-ops like Energy Co-Op	Continue gathering of info and refine plans in 2012.	In-process	On-going	Extreme Heat	**16**	Retained - redefined as Action #1
15	Continue building CBRNE capabilities and technologies	Emergency Management, Fire, Police, and Public Works	Annual Operating Budgets, various federal grants, HSEM training assistance, DHS TA visits and Training Consortiu	Continue to implement in 2012 and beyond	In-process	On-going	CBRNE	**16**	Removed- Upon further review this project is not relevant to hazard mitigation.

			m assistance						
16	Standardize Electrical Connections at City-owned shelters	Parks and Recreation Department	Annual Operating Budget & Federal Mitigation Grant	As resources allow over next 5 years	No	On-going	All	**16**	Removed – Completed
17	Emergency Alert System capabilities in Dispatch Center	Police Department, Ramsey County Communications Center	Annual Operating Budget	Continue developing capability as technology improves.	In-process	On-going	All	**16**	Removed – The project is being addressed by the current operating budget
18	Identify Points of Dispensing (PODS) facilities, negotiate MOUs, and train POD partners	St. Paul Ramsey Health	Annual Operating Budget	Begin analysis of options in 2012 and continue to implement as resources become available.	NEW	2014	CBRNE	**16**	Removed - completed
19	Develop ability to establish and manage a Community Reception Center (CRC) following the detonation of an RDD. Develop OPLAN for CRC	St. Paul Ramsey Health and Emergency Management	Private and Corporate funding, Annual Operating Budget and Federal Mitigation Grants	Analyze options in 2012 and continue to implement as resources become available.	NEW	2014	CBRNE	**16**	Removed – Response

20	Develop plans for Como Zoo in the event of animal escape	Parks and Recreation Department	Annual Operating Budget	Analyze options in 2012 and continue to implement as resources become available.	New	2014	Animal Escape	**16**	Removed – The project is being addressed by the current operating budget
21	Mass Feeding - immediate need for food/hydration for several thousand	Emergency Management, VOAD, Private Sector	Annual Operating Budget	Identify capacities to serve several thousand, work towards agreements and other private contracts	New	2014	All	**16**	Removed – Response
22	Insert flood recovery and mitigation scenario in disaster exercise schedule	Emergency Management & Public Works	Annual Operating Budgets	Continue to implement in 2012 and beyond	No	On-going	Flood	**15**	Retained - Action #4
23	Standardized WMD Awareness & Incident Response to Terrorism Bombing classes	Emergency Management, Fire and Police	Annual Operating Budgets, HSEM training assistance, DHS TA visits and Training Consortium assistance	Continue to implement in 2012 and beyond	In-process	On-going	CBRNE	**15**	Removed - response
24	Identify shelters co-located with pet shelters	Emergency Management, VOAD, &	Annual Operating Budget, various	Continue to implement in 2012 and beyond	Yes	On-going	All	**15**	Removed - completed

		Parks & Recreation	grant programs, public and private partnerships						
25	Risk Management Plan Compliance Audit at highest risk Hazmat sites	Fire Department	Annual Operating Budget	Begin audit implementation procedures and timeline in 2012 and continue thereafter each year.	No	Implement in 2012	All	**15**	Removed – The project is being addressed by the current operating budge
26	Provide electronic copies of 302 facility plans to first responders	Fire Department	Annual Operating Budget	Continue in 2012 and beyond.	Yes	On-going	All	**15**	Removed – The project is being addressed by the current operating budge
27	Continue West Side cave/tunnel mitigation efforts	Fire Department, Public Works, Parks and Rec, and Police	Annual Operating Budget	Continue work in 2012 and beyond.	No	On-going	Karst	**15**	Removed - maintenance focus
28	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	Fire	Annual Operating Budget	Begin analysis of options in 2012 and continue to implement as resources become available.	NEW	2014	All	**15**	Removed - response

