DRAFT

City of Portsmouth, NH
Hazard Mitigation Plan Update 2024

Adopted by the

Portsmouth City Council
_____(date)_____

Prepared with the Assistance of the

ROCKINGHAM PLANNING COMMISSION
theRPC.org

This project was partially funded by
New Hampshire Homeland Security and Emergency Management

CERTIFICATE OF ADOPTION

WHEREAS, the City of Portsmouth received funding from the NH Office of Homeland Security and Emergency Management and assistance from Rockingham Planning Commission in the preparation of the Portsmouth Hazard Mitigation Plan Update 2024; and

WHEREAS, several public planning meetings were held between April 2024 and August 2024 regarding the development and review of the Portsmouth Hazard Mitigation Plan Update 2024; and

WHEREAS, the Portsmouth Hazard Mitigation Plan Update 2024 contains several potential future projects to mitigate hazard damage in the City of Portsmouth; and

WHEREAS, a duly noticed public hearing was held by the Portsmouth City Council on _____ to formally approve and adopt the Portsmouth Hazard Mitigation Plan Update 2024.

NOW, THEREFORE BE IT RESOLVED that the Portsmouth City Council:

- The Plan is hereby adopted as the official plan of the City of Portsmouth:
- The respective individuals identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
- Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution;
- An annual report of the progress of the implementation elements of the Plan shall be presented to the City Council by the City Manager/Emergency Management Director or the Emergency Management Coordinator.

NOW, THEREFORE BE IT RESOLVED that the City Council adopts the Portsmouth Hazard Mitigation Plan Update 2024.

IN WITNESS THEREOF, the undersigned has affixed his/her signature and the corporate seal of the City of Portsmouth on this _____ day of _____.

_____
Mayor

_____
Public Notary

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Appendices:

ACKNOWLEDGEMENTS

The City of Portsmouth extends special thanks to those that assisted in the development of the Hazard Mitigation Plan Update 2024 by serving as members of Natural Hazards Mitigation Committee:

Karen Conard, City Manager/Emergency Management Director, City of Portsmouth, NH
William McQuillen, Fire Chief/Emergency Management Coordinator, City of Portsmouth, NH
Jason Gionet, Assistant Fire Chief, City of Portsmouth, NH
Mark Newport, Police Chief, City of Portsmouth, NH
Mike Maloney, Deputy Police Chief, City of Portsmouth, NH
Peter Britz, Planning Director, City of Portsmouth, NH
Kate Homet, Associate Environmental Planner, City of Portsmouth, NH
Peter Rice, Public Works Director, City of Portsmouth, NH
Brian Goetz, Deputy Public Works Director, City of Portsmouth, NH
Eric Eby, City Engineer, City of Portsmouth, NH
Erich Fiedler, Engineering Supervisor, City of Portsmouth, NH
Sean Clancy, Assistant City Manager for Economic and Community Development, City of Portsmouth, NH
Kim McNamara, Health Officer, City of Portsmouth, NH
Ellen Tully, Welfare Director, City of Portsmouth, NH
Joanna Diemer, Administrative Assistant, City of Portsmouth, NH
Monte Bohanan, Director of Communications, City of Portsmouth, NH

Appendix O lists additional people that participated in the Plan Update 2024 process.

The City of Portsmouth offers thanks to the NH Homeland Security and Emergency Management and FEMA for providing funding and technical assistance with the development of this Plan Update.

In addition, special thanks are extended to the staff of the Rockingham Planning Commission for professional services, process facilitation, and preparation of this document.

EXECUTIVE SUMMARY

The Portsmouth Hazard Mitigation Plan Update 2024 (herein after, the Plan), was compiled to assist the City of Portsmouth in reducing and mitigating future losses from natural hazard events. The Plan was developed by the City of Portsmouth Hazard Mitigation Committee, representatives of the business community, academia, and organizations assisting vulnerable populations, and the Rockingham Planning Commission. The Plan Update identifies specific natural hazards impacting Portsmouth and outlines existing and future natural hazard mitigation efforts.

The following natural hazards are addressed:

- Flooding
- Hurricane and High Wind Events
- Severe Winter Weather
- Wildfire and Conflagration
- Earthquakes
- Coastal Storms
- Extreme Temperatures
- Drought
- Climate Change
- Infectious Disease

The list of critical facilities includes:

- Municpal facilities;
- Communication facilities;
- Fire stations and law enforcement facilities;
- Schools;
- Shelters;
- Evacuation routes; and
- Vulnerable Populations

The Portsmouth Hazard Mitigation Plan Update 2024 is considered a work in progress and should be revisited after every natural hazard event to assess whether the existing and suggested mitigation strategies are successful. Copies are available in the City Manager's Office and the office of the Emergency Management Coordinator, and a copy will remain on file at the Rockingham Planning Commission. A copy of this plan is also on file at the New Hampshire Homeland Security and Emergency Management (NHHSEM) and the Federal Emergency Management Agency (FEMA). This plan was approved by both agencies prior to its adoption at the local level.

CHAPTER I - INTRODUCTION

Background

The New Hampshire Homeland Security and Emergency Management (NHHSEM) has a goal for all communities within the State to establish local hazard mitigation plans to reduce and mitigate future losses from natural hazard events. The NHHSEM outlines a process whereby communities throughout the State may be eligible for grants and other assistance upon completion of a local hazard mitigation plan. A handbook entitled *Hazard Mitigation Planning for New Hampshire Communities* was created by NHHSEM to assist communities in developing local plans. The State's Regional Planning Commissions are charged with providing assistance to selected communities to develop local plans.

The Portsmouth Hazard Mitigation Plan Update 2024 was prepared by participants from the City of Portsmouth Hazard Mitigation Committee with the assistance and professional services of the Rockingham Planning Commission (RPC). The City's Hazard Mitigation Committee included representatives from all City departments, academia, local businesses, and organizations assisting socially vulnerable and underserved members of the community. The Plan serves as a strategic planning tool for use by the City of Portsmouth in its efforts to identify and mitigate the future impacts of natural hazard events. Upon adoption of this Plan by the Portsmouth City Council, it will become an appendix to the Portsmouth Emergency Operations Plan.

Methodology

The Rockingham Planning Commission (RPC) organized the first Plan Update meeting with the City Manager/EMD, Emergency Management Coordinator, and department heads from the City of Portsmouth on April 18, 2024, and June 26, 2024. Updating the Plan was on a very accelerated timetable, resulting in a draft Plan going to the City Council on July 15, 2024, within three months of funds being awarded to the City. The Emergency Management Coordinator and RPC solicited information for the Plan Update from local officials, academia, organizations assisting vulnerable populations, and residents throughout the Plan development process. Notice of the Plan Update process was posted on the City's website. RPC staff kept communities in the region informed of the Plan Update process and requested feedback at monthly Commissioner meetings which involve members of Planning Boards, Boards of Selectmen, and Conservation Commissions in surrounding towns. In addition, RPC staff working in the abutting towns of New Castle, Greenland, Newington and Rye shared information on the Plan Update and provided opportunities to comment on regional mitigation strategies.

The City's Hazard Mitigation Plan Update 2017 served as a starting point for discussions on hazards impacting the city, as well as discussions on mitigation strategies. The 2017 Plan has served as a reference for local land use regulations and policies, development of the City's Capital Improvement Plan and department budgets and has been referenced in several reports and policies including extended flood hazard areas and climate resiliency initiatives. The city continues to actively work on hazard mitigation and several new initiatives have been completed or are underway since the 2017 Plan Update and this work has been documented in this Plan Update.

Step 1 – Form Committee

A Committee comprised of the City Manager/EMD, Fire Chief/Emergency Management Coordinator, Assistant Fire Chief, Director of Communications, Police Chief, Deputy Police Chief, Planning Director, Associate Planner, Public Works Director, Public Works Deputy Director, Public Works Engineering Supervisor, City Engineer, Economic Development Manager, Health Officer, and Welfare Director was established to work with staff from the Rockingham Planning Commission to update the Plan. RPC staff informed local officials of surrounding communities of the plan update at monthly meetings of RPC Commissioner. Assistance with Plan development was provided by staff from NH Homeland Security and Emergency Management and FEMA.

Step 2 – Public Outreach and Stakeholder Involvement

RPC staff worked with the Emergency Management Coordinator on meaningful community engagement and public outreach about the Plan Update process to residents, local businesses, academia, organizations supporting socially vulnerable populations, and Emergency Management Directors in the abutting municipalities of Newington, NH, New Castle, NH, Greenland, NH, and Rye, NH. All these stakeholders were provided with an opportunity to comment on the draft Plan and contribute updated information.

Public notices about the Plan Update meetings were posted on the city website and social media to inform viewers and followers about the plan update process and to solicit review and comment on the Plan. Notice about the Plan Update process was also posted on the Rockingham Planning Commission's website and published in the RPC's monthly newsletter. The newsletter is distributed to local officials in the 27-town RPC region. RPC and the Emergency Management Coordinator worked with the City's Economic Development Director to directly seek input from the business community and with the director of the Housing Authority to ensure the needs of Housing Authority residents were represented. Representatives from the school district were also invited to participate in the Plan Update process.

RPC staff facilitated the Plan Update Committee meetings, guided the plan update process, and prepared the Plan Update in close consultation with the Plan Update Committee. Appendix O documents the individuals and organizations involved in the Plan Update as well as the public outreach materials distributed by the City of Portsmouth and the Rockingham Planning Commission.

Step 3 – Identify Natural Hazards Impacting Portsmouth

The Committee reviewed the list of natural hazards impacting Portsmouth that were included in the 2017 Plan and added Infectious Disease to the list of hazards impacting the community.

Step 4 – Identify Critical Facilities and Areas of Concern

The Committee identified facilities and areas considered to be important to the City for emergency management purposes, for provision of utilities and community services, evacuation routes, and for recreational, historical, cultural, and social value. Participants in the Committee identified areas where damage from past natural disasters have occurred and areas where critical man-made facilities and other features may be at risk

in the future for loss of life, property damage, environmental pollution, and other risk factors. RPC generated a set of base maps with GIS (Geographic Information Systems) that were used in the process of identifying past and future hazards.

Step 5 – Identify Existing Mitigation Strategies

After identifying critical facilities in Portsmouth, the Committee and RPC staff reviewed the City's existing mitigation strategies relative to flooding, hurricane and wind events, severe winter weather, wildfire, earthquake, drought, extreme temperatures, climate change, and infectious disease. This process involved reviewing the City's Hazard Mitigation Plan Update 2017 and resources listed under Step 7.

Step 6 – Identify the Gaps in Existing Mitigation Strategies

The existing strategies were then reviewed by the RPC and the Committee for coverage and effectiveness, degree of completion and the need for improvement.

Step 7 – Identify Potential Mitigation Strategies

A list was developed of additional hazard mitigation actions and strategies for the City of Portsmouth. Natural Hazard Mitigation Plans for other communities in the region were utilized to identify new mitigation strategies as well as the following relevant resources:

- 2013 FEMA Mitigation Ideas – A Resource for Reducing Risk to Natural Hazards
- 2013 City of Portsmouth Coastal Resilience Initiative report
- 2015 City of Portsmouth Climate Change Vulnerability Assessment
- 2015 City of Portsmouth Climate Resilience Evaluation and Awareness Exercise Tool and Report
- 2016 New Hampshire Coastal Risks and Hazards Commission Report
- 2017 City of Portsmouth Hazard Mitigation Plan Update
- 2017 Prescott Park Master Plan
- 2018 Climate Adaptation and Resilience Checklist and Guidance
- 2018 City of Portsmouth Historic Resources Climate Change Vulnerability Assessment and Adaptation Plan
- 2019 New Hampshire Coastal Flood Risk Summary
- 2020 City of Portsmouth Open Space Plan
- 2022 Seacoast Transportation Corridors Vulnerability Assessment
- 2023 State of New Hampshire Hazard Mitigation Plan Update
- 2023-2028 City of Portsmouth Capital Improvements Plan
- 2024 City of Portsmouth Zoning Ordinance
- 2024 City of Portsmouth Emergency Operations Plan
- 2024 State of New Hampshire Priority Climate Action Plan
- 2025 City of Portsmouth Master Plan
- NH Coastal Adaptation Workgroup reports
- Portsmouth Smart Growth reports
- Portsmouth's Climate Future reports

Step 8 – Develop the Action Plan

The proposed hazard mitigation actions and strategies were reviewed, and each strategy was rated (good, average, or poor) for its effectiveness according to several factors (e.g., technical, and administrative applicability, political and social acceptability, legal authority, environmental impact, financial feasibility). Each factor was then scored, and all scores were totaled for each strategy. Strategies were ranked by overall score for preliminary prioritization then reviewed again under Step 9.

Step 9 – Determine Priorities

The preliminary prioritization list was reviewed to make changes and determine a final prioritization for new hazard mitigation actions and improvements to existing protection strategies. RPC staff also presented recommendations sourced from the resources listed in Step 7 for review and prioritization by the Plan Update Committee.

Step 10 – Develop Implementation Strategy

Using the chart provided under Step 9 in the handbook, an implementation strategy was created which included person(s) responsible for implementation (who), a timeline for completion (when), and a funding source and/or technical assistance source (how) for each identified hazard mitigation actions. Whenever the Master Plan or Capital Improvement Plan (CIP) are updated the Portsmouth Hazard Mitigation Plan Update 2024 shall be consulted to determine if strategies or actions suggested in the Plan can be incorporated into the City's future land use recommendations and capital expenditures.

Step 11 - Adopt and Monitor the Plan

RPC staff compiled the results of Steps 1 to 10 into a draft document for review by the Committee. The draft Plan Update 2024 was posted on the City of Portsmouth website and social media for review and comment. Stakeholders listed in Appendix O were emailed the draft Plan and invited to comment on the draft Plan and to meet with RPC staff and the Emergency Management Coordinator. Stakeholders included Emergency Management Directors in neighboring communities, academia, local businesses, and agencies serving socially vulnerable and underrepresented communities. A duly noticed public meeting was held by the Portsmouth City Council on July 15, 2024. The meeting allowed anyone to provide comments and suggestions for the draft Plan Update in person, prior to the document being finalized. After the meeting the City Council instituted a two-week comment period, ending on July 30, 2024. The draft Plan was revised to incorporate comments received and submitted to the NHHSEM and FEMA Region I for their review and comments. Any changes required by NHHSEM and FEMA were made, and a revised draft document was then submitted to the Committee for review. A public meeting was then held by the City Council on _____ to approve and adopt the Plan. (Info re: comments from public). The formal letter of approval from FEMA Region 1 can be found in the Appendix. The city will post the approved Plan Update on the Town website to facilitate continued public participation in hazard mitigation initiatives.

To track progress and update the Mitigation Strategies identified in the Action Plan, the City's Hazard Mitigation Committee will remain active and will revisit the Plan annually and after each natural hazard event. These reviews will assess the Plan's effectiveness,

accuracy, and completeness in achieving its stated purpose and goals. The Emergency Management Director and Emergency Management Coordinator will coordinate Plan reviews, which will include robust public outreach and address the recommended improvements to the Plan as contained in the FEMA plan review checklist, as well as any weaknesses the city has identified that the Plan did not adequately address. The Plan will also be thoroughly updated every five years.

HAZARD MITIGATION GOALS AND OBJECTIVES

The City of Portsmouth sets forth the following hazard mitigation goals and objectives:

- Reduce or avoid long-term vulnerabilities posed by natural hazards impacting Portsmouth, including the impacts from flooding, hurricanes and high wind events, severe winter weather, wildfire and conflagration, earthquakes, coastal storms, extreme temperatures, drought, climate change, including sea-level rise and increased precipitation events, and infectious disease.

- Improve upon the protection of the City of Portsmouth's general population, the citizens of the State and guests, from all natural and man-made hazards.

- Reduce the potential impact of natural and man-made disasters on Portsmouth and the State's Critical Support Services.

- Reduce the potential impact of natural and man-made disasters on Portsmouth's Critical Facilities in the State.

- Reduce the potential impact of natural and man-made disaster on Portsmouth's and the State's infrastructure.
- Improve Portsmouth's Emergency Preparedness.
- Improve Portsmouth's Disaster Response and Recovery Capability.
- Reduce the potential impact of natural and man-made disasters on private property in Portsmouth.
- Reduce the potential impact of natural and man-made disasters on Portsmouth's and the State's economy.
- Reduce the potential impact of natural and man-made disasters on Portsmouth's and the State's natural environment.
- Reduce Portsmouth's and the State's liability with respect to natural and man-made hazards generally.
- Reduce the potential impact of natural and man-made disasters on Portsmouth's and the State's specific historic treasures and interests as well as other tangible and intangible characteristics that add to the quality of life to the citizens and guests of the State and the City.
- Identify, introduce and implement cost effective Hazard Mitigation measures so as to accomplish Portsmouth's and the States' goals and objectives in order to raise the awareness and acceptance of hazard mitigation planning.

Through the adoption of this Plan the City of Portsmouth concurs and adopts these goals and objectives.

CHAPTER II – COMMUNITY PROFILE

The City of Portsmouth is in the Seacoast region of southeastern New Hampshire. The 2022 U.S. Census estimated the population to be 22,713, with that number increasing significantly during peak periods of tourism. The median age was 42 years, and the median household income was $91,915, higher than the statewide median household income of $88,235. The population density was 1,448 people per square mile of land.

Portsmouth encompasses 15.7 square miles of land area and 1.1 square miles of inland water area. Portsmouth is part of the Seaboard Lowlands of New England with a landscape that is generally flat. The elevation of this region is typically less than 200 feet above sea level. As seen in Figure 1, Portsmouth is bordered by the New Hampshire communities of New Castle, Rye, Greenland and Newington. The northern border of Portsmouth follows the tidal Piscataqua River as it enters Portsmouth Harbor and the Atlantic Ocean. The towns of Kittery and Eliot, Maine are on the opposite bank. Wetlands cover 33% of Portsmouth, including the major wetland areas of Great Bog, Berry Brook, Sagamore Creek and Packer Bog.

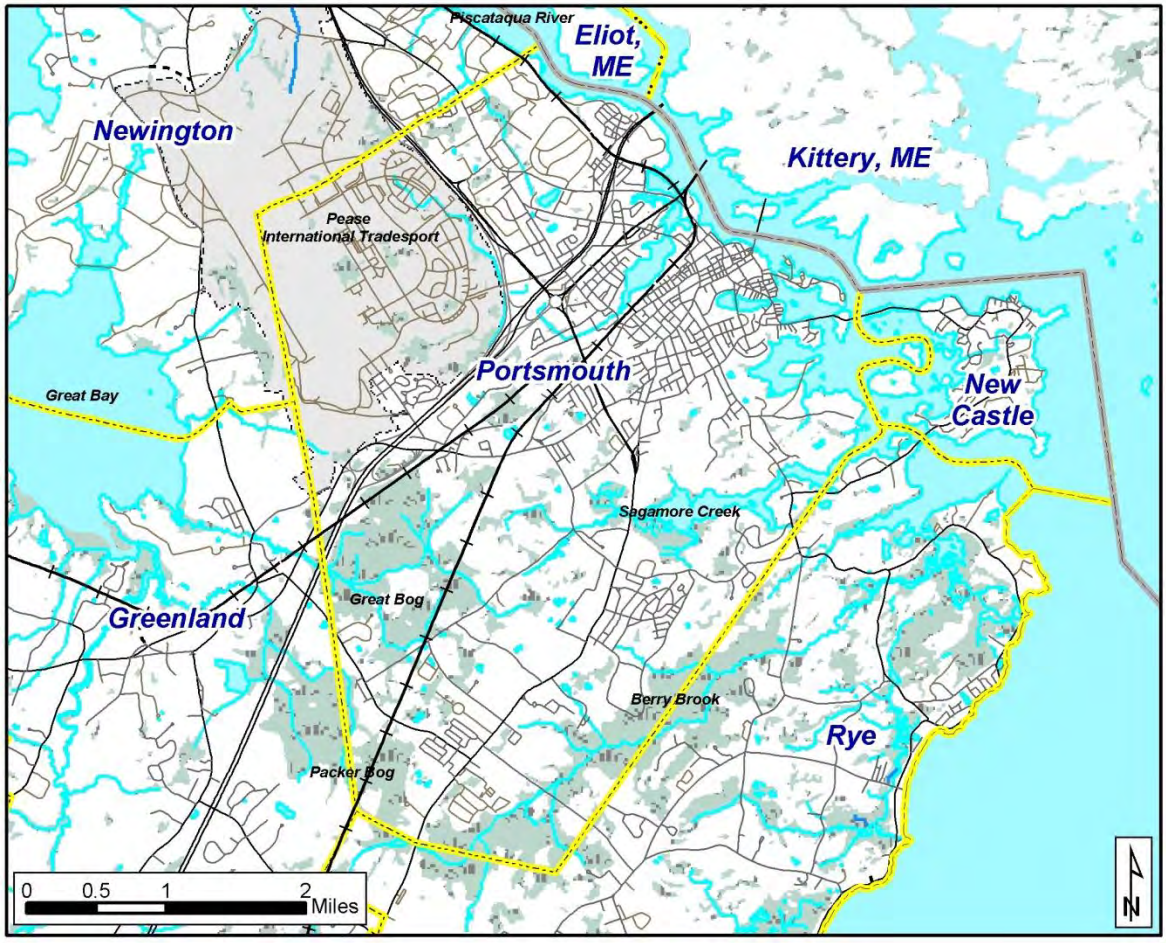


Figure 1: Location Map of Portsmouth, New Hampshire

Portsmouth's urban center is in the northern half of the city, while the southern half of the city is home to most of the wetlands. The city is served by major transportation routes, including Interstate 95, the Spaulding Turnpike, and Route 1.

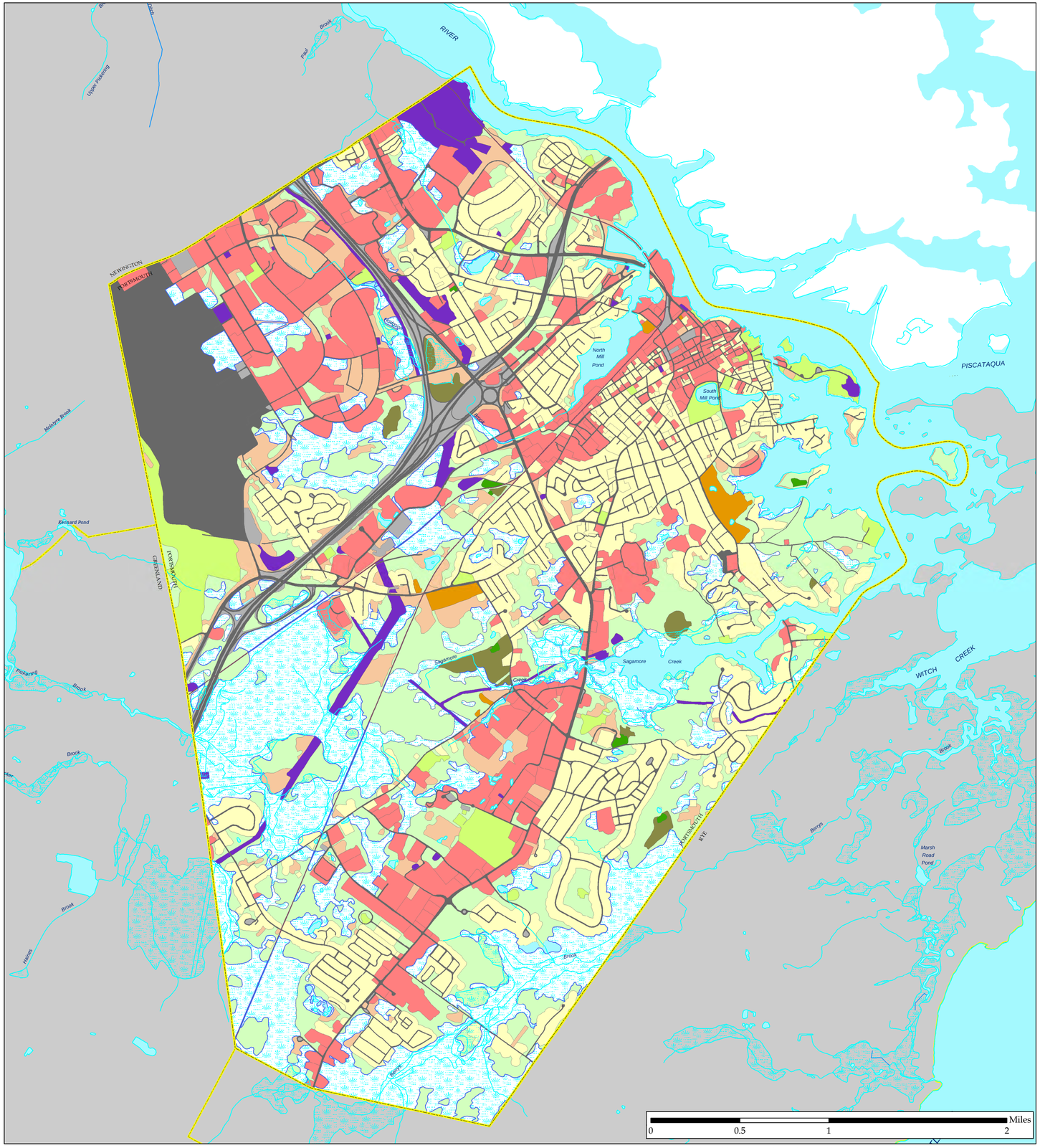
Current and Future Development Trends

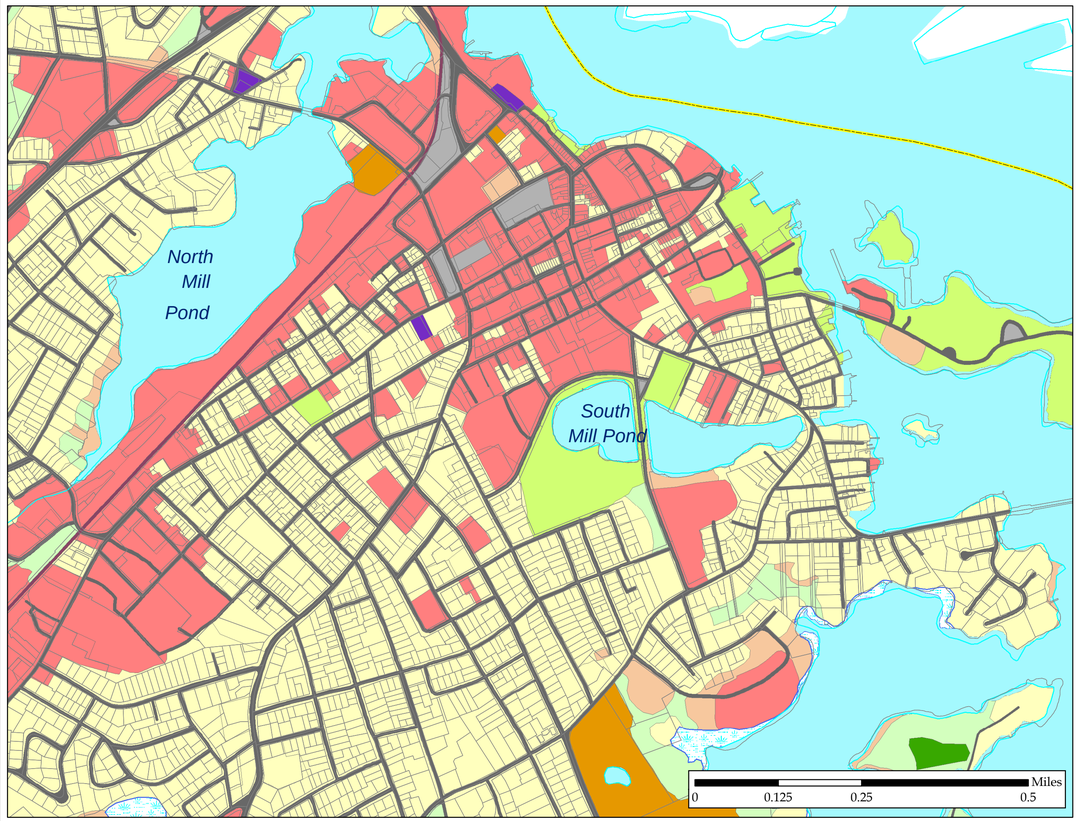
Current and future development is predicated on the City's Zoning Ordinance. The City is divided into ten different zoning district types encompassing residential, mixed residential business and industrial, Pease/airport, municipal, conservation, and transportation corridors, which includes overlay districts guiding development in the downtown in the floodplain, historic district, and others.

Portsmouth contains a mix of residential, commercial and industrial land uses. A great deal of the remaining undeveloped publicly owned land and private land cannot be developed due to wetland restrictions. Future growth in Portsmouth will therefore come from redevelopment of existing commercial and industrial areas on the southern and western edges of downtown that public or private developers can repurpose and rebuild with more density. The increase in building density in these areas will result in additional impervious surfaces, requiring expanded stormwater management and the inclusion of low impact development strategies, such as rain gardens and pervious pavement. Additionally, much of the historic downtown core and surrounding districts more closely control the forms and uses of new buildings, which regulates allowed development and works to introduce more community space throughout the downtown. Residentially zoned areas of the city comprise 34% of the city, but residents are traditionally resistant to increasing density, adding further challenges to the repurposing of commercial and industrial lands. Changes to the zoning ordinance and other land use regulations have increased flexibility in corridor areas, with a specific goal of enhancing visual character and environmental quality. A recent effort by the City to rezone areas zoned for office to the mixed-use Gateway District is seeking to encourage affordable housing and mixed-use development.

The City has adopted and enforces land use regulations designed to mitigate hazards, including extended flood hazards areas, shoreland buffer protection, wetlands protection, and stormwater management. All these regulations are increasing the resiliency to climate change in the City's vulnerable downtown and historic shorefront neighborhoods which are threatened by sea-level rise, coastal storm surge, and compound flooding from extreme precipitation events. Portsmouth is a leader in climate change adaptation and resiliency planning in the region, assessing risks to infrastructure, historic resources, and residential neighborhoods. In fact, the areas at greatest risk for impacts from coastal flooding, sea level rise, and groundwater intrusion include the City's Historic District. The City has identified strategies to help make residents and businesses in the historic downtown more resilient to these impacts, including basement floodproofing, structural elevation, and the construction of flood walls. Despite these efforts the City's vulnerability to natural hazards may increase due to climate change and an increasing number of hazard events. Natural hazards identified in this plan update, as well as mitigation strategies discussed in the plan, will be considered during local review of development proposals, development and update of land use regulations, infrastructure planning, the Master Plan and CIP, and the Emergency Operations Plan.

Map 1:
2015 Land Use, Portsmouth, New Hampshire





Land Use 2015

- Active Agricultural
- Aux Transportation
- Farmsteads
- Forested
- Industrial/Commercial
- Mixed Urban
- Open Wetlands
- Other/Idle
- Playing fields / Recreation
- Railroad
- Residential
- Transportation
- Utilities
- Water

BASE FEATURES

- Interstate
- US Route
- State Route
- Local
- Interstate Ramp
- Major Road Ramp
- Political Boundaries
- Stream or Shoreline
- Apparent Wetland Limit
- Intermittent Stream
- Other Surface Water Feature
- Wetlands (USGS)
- Surface Water Bodies
- Parcels

The land use delineations were determined from aerial photos. The process has been completed for various years and was last updated based on 2015 air photos. The work was a combined effort of the Rockingham Planning Commission, NH GRANIT at UNH.

Base data (town boundaries, hydrography, roads, railroads and utility lines) are taken from the USGS Digital Line Graph data, 1:24,000, as archived in the GRANIT database at Complex Systems Research Center, Institute for thestudy of Earth, Oceans and Space, University of New Hampshire, Durham, NH; 1992-1999. Roads have been updated from work done by Rockingham Planning Commission and NH Department of Transportation. Partial updates have been completed through 2023.

N W E S

NH GRANIT
NH's Statewide GIS Clearinghouse

ROCKINGHAM PLANNING COMMISSION
theRPC.org

October 2004, Updated June 2024

O:/d-multiyear/d-NHOEM/d-towns/d-Portsmouth_upd09/d-maps/Map2_hazards2.mxd

CHAPTER III – NATURAL HAZARDS IN THE CITY OF PORTSMOUTH

Introduction

The first step in planning for natural hazard mitigation is to identify hazards that may affect the city. Some communities are more susceptible to certain hazards (i.e., flooding near rivers, hurricanes on the seacoast, etc.). The City of Portsmouth is prone to several types of natural hazards. These hazards include flooding, hurricanes or other high-wind events, severe winter weather, wildfires and conflagration, earthquakes, coastal storms, extreme temperatures, drought, and sea-level rise and increased precipitation events arising from climate change, and infectious disease. Other natural hazards can and do affect the City of Portsmouth, but these were the hazards prioritized by the Committee for mitigation planning. These hazards were considered to occur with regularity and/or to have high damage potential.

Natural hazards that are included in the State's Hazard Mitigation Plan 2023 Update that are not included in this Plan include: landslide, subsidence, radon, avalanche, solar storm, and space weather. Subsidence and avalanche are rated by the State as having Low and No risk in Rockingham County, respectively; due to this they were left out of the plan. Portsmouth has no record of landslides and little chance of one occurring that could possibly damage property or cause injury, so landslides were not included in this Plan. The State's Plan indicates that Rockingham County is at Moderate risk to radon and this hazard was not included in this Plan. When compared to natural hazards that could be potentially devastating to the City, such as hurricanes or natural hazards that occur with regularity, such as flooding or winter storms, it was not considered an effective use of the Committee's time to include radon on the Plan at this time. Solar storms and space weather are rated as a low risk for all of New Hampshire. There are no significant past occurrences of impact from space weather or solar storms in the state per the State Plan Update 2023, so the Committee did not include these hazards in the Plan Update.

The hazard profiles below include a description of the natural hazard, the geographic location of each natural hazard (if applicable), the extent of the natural hazard (e.g. magnitude or severity), probability, past occurrences, and community vulnerability. Past occurrences of natural hazards were mapped on Map 2: Past and Future Hazards. Community vulnerability identifies the specific areas, general type of structures, specific structures, or general vulnerability of Portsmouth to each natural hazard. Probability was defined as high, a roughly 66-100% chance of reoccurrence annually; medium, roughly a 33-66% chance of reoccurrence annually; and low, roughly a 0-33% chance of reoccurrence annually.

Flooding

Description - Floods are defined as a temporary overflow of water onto lands that are not normally covered by water. Flooding results from the overflow of major rivers and tributaries, storm surges, and inadequate stormwater management. Floods can cause loss of life, property damage, crop damage, and water supply contamination. Floods can also disrupt travel routes on roads and bridges.