	Structural Collapse								
29	Disseminate info on common sense terrorism & CBRNE awareness	Emergency Management, Fire and Police	Annual Operating Budget	Develop and deliver information beginning in 2012. Continue continually thereafter.	In-process	On-going	CBRNE	**14**	Retained - merged with Action #2
30	Identify residents who are susceptible to heat-related illnesses	Ramsey County Social Services, St. Paul Ramsey Public Health	Annual Operating Budget	Begin analysis of options in 2012 and continue to implement as resources become available.	NEW	2014	Extreme Heat	**14**	Removed - completed
31	Develop Resource Manual	Emergency Management	Annual Operating Budget and Emergency Management Performance Grant (EMPG)	Develop in 2012-2013	No	2014	All	**13**	Removed - completed
32	Trained Fire & Health Department cadre for radiation monitoring	Fire Department & Health Department	Annual Operating Budget, State and federal training assistance, DHS Training Consortiu	Continue in 2012and thereafter	No	Implement in 2012	CBRNE	**13**	Removed - response

			m, and federal grants						
33	Protection and patrol plans for critical infrastructure nodes	Police Department	Annual Operating Budgets and Law Enforcement Training and Terrorism Prevention (LETPP) grants	Develop in 2012-2013 and implement as necessary as each plan becomes available	In-process	On-going	All	**13**	Removed – The project is being addressed by the current operating budgets.
34	Harden infrastructure and build capacity to mitigate, prepare for, respond to, and recover from terrorism at key infrastructure nodes	Police Department	Annual Operating Budgets and Law Enforcement Training and Terrorism Prevention (LETPP) grants	Develop in 2012-2013 and implement as necessary as each plan becomes available	In-process	On-going	Technological or Man-Made	**13**	Retained - Action #3
35	Increase law enforcement patrols of water facilities during Orange or Red alerts	Police Department and County Sheriff	Private funding, Annual Operating Budget, and federal protection grants	Begin in 2012 and continue thereafter during high alerts.	In-process	On-going	Terrorism CBRNE	**13**	Removed - response
36	Develop Electrical Supply Options for critical Public Works, Sewer, and Water facilities	Public Works and Water Utility	Annual Operating Budget & Federal Mitigation Grant	As resources allow over next 5 years	In-process	On-going	Technological or Man-Made	**13**	Retained

37	Physical Safeguards on Water facility sites - 4 separate Action Steps	Water Department and Waste Water Treatment Plan	Annual Operating Budget, public and private funding	Begin in 2012 and complete in 2013 and 2014.	In-process	On-going	Technological or Man-Made	**13**	Completed
38	Building Officials aware of hazardous geology areas	Department of Safety and Inspection	Annual Operating Budget	Begin work in 2012, finalize plans in 2013, and implement thereafter in all plan & permit reviews.	In-process	On-going	Karst	**12**	Removed - site development action
39	Discourage the public from video-taping severe weather	Emergency Management	Annual Operating Budget and EMPG grant funding	Continue action plan in 2012 and implement beyond	No	2014	Natural Hazards	**12**	Retained - merged with Action #2
40	Conduct Isolation & Quarantine Tabletop Exercise	Emergency Management	Annual Operating Budget	Schedule and hold exercise in 2012 and continue thereafter	Yes	On-going	All	**12**	Retained - Action #5
41	Promote use of winter survival kits	Emergency Management	Annual Operating Budget	Start in 2012 and continue thereafter	Yes	On-going	Extreme Cold	**12**	Retained - merged with Action #2
42	Educate Public on disease precautions	Emergency Management and Health Department	Annual Operating Budget	Formulate and deliver message in 2012. Deliver continually thereafter.	In-process	On-going	Infectious Disease	**12**	Retained - merged with Action #2
43	Radiological Emergency Preparedness	Fire and Health Departments	Annual Operating Budget & State and federal	Begin in 2012 and continue annually thereafter.	No	Unknown	CBRNE	**12**	Removed - response

	exercise & training		training and exercise opportunities						
44	Trained cadre for radiation monitoring	Fire and Health Departments	Annual Operating Budget, State and federal training assistance, DHS Training Consortium, and federal grants	Continue in 2012and thereafter	No	On-going	CBRNE	**12**	Removed- Upon further review this project is not relevant to hazard mitigation
45	Radiological protective measure training for first responders	Fire Department	Annual Operating Budget, State and federal training assistance, DHS Training Consortium, and federal grants	Continue in 2012 and thereafter	Yes	On-going	CBRNE	**12**	Removed- Upon further review this project is not relevant to hazard mitigation
46	Develop railroad derailment plans	Emergency Management and Public Works	Annual Operating Budget	Begin analysis of options in 2012 and continue to implement as resources become available.	New	2014	Infrastructure	**12**	Removed – The project is being addressed by the current operating budget