Inland floods are most likely to occur in the spring due to the increase in rainfall and melting of snow; however, floods can occur at any time of the year. A sudden thaw in the winter or a major

downpour in any season can cause flooding because there is suddenly a lot of water in one place with nowhere to go.

- **100-year Floodplain Events** - Floodplains are usually located in lowlands near rivers, and flood on a regular basis. The term 100-year flood does not mean that flood will occur once every 100 years. It is a statement of probability that scientists and engineers use to describe how one flood compares to others that are likely to occur. It is more accurate to use the phrase "1% annual chance flood". What this means is that there is a 1% chance of a flood of that size happening in any year.

- **Erosion and Mudslides** - Erosion is the process of wind and water wearing away soil. Typically, in New Hampshire, the land along rivers is relatively heavily developed. Mudslides may be formed when a layer of soil atop a slope becomes saturated by significant precipitation and slides along a more cohesive layer of soil or rock. Erosion and mudslides become significant threats to development during floods. Floods speed up the process of erosion and increase the risk of mudslides.

- **Rapid Snowpack Melt** - Warm temperatures and heavy rains cause rapid snowmelt. Quickly melting snow coupled with moderate to heavy rains are prime conditions for flooding.

- **River Ice Jams** - Rising waters in early spring may break ice into chunks, which float downstream and often pile up, causing flooding. Small rivers and streams pose special flooding risks because they are easily blocked by jams. Ice in riverbeds and against structures presents significant flooding threats to bridges, roads, and the surrounding lands.

- **Dam Breach and Failure** - Dam failure results in rapid loss of water that is normally held by the dam. These kinds of floods can be extremely dangerous and pose a significant threat to both life and property.

- **Severe Storms** - Flooding associated with severe storms can inflict heavy damage to property. Heavy rains during severe storms are a common cause of inland flooding.

- **Sea Level Rise, Coastal Flooding, Storm Surge, and Compound Flooding** – Portsmouth's tidal coastline along the Piscataqua River means homes and businesses, roadways and infrastructure, and critical natural habitats such as salt marsh and mud flats are at risk due to coastal flooding caused by storm surges and rising sea level. A storm surge, especially when coupled with astronomical high tides and sea level rise, presents a threat to all land areas adjacent to the marine environment. Compound flooding can occur when storm surge and heavy precipitation happen concurrently. High tide or surge water levels can impede stormwater draining, causing flooding inland. The risks of flood impacts from compound flooding in low-lying coastal areas is often much greater than from either coastal flooding or inland flooding in isolation. The city has completed several climate adaptation and resiliency initiatives to identify areas most at risk of flooding.

Research shows the climate of New Hampshire, and the Seacoast region has changed over the past century and predicts the future climate of the region will be affected by human activities that are warming the planet. Overall, New England has been getting warmer and wetter over the last century, and the rate of change has increased over the last four decades. The challenges posed by climate change, such as more intense storms, frequent heavy precipitation, heat waves, drought, extreme flooding, and higher sea levels could significantly alter the types and magnitudes of hazards faced by Portsmouth.

Location - Portsmouth is vulnerable to flooding in several locations. Generally, the city is at risk within the Flood Zones identified by FEMA on Flood Insurance Rate Maps (FIRM) as well as the extended flood hazard areas defined by the City's Zoning Ordinance. Portsmouth has three flood zones: A, AE, and O. There are also several areas susceptible to flooding that are not within these flood zones.

In addition, there are several studies completed by the city, Rockingham Planning Commission, and the State of New Hampshire that have identified areas in Portsmouth that are experiencing repeated flooding or are predicted to experience repeated flooding. These studies include the 2025 Master Plan, 2024 Emergency Operations Plan, 2023 Seacoast Transportation Corridors Vulnerability Assessment, 2018 Historic Resources Climate Change Vulnerability Assessment and Adaptation Plan, 2017 Prescott Park Master Plan, 2015 Climate Change Vulnerability Assessment, and 2015 Climate Resilience Evaluation and Awareness Exercise Tool and Report. Map 2: Past and Future Hazards highlights areas prone to flooding and other natural hazards.

The Committee identified the following areas of Portsmouth at risk of recurring flooding or the high potential for future flooding:

- North Mill Pond
- South Mill Pond
- South End
- Peirce Island
- Little Harbour
- Sagamore Creek

These areas contain significant historical, cultural, and economic development resources, including Strawbery Banke and the Historic District, and the downtown business district, which is central to the Port of New Hampshire and the region's tourism, recreation, and fisheries economy.

Extent – Portsmouth's coast is vulnerable to flooding from major coastal storms year-round. Tropical storms and hurricanes are a threat from late summer through fall. Extra-tropical storms, such as Nor'Easters, can occur in any month. These storms bring strong onshore winds, causing significant changes in the water level along the coast in addition to tides. Storm surge can result in significant flooding and damage to the natural and built environment and is exacerbated by rising-sea levels. The extent of flooding in Portsmouth can range from minimal to severe. Minimal flooding can result in high water alongside roads and in yards; severe flooding can result in washed out roads and homes and businesses isolated by high and fast-moving water. The extent of the flood zones can be seen in Map 2: Past and Future Hazards. The NH Dam Bureau reports there are three active dams in Portsmouth, listed below. Two of the dams are categorized as Non-Menace and one is categorized as Low Hazard.

Dams – The State of New Hampshire places every dam into one of four classifications, which are differentiated by the degree of potential damage that a failure of the dam is expected to cause. The classifications are as follows:

- Non-Menace structure – not a menace because it is in a location and of a size that failure or mis-operation of the dam would not result in probable loss of life or loss to property, less than six feet in height if it has a storage capacity greater than 50-acre feet, or less than 25 feet in height if it has a storage capacity of 15 to 50 acre-feet.

- Low Hazard structure – has a low hazard potential because it is in a location and of a size that failure or mis-operation of the dam would result in no possible loss of life, low economic loss to structures or property, structural damage to local or private roads that could render roads impassable, the release of liquid industrial, agricultural or commercial wastes, septage or contaminated sediment if the storage capacity is less than two-acre feet and is located more than 250 feet from a water body, reversible environmental losses to environmentally sensitive areas.

- Significant Hazard structure – has a significant hazard potential because it is in a location and of a size that failure or mis-operation of the dam would result in no probable loss of lives, major economic loss to structures or property, structural damage to a Class I or II road that could render the road impassable, major environmental or public health losses.

- High Hazard structure – has a high hazard potential because it is in a location and of a size that failure or mis-operation of the dam would result in probable loss of human life, structural damage to an interstate highway which could rend the road impassable, the release of a quantity and concentration of hazardous waste, and any other circumstance that would more likely cause one or more deaths.

Table 1 - Active Dams in Portsmouth
Source: NH Dam Bureau, June 2024

Dam Name	Dam Owner	Hazard Classification	River/Source	Height/ Impoundment Area
South Mill Pond Dam	City of Portsmouth	Low	Atlantic Ocean	13.5 feet/9 acres
Sagamore Creek Dam	Iafolla Co.	Non-Menace	Sagamore Creek	8 feet/1 acre
Homewoods by Hilton Detention Pond Dam	Doaks LLC	Non-Menace	Runoff	13 feet/0.17 acre

Probability - The probability of flooding roadways and properties from heavy rain, storm surge, rapid snow melting, and compound flooding is high, especially in the areas listed above. The NH Dam Bureau classifies one dam owned by the City as Low Hazard and two privately owned dams

as Non-Menace, as described in Table 2. The City works with dam owners and abutters to monitor dam integrity and manage water levels. The City also regularly assesses culverts to ensure integrity and the ability to pass stormwater. See Table 3, Hazard Identification and Risk Assessment.

Past Occurrence – Flooding is the most common hazard impacting Portsmouth. The City's location along the tidal Piscastaqua River increases the risks posed by climate change, including sea-level rise, coastal storm surge, compound flooding, and extreme precipitation events. Portsmouth and surrounding coastal communities experience frequent inundation of roads and properties from storm events and high astronomical tides. Several flood events have occurred since the 2017 Plan Update, including January 13, 2024, when the combination of a high tide at 9.6 feet, a storm surge of two feet, one inch of rain combined with snow melt, and 30 mph winds resulted in widespread flooding across roadways and properties in downtown and low-lying neighborhoods. Strawbery Banke Museum experienced unprecedented flooding, damaging historic buildings. Extensive coastal flooding impacted Portsmouth on December 23, 2022, when a winter storm combined with peak high tide to create a nearly three-foot storm surge. The Seavey Island tide gauge along the Maine/New Hampshire border registered the peak tide at 12.5 feet, a full foot above flood stage. Storms in July 2023 and March 2018 also resulted in extensive flooding. Several locations were identified by the Committee as areas of chronic reoccurring flooding or high potential for future flooding, as listed above and identified on Map 2 and listed above. The City has not experienced a dam failure and maintains a pro-active dam management program.

Community Vulnerability – The Committee identified several areas in Portsmouth as being vulnerable to flooding caused by heavy rains, coastal high tides, storm surge, compound flooding, snow melt, ice jams, and rising sea-level. These areas are listed above and depicted on Map 2. Closure of these roads due to high water and/or unsafe driving conditions can prevent travel to homes, schools, and businesses, and restrict emergency response vehicles. High water levels and swiftly moving water can also cause culvert failure and erosion, undermining road safety.

National Flood Insurance Program (NFIP) - In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer funded disaster relief for flood victims and the increasing amount of damage caused by floods. The Federal Insurance and Mitigation Administration (FIMA), a component of the Federal Emergency Management Agency (FEMA) manages the NFIP and oversees the floodplain management and mapping components of the program.

Communities participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce flood damage. In exchange, the NFIP makes federally subsidized flood insurance available to homeowners, renters, and business owners in these communities. Flood insurance, Federal Grants and loans, Federal disaster assistance and federal mortgage insurance is unavailable for the acquisition or construction of structures located in the floodplain shown on the NFIP maps for those communities that do not participate in the program.

To get secure financing to buy, build or improve structures in the Special Flood Hazard areas, it is legally required by federal law to purchase flood insurance. Lending institutions that are federally regulated or federally insured must determine if the structure is in the SFHA and must provide

written notice requiring flood insurance. Flood insurance is available to any property owner located in a community participating in NFIP.

Table 2: Portsmouth NFIP Policy and Loss Statistics
Source: NH Office of Planning and Development, June 2024

Policies in force	Insurance in Force	Number of Paid Losses (since 1978)	Total Losses Paid (since 1978)
132 82 Pre-FIRM policies 50 Post-FIRM policies 71 single-family residential 15 multi-family residential 28 other residential 18 non-residential	$41,636,000	40	$506,074

Portsmouth joined the Regular Program of the NFIP on May 17, 1982. Initial FIRMs were dated May 17, 1982, and current FIRM and FIS are dated January 29, 2021. The most recent community assistance visit was August 17, 2016.

Portsmouth has adopted and implemented substantial improvements to the City's floodplain management regulations. The Floodplain Overlay District encompasses Special Flood Hazard Areas and Extended Flood Hazards Areas. The City's Planning and Sustainability Department, Zoning and Code Enforcement Department, Emergency Management, Planning Board, and City Council guide development and ensure compliance and enforcement of NFIP standards. Code Enforcement oversees floodplain administration and is responsible for determining substantial improvement and damage. These determinations are made for all development in the Floodplain Overlay District that proposes to improve an existing structure, including alterations, movement, enlargement, replacement, repair, additions, rehabilitations, renovations, repairs of damage from any origin, and other improvements of or work on such structure including within its existing footprint.

The City has created a robust outreach and awareness program to inform residents and property owners about NFIP, City floodplain management regulations, and flood mitigation initiatives. This information is available on the City's website. In addition, outreach to residents and property owners in the floodplain is a cornerstone of the City's many Climate and Resiliency projects, enabling the City to partner with property owners to define and prioritize the actions needed from City staff and leadership.

Repetitive Loss Properties - A specific target group of repetitive loss properties is identified and serviced separately from other NFIP policies by the Special Direct Facility (SDF). The target group includes every NFIP insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced four or more paid losses, two paid flood losses within a 10-year period that equal or exceed the current value of the insured property, or three

or more paid losses that equal or exceed the current value of the insured property, regardless of any changes of ownership, since the buildings construction or back to 1978. Target group policies are afforded coverage, whether new or renewal, only through the SDF.

The FEMA Regional Office provides information about repetitive loss properties to State and local floodplain management officials. The FEMA Regional Office may also offer property owners building inspection and financial incentives for undertaking measures to mitigate future flood losses. These measures include elevating buildings from the flood area, and in some cases drainage improvement projects. If the property owners agree to mitigation measures, their property may be removed from the target list and would no longer be serviced by the SDF.

Portsmouth NFIP Repetitive Flooding - As of June 2024, Portsmouth has had five repetitive loss buildings with payments totaling $88,096.05.

Floodplain Management Goals for Reducing Flood Risks - A major objective to floodplain management is to continue participation in the NFIP. Communities that agree to manage Special Flood hazard Areas shown on NFIP maps participate in the NFIP by adopting minimum standards. The minimum requirements are the adoption of the floodplain Ordinances and Subdivision/Site Plan Review requirements for land designated as Special Flood hazard Areas. Under Federal Law, any structure located in a floodplain is required to have flood insurance. Federally subsidized flood insurance is available to any property owner located in a community participating in the NFIP. Communities that fail to comply with the NFIP will be put on probation and/or suspended. Probation is a first warning where all policy holders receive a letter notifying them of a $50 increase in their insurance. In the event of suspension, the policyholders lose their NFIP insurance and are left to purchase insurance in the private sector, which is of significantly higher cost. If a community is having difficulty complying with NFIP policies, FEMA is available to meet with staff and volunteers to work through the difficulties and clear up any confusion before placing the community on probation or suspension.

Potential Administrative Techniques to Minimize Flood Losses in Portsmouth - A potential step in mitigating flood damage is participating in NFIP. Portsmouth continues to consistently enforce NFIP compliant policies to continue its participation in this program and has effectively worked within the provisions of NFIP. Below is a list of actions Portsmouth should consider, or continue to perform, to comply with NFIP:

- Participate in NFIP training offered by the State and/or FEMA (or in other training) that addresses flood hazard planning and management.
- Establish Mutual Aid Agreements with neighboring communities to address administering the NFIP following a major storm event.
- Address NFIP monitoring and compliance activities.
- Revise/adopt subdivision regulations, erosion control regulations, board of health regulations to improve floodplain management in the community.
- Prepare, distribute, or make available NFIP insurance and building codes explanatory pamphlets or booklet.
- Identify and become knowledgeable of non-compliant structures in the community.

- Inspect foundations at time of completion before framing to determine if lowest floor is at or above Base Flood Elevation (BFE) if they are in the floodplain.
- Require the use of elevation certificates.
- Enhance local officials, builders, developers, local citizens, and other stakeholders' knowledge of how to read and interpret the FIRM.
- Work with elected officials, the state and FEMA to correct existing compliance issues and prevent any future NFIP compliance issues through continuous communications, training, and education.
- Prohibit septic systems in floodplains.

Hurricane-High Wind Events

Description - Significantly high winds occur especially during hurricanes, tornadoes, winter storms and thunderstorms. Falling objects and downed power lines are dangerous risks associated with high winds. In addition, property damage and downed trees are common during high wind occurrences.

- **Hurricanes and Coastal Storms** - A hurricane is a tropical cyclone in which winds reach speeds of 74 miles per hour or more and blow in a large spiral around a relatively calm center. The eye of the storm is usually 20-30 miles wide and may extend over 400 miles. High winds are a primary cause of hurricane-inflicted loss of life and property damage. Hurricanes can also include coastal storm surges. The Saffir–Simpson hurricane wind scale (SSHWS), or the Saffir–Simpson hurricane scale (SSHS) for short, classifies hurricanes into five categories distinguished by the intensities of their sustained winds. To be classified as a hurricane, a tropical cyclone must have maximum sustained winds of at least 74 mph, Category 1. The highest classification in the scale, Category 5, is reserved for storms with winds exceeding 156 mph. The Saffir/Simpson Hurricane Scale is included in Appendix C. Portsmouth's proximity to the Atlantic Ocean makes the community vulnerable to coastal storms and the associated storm surge.

- **Tornadoe***s* - A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity, and the convergence of warm, moist air at low levels with cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down, they become a force of destruction. Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. Damage paths can be more than one mile wide and 50 miles long. Violent winds and debris slamming into buildings cause the most structural damage. The Enhanced Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison with a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

- **Severe Thunderstorms** - All thunderstorms contain lightning. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to ambient temperatures. This rapid expansion and

contraction of the air causes a shock wave that we hear as thunder, which can damage building walls and break glass.

- **Lightning** - Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through the air, it heats the air to a temperature of about 50,000 degrees Fahrenheit, considerably hotter than the surface of the sun. Lightning strikes can cause death, injury, and property damage.

- **Hail** - Hailstones are balls of ice that grow as they're held up by winds, known as updrafts, which blow upwards in thunderstorms. The updrafts carry droplets of supercooled water – water at a below freezing temperature – but not yet ice. The supercooled water droplets hit the balls of ice and freeze instantly, making the hailstones grow. The faster the updraft, the bigger the stones can grow. Most hailstones are smaller in diameter than a dime, but stones weighing more than a pound have been recorded. Details of how hailstones grow are complicated, but the results are irregular balls of ice that can be as large as baseballs, sometimes even bigger. While crops are the major victims, hail is also a hazard to vehicles and windows.

Location - Hurricane events are more potentially damaging with increasing proximity to the coast. Portsmouth's location adjacent to the Atlantic Coast makes hurricanes and high wind events severe threats. For this Plan, high-wind and lightning events were considered to have an equal chance of affecting any part of Portsmouth.

Extent – Hurricane strength is measured using the Saffir-Simpson scale, located in the appendix of this Plan. Portsmouth is located within Zone II hurricane-susceptible region (indicating a design wind speed of 160 mph). From 1950 to 2018 Rockingham County was subject to 9 tornado events, these included 2 type F0 (Tornado, 40-72 mph), 2 type F1 (Moderate Tornado, 73-112 mph), 4 type F2 (Significant Tornado, 113-157 mph) and 1 type F3 (Severe Tornado, 158-206 mph). Type 3 tornados can cause severe damage including tearing the roofs and walls from well-constructed homes, trees can be uprooted, trains over-turned, and cars lifted off the ground and thrown. Between 1900 and 2018 2 hurricanes have made landfall in New Hampshire, category 1 and category 2. Measurement scales for thunderstorms, lightning risk, and hail are in the appendix of this Plan.

Probability -High. The State of New Hampshire's Multi-Hazard Mitigation Plan Update 2023 rates Rockingham County with high likelihood of hurricane, tornado, and "Nor'-Easters" events. Also, it rates the risk of downbursts, lightning, and hail events as moderate. See Table 3, Hazard Identification and Risk Assessment.

Past Occurrence – Between 1635 and 2018 14 hurricanes have impacted the State of New Hampshire. The worst of these occurred on September 21, 1938, with wind speeds of up to 186 mph in MA and 138 mph elsewhere. Thirteen of 494 people killed by this storm were residents of New Hampshire. The Storm caused $12,337,643 in damage (1938 dollars); timber not included. Hurricanes Sandy and Irene created areas of localized flooding in Portsmouth and power loss. High wind events in 2010, 2014, 2018, 2023, and 2024 resulted in extensive power outages, downed wires and trees in neighborhoods throughout the city. Lightning strikes from a fast-

moving thunderstorm on June 4, 2024, caused two separate house fires within minutes of each other.

Community Vulnerability – The Committee determined that high winds and heavy rain associated with hurricanes, as well as lightning and hail, can impact every neighborhood in Portsmouth before, during, and after the storm, resulting in downed trees, flooding of ponds, rivers, streams, roads and basements, and damage to home, businesses, and infrastructure. Infrastructure most at risk includes power lines, shoreline infrastructure, trees, shingled roofs, chimneys, shorefront neighborhoods, boats and docks, parks and harbors.

Severe Winter Weather

Description – Severe winter weather in the form of heavy snowstorms, ice storms and Nor'easters are a threat to the community with subzero temperatures from extreme wind chill and storms causing low visibility for commuters. Heavy snow loads from storms are known to collapse buildings. Ice storms disrupt power and communication services. Extreme cold affects vulnerable populations, including the elderly and unhoused.

- **Heavy Snowstorms** - A winter storm can range from moderate snow to blizzard conditions. Blizzard conditions are considered blinding wind-driven snow over 35 mph that lasts at least three hours. A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period.

- **Ice Storms** - An ice storm involves rain, which freezes upon impact. Ice coating at least one-fourth inch in thickness is heavy enough to damage trees, overhead wires, and similar objects. Ice storms also often produce widespread power outages.

- **Nor'easter** - A Nor'easter is a large weather system traveling from South to North passing along or near the seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas form a Northeasterly direction. The sustained winds may meet or exceed hurricane force, with larger bursts, and may exceed hurricane events by many hours (or days) in terms of duration.

Location - Severe winter weather events have an equal chance of affecting any part of Portsmouth.

Extent - Large snow events in Southeastern New Hampshire can produce 30 inches of snow. Portions of central New Hampshire recorded snowfalls of 98" during one slow moving storm in February of 1969. Ice storms occur regularly in New England. The Sperry-Piltz ice accumulation scale is found in the Appendix of this Plan. Many severe ice storms have been recorded that have affected New Hampshire since 1929. These events caused disruption of transportation, loss of power and millions of dollars in damage.

Probability - High. The State of New Hampshire's Multi-Hazard Mitigation Plan Update 2023 rates Rockingham County with high likelihood of heavy snows and ice storms. See Table 3, Hazard Identification and Risk Assessment.

Past Occurrence – Portsmouth has been impacted by six severe winter storms in the past five years. Two Nor'easters in 2018 and a heavy snowstorm in December 2022 resulted in power outages and damage to coastal infrastructure. At its peak the 2022 snowstorm dropped four inches of snow in one hour. Two Nor'Easters in March 2023 and March 2024 resulted in wet, heavy snowfall amounts over six inches combined with gusty winds, resulting in power outages and required extensive snow removal, removal of fallen trees, and utility repairs.

Community Vulnerability - Severe winter weather has struck Portsmouth and every other community in the region on an annual basis in recent memory. The Committee determined that heavy snow, strong and gusty winds, and frigid temperatures can impact all parts of the city equally, resulting in downed trees and power lines, extended power outages, and unsafe driving conditions. Extended power outages and the resulting loss of heat in homes of elderly and vulnerable residents are of concern. Rapid snow melting after severe winter weather can result in flooding of rivers and streams, posing risk to roads and structures. The Committee identified the elderly and vulnerable populations, utility lines and towers, and trees at greatest risk from severe winter weather.

Wildfire

Description - Wildfire is defined as an uncontrolled and rapidly spreading fire, including grass and forest fires. A forest fire is an uncontrolled fire in a woody area. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassy areas.

Location - The Committee identified the southern half of the city and the forest surrounding the Urban Forestry Center as most at risk of wildfire.

Extent - A wildfire in Portsmouth is unlikely, but if a crown fire were to occur it could be very damaging to structures abutting wooded areas of the city The neighborhoods in the southern half of the city are relatively low-density residential compared to the more urban center of the city. A large grass fire could damage structures and neighborhood buildings near large open areas. A large grass and forest fire has not impacted Portsmouth in recent memory. The largest wildfire in Portsmouth has not surpassed six acres. The Hazard Mitigation Committee expects a wildfire of less than 10 acres to be the worst-case scenario. The Wildland-Urban Interface Scale, a tool to quantify the expected severity of wildfire events in developed areas, is included in Appendix K.

Probability - Medium. The State of New Hampshire's Multi-Hazard Mitigation Plan Update 2023 rates Rockingham County with moderate risk to wildfires. See Table 3, Hazard Identification and Risk Assessment

Past Occurrence - Most wildfires in Portsmouth are minor brush fires. No Large fires have occurred within recent memory. Smoke form Canadian wildfires impacted air quality in 2023.

Community Vulnerability - The Committee determined that all forested and open areas in Portsmouth are prone to wildfires, with the threat increasing during periods of drought. Increasing development in the southern and more forested part of the city increases vulnerability

to wildfire as the number of structures and the population increases. The Committee summarized the threat as follows:

- Structures located near large open vegetated areas are prone to lightning strikes.
- Vulnerability increases during drought events.
- Tree debris created by high wind and winter storm events.

Conflagration

Description – Conflagration is a large destructive fire. In this Plan, it refers to an urban fire that is spread due to tightly spaced buildings.

Location – The Committee identified the urban center of Portsmouth as at risk of conflagration.

Extent – The extent of conflagration could be extreme given the tight building density and old wooden structures located in downtown Portsmouth and abutting neighborhoods.

Probability – The Committee determined the probability of conflagration is medium. See Table 3, Hazard Identification and Risk Assessment.

Past Occurrence – Three fires over a decade in the early 19th century destroyed 500 buildings in downtown Portsmouth, resulting in the brick buildings present today. Multi-alarm fires in downtown Portsmouth have occurred in 2013 and 2015. A fire destroyed the State Street Saloon downtown in April 2017, with over fifty departments responding.

Community Vulnerability – The Committee determined that closely situated wooden structures, historic buildings, and structures without adequate fire protection are most at risk of conflagration. Redevelopment in Portsmouth's downtown increases the risk of conflagration as building density and population increase.

Earthquakes

Description – Seismic activity including landslides and other geologic events. Geologic events are often associated with California, but New England is considered a moderate risk earthquake zone. An earthquake is a rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, and avalanches. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and end in vibrations of gradually diminishing force called aftershocks. The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake is determined using scales such as the Richter Magnitude Scale, located in the Appendix of this Plan.

Location – An earthquake has an equal chance of affecting all areas of Portsmouth.

Extent - New England is particularly vulnerable to the injury of its inhabitants and structural damage because of our built environment. Few New England States currently include seismic

design in their building codes. Massachusetts introduced earthquake design requirements into their building code in 1975 and Connecticut very recently did so. However, these specifications are for new buildings, or very significantly modified existing buildings only. Existing buildings, bridges, water supply lines, electrical power lines and facilities, etc. have rarely been designed for earthquake forces (New Hampshire has no such code specifications).

Probability - Moderate. The State of New Hampshire's Multi-Hazard Mitigation Plan 2023 ranks all the Counties in the State with at moderate risk to earthquakes. See Table 3, Hazard Identification and Risk Assessment.

Past Occurrence - Large earthquakes have not affected the City of Portsmouth within recent memory. The strongest damaging quakes to impact New Hampshire were centered in Tamworth on December 20 and 24, 1940, both with a measured magnitude of 5.8. The Hazard Mitigation Committee expects a magnitude 3.4 to 4.5 magnitude to be the worst-case scenario.

Community Vulnerability - The Committee determined that earthquakes do not pose a frequent threat to Portsmouth, but if one were to occur the most vulnerable structures include brick buildings, steeples, bridges and other infrastructure, dams, and utility lines, as well as secondary hazards such as fire, power outages, or a hazardous material leak or spill.

Drought

Description - Drought is a period of unusually constant dry weather that persists long enough to cause deficiencies in water supply (surface or underground). Droughts are slow-onset hazards that can severely affect municipal water supplies, private water wells, crops, recreation resources, and wildlife. The City of Portsmouth operates a regional water system that includes Portsmouth, Pease Tradeport, Newington, New Castle, Greenland, and portions of Rye and Madbury. Water supply wells and a reservoir are located outside of the City's limits. If drought conditions extend over several years, the direct and indirect economic impacts can be significant. High temperatures, high winds, and low humidity can worsen drought conditions and make areas more susceptible to wildfire. In addition, human actions and demands for water resources can accelerate drought-related impacts.

Location – The Committee determined that drought poses risks to the municipal water supply serving the city and to private wells. The risks of wildfire associated with drought conditions are greatest in forested and open grassland areas.

Extent - Although New Hampshire is typically thought of as a water-rich state, there are times the demand for water can be difficult to meet. A combination of increased population and extended periods of low precipitation can cause reduced water supplies. Drought can impact Portsmouth after extended periods with limited rain and snowfall, often for several months, and is a city-wide hazard, impacting both private wells and the City's municipal water system surface water and groundwater supplies. Rockingham County experienced extreme drought in 2021 and 2022 referred to as a D3 on the U.S. Drought Monitor Scale. The Hazard Mitigation Committee expects extreme drought to be the worst-case scenario. The City's DPW monitors the information provided by NH DES Drought Management Program. The U.S. Drought Monitor Scale is in the appendix of this Plan.

Probability - Low. See Table 3, Hazard Identification and Risk Assessment.

Past Occurrence - The State of New Hampshire Multi-Hazard Mitigation Plan Update 2023 rates Rockingham Count at low risk for drought. However, drought conditions persisted across southern New Hampshire for two of the last five years, resulting in the City activating a water-use restriction schedule in 2021 and 2022.

Community Vulnerability - The Committee determined that water supply and fire flow are the most at risk due to drought conditions. Increasing development and associated population growth, year-round and seasonal, also stress water supply during periods of drought.

Climate Change

Description - Climate is defined as the long-term, prevailing pattern of temperature, precipitation, and other weather variables at a given location as described by statistics, such as means and extremes. Climate differs from weather in that weather is the current state or short-term variation of these variables at a given location. Climate change is the observed change in atmospheric variables over time that are the result of natural and anthropogenic, or human-caused, influences. Climate change is directly related to the ongoing increase in global temperature, a rise that is influenced by the steady increase in the concentration of atmospheric greenhouse gases that has been occurring and continues to occur across the globe.

Location – Climate change can affect all areas of Portsmouth, in the form of increased temperatures, extreme precipitation events, drought, sea-level rise, and coastal storm surge. All these events could significantly alter the types and magnitudes of hazards impacting Portsmouth. Rising sea-levels are already impacting neighborhoods and infrastructure along the coastline and shoreline of tidal rivers and streams.

Extent – Extreme heat events impact Portsmouth for 3-4 days each summer and the number of days may increase as the result of climate change. The average annual temperature in New Hampshire has increased three degrees since the early 20th century. Winter warming has been larger than any other season. Future winter warming will have large effects on snowfall and snow cover. Flooding from extreme precipitation events, sea-level rise, and coastal storm surge increasingly impacts Portsmouth. Mean precipitation and precipitation extremes are projected to increase in the future, with associated increases in flooding. Portsmouth is planning for a 1-to-1.7-foot sea-level rise by 2050, and six-foot rise by 2010.

Probability – The Committee determined the probability of climate change impacting Portsmouth as high given the increase in hazard events since the last Plan Update. See Table 3, Hazard Identification and Risk Assessment.

Past Occurrence – Annually. Since the 2017 Plan Update, Portsmouth has experienced drought, extreme heat, coastal storms, sea-level rise, and extreme precipitation events, as described under the individual hazard.

Community Vulnerability - The Committee determined that all of Portsmouth is at risk of impacts associated with climate change and the effects of climate change pose real and significant threats to community safety, resilience, and quality of life. The Committee determined that climate change impacts the City in the following ways:

- Flooding of roadways, including evacuation routes, and homes and businesses due to rising sea-levels and increase in extrement precipitation events.
- Rising sea-levels along the coast also threaten City infrastructure, historic resources, and public recreation facilities.
- Increasing periods of extreme heat impact human health, especially among the elderly and vulnerable populations, and stress water supplies.

Extreme Temperatures

Description – Temperatures across New Hampshire have increased by an average of three degrees since 1901, the result of climate change. Warming is highest during the fall and winter seasons and is associated with a decrease in frequency and severity of cold extremes. Conditions of extreme heat are defined as a prolonged period of excessively hot weather, with temperatures above the average high temperature for a particular region for that time of year, often combined with high humidity. In New Hampshire, extreme heat conditions are defined as two days of temperatures over 90 degrees. The heat index is a measure of how hot it really feels when relative humidity is factored in with actual air temperature. The hottest temperature recorded in Portsmouth was 104 degrees on August 2, 1975.

Winter storms, blizzards, and episodes of high barometric pressure accompanied by clear night skies can bring extreme cold temperatures to the region, increasing the risk of frostbite and hypothermia. The risk of extended power outages increases during winter storms, increasing the vulnerability of elderly and vulnerable residents. The coldest temperature recorded in Portsmouth was -26 degree on January 22, 1984.

Location – Extreme temperatures can affect all areas of Portsmouth.

Extent - Extreme heat events impact Portsmouth for 3-4 days each summer, and extreme cold events impact the city 2-3 days each winter. Extreme heat events have impacted Portsmouth in 2021, 2023, and 2024, with temperatures exceeding 90 degrees.The National Weather Service Heat Index is included in this Plan as Appendix K, and the Wind Chill Chart is included as Appendix L.

Probablility – High.

Past Occurrence – Annually. The City opened cooling centers during an extreme heat event on Jne 19-21,2024.

Community Vulnerability - The Committee determined that all parts of Portsmouth are at risk of impacts associated with extreme temperatures. Extreme heat can cause heat-related illnesses, like heat stroke or heat exhaustion, which occur when the body is unable to cool itself fast enough.

The young, elderly and vulnerable populations are especially at risk of heat stroke.The Emergency Management Coordinator maintains a list of these populations, including addresses for homes, day care centers, and congregate care facilities.

Infectious Disease

Description – Infectious diseases are illnesses caused by organisms – such as bacteria, viruses, fungi, or parasites. Many organisms live in and on our bodies. They are normally harmless or even helpful, but under certain conditions, some organisms may cause disease. Some infectious diseases can be passed from person to person, some are transmitted by bites from insects or animals, and others are acquired by ingesting contaminated food or water or being exposed to organisms in the environment. Signs and symptoms vary depending on the organism causing the infection, but often include fever and fatigue. Mild infections get better on their own without treatment, while some life-threatening infections may require hospitalization. A definition of infectious diseases by the Mayo Clinic is in the Appendix.

According to the Unites States Centers for Disease Control and Prevention (CDC), the number of people with a disease that is usually present in a community is referred to as the baseline or endemic level of the disease. This number of infections is not necessarily the desired level, which may in fact be zero, but rather is the typical or normal number of people infected. In the absence of intervention and if the number of infections is not high enough to deplete the pool of susceptible persons, the disease may continue to occur at this level indefinitely. Thus, the baseline level is often regarded as the expected level of the disease. While some diseases are so rare in each population that a single case warrants an epidemiologic investigation (e.g., rabies, plague, polio), there are other diseases that occur more commonly so that only deviations from the norm (i.e., seeing more cases than expected) warrants investigation.

Epidemics occur when an agent (the organism) and susceptible hosts are present in adequate numbers, and the agent can be effectively conveyed from a source to the susceptible people. More specifically, an epidemic may result from a recent increase in amount or virulence of the agent, the recent introduction of the agent into a setting where it has not been before, an enhanced mode of transmission so that more susceptible persons are exposed, a change in the susceptibility of people's response to the agent, and/or factors that increase exposure or involve introduction through new portals of entry.