47	Flood fight training to City workers	Emergency Management	Annual Operating Budget and HSEM training assistance	Deliver annually beginning in 2012	Yes	On-going	Flood	**11**	Removed - response
48	Identify Off Site and Mass Clinic Sites and develop logistics support plans for each	Emergency Management and Health Department	Annual Operating Budget	Identify add'l sites in 2012 and develop logistics needs in 2013. Develop support plans in 2013 & 2014	In-process	Dec-13	Infectious Disease	**11**	Removed - completed
49	Complete the Terrorism Annex of the EOP	Emergency Management and Police	Annual Operating Budget	Complete in 2012. Update annually thereafter.	In-process	On-going	Terrorism CBRNE	**11**	Removed - completed
50	Develop Shelter Plans	Parks and Recreation Department	Annual Operating Budget	Begin analysis of options in 2012 and continue to implement as resources become available.	New	2014	All	**11**	Removed - completed
51	Develop Action Plans dealing with Light Rail Issues: Large event plans, pedestrian/traffic hazards, signage/cameras, patrol/dept manning requirements	Emergency Management, Police, MNDOT and Public Works	Annual Operating Budget	Begin analysis of options in 2012 and continue to implement as resources become available.	New	2014	All	**11**	Retained - redefine mitigation action (#6)

52	Community Outreach Education/Planning Discussions on EOP and subsequent ESF's	Emergency Management, VOAD, Private Sector	Annual Operating Budget	Training on current procedures and plans for various hazards and existing contingencies	New	2014	All	**11**	Retained - merged with Action #2
53	Educate citizens on low interest loans for improving structural ability of homes/businesses	~~Emergency Management~~ Planning and Economic Development	Annual Operating Budget	Start in 2012 and continue thereafter	No	2014	All	**10**	Retained - merged with Action #2
54	Gather heat-related information	Emergency Management & Health	Annual Operating Budget, Private & public partnerships like Superhot Task Force, and private Co-ops like Energy Co-Op	Gather info in 2012.	No	On-going	Extreme Heat	**10**	Retained - merged with Action #2
55	Seek funding to improve firefighter staffing and equipment	Fire Department	Annual Operating Budget, various grant programs, public and private partnerships	Continue efforts in 2012 and annually thereafter	Yes	2014 but looking in 2013 budget	All	**10**	Completed

56	Seek funding to improve police staffing and equipment	Police Department	Annual Operating Budget, various grant programs, public and private partnerships	Begin efforts in 2012 and annually thereafter	New	2014 but looking in 2013 budget	New	**10**	Removed- Upon further review this project is not relevant to hazard mitigation
57	Develop Bridge Infrastructure Failure plans	Emergency Management, MNDOT and Public Works	Annual Operating Budget	Begin analysis of options in 2012 and continue to implement as resources become available.	New	2014	Infrastructure	**10**	Redefined as response
58	Gather & Disseminate info on lessons learned from Severe weather	Emergency Management	Annual Operating Budget and EMPG funding	Implement program in 2012 and continue annually thereafter.	Yes	2012-2007	Natural Hazards	**8**	Removed - exercise follow-up
59	Ensure training and TA visits are used to close jurisdictional assessment gaps & is compliant with UASI and State HS Strategies	Emergency Management, Fire, Police, DSI, and Public Works	Annual Operating Budget & federal grant funding	Continue this work in 2012 and beyond, especially at the time of training applications.	In-process	On-going	All	**8**	Removed – Upon further review this project is not relevant to hazard mitigation.
60	Train and exercise with Hazmat facility personnel & hazmat vendors	Fire Department	Private & Corporate funding, Annual Operating Budget & Hazmat	Develop training and exercise plans in 2012, hold training in 2013, and	No	Implement in 2013	Technological or Man-Made	**7**	Removed- Upon further review this project is not relevant