Epidemics may be caused by infectious diseases, which can be transmitted through food, water, the environment, or person-to-person or animal-to-person, and noninfectious diseases, such as chemical exposure, which causes increased rates of illness. Infectious diseases that may cause an epidemic can be broadly categorized into the following groups: foodborne (E.Coli), water (Giardiasis), vaccine preventable (Measles), sexually transmitted (HIV), person-to -person (TB), arthropod borne (Lyme), zoonotic (Rabies), and opportunistic fungal and fungal infections (Candidiasis). An epidemic may also result from a bioterrorist event in which an infectious agent is released into a susceptible population, often through an enhanced mode of transmission, such as aerosolizing.

Location – Infectious disease can affect all areas of Portsmouth.

Extent – The magnitude and severity of infectious disease is described by its speed of onset (how quickly people become sick, or cases are reported) and how widespread the infection is. Some infectious diseases are inherently more dangerous and deadly than others, but the best way to describe the extent of infectious diseases relates to the disease occurrence:

- Endemic – Constant presence and/or usual prevalence of a disease or infection agent in a population within a geographic area
- Hyperendemic – Persistent, high levels of disease occurrence.
- Cluster – Aggregation of cases grouped in place and time that are suspected to be greater than the number expected even though the expected number may not be known.
- Epidemic – An increase, usually sudden, in the number of cases of a disease above what is normally expected.
- Outbreak – The same as epidemic, but over a much smaller geographical area.
- Pandemic – Epidemic that has spread over several countries or continents, usually affecting many people.

Probability – The probability of infectious disease is high.

Past Occurrence – Infectious diseases, such as seasonal influenza, and gastrointestinal illness occur annually in Portsmouth. The COVID-19 pandemic impacted Portsmouth beginning in 2020 and the city continues to experience cases of COVID-19 and community transmission.

Community Vulnerability – The Committee determined that all parts of Portsmouth are at risk of impacts associated with infectious disease. Rates of illness, duration of disease, and the ability to treat or prevent illness once the causative agent is identified are just a few factors that will further determine the vulnerability of the population.

In response to the COVID-19 pandemic, City staff collaborated to oversee information sharing and coordination of the City's pandemic response. Information was distrubited via City and school newsletters and emails. The Police and Fire Departments and Health and Welfare Departments worked with City adminstration to form a task force to share information, and the Recreation Department and Housing Authority also worked as community liasons, coordinating and transporting food to elderly and homebound residents. The COVID-19 pandemic impacted all facets of municipal government, the general work force, and supply chains for everyday items

Table 3 summarizes Portsmouth's vulnerability to the natural hazards identified in this Plan Update. Flooding, from sea-level rise, coastal storm surge, and extreme precipiation events resulting from climate change, is the greatest risk facing Portsmouth. The City's location along a tidal river increases the probability that flooding will result in death or injury, physical losses and damages, and interrruptions of service. Portsmouth's historic downtown is an important economic development resource for the region and state. Locations vulnerable to flooding include critical infrastucture such as the wastewater treatment plant, Portsmouth Middle School, the public library, as well as commercial, industrial, and residential development, shoreland neighborhoods, and significant historical, cultural, and recreational resources, including Prescott Park and Strawbery Banke Museum.

Table 3 – Hazard Identification and Risk Assessment

Scoring for Probability Columns A, B & C	**Column A** Probability of death or injury	**Column B** Probability of physical losses and damage	**Column C** Probability of interruption of service	**Column D** Probability of occurring within 25 years	**Column E** (A+B+C/3) Impact average	**Column F** (D x E) Relative threat	**Column G** Risk
1=Very Low (0-20%)							**High** 13.0-21.9
2=Low (21-40%)							
3=Moderate (41-60%							**Medium** 6.0-12.9
4=High (61-80%)							
5=Very High (81-100%							**Low** 0-5.9
	Human Impact	**Property Impact**	**Business Impact**	**Probability of Occurrence**	**Severity**	**Risk Severity x Occurrence**	
Natural Hazard							
Flooding	4.00	5.00	5.00	5.00	4.66	23.30	High
Hurricane/High Wind	3.00	5.00	5.00	5.00	4.33	21.66	High
Coastal Storms	3.00	5.00	5.00	5.00	4.33	21.66	High
Severe Winter Weather	4.00	4.00	4.00	5.00	4.00	20.0	High
Climate Change includes sea-level rise, extreme precipitation events	2.00	5.00	5.00	5.00	4.00	20.00	High
Extreme Temperatures	3.00	3.00	2.00	5.00	2.66	13.33	High
Infectious Disease	5.00	1.00	5.00	4.00	3.66	14.66	High
Earthquakes	5.00	5.00	5.00	2.00	5.00	10.00	Medium
Wildfires	2.00	4.00	3.00	3.00	3.00	9.00	Medium
Conflagration	4.00	5.00	4.00	2.00	4.33	8.66	Medium
Drought	1.00	2.00	2.00	3.00	1.66	5.00	Low
Lightning/Hail	2.00	2.00	2.00	2.00	2.00	4.00	Low

Table 4 highlights Presidentially declared disaster and emergency declaration for natural hazard events in New Hampshire from 1986 – 2024.

Table 4: State of New Hampshire
Presidentially Declared Disasters (DR) and Emergency Declarations (EM) 1986-2024
Source: *State of NH Multi-Hazard Mitigation Plan, 2013 Update and FEMA*

Date Declared	Event	FEMA DR	Program	Amount	Counties Declared
08/27/86	Severe storms/flooding	FEMA-771-DR	PA	$1,005,000	Cheshire and Hillsborough
04/16/87	Severe storms/flooding	FEMA-789-DR	PA/IA	$4,888,889	Carroll, Cheshire, Grafton, Hillsborough, Merrimack, Rockingham, and Sullivan
08/29/90	Severe storms/winds	FEMA-876-DR	PA	$2,297,777	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, and Sullivan
09/09/91	Hurricane	FEMA-917-DR	PA	$2,293,449	Statewide
11/13/91	Coastal storm/flooding	FEMA-923-DR	PA/IA	$1,500,000	Rockingham
03/16/93	Heavy snow	FEMA-3101-DR	PA	$832,396	Statewide
01/03/96	Storms/floods	FEMA-1077-DR	PA	$2,220,384	Carroll, Cheshire, Coos, Grafton, Merrimack, and Sullivan
10/29/96	Severe storms/flooding	FEMA-1144-DR	PA	$2,341,273	Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
01/15/98	Ice storm	FEMA-1199-DR	PA/IA	$12,446,202	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Strafford, and Sullivan
07/02/98	Severe storms	FEMA-1231-DR	PA/IA	$3,420,120	Belknap, Carroll, Grafton, Merrimack, Rockingham, and Sullivan
10/18/99	Hurricane/tropical storm Floyd	FEMA-1305-DR	PA	$750,133	Belknap, Cheshire, and Grafton
3/2001	Snow emergency	FEMA-3166-EM	PA	$4,500,000	Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, and Strafford
2/17/2003 - 2/18/2003	Snow emergency	FEMA-3177-EM	PA	$3,000,000	Cheshire, Hillsborough, Merrimack, Rockingham, and Strafford
09/12/03	Severe storms/flooding	FEMA-1489-DR	PA	$1,300,000	Cheshire and Sullivan

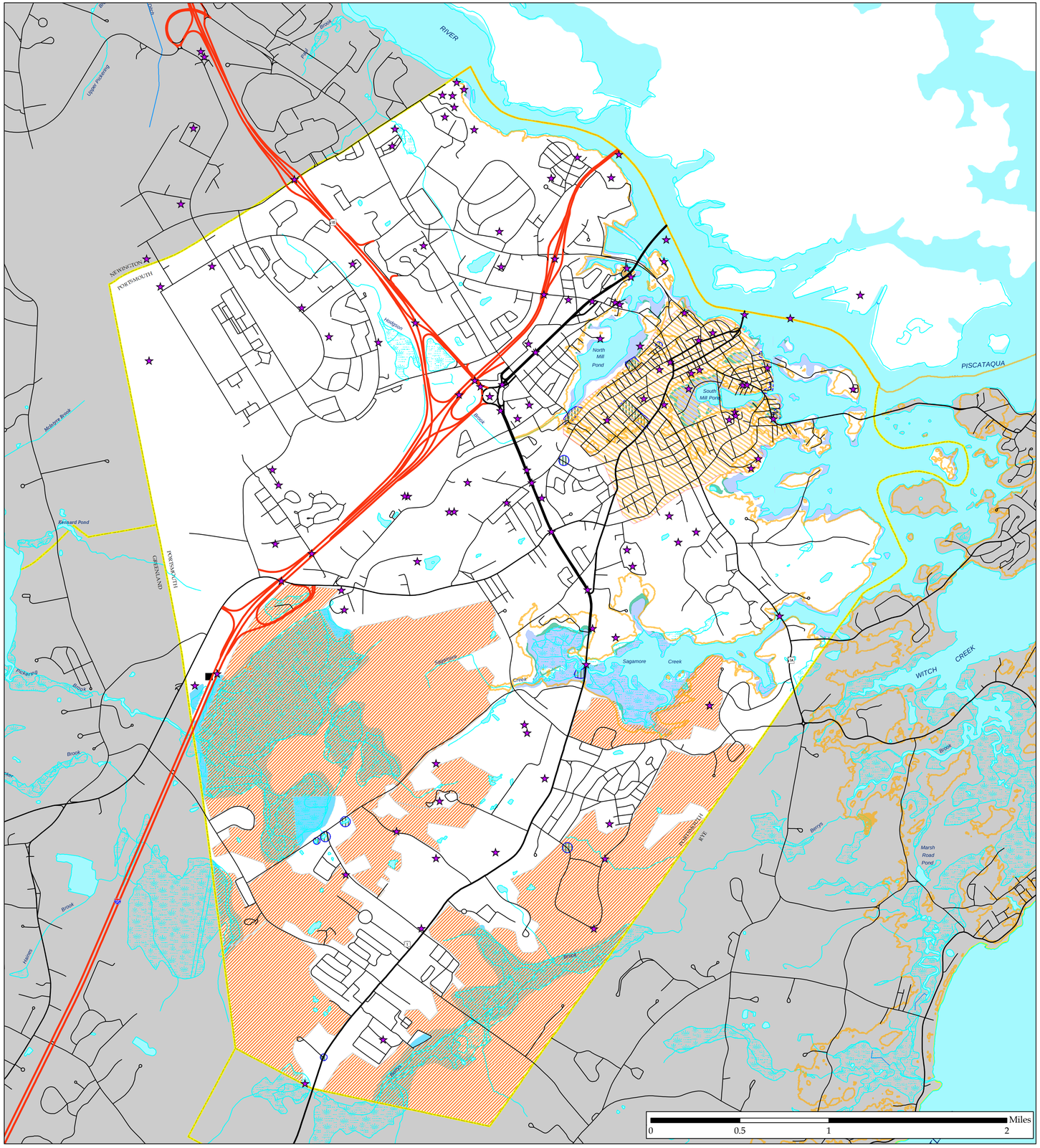
03/11/03	Snow emergency	FEMA-3177-EM	PA	$3,000,000	Cheshire, Hillsborough, Merrimack, Rockingham, and Strafford
01/15/04	Snow emergency	FEMA-3193-EM	PA	$3,200,000	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, and Sullivan
03/30/05	Snow emergency	FEMA-3207-EM	PA	$4,654,738	Belknap, Carroll, Cheshire, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
03/30/05	Snow emergency	FEMA-3208-EM	PA	$1,417,129	Carroll, Cheshire, Coos, Grafton, and Sullivan
04/28/05	Snow emergency	FEMA-3211-EM	PA	$2,677,536	Carroll, Cheshire, Hillsborough, Rockingham, and Sullivan
10/26/05	Severe storm/flooding	FEMA-1610-DR	PA/IA	$14,996,626	Belknap, Cheshire, Grafton, Hillsborough, Merrimack, and Sullivan
05/31/06	Severe storm/flooding	FEMA-1643-DR	PA/IA	$17,691,586	Belknap, Carroll, Grafton, Hillsborough, Merrimack, Rockingham, and Strafford
4/15/2007 - 4/23/2007	Severe storm/flooding	FEMA-1695-DR	PA/IA	$27,000,000	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
08/11/08	Severe storms/tornado/flooding	FEMA-1782-DR	PA	$1,691,240	Belknap, Carroll, Merrimack, Rockingham, and Strafford
09/05/08	Severe storms/flooding	FEMA-1787-DR	PA	$4,967,595	Belknap, Coos, and Grafton
10/03/08	Severe storms/flooding	FEMA-1799-DR	PA	$1,050,147	Hillsborough and Merrimack
12/11/08	Severe winter storm	FEMA-3297-EM	DF A/P A	$900,000	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
01/02/09	Severe winter storm	FEMA-1812-DR	DF A/P A	$19,789,657	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan

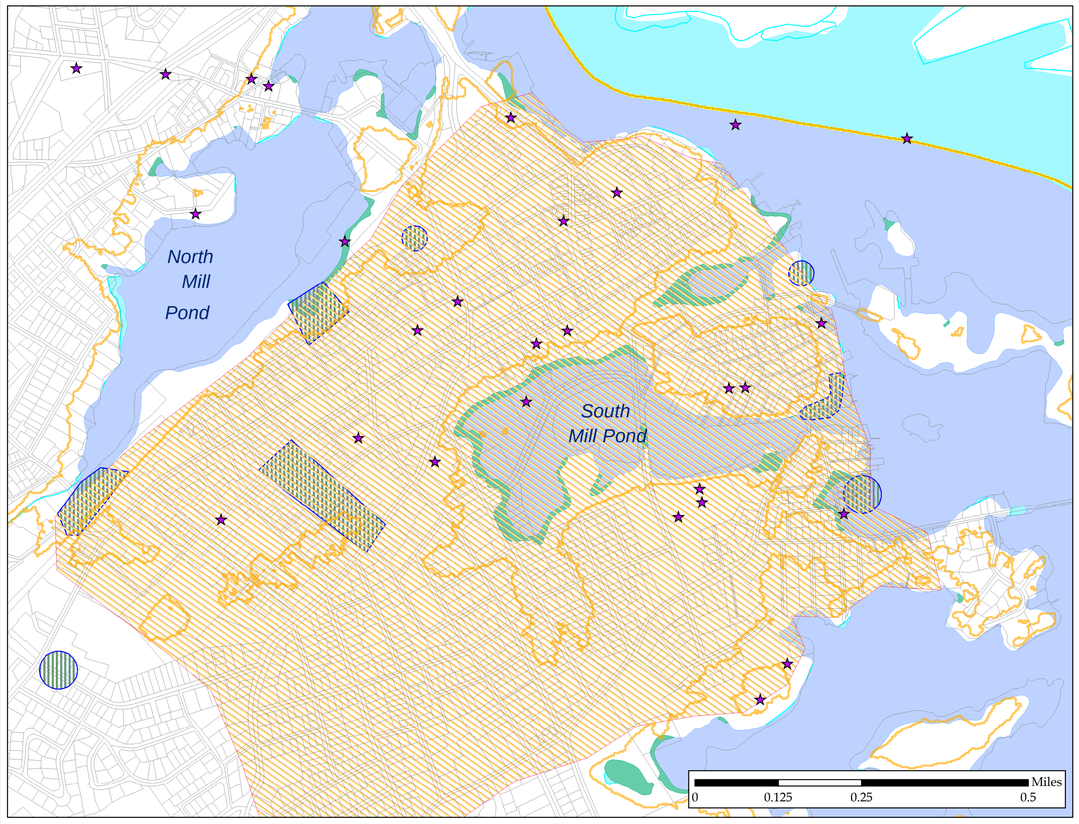
03/29/10	Severe winter storm	FEMA-1892-DR	PA	$9,103,138	Merrimack, Rockingham, Strafford, and Sullivan
05/12/10	Severe winter storm	FEMA-1913-DR	PA	$3,057,473	Hillsborough and Rockingham
07/22/11	Severe storms/flooding	FEMA-4006-DR	PA	$1,664,140	Coos and Grafton
09/03/11	Tropical storm Irene	FEMA-4026-DR	PA/IA	$11,101,752	Belknap, Carroll, Coos, Grafton, Merrimack, Strafford, and Sullivan
12/07/11	October Nor'easter	FEMA-4049-DR	PA	$4,411,457	Hillsborough and Rockingham
06/18/12	Severe storms/flooding	FEMA-4065-DR	PA	$3,046,189	Cheshire
10/30/12	Hurricane Sandy	DR-4095 EM-3360	PA DFA	$2,132,376	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
2/8/2013 - 2/10/2013	Severe storm/blizzard	DR-4105	PA	$6,127,598	Belknap, Carroll, Cheshire, Hillsborough, Merrimack, Strafford, and Rockingham
6/26/2013 – 7/3/2013	Severe storms/flooding	DR-4139	PA	$6,389,705	Cheshire, Sullivan, and Grafton
1/26/2015 – 1/29/2015	Severe winter storm/snowstorm	DR-4209	PA	$4,607,527	Strafford, Rockingham, and Hillsborough
3/14/2017 – 3/15/2017	Severe winter storm/snowstorm	DR-4316	PA	$8,306.550	Belknap and Carroll
1/1/2017 – 1/2/2017	Severe storms/flooding	DR-4329	PA	$6,218,291	Grafton and Coos
10/29/2017 - 11/1/2017	Severe Storm/flooding	DR-4355	PA	$4,710,744	Sullivan, Merrimack, Belknap, Carroll, Grafton, Coos
3/2/2018 – 3/8/2018	Severe Storm/flooding	DR-4370	PA, IA	$8,588,765	Rockingham
3/13/2018 – 3/14/2018	Severe Winter Storm/snowstorm	DR-4371	PA. IA	$1,981,453	Carroll, Strafford, Rockingham
7/11/2019- 7/12/2019	Severe Storm/flooding	DR-4457	PA	$675,907,70	Grafton
7/17/2021- 7/19/2021	Severe Storm/flooding	DR-4622	PA	$1,195,832	Cheshire
3/13/2020 – 5/11/2023	COVID-19 Pandemic	EM-3445	PA, IA	NA – still active	New Hampshire
1/20/2020- 5/11/2023	COVID-19 Pandemic	DR-4516	PA, IA	NA – still active	New Hampshire