			Emergency Preparedness Grant	exercise in 2014. Continue 3 year cycle after that.					to hazard mitigation
61	Coordinate the gathering and dissemination of commonsense directions for terrorism prevention, preparation, response, recovery actions.	Emergency Management	Annual Operating Budget	Continue work in 2012 and continue thereafter.	Yes	On-going	All	**7**	Retained - merged with Action #2
62	Comprehensive NIMS integration	All Departments	Annual Operating Budgets, HSEM training assistance, DHS TA visits and Training Consortium assistance	Continue to implement in 2012 and beyond	Yes	On-going	All	**6**	Removed - response
63	Fan and A/C resources into Resource Manual	Emergency Management	Annual Operating Budget	Incorporate into Resource Plan Development in 2012 & 2007	Yes	On-going	Extreme Heat	**5**	Removed – Upon further review this project is not relevant to hazard mitigation.

64	Create partnership to disseminate info on use of emergency generators	Emergency Management and electrical utilities	Annual Operating Budget, Private & Corporate Funding, Co-Op resources	Develop plan in 2012 and deliver continually thereafter	No	2014	All	**3**	Retained - merged with Action #2

Table C-3: 2019 Prioritized Mitigation Actions – Comprehensive List

2019 Action #	2012 Action #	Action Step	Responsible Department/ Staff Member	Potential Funding Source	Timeline	2019 Goal & Obj.	2012 Status - Completed? (Yes, No, or In Process)	Anticipated Completion	Continue in 2019 Plan? (Yes or No)	Hazard	Priority High Medium Low
Natural Hazards: Dam/Levee Failure, Damaging Winds/Thunderstorms, Drought, Extreme Heat/Cold, Flood, Human Infectious Disease, Landslide/Slope Failure, Severe Winter Storm, Tornado, Urban/Wildland Fire; Technological or Man-Made: CIKR Lifeline Failure, Critical Supply Chain Disruption, Terrorism/CBRNE, HazMat, Criminal Acts, Civil Disorder											
1	3	**Preparedness/Response** Extreme Temperature Shelters - Coordinate with the Department of Parks & Recreation (P & R) to identify, procure, supplies and plans for implementation.	Emergency Management, VOAD and Parks & Recreation	Annual Operating Budget, various grant programs, public and private partnerships	Continue the identification of supply lists compiled in 2012; continue to procure and stock supplies.	**1.5**	No	2 years	Yes	Extreme Heat/ Cold	**M**

2	4	Public Education Awareness Campaigns - General; Promote the use of Family Emergency Plans, NOAA Weather radios, and Severe Weather Awareness activities... Winter; Promote use of home and auto survival kits and urge public to heed winter weather warnings... Summer; Coordinate with Libraries and Parks & Rec for cooling sites, and urge public to heed winter weather warnings… Terrorism; Educate and disseminate info on "See Something, Say Something campaign, common sense terrorism & CBRNE awareness... EOP and ESF's; Community Outreach Education, Planning Discussions... Economic Development; Educate citizens on low interest loans for improving structural ability of homes & businesses	EM & topic related departments and organizations	Annual Operating Budget	Continue to implement in 2019 and beyond	**5.1, 5.2, 5.4**	In process	On-going	Yes	All	**H**

3	22	Disaster Exercise Development - Develop flood recovery and mitigation scenarios and integrate into disaster exercises	Emergency Management & Public Works	Annual Operating Budgets	Continue to implement in 2019 and beyond	**1.4, 2.10**	No	On-going	Yes	Flood	**H**
4	34	Infrastructure Hardening - Conduct study to identify eligible projects and build capacity by mitigating key infrastructure nodes to harden against terrorism and other hazards	Emergency Management, Police, Public Works & Regional Water	Annual Operating Budgets and Law Enforcement Training and Terrorism Prevention (LETPP) grants	Development initiated in 2012-2013; continue to implement as each plan becomes available	**2.3**	In-process	On-going	Yes	Flood; Tech. & human-caused	**L**
5	40	Public Health Exercise Development – Assist in conducting Isolation & Quarantine Tabletop Exercise(s)	Emergency Management & Public Health	Annual Operating Budget	Schedule and hold periodic exercise to a test mitigation actions for infectious disease outbreak	**1.4, 2.10**	Yes	On-going	Yes	Human Infect. Disease	**H**
6	51	Business Continuity Plan Development - Assist businesses in developing plans and resources to minimize hazard impacts.	Emergency Management, Police, MNDoT & Public Works	Annual Operating Budget; public-private partnerships; grants	Establish partnership with business organizations to assist in developing continuity plans and resources	**3.3, 3.4**	In process	2022	Yes	All	**M**

7	57	Bridge Infrastructure Failure Plans – Assist in development of response plans	EM, MNDoT and Public Works	Annual Operating Budget	Continue to implement as resources become available.	**2.3**	N/A	2021	NEW	Flood; Tech. & human-caused	**M**
8		Develop plans to address Riverfront Fire Hydrant Gaps based on Southport Industrial Study Item	FD	Annual Operating Budget; Fire Assistance Grants	Develop project criteria and implement	**1.1, 2.4**	N/A	2021	NEW	Urban Fire	**M**
9		Assist in development Downtown Evacuation Plan	PW	Annual Operating Budget; grants	Develop project criteria & implement	**1.4, 1.5**	N/A	2020	NEW	All	**H**
10		Develop alternate transportation plan for post-failure bridge collapse	PW	Annual Operating Budget, various grant programs,	Develop & Complete plans to identify resource needs to mitigate post-failure bridge incidents	**1.4, 2.3, 2.6**	No	2021	Yes	Infrastructure	**M**
11	**51**	Incident Response Plans for Large Event Venues – Pedestrian/traffic hazards, signage/cameras, patrol, personnel requirements	EM	Annual Operating Budget; UASI funding; public/private partnerships	Establish planning group to identify mitigation needs for large event venues to consider public safety; impacts to businesses, tourism,	**1.1, 2.3, 2.6**	No	2022	Yes	All	**H**

					government. Develop mitigation options.						
12		Water Street – Due to persistent flooding events, elevate the street in numerous low areas. Finalize plans and complete	PW	Annual Operating Budget; transportation funding	Conduct feasibility study and implement mitigation action to prevent future flood impact	**2.3**	N/A	2-5 years	NEW	Flood	M
13		Wabasha Hill/Street Stabilization Plan – To mitigate hillside erosion Develop plan and complete	PW	Annual Operating Budget; transportation funding	Continue to identify and implement mitigation actions to stabilize Wabasha Hill/Street	**1.1, 2.3**	N/A	1-2 Years	NEW	Landslide/ Slope Failure	**M**
14		Raspberry Island - Bridge Deflector Project needed. Develop plan and complete	P&R	Annual Operating Budget; transportation funding	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**
15		Raspberry Island - Debris entanglement clean-up for tip of island. Develop plan and complete	P&R	Annual Operating Budget; grant funding (FMA)	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**

16		City House Building - Utility Protection & Sewage Ejector Relocation	P&R	Annual Operating Budget; grant funding (FMA)	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**
17		Chestnut Plaza - Feature Fountain Pump Pit Relocation	P&R	Annual Operating Budget; grant funding (FMA)	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**
18		Upper Landing Feature Fountains (4) - Pump Pit Relocation	P&R	Annual Operating Budget; grant funding (FMA)	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**
19		Hidden Falls Park - Pathway Removal/Realignment near low spots along river	P&R	Annual Operating Budget; grant funding (HMA)	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**
20		Harriet Island Public Dock - Add more structural support related to debris entanglement to reduce repetitive costs for contract debris and dredging	P&R	Annual Operating Budget; transportation funding	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**
21		Watergate Marina - Define and develop new facility electrical and fueling station systems to protect against annual flooding	P&R	Annual Operating Budget; grant funding (FMA)	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**

22		Crosby Bog Walk – Fishing Pier needs to be repositioned during high water events	P&R	Annual Operating Budget; grant funding	Identify and implement eligible mitigation project	**2.4**	N/A	2-5 years	NEW	Flood	**M**
23		Flood Plain Structure Inventory Project - Inventory all structures that are at flood risk within the Mississippi River flood plain at Saint Paul. Determine individual Risk Assessments for existing structures. Includes: inventorying (marrying-up with Conditional Use Permits), developing Key Contacts Lists, facilitate accomplishment of Flood Response Plans and the creation of maps.	DSI	Annual Operating Budget, Federal USACE funding, grant funding (FMA)	Identify and implement eligible mitigation project	**2.1, 2.2, 2.10**	N/A	2-5 years	NEW	Flood	**M**
24		Community Rating System Project – This voluntary program recognizes and encourages community floodplain management activities exceeding the minimum National Flood Insurance	DSI	Annual Operating Budget, Federal grant funding	Identify and implement eligible mitigation project	**2.5, 2.10**	N/A	2-5 years	NEW	Flood	**M**