7/29/2021-8/2/2021	Severe Storm/flooding	DR-4624	PA	$3,530,071	Cheshire, Sullivan
12/22/2022-12/25/2022	Severe Storm/flooding	DR-4693	PA	$1,251,386	Belknap, Carroll, Grafton, Coos
7/9/2023-7/13/2023	Severe Storm/flooding	DR-4740	PA	$170,675	Rockingham, Cheshire, Sullivan, Grafton, Belknap, Carroll, Coos
12/17/2023-12/21/2023	Severe Storm/flooding	DR-4761	PA	NA	Carroll, Grafton, Coos
1/9/2024-1/14/2024	Severe Storms/flooding	DR-4771	PA	NA	Rockingham, Grafton

Program Key: PA – Public Assistance; IA – Individual Assistance; DFA – Direct Federal Assistance

Map 2:
Past and Future Hazards, Portsmouth, New Hampshire





Portsmouth Critical Facilities

- Portsmouth Critical Facilities
- Portsmouth Storm Surge Zone
- Portsmouth Conflagration
- Portsmouth Floods
- Portsmouth Wildfire
- Portsmouth FEMA A Zone
- Portsmouth FEMA 500 Year Zone
- Portsmouth FEMA VE Zone
- Portsmouth FEMA AE Zone

BASE FEATURES

- Interstate
- US Route
- State Route
- Local
- Interstate Ramp
- Major Road Ramp
- Political Boundaries
- Stream or Shoreline
- Apparent Wetland Limit
- Intermittent Stream
- Other Surface Water Feature
- Wetlands (USGS)
- Surface Water Bodies
- Parcels

Past and future hazards were identified by the Hazard Mitigation Planning Committee from the City of Portsmouth. Information was gathered to accompany the development of a Hazard Mitigation Plan under the guidance and funding of the NH Bureau of Emergency Management. April, 2004, Updated Jan. 2017

FEMA Q3 Flood Data was created from the Federal Emergency Management Agency, National Flood Insurance Program, Q3 Flood Data DISC 23 (Maine, New Hampshire, Vermont). ARC/INFO Export files were retrieved from the CD cited above, imported into ARC/INFO, projected (from geographic coordinates, NAD27 to NH State Plane feet, NAD83), processed to reconstruct topology, and written back out as Export files. Any documentation files for the data can be had from RPC, and do not reflect the processing noted above and performed by Complex Systems Research Center, UNH, December, 1997.

Base data (town boundaries, hydrography, roads, railroads and utility lines) are taken from the USGS Digital Line Graph data, 1:24,000, as archived in the GRANIT database at Complex Systems Research Center, Institute for the study of Earth, Oceans and Space, University of New Hampshire, Durham, NH; 1992-1999. Roads have been updated from work done by Rockingham Planning Commission and NH Department of Transportation. Partial updates have been completed through 2000.

N W E S

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October 2004, Updated June 2024

O:/d-multiyear/d-NHOEM/d-towns/d-Portsmouth_upd09/d-maps/Map2_hazards2.mxd

CHAPTER IV - CRITICAL FACILITIES

The Critical Facilities List for the City of Portsmouth was developed by Portsmouth's Hazard Mitigation Committee. The Critical Facilities List has been broken up into three categories. The first category contains facilities needed for Emergency Response in the event of a disaster. The second category contains Non-Emergency Response Facilities that have been identified by the committee as non-essential. These are not required in an emergency response event but are considered essential for the everyday operation of Portsmouth. The third category contains Facilities/Populations that the committee wishes to protect in the event of a disaster. A description of critical facilities can be found in Table 5 through Table 7 and locations can be found on Map 3: Critical Facilities.

Table 5: Category 1 - Emergency Response Services and Facilities:

Critical Facility	Facility Type	City	Address
City Fuel Pumps	Emergency Fuel Storage	Portsmouth	680 Peverly Hill Rd.
Portsmouth Fire Department Station #3	Fire Station	Portsmouth	127 International Dr
Portsmouth Fire Department Station #2	Fire Station	Portsmouth	3010 Lafayette Rd.
Portsmouth Fire Station Fire Central	Fire Station	Portsmouth	170 Court St
Portsmouth Regional Hospital	Medical Facility	Portsmouth	333 Borthwick Ave.
Police Station	Police Station	Portsmouth	1 Junkins Ave.
Public Works	Public Works	Portsmouth	680 Peverly Hill Rd.
City Hall	City Hall	Portsmouth	1 Junkins Ave.

Table 6: Category 2- Non-Emergency Response Facilities:

Critical Facility	Facility Type	City	Address
Pease International Tradeport	Airport	Portsmouth	42 Airline Ave.
Sarah Mildred Long Bridge	Bridge	Portsmouth/Kittery, ME	Route 1 Bypass
Memorial Bridge	Bridge	Portsmouth/Kittery, ME	Route 1
Interstate 95 High-Level Bridge	Bridge	Portsmouth/Kittery, ME	I-95
Cell Antenna	Cell Tower	Portsmouth	680 Peverly Hill Rd
Verizon	Cell Tower	Portsmouth	56 Islington St
Capstar Radio Operating Company	Cell Tower	Portsmouth	815 Lafeyette Rd
Capstar Radio Operation Company	Cell Tower	Portsmouth	333 Borthwick Ave
Capstar Radio Operation Company	Cell Tower	Portsmouth	1555 Islington St
I-95	Critical Road	Portsmouth	Rt. 95

Critical Facility	Facility Type	City	Address
Rt. 1	Critical Road	Portsmouth	Rt. 1
Rt. 1 BYP	Critical Road	Portsmouth	Rt. 1 BYP
Rt. 16	Critical Road	Portsmouth	Rt. 16
Portsmouth Traffic Circle	Major Intersection	Portsmouth	Rt. 1, 16
Paul A. Doble Army Reserve Center	Government Facility	Portsmouth	145 West Rd.
Federal Building	Government Facility	Portsmouth	62 Daniel St
Naval Shipyard	Government Facility	Portsmouth	N\A
NH Air National Guard -157	Government Facility	Portsmouth	302 Newmarket St.
NH Port Authority	Government Facility	Portsmouth	555 Market St
Pease Control Tower	Government Facility	Newington	42 Airline Ave.
Portsmouth Harbor	Harbor	Portsmouth	Pistcataqua River
Clear Choice MD	Medical Facility	Portsmouth	750 Lafayette Rd.
Convenient MD Urgent Care	Medical Facility	Portsmouth	599 Lafayette Rd.
Portsmouth Regional Hospital Medical – Center for Rehabilitation and Wellness	Medical Facility	Portsmouth	155 Borthwick Ave.
Northeast Rehabilitation Hospital	Medical Facility	Portsmouth	105 Corporate Dr.
Cutts St. Substation	Power Station	Portsmouth	560 Maplewood Ave
Islington St. Substation	Power Station	Portsmouth	435 Interstate Bye-Pass
Jackson Hill Sub Station	Power Station	Portsmouth	2 Jackson Hill St
Lafayette Rd. Substation	Power Station	Portsmouth	940 Lafayette Road
Pease Substation	Power Station	Portsmouth	7 Exeter St.
PSNH	Power Station	Portsmouth	Maplewood Ave
Schiller (PSNH) Power Plant	Power Station	Portsmouth	400 Gosling Rd
Rail Yard	Railroad	Portsmouth	N\A
Atlantic Heights Pump Station	Sewage Facility	Portsmouth	134 Preble Way
Clough Drive Pump Station	Sewage Facility	Portsmouth	210 Clough Dr.
Constitution Avenue Pump Station	Sewage Facility	Portsmouth	280 Constitution Ave.
Corporate Drive Pump Station	Sewage Facility	Portsmouth	215 Corporate Dr.
Deer Street Pump Station	Sewage Facility	Portsmouth	2 Deer St.
Gosling Road Pump Station	Sewage Facility	Portsmouth	120 Gosling Rd
Griffin Road Pump Station	Sewage Facility	Portsmouth	205 Griffin Rd.
Heritage Avenue Pump Station	Sewage Facility	Portsmouth	329 Heritage Ave.
Lafayette Road Pump Station	Sewage Facility	Portsmouth	630 Lafayette Rd
Leslie Drive Pump Station	Sewage Facility	Portsmouth	590 Market St
Marcy Street Pump Station	Sewage Facility	Portsmouth	535 Marcy St.

Critical Facility	Facility Type	City	Address
Marsh Lane Pump Station	Sewage Facility	Portsmouth	4 Marsh Lane
Mechanic Street Pump Station	Sewage Facility	Portsmouth	113 Mechanic St.
Mill Pond Way Pump Station	Sewage Facility	Portsmouth	131 Mill Pond Way
Northwest Street Pump Station	Sewage Facility	Portsmouth	221 Northwest St
Pease Wastewater Treatment Plant	Sewage Facility	Portsmouth	135 Corporate Dr.
Peirce Island Sewage Treatment Plant	Sewage Facility	Portsmouth	200 Peirce Island Rd.
Rye Line Pump Station	Sewage Facility	Portsmouth	3618 Lafayette Rd
Tucker's Cove Pump Station	Sewage Facility	Portsmouth	91 Gosport Rd.
West Road Pump Station	Sewage Facility	Portsmouth	280 West Rd
Woodlands 1 Pump Station	Sewage Facility	Portsmouth	306 FW Hartford Dr.
Woodlands 2 Pump Station	Sewage Facility	Portsmouth	516 FW Hartford Dr.
Control Station #1	Water Facility	Madbury	60 Freshet Rd.
Newington Booster Station	Water Facility	Newington	Arboretum Dr.
Pease Water Treatment Plant	Water Facility	Portsmouth	Grafton Dr
Water Treatment Plant	Water Facility	Madbury	60 Freshet Rd.
Bellamy Reservoir Dam	Water Facility-Reservoir	Madbury	Mill Hill Rd.
Constitution Avenue Tank	Water Tank	Portsmouth	95 Constitution Ave.
Hobbs Hill Tank	Water Tank	Portsmouth	International Dr
Newington Booster Station Tank	Water Tank	Newington	165 Arboretum Drive
NHANG Water Tank	Water Tank	Newington	182 Arboretum Dr.
Spinney Road Tank	Water Tank	Portsmouth	Spinney Lane
Collins Well	Water Facility-Well	Portsmouth	Harvard St
Greenland Well #5	Water Facility-Well	Greenland	Post Rd.
Harrison Well	Water Facility-Well	Portsmouth	Grafton Dr
Haven Well	Water Facility-Well	Portsmouth	Airport Taxiway
Madbury Well #2	Water Facility-Well	Madbury	60 Freshet Rd.
Madbury Well #3	Water Facility-Well	Madbury	60 Freshet Rd.
Madbury Well #4	Water Facility-Well	Madbury	60 Freshet Rd.
Portsmouth Well #1	Water Facility-Well	Portsmouth	Griffin Rd
Smith Well	Water Facility-Well	Portsmouth	Country Club Rd

Table 7: Category 3 - Facilities/Populations to Protect:

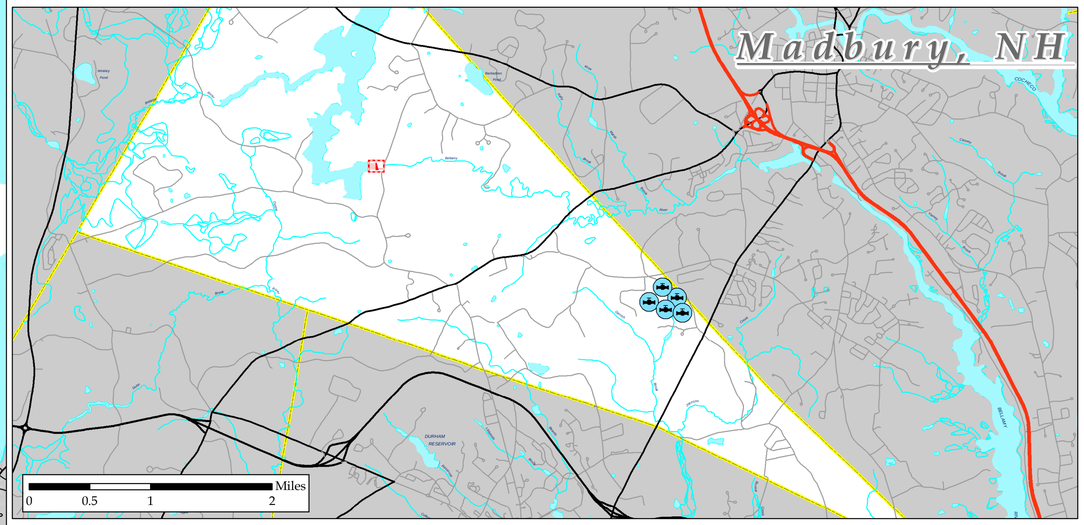
The third category contains people and facilities that need to be protected in the event of a disaster.

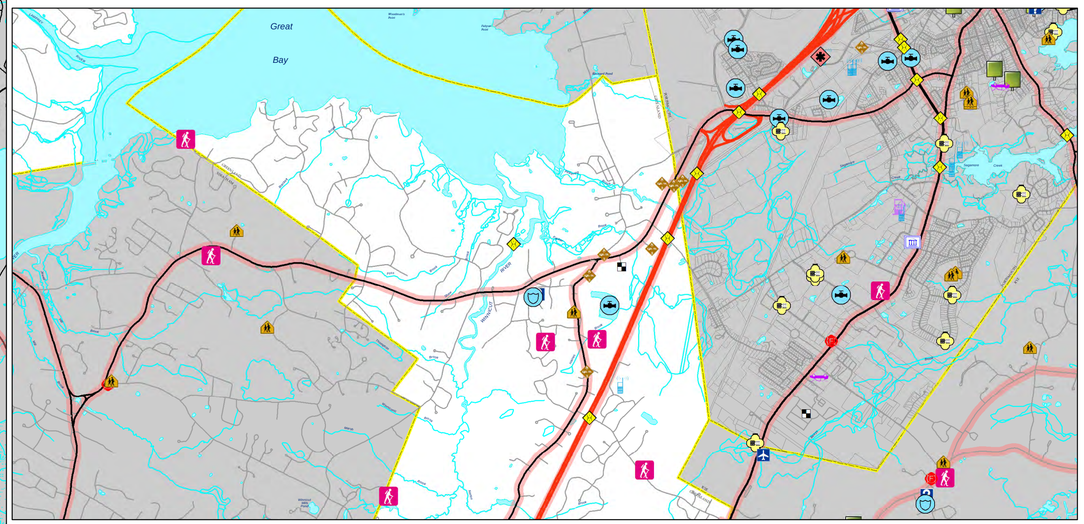
Critical Facility	Facility Type	City	Address
Portsmouth High School	Emergency Shelter	Portsmouth	50 Andrew Jarvis Dr.
Amerigas	Hazardous Material	Portsmouth	1407 NH 33
Irving Oil Terminal	Hazardous Material	Portsmouth	50 Pebble Way
LP Storage at Barberry Lane	Hazardous Material	Portsmouth	139 Barberry Lane
NHANG Fuel Tanks	Hazardous Material	Newington	400 Gosling Road
Schiller Station Coal Pile	Hazardous Material	Portsmouth	400 Gosling Road
Schiller Station Fuel Tanks A	Hazardous Material	Portsmouth	400 Gosling Road

Critical Facility	Facility Type	City	Address
Schiller Station Fuel Tanks B	Hazardous Material	Portsmouth	400 Gosling Road
Schiller Station Fuel Tanks C	Hazardous Material	Portsmouth	400 Gosling Road
Schiller Station Woodshed	Combustible Material	Portsmouth	400 Gosling Road
Portsmouth Atheneum	Historical Society	Portsmouth	9 Market Square
Portsmouth Library	Library	Portsmouth	125 Parrot Ave
Hillcrest Estates	Mfd Housing Park	Portsmouth	3201 Lafayette Rd.
Oriental Gardens	Mfd Housing Park	Portsmouth	Woodbury Ave.
Snug Harbor	Mfd Housing Park	Portsmouth	1338 Woodbury Ave.
Edgewood Center	Nursing Home	Portsmouth	928 South St.
Wentworth Senior Living	Nursing Home	Portsmouth	346 Pleasant St
Sunbridge Nursing Home	Nursing Home	Portsmouth	188 Jones Ave.
Atlantic Heights	Senior Housing Facility	Portsmouth	40 Bedford Way
Lafayette School	Senior Housing Facility	Portsmouth	100 Lafayette Road
Margeson Apartments	Senior Housing Facility	Portsmouth	245 Middle St.
Feaster Apartments	Senior Housing Facility	Portsmouth	140 Court St.
Woodbury Manor	Senior Housing Facility	Portsmouth	60 Manor Drive
Pleasant Street Apartments	Senior Housing Facility	Portsmouth	438 Pleasant St.
State Street Apartments	Senior Housing Facility	Portsmouth	948 State St.
Cottage Connors Cottage	Senior Housing Facility	Portsmouth	5 Junkins Ave
Water Country	Outdoor Recreation	Portsmouth	2300 Lafayette Rd.
Community Campus	Community Center	Portsmouth	100 Campus Dr.
Dondero Elementary School	School	Portsmouth	32 Van Buren Ave.
Little Harbour Elementary School	School	Portsmouth	50 Clough Dr.
New Franklin Elementary School	School	Portsmouth	1 Franklin Dr
Portsmouth High School	School	Portsmouth	50 Andrew Jarvis Dr.
Portsmouth Middle School	School	Portsmouth	155 Parrot Ave
Robert Lister Academy	School	Portsmouth	35 Sherburne Rd.
Seacoast Community School	School	Portsmouth	100 Campus Dr.
St. Patrick Academy	School	Portsmouth	315 Banfield Rd.
Agape School	Pre-school	Portsmouth	397 Lafayette Rd.
Early Learning Center at Temple Israel	Pre-school	Portsmouth	200 State St.
Portsmouth Head Start	Pre-school	Portsmouth	100 Campus Dr.
KinderCare Learning Center	Pre-school	Portsmouth	72 Mirona Rd.
Camp Seaweed	Child Care	Portsmouth	350 Banfield Rd.
Children’s Garden	Child Care	Portsmouth	290 Peverly Hill Rd.