		Program standards. This action tailors Saint Paul's own particular hazards, character, and goals. The city implementing standards in turn ultimately leads to discounted premiums rates.									
25		Localized NOAA Atlas 14 Map Assessment Update Project - Utilize current data and provide updated assessment for Saint Paul flood plain.	DSI	Annual Operating Budget, Federal grant funding	Identify and implement eligible mitigation project	**2.3**	N/A	2-5 years	NEW	Flood	**M**
26		West Levee - Determine FEMA re-certification and PAL status	DSI	Annual Operating Budget, Federal USACE funding, grant funding (FMA)	Identify and implement eligible mitigation project	**2.3**	N/A	1-2 years	NEW	Flood	**M**
27		Localized NOAA Atlas 14 Map Assessment Update - Utilize current data and provide updated assessment for Saint Paul flood plain.	DSI	Annual Operating Budget, Federal grant funding	Identify and implement eligible mitigation project	**2.3**	N/A	2-5 years	NEW	Flood	**M**
28		West Levee Re-Certification Project - Determine future FEMA re-certification and PAL	DSI	Annual Operating Budget, Federal USACE funding, grant funding (FMA)	Identify and implement eligible mitigation project	**2.3**	N/A	2-5 years	NEW	Flood	**M**

29		Enact Combined Enhanced Fire Safety Ordinances - Automatic Fire Sprinkler Mitigation Initiatives a. DSI and Mayor's Intergovernmental Relations personnel should continue to push for the adoption of the most current International Residential Code without any redactions of fire sprinkler requirements b. OFS, PED, and elected officials should pass an ordinance and make it standard practice that any housing renovations or construction of residential buildings funded in part or in total by city funding or tax incentives include the requirement to install fire sprinkler systems	DSI, OFS, PED, Council & Mayor's Intergovern-mental Rel-ations	Annual Operating Budgets	Align with State and City Council calendars	**5.4**	No	1-2 years	Yes	Fire	**M**

30		Incorporating Fire Sprinkler Technology in New and Existing Buildings - Automatic Fire Sprinkler Mitigation Initiatives a. FD, DSI, and EM officials should make use of State and Federal Hazard Mitigation Grant Program (HMGP) to retrofit municipal buildings and publicly-owned housing with automatic fire sprinklers. DSI and FD could make a prioritized list of these buildings based on risk, difficulties anticipated in fire/rescue operations, and at-risk occupants, and remove them off the list as funding becomes available. b. PED, DSI, and FD should conduct Public Education and outreach efforts that include information regarding the recent changes in tax law that	DSI, EM, FD & Mayor's Office	State and Federal Hazard Mitigation Grant Program (HMGP)	Identify and implement eligible mitigation project	**5.4**	No	1-2 years	Yes	Fire	**M**

	provides tax relief of up to $1 million for small business owners who retrofit their buildings with fire sprinklers. (Ref: Tax Cuts and Jobs Act, Section 179 of Public Law 115-97). c. FD should ensure that follow up discussions occur with every home and business owner or any property manager where fire has occurred regarding recovery efforts/restoration incorporating fire sprinkler technology. d. The Mayor's Intergovernmental Relations personnel should adopt a pro-sprinkler stance in the state and national legislative arenas and fight any efforts to ban local jurisdictions from adopting more stringent fire code and fire sprinkler ordinances.									

31	8	Smoke Detector Education Program - Continue to implement smoke detector education and giveaway program	FD	Annual Operating Budget, fire prevention grants, public-private partnerships (American Red Cross…)	Identify facilities needing equipment and access funding to implement program	**5.4**	No	1-2 Years	Yes	Fire	**M**

Appendix C-4: Mitigation Ranking Criteria and Ranking Worksheet

The criteria presented below provides a uniform format for ranking mitigation actions which is consistent with planning requirements of 44 CFR, Part 201.6. The prioritization criteria will be used to prioritize all Mitigation Actions submitted during the ***2019-2024*** mitigation planning cycle.

The table below demonstrates the ranking criteria utilized for prioritizing potential actions and planning alternatives.

Table C-4-1: Ranking Criteria

Category	Points	Criteria
(1) Life Safety/Property Protection	4	Likely to protect more than 50% of the population and/or critical infrastructure and community assets.
	3	Likely to protect at least 50 % of the population and/or critical infrastructure and community assets.
	2	Could potentially protect up to 25 % of the population and could potentially protect critical infrastructure and community assets
	1	Could potentially protect up to 10 % of the population and could potentially protect critical infrastructure and community assets
	0	Potential for protecting lives and critical infrastructure and/or community assets cannot be determined at this time.
(2) Funding Availability	4	Little to no direct expenses
	3	Can be funded by annual operating budget
	2	Grant funding identified
	1	Grant funding needed
	0	Potential funding source unknown
(3) Probability of Matching Funds	4	Funding match is available or funding match not required
	-	N/A
	2	Partial funding match available
	-	N/A
	0	No funding match available or funding match unknown
(4) Benefit Cost Review	4	Likely to meet Benefit Cost Review
	-	N/A
	2	Benefit Cost Review not required
	-	N/A
	0	Benefit Cost Review unknown

(5) Environmental Benefit	4	Environmentally sound and relatively easy to implement; or no adverse impact on environment.
	3	Environmentally acceptable and not anticipated to be difficult to implement
	2	Environmental concerns and somewhat difficult to implement because of complex requirements
	1	Difficult to implement because of significantly complex requirements and environmental permitting
	0	Very difficult to implement due to extremely complex requirements and environmental permitting problems
(6) Technical Feasibility	4	Proven to be technically feasible
	-	N/A
	2	Expected to be technically feasible
	-	N/A
	0	Technical feasibility unknown or additional information needed
(7) Timeframe of implementation	4	1 year or less (Short Term)
	-	N/A
	2	2 – 5 years (Long-Term)
	-	N/A
	0	More than 5 years (Long-Term)
Minimum = 0 Maximum = 28	**Ranking Level: Low: 0-10 Medium: 11-20 High: 21-28**	

Using the total score ranges established through the ranking process described in the table above, each action was prioritized as **high, medium** or **low**.

The list of prioritized actions demonstrates the City's commitment to address the hazards of highest concern which represent the greatest opportunity to reduce future losses.

Table C-4-2: Mitigation Actions Ranking Worksheet

2019 Action #	Action Step	Life Safety/Property	Funding Availability	Matching Funds	Benefit Cost	Environmental Benefit	Technical Feasibility	Implementation Timeframe	TOTAL	Priority High Medium Low
Natural Hazards: Dam/Levee Failure, Damaging Winds/Thunderstorms, Drought, Extreme Heat/Cold, Flood, Human Infectious Disease, Landslide/Slope Failure, Severe Winter Storm, Tornado, Urban/Wildland Fire; **Technological or Man-Made:** CIKR Lifeline Failure, Critical Supply Chain Disruption, Terrorism/CBRNE, HazMat, Criminal Acts, Civil Disorder		Points	Points	Points	Points	Points	Points	Points	Points	
1	Extreme Temperature Shelters - Coordinate with the Department of Parks & Recreation (P & R) to identify procures, supplies and plans for implementation.	1	2	4	2	4	4	2	**19**	**M**
2	Public Education Awareness Campaigns - General; Promote the use of Family Emergency Plans, NOAA Weather radios, and Severe Weather Awareness activities... Winter; Promote use of home and auto survival kits and urge public to heed winter weather warnings... Summer; Coordinate with Libraries and Parks & Rec for cooling sites, and urge public to heed winter weather warnings...Terrorism; Educate and disseminate info on "See Something, Say Something campaign, common sense	4	3	4	2	4	4	2	**23**	**H**