Critical Facility	Facility Type	City	Address
Discovery Child Enrichment Center	Child Care	Portsmouth	30 Rye St.
Little Blessings Child Care Center	Child Care	Portsmouth	1035 Lafayette Rd.
Pat's Family Group Child Care	Child Care	Portsmouth	1400 Woodbury Ave.
Dondero Peak/Community School	Child Care	Portsmouth	32 Van Buren Dr.
Place for Friends and Fun	Child Care	Portsmouth	400 Coolidge Dr.
Edgewood Learning Center	Child Care	Portsmouth	928 South St.
Great Bay Kids Company	Child Care	Portsmouth	81 New Hampshire Ave.
Unal Kaya Davis Childcare	Child Care	Portsmouth	347 Lincoln Ave.
Little Harbor Peak Program	On-site Child Care	Portsmouth	50 Clough Dr.
New Franklin Peak Program	On-site Child Care	Portsmouth	1 Franklin Dr.
Clipper Harbor	Congregate Care	Portsmouth	188 Jones Ave.
Great Bay Residential Facility	Congregate Care	Portsmouth	413 Lafayette Rd.
Inn at Edgewood	Congregate Care	Portsmouth	926 South St.
Chase Home for Children	Congregate Care	Portsmouth	698 Middle St.
Betty's Dream Rainbow Apartments	Housing Facility	Portsmouth	75 Longmeadow Rd.
Krempels Center	Community Center	Portsmouth	100 Campus Dr.
New Heights	Community Center	Portsmouth	100 Campus Dr.
Seacoast District YMCA	Community Center	Portsmouth	550 Peverly Hill Rd.

Map 3:
Critical Facilities, Portsmouth, New Hampshire





Critical Facilities

- Airport
- Bridge
- Cell Tower
- Critical Road
- Emergency Fuel Stora
- Emergency Shelter
- Fire Station
- Government Facility
- Harbor
- Hazardous Material
- Historical Society
- Junkyard
- Library
- Major Intersection
- Medical Facility
- Mfd Housing Park
- Nursing Home
- Police Station
- Power Station/Substn
- Railroad
- Recreation - Outdoor
- School
- Sewage Facility
- Town Hall
- Water Facility

BASE FEATURES

- Interstate
- US Route
- State Route
- Local
- Interstate Ramp
- Major Road Ramp
- Political Boundaries
- Stream or Shoreline
- Apparent Wetland Limit
- Intermittent Stream
- Other Surface Water Feature
- Wetlands (USGS)
- Surface Water Bodies
- Parcels

Base data (town boundaries, hydrography, roads, railroads and utility lines) are taken from the USGS Digital Line Graph data, 1:24,000, as archived in the GRANIT database at Complex Systems Research Center, Institute for the study of Earth, Oceans and Space, University of New Hampshire, Durham, NH; 1992-1999. Roads have been updated from work done by Rockingham Planning Commission and NH Department of Transportation. Partial updates have been completed through 2000.

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October 2004, Updated June 2024

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CHAPTER V – POTENTIAL HAZARD DAMAGE

Identifying Vulnerable Facilities and Calculating the Potential Loss

Numerous studies to identify areas in Portsmouth at risk of natural hazard, as well as options for mitigating hazards, have been completed by the City, Rockingham Planning Commission, and the State of New Hampshire. Several of these mitigation measures have been completed by the City, such as adopting an ordinance regulating development in extended flood hazard areas and assessing historic resources vulnerable to hazards, or are underway, such as the Climate Action Report, which will include city-wide mitigation and adaptation strategies. Preparing to protect Portsmouth's wealth of cultural and historic resources is an important challenge facing the community.

Flooding

The 2015 Portsmouth Vulnerability Assessment completed by the Rockingham Planning Commission reports that the greatest flood impacts will be to upland areas (particularly within the 100-year floodplain), tidal wetlands, and conserved wetlands. Moderate impacts are anticipated for roadways and critical facilities. Critical facilities impacted by flooding are sewage pump stations and stormwater outfalls. The City continues to work on redesigning and relocating utility infrastructure in the highest risk locations.

Geographically, flooding from the sea-level rise and storm surge scenarios will impact areas surrounding North Mill Pond, South Mill Pond, the South End, Peirce Island, Little Harbour, Sagamore Creek. These areas contain significant historical, cultural, and economic development resources, including Strawbery Banke and the Historic District, and the downtown business district, which is central to the Port of New Hampshire and the region's tourism, recreation, and fisheries economy. Most of the land affected by projected sea-level rise and coastal storm flooding is located within the current 100-year floodplain with minor extension of flooding into the 500-year floodplain. The occurrence of the three sea-level rise scenarios within the 100-year floodplain provides the rationale to implement climate adaptation strategies within the current 100-year floodplain.

Table 8 – Summary of 2015 Vulnerability Assessment Data

Sea-Level Rise (SLR)Scenarios	SLR 1.7 feet	SLR 4.0 feet	SLR 6.3 feet	SLR 1.7 feet + storm surge	SLR 4.0 feet + storm surge	SLR 6.3 feet + storm surge
Infrastructure (# of sites)	23	30	35	33	40	54
Critical Facilities (# of sites)	0	0	11	8	11	11
Roadways (miles)	1.1	2.1	4.9	4.2	7.5	11.0
Uplands (acres)	104.5	197.3	313.9	287.7	406.6	534.6
Freshwater Wetlands (acres)	1.2	8.6	11.1	10.7	11.8	14.5
Tidal Wetlands (acres)	87.3	94.4	96.3	96.0	97.1	97.9
Conserved and Public Lands (acres)	52.2	64.7	76.1	73.6	85.0	95.4
100-year Floodplain (acres)	927.3	1,017.8	1,023.1	1,022.1	1,023.8	1,023.9
500-year Floodplain (acres)	927.3	1,017.9	1,028.8	1,028.0	1,030.8	1,031,3

The 2013 Coastal Resilience Initiative report completed by the City of Portsmouth modeled four sea-level rise scenarios – 7.5 feet, 11.5 feet, 13.5 feet and 18 feet – and recommends adaptation strategies including flood walls, tide gates, culvert replacements, and elevating roadways and properties. The report estimated the potential financial impact to buildings from flooding based on the monetary value of damages under each of SLR scenarios. Using 2013 property values, the flood impacts range from $32 million under the 7.5 feet SLR scenario to $600 million under the 18 feet SLR scenario.

In 2018 the city completed a Historic Resources Climate Change Vulnerability Assessment and Adaptation Plan. The plan integrated quantitative data, such as flood elevation, type of structure, and economic value, with qualitative data, such as National Park Service designations and historic survey, to develop the Historic Resource Valuation and Risk Assessment Map. The study area focused on target areas to evaluate the economic impact of flooding, including groundwater seepage, and sea-level rise – Strawbery Banke Museum, South End, North Mill Pond, Prescott Park, and the working waterfront. The Plan recommends changes to land use regulations, emergency preparedness, evacuation plans, and flood monitoring, and assesses options for fortifying, accommodating, and relocating historic resources.

The 2022 Seacoast Transportation Corridors Vulnerability Assessment completed by the Rockingham Planning Commission evaluated the impacts to travel in the region as the result of sea-level rise and storm surge along roadways in ten coastal communities, including Portsmouth. Roads assessed were Route 1A, Route 1B, Route 1, and I-95 – the primary roadways running from North-South – and Route 101 and Route 286 – the primary evacuation routes running East/West along New Hampshire's coast. All these roads are vulnerable to sea-level rise and sea-level rise induced groundwater rise in certain areas. Flooding scenarios studied were 1 foot of sea-level rise (SLR), 1.7 feet SLR, 4.0 feet SLR, and 6.3 feet SLR. Table 8 depicts the roadway location in Portsmouth impacted under each SLR scenario.

Table 9 – Portsmouth Roadway Locations Impacted by Sea-Level Rise
Source: 2022 Seacoast Transportation Corridors Vulnerability Assessment

SLR Scenario	1 feet SLR	1.7 feet SLR	4 feet SLR	6.3 feet SLR
Locations	none	none	State St./Daniel St. Marcy St. New Castle Ave. Parrott Ave. Junkins Ave. US 1 at Sagamore Creek	Market St./Russell St. Bartlett St. Richards Ave. Bridge St. NH 1B at Rye town line NH 1A at Sagamore Creek US 1 North of Sagamore Creek

Four feet of sea-level rise brings inundation to Junkins Ave., Parrott Ave., Marcy St., and State St./Daniel St. The segment of roadway underneath the Memorial Bridge ramp is inundated and traffic will need to be re-routed. Flooding along Marcy St. limits access to Prescott Park, Strawbery Banke, Pierce Islands, as well as many homes and businesses along the waterfront between Peirce Island Rd. and New Castle Ave. Impacts along the South Mill Pond affect Junkins Ave. and Parrott Ave. and limit accessibility to City Hall, the Public Library, and the Middle School. The Assessment included a site prioritization, with four locations in Portsmouth prioritized - State St./Daniel St. near the Memorial Bridge, Marcy St. near Prescott Park, Junkins Ave and Parrott Ave., and US 1 over Sagamore Creek.

Hurricane/ High Wind Events

Hurricanes do affect the Northeast coast periodically. Since 1900, two hurricanes have made landfall in the State of New Hampshire. Due to the location of the City of Portsmouth most hurricanes would likely degrade to tropical storms by the time they impact the city. Even degraded hurricanes or tropical storms could still cause significant damage to the City of Portsmouth. Tornadoes are uncommon in New Hampshire and damage largely depends on where the tornado strikes. The potential loss posed by high wind events was calculated by multiplying the assessed value of structures by the percent of damage expected by the hazard event. The 2023 assessed value of all the residential and commercial structures in the City of Portsmouth was $6,394,367,400. Assuming 1% to 5% damage, a hurricane or tornado could result in $63,943,674 to $3,197,183,700 of structure damage. The amount of damage caused by lightning will vary according to the type of structure hit and the type of contents inside.

Severe Winter Weather

Heavy snowstorms typically occur during January and February. New England usually experiences at least one or two heavy snowstorms with varying degrees of severity each year. Power outages, extreme cold and impacts to infrastructure are all effects of winter storms that have been felt in Portsmouth in the past. All these impacts are a risk to the community, including isolation, especially of the elderly, and increased traffic accidents. Damage caused because of this type of hazard varies according to wind velocity, snow accumulation and duration. The potential loss posed by severe winter weather was calculated by multiplying the assessed value of structures by the percent of damage expected by the hazard event. The 2023 assessed value of all the residential and commercial structures in the City of Portsmouth was $6,394,367,400. Assuming 1% to 5% damage, severe winter weather could result in $63,943,674 to $3,197,183,700 of structure damage. The amount of damage caused by lightning will vary according to the type of structure hit and the type of contents inside.

Wildfire

The risk of fire is difficult to predict based on location. Forest fires are more likely to occur during years of drought. The areas identified as at risk of wildfire (Map 2: Past and Future Hazards) by the Hazard Mitigation Committee are in the southern half of the City of Portsmouth. These areas include large tracts of open vegetation including forests and wetlands. Drought conditions increase the risks of wildfire in these open vegetated areas.

Conflagration

Conflagration, a large and damaging urban fire, is a potential hazard in the urban center of Portsmouth. This is due to the age and construction materials of many of the buildings. These structures are also built on small lots, close together. The risk of fire spreading from one building to an adjacent building is high. It is highly unlikely that a fire would burn a large portion of the city before being controlled by the fire department. The potential loss posed by conflagration was calculated by multiplying the assessed value of structures by the percent of damage expected by the hazard event. The 2023 assessed value of all the residential and commercial structures in the City of Portsmouth was $6,394,367,400. Assuming 1% to 5% damage, conflagration could result in $63,943,674 to $3,197,183,700 of structure damage.

Extreme Temperatures

The Committee determined that all parts of the City of Portsmouth are at risk of the impacts associated with extreme temperatures. Young and elderly populations are particularly vulnerable to heat stroke and the Emergency Management Coordinator can direct vulnerable residents and visitors to municipal cooling stations.

Drought

Extended drought can impact municipal water supplies, private drinking wells, and make vegetated areas more susceptible to wildfire. There is no record of monetary damage in the City of Portsmouth related to drought. The 2015 Climate Resilience Evaluation and Awareness Exercise Tool and Report assesses drought impacts on water supply and coastal storm surge on water and wastewater infrastructure.

Earthquakes

Earthquakes can cause buildings and bridges to collapse, disrupt utility infrastructure, and are often associated with landslides and flash floods. Four earthquakes in New Hampshire between 1924-1989 had magnitudes of 4.2 or more. Two of these occurred in Ossipee, one west of Laconia, and one near the Quebec border. If an earthquake were to impact the City of Portsmouth, buildings that are not built to a high seismic design level would be susceptible to structural damage. The potential loss posed by an earthquake was calculated by multiplying the assessed value of structures by the percentage of damage expected by the hazard event. The 2023 assessed value of all the residential and commercial structures in the City of Portsmouth was $6,394,367,400. Assuming 1% to 5% damage, an earthquake could result in $63,943,674 to $3,197,183,700 of structure damage.

Climate Change

The potential hazard damage from climate change is described above under flooding, extreme temperatures, and drought.

Infectious Disease

Epidemics have the potential to cause a significant loss of life and/or widespread illness throughout the State, as well as cause disruptions to economies at all levels. The threat of a pandemic influenza, such as COVID-19, exemplifies a devastating situation where there may be an extreme shortage of essential service workers, a rapid transmission of disease from person-to-person, and no effective vaccination to prevent the illness. The monetary value of this impact cannot be determined.

CHAPTER IV - EXISTING HAZARD MITIGATION PROGRAMS

Research shows how the climate of New Hampshire and the Seacoast region has changed over the past century and predicts the future climate of the region will be affected by human activities that are warming the planet. Overall, New England has been getting warmer and wetter over the last century and the rate of change has increased over the last four decades. As a coastal city on a tidal river, Portsmouth is increasingly vulnerable to storm surges and sea-level rise. Higher temperature events and more intense storm events will impact both the built and natural environments. To address these challenges, the City has proactively designed several hazard mitigation programs to increase mitigate the impacts of natural hazards and increase resiliency. Table 10 describes programs that are currently in place as hazard mitigation actions or strategies for Portsmouth.