	terrorism & CBRNE awareness... EOP and ESF's; Community Outreach Education, Planning Discussions... Economic Development; Educate citizens on low interest loans for improving structural ability of homes & businesses									
3	Disaster Exercise Development - Develop flood recovery and mitigation scenarios and integrate into disaster exercises	2	3	4	2	4	4	2	**21**	**H**
4	Infrastructure Hardening - Conduct study to identify eligible projects and build capacity by mitigating key infrastructure nodes to harden against terrorism and other hazards	1	2	2	0	2	0	2	**9**	**L**
5	Public Health Exercise - Conduct Isolation & Quarantine Tabletop Exercise	3	3	4	3	4	4	2	**23**	**H**
6	Assist businesses in developing business continuity plans and resources to minimize hazard impacts.	4	1	2	2	3	4	2	**18**	**M**
7	Develop Bridge Infrastructure Failure response plans	1	3	4	2	4	2	2	**18**	**M**
8	Riverfront Fire Hydrant Gaps (Southport Industrial Study Item)	1	1	0	2	3	2	2	**11**	**M**
9	Downtown Evacuation Plan - Develop & Complete	2	4	4	2	3	2	4	**21**	**H**
10	Bridge Post-Failure Plans - Alternate transportation plan post-failure	3	3	4	2	3	2	2	19	**M**
11	Incident Response Plans for Large event venues - pedestrian/traffic hazards, signage/cameras, patrol, personnel requirements	2	3	4	2	4	4	2	**21**	**H**
12	Water Street - Raising the street in low area(s)…	1	1	2	4	3	2	2	15	M

13	Wabasha Hill/Street Stabilization Plan - Develop and Complete	1	1	2	4	3	2	2	15	**M**
14	Raspberry Island - Bridge Deflector Project	1	1	2	4	3	2	2	15	**M**
15	Raspberry Island - Debris Deflector for tip of island	1	1	2	4	3	2	2	15	**M**
16	City House Building - Utility Protection & Sewage Ejector Relocation	1	1	2	4	3	2		2	**M**
17	Chestnut Plaza - Feature Fountain Pump Pit Relocation	1	1	2	4	3	2	2	15	**M**
18	Upper Landing Feature Fountains (4) Pump Pit Relocation	1	1	2	4	3	2	2	15	**M**
19	Hidden Falls Park - Pathway Removal/Realignment Near Low Spot Along River	1	1	2	4	3	2	2	15	**M**
20	Harriet Island Public Dock - Add more structural support related to debris entanglement to reduce repetitive costs for contract debris and dredging	1	1	2	4	3	2	2	15	**M**
21	Watergate Marina - Define and develop new facility electrical and fueling station systems to protect against annual flooding	1	1	2	4	3	2	2	15	**M**
22	Crosby Bog Walk - Build New Structure	1	1	2	4	3	2	2	15	**M**

23	Flood Plain Structure Inventory Project - Inventory all structures that are at flood risk within the Mississippi River flood plain at Saint Paul. Determine individual Risk Assessments for existing structures. Includes: inventorying (marrying-up with Conditional Use Permits), developing Key Contacts Lists, facilitate accomplishment of Flood Response Plans and the creation of maps.	2	2	2	0	3	2	2	13	**M**
24	Community Rating System Project – This voluntary program recognizes and encourages community floodplain management activities exceeding the minimum National Flood Insurance Program standards. This action tailors Saint Paul's own particular hazards, character, and goals. The city implementing standards in turn ultimately leads to discounted premiums rates.	2	0	2	2	2	2	2	12	**M**
25	Localized NOAA Atlas 14 Map Assessment Update Project - Utilize current data and provide updated assessment for Saint Paul flood plain.	1	1	2	2	3	4	2	15	**M**
26	West Levee - Determine FEMA re-certification and PAL status	1	1	2	2	3	4	2	15	**M**
27	Localized NOAA Atlas 14 Map Assessment Update - Utilize current data and provide updated assessment for Saint Paul flood plain.	1	1	2	2	3	4	2	15	**M**
28	West Levee Re-Certification Project - Determine future FEMA re-certification and PAL	1	1	2	2	3	4	2	15	**M**

29	Enact Combined Enhanced Fire Safety Ordinances - Automatic Fire Sprinkler Mitigation Initiatives	1	1	2	2	3	4	2	15	**M**
30	Incorporating Fire Sprinkler Technology in New and Existing Buildings - Automatic Fire Sprinkler Mitigation Initiatives	1	1	2	2	3	4	2	14	**M**
31	Continue to implement smoke detector education and giveaway program	1	1	2	2	4	4	2	16	**M**