Table 10 - Existing Hazard Mitigation Programs for the City of Portsmouth

Existing Hazard Mitigation Programs	Description	Recommended Actions
2025-2030 City Capital Improvements Plan	Prioritizes public improvements and infrastructure needs, including hazard mitigation and adaptation planning, and sets a six-year schedule and financing strategy	Review annually and revise every five years
2025 City Master Plan	Guides land use and development and provides comprehensive vision for the future	Review annually and update as needed
2024 City Climate Action Plan/Climate Future	Establishes climate mitigation targets including climate-smart land use	Review and update as needed
2024 City Zoning Ordinance	Includes floodplain development and shoreline development regulations, wetland buffer regulations, stormwater management	Review annually and revise as needed
2024 City Emergency Operations Plan	Establishes lines of responsibility during a disaster, as well as procedures and resources	Review annually and revise as needed
2023 Seabrook Station Radiological Emergency Plan	Plan for all the municipalities within 10 miles of Seabrook Station; Portsmouth is within the 50-mile radius	Reviewed annually
2022 Seacoast Transportation Corridors Vulnerability Assessment	Identifies and prioritizes roadways and travel corridors in the region at risk of flooding	Revise as needed
2022 City Open Space Plan	Identifies and prioritizes land for protection and includes climate resiliency objectives	Review annually and update as needed
2020 City Subdivision Regulations	Includes flood hazard areas, erosion and sediment control, and stormwater management regulations	Review annually and update as needed
2018 City Historic Properties Climate Change Vulnerability	Uses economic, historic, cultural, and flood water vulnerability measurements to	Review annually and update as needed

Assessment and Adaptation Plan	characterize, risk-assess, and prioritize key historic assets in the City	
2015 City Climate Resilience Evaluation and Awareness Exercise Tool and Report	Assesses risk of drought on drinking water supply and impacts of coastal storm surge on wastewater pump stations	Review annually and update as needed
2013 City Coastal Resilience Initiative	Identifies the impacts of climate change and recommends adaptation measures	Review annually and update as needed
2018 Building Codes	Set minimum safety requirements for residential and commercial buildings relative to hazards, including wind, rain, hail, and other natural hazards	Reviewed annually for compliance with state codes and updated as needed
2007 City Stormwater Management Master Plan	Details City's stormwater management plans to ensure water discharges comply with State of NH MS4 Permit requirements	Update needed
MS4 Permit Requirements	Permit requirements include enhanced post-construction stormwater management, limits on impervious cover, and retrofitting stormwater management infrastructure	Review annually
Emergency Services	Emergency services are provided by Police and Fire Departments in cooperation with other municipal departments, including Emergency Management, Public Works, Health, and Welfare	Emergency service personnel participate in on-going training related to hazard mitigation prevention and response
Emergency Communication Center	Assists the fire department, police department, emergency medical services, and public works	Emergency service personnel participate in on-going training related to hazard mitigation prevention and response
Mutual Aid Agreements	Seacoast Chief Fire Officers Mutual Aid District (SCFOMAD), includes southeastern NH, southern ME, and northeastern MA, assets include a Mobile Command Unit; Seacoast Technical Assistance Response Team (START) is a subsidiary of SCFOMAD and provides all-hazard and all-planning emergency hazardous materials response	Reviewed annually and updated as needed
Public Education and Outreach	City Emergency Management oversees extensive and inclusive public messaging about hazard mitigation and hazard events with information shared on social media, City website and newsletters	Identify stakeholders to assist City with additional messaging relative to hazard mitigation and emergency preparedness

CHAPTER VII – POTENTIAL MITIGATION ACTIONS

The Hazard Mitigation Committee reviewed the City's existing hazard mitigation programs described in Table 10 and mitigation actions listed in the *2013 FEMA Mitigation Ideas Resource Guide* to develop a comprehensive list of potential mitigation actions, listed below in Table 11. Actions listed in the 2017 Plan were also reviewed by the Committee to determine if they were relevant to this Plan Update and if the action was completed, ongoing, or no longer necessary and removed. Actions were ranked in five mitigation categories – prevention, preparedness, structural protection, emergency services, and public information and involvement, as well as by the type of hazards mitigated. Many new actions were identified by the Committee, incorporating recommended actions outlined in many climate adaptation and resilience reports completed by the City.

Table 11: Potential Mitigation Actions

Mitigation Strategies or Action	Mitigation Category	Natural Hazard(s) Mitigated	Description	Status 2024: New/Completed/ Deferred/ Removed
Develop vegetation setbacks plan	Prevention	Wildfire	Manage vegetation setbacks in areas at risk of wildfire	Removed
Complete culvert replacements in multiple locations	Preparedness, Prevention	Flooding	Replace undersized and improperly sited culverts in locations prone to flooding	Complete and ongoing with additional culvert installation ongoing throughout the life of this Plan
Create shelter at New Franklin School	Emergency Services	All Hazards	New Franklin School is located outside of the floodplain	Removed
Increase GIS capacity for real-time emergency access	Emergency Services	All Hazards	Allows increased efficiency in dispatching emergency services	Completed
Review Building Codes for wind and earthquake standards	Structural Protection	High Wind, Earthquake	Continue researching current codes for high wind	Completed for wind Removed for earthquake
Acquire new imagery of the city	Emergency Services	All Hazards	Imagery benefits City's mitigation and emergency services	Completed
Purchase fixed electronic variable message boards	Emergency Services	All Hazards	Enable timely communication about hazard preparation and hazard events with the public	Completed and ongoing with new message boards being purchased throughout the life of this Plan
Purchase new vacuum truck	Prevention, Emergency Services	Flooding	Used as part of stormwater management program; truck is shared with other	Completed

Mitigation Strategies or Action	Mitigation Category	Natural Hazard(s) Mitigated	Description	Status 2024: New/Completed/ Deferred/ Removed
			communities as part of a regional mutual aid program	
Acquire backup power for municipal and school buildings and wells	Emergency Services	All Hazards	Backup power would enable these buildings to serve as emergency shelters	Completed and ongoing with new generators being purchased throughout the life of this Plan
Update City's stormwater management plan	Prevention, Structural Protection	Flooding	Stormwater management is difficult in the City's densely developed down City	Completed
Purchase and install signs indicating evacuation routes in parking garages and lots	Emergency Services	All Hazards	Signs would inform visitors and residents of routes identified in the Traffic Hazard Management Plan	Completed and ongoing with new signs being installed throughout the life of this Plan
Improve mutual aid for water support	Emergency Services	Conflagration, Wildfire, Drought	Mutual aid would assure adequate water supply for firefighting	Completed
Protect wastewater pump stations from flooding	Structural Protection	Flooding, including sea-level rise and storm surge	Wastewater pump stations are in areas prone to flooding and sea level rise	Some sites completed and others ongoing throughout the life of this Plan
Develop an urban forestry management plan to reduce fire risk	Prevention, Emergency Services	Conflagration, Wildfire	Identify areas of fire risk in urban areas and develop a management plan	Removed
Study improvement of water transmission from Bellamy Reservoir	Property Protection, Emergency Services	Fire, Drought	Increase the efficiency of transmitting water from Bellamy Reservoir in Madbury to City	Partially completed and ongoing throughout the life of this Plan
Protect historic structures in Prescott Park during stormwater management and climate adaptation infrastructure retrofits	Property Protection	Flooding, including sea-level rise and coastal storm surge	Historic structures in Prescott Park are at risk of damage during construction and installation of upgraded stormwater management and climate adaptation infrastructure	New
Complete Fleet Street sewer separation feasibility study	Structural Protection	Flooding	Project includes water, sewer, and drainage upgrades to improve stormwater management	New

Mitigation Strategies or Action	Mitigation Category	Natural Hazard(s) Mitigated	Description	Status 2024: New/Completed/ Deferred/ Removed
Complete Capacity Management Plan for Public Works Department	Emergency Services	All Hazards	Efficeient management of Public Works resources (staff, equipment, training) is needed to reduce the risk of natural hazards	New
Complete Mechanic Street pump station upgrade	Structural Protection	Flooding, including sea-level rise and coastal storm surge	Mechanic Street sewer pump station is at risk of inundation from rising sea-levels and coastal storm surge	New
Formalize agreements for pre-treatment of industrial wastewater	Structural Protection, Natural Resource Protection	Protects human health and the environment	Pre-treating industrial wastewater will improve water quality discharged from the wastewater treatment plant	New
Establish a groundwater monitoring program to measure groundwater flows and the impacts of tidal intrusion on infrastructure	Structural Protection, Property Protection	Flooding, including sea-level rise and coastal storm surge	Coastal storm surge, rising sea-levels, and saltwater intrusion threaten infrastructure and land	New
Rebuild Junkins Avenue causeway to prevent flooding of roadway	Structural Protection	Flooding, including sea-level rise and coastal storm surge	Junkins Avenue is a critical roadway, serving the Police Dept., City Hall, Senior Housing, Middle School, and Public Library	New
Purchase cots and storage trailers for City Health Department for use at emergency shelters	Emergency Services	All Hazards	Health Department needs cots and storage trailers for use at emergency shelters	New
Convert City garage to a secure and climate-controlled storage for Health Department supplies	Emergency Services	All Hazards	Health Department needs secure and climate-controlled storage for supplies	New
Conduct climate change vulnerability assessments every five years	Prevention, Property Protection, Structural Protection,	Climate Change, including flooding, sea-level rise,	Climate change science and data is updated frequently, and accurate vulnerability assessments are needed to	New

Mitigation Strategies or Action	Mitigation Category	Natural Hazard(s) Mitigated	Description	Status 2024: New/Completed/ Deferred/ Removed
	Emergency Services, Public Information and Involvement, Natural Resource Protection	coastal storm surge, extreme precipitation, extreme temperatures, drought	guide City policies and programs	
Continue allocating funds through the CIP for land conservation and natural resource protection projects identified in the City Open Space Plan, including salt marsh and coastal land protection	Prevention, Property Protection, Structural Protection, Natural Resource Protection	Flooding, Hurricane, Coastal Storms, Climate Change, Drought	Conserving undeveloped land from development enables increase resiliency in the form of flood storage, salt marsh and wetland migration, water quality and quantity protection	New
Increase public education and outreach about the types of hazards impacting Portsmouth, the public's role in stormwater management, and pre-disaster mitigation	Public Information and Involvement	All Hazards	The City maintains a robust public information program with opportunities for sharing more information about hazard mitigation and emergency preparedness	New
Update City Stormwater Management Infrastructure Master Plan	Prevention, Structural Protection	Flooding	An update to the 2007 Stormwater Management Infrastructure Master Plan is needed to enable accurate and efficient stormwater management	New
Provide safe pedestrian and bike access into and out of the downtown, including accessing the rail trail	Emergency Services	All Hazards		New
Develop and adopt an MOU with Seacoast Public Health Network to	Emergency Services	Infectious Diseases	Partnering with Seacoast Public Health Network strengthens the City's capacity to serve residents	New

Mitigation Strategies or Action	Mitigation Category	Natural Hazard(s) Mitigated	Description	Status 2024: New/Completed/ Deferred/ Removed
strengthen the partnership with the City during public health emergencies			during an infectious disease outbreak	
Partner with State, Seacoast Municipalities, and the Red Cross to identify a regional emergency shelter location	Emergency Services	All Hazards	A regional emergency shelter location is needed away from the coast for all hazards, especially hurricanes and coastal storms	New
Expand urban tree planting program	Prevention	Extreme Heat	Increasing the number of trees in urban areas can reduce temperatures, mitigating impacts of extreme heat on public health	New

CHAPTER VIII - FEASIBILITY AND PRIORITIZATION OF PROPOSED MITIGATION ACTION

The goal of each strategy or action is reduction or prevention of damage from a hazard event. To determine their effectiveness in accomplishing this goal, a set of criteria was applied to each proposed strategy. A set of questions developed by the Committee that included the STAPLEE method was developed to rank the proposed mitigation actions. The STAPLEE method analyzes the Social, Technical, Administrative, Political, Legal, Economic and Environmental aspects of a project and is commonly used by public administration officials and planners for making planning decisions. The following questions were asked about the proposed mitigation strategies identified in Table 11:

- Does it reduce disaster damage?
- Does it benefit the environment?
- Does it meet regulations?
- Will historic structures be saved or protected?
- Does it help achieve other community goals?
- Could it be implemented quickly?

STAPLEE criteria:

- **Social**: Is the proposed strategy socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- **Technical**: Will the proposed strategy work? Will it create more problems than it solves?
- **Administrative**: Can the community implement the strategy? Is there someone to coordinate and lead the effort?
- **Political**: Is the strategy politically acceptable? Is there public support both to implement and to maintain the project?
- **Legal**: Is the community authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?
- **Economic**: What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?
- **Environmental**: How will the strategy impact the environment? Will the strategy need environmental regulatory approvals?

Each proposed mitigation strategy was evaluated using the above criteria and assigned a score (Good = 3, Average = 2, Poor = 1) based on the above criteria. An evaluation chart with total scores for each strategy can be found in the collection of individual tables under Table 12.

After each strategy was evaluated and prioritized according to the final score. The highest scoring strategies were determined to be of more importance, economically, socially, environmentally, and politically feasible and, hence, prioritized over those that were lower scoring. This prioritizing was used as a basis for developing the Action Plan outlined in Table 13.

Table 12.1 Complete culvert replacements in multiple locations

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	2
Score	**37**

Table 12.2 Purchase fixed electronic variable message boards

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	1
Does it contribute to other goals?	2
Does it benefit the environment?	1
Does it meet regulations?	1
Will historic structures be saved or protected?	1
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**29**

Table 12.3 Acquire backup power for municipal and school buildings and wells

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Could it be implemented quickly?	3
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**39**

Table 12.4 Purchase and install signs indicating evacuation routes

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	1
Does it contribute to other goals?	2
Does it benefit the environment?	1
Does it meet regulations?	2
Will historic structures be saved or protected?	1
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**30**

Table 12.5 Protect wastewater pump stations from flooding

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	2
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	2
Score	**35**

Table 12.6 Study improvement of water transmission from Bellamy Reservoir

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	2
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	1
Score	**30**

Table 12.7 Protect historic structures in Prescott Park during infrastructure retrofits

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	2
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	2
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	1
Score	**33**

Table 12.8 Complete Fleet St. sewer separation study

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	2
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	1
Score	**33**

Table 12.9 Complete capacity management plan for Public Works Dept.

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**38**

Table 12.10 Complete Mechanic St. pump station upgrade

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	2
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	2
Score	**35**

Table 12.11 Formalize agreements for pre-treatment of industrial wastewater

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**35**

Table 12.12 Establish groundwater monitoring program

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**35**

Table 12.13 Rebuild Junkins Ave. causeway to prevent flooding of roadway

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	1
Score	**32**

Table 12.14 Purchase cots and trailers for Health Dept.

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	1
Does it contribute to other goals?	3
Does it benefit the environment?	1
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**32**

Table 12.15 Convert City garage to secure and climate-controlled storage for Health Dept. supplies

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	1
Does it contribute to other goals?	3
Does it benefit the environment?	1
Does it meet regulations?	2
Will historic structures be saved or protected?	1
Could it be implemented quickly?	3
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**33**

Table 12.16 Conduct climate change vulnerability assessments every five years

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**38**

Table 12.17 Continue allocating funds through CIP for land conservation projects

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	2
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**36**

Table 12.18 Increase public education and outreach about hazards mitigation

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2
Does it contribute to other goals?	3
Does it benefit the environment?	2
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Could it be implemented quickly?	3
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**35**

Table 12.19 Update Stormwater Management Infrastructure Master Plan

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**38**

Table 12.20 Provide safe pedestrian and bike access into and out of downtown

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	1
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	2
Will historic structures be saved or protected?	1
Could it be implemented quickly?	3
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**34**

Table 12.21 Develop and adopt an MOU with Seacoast Public Health Network to strengthen the partnership with the City during public health emergencies

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2
Does it contribute to other goals?	3
Does it benefit the environment?	1
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**33**

Table 12.21 Partner with the State, Seacoast municipalities, and the Red Cross to identify a regional emergency shelter location

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	1
Does it contribute to other goals?	3
Does it benefit the environment?	1
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**31**

Table 12.22 Expand urban tree planting program

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	1
Will historic structures be saved or protected?	1
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Score	**33**

CHAPTER IX – IMPLEMENTATION SCHEDULE FOR PRIORITY MITIGATION ACTIONS

This step involves developing an action plan that outlines who is responsible for implementing each of the prioritized strategies determined in the previous step, as well as when and how the actions will be implemented. The following questions were asked to develop an implementation schedule for the identified priority mitigation strategies:

WHO? Who will lead the implementation efforts? Who will put together funding requests and applications?

HOW? How will the community fund these projects? How will the community implement these projects? What resources will be needed to implement these projects?

WHEN? When will these actions be implemented, and in what order?

Table 13 is the Action Plan. In addition to the prioritized mitigation projects, Table 14 includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN).

Table 13: Action Plan for Proposed Mitigation Actions

Score	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Timeframe
39	Purchase and install backup power for municipal and school buildings, water wells, and wastewater pumps	DPW	City/State Grants/ Federal Grants	$500,000	Short Term 1 year
38	Conduct climate change vulnerability assessments every five years	Planning and Sustainability/ DPW	City/State Grants/ Federal Grants	$120,000	Long Term 3-5 years
38	Complete capacity management plan for Public Works Department	DPW	City	$200,000	Medium Term 2-3 years
38	Update Stormwater Management Infrastructure Master Plan	DPW	City/State Grants/ Federal Grants	$200,000	Medium Term 2-3 years
37	Complete culvert replacements in multiple locations	DPW	City/State Grants/ Federal Grants	$5M	Long Term 3-5 years
36	Allocate funds through CIP for land conservation projects	Planning and Sustainability	City/State Grants/ Federal Grants	$750,000	Long Term 3-5 years

Score	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Timeframe
35	Protect wastewater pump stations from flooding	DPW	City/State Grants/Federal Grants	$2M	Long Term 3-5 years
35	Increase public education and outreach about hazard mitigation	EMD/EMC	City/State Grants/Federal Grants	$150,000	Short Term 1 year
35	Complete Mechanic Street pump station upgrade	DPW	City/State Grants/Federal Grants	$20M	Long Term 3-5 years
35	Formalize agreements for pretreatment of industrial wastewater	DPW	City/State Grants/Federal Grants	$400.000	Short Term 1 year
35	Establish groundwater monitoring program	DPW	City/State Grants/Federal Grants	$300.000	Medium Term 2-3 years
34	Provide safe pedestrian and bike access into and out of downtown	DPW	City/State Grants/Federal Grants	$150,000	Short Term 1 year
33	Protect historic structures in Prescott Park during stormwater management retrofits	DPW	City/State Grants/Federal Grants	$8M	Long Term 3-5 years
33	Complete Fleet Street sewer separation feasibility study	DPW	City/State Grants/Federal Grants	$16M	Long Term 3-5 years
33	Expand urban tree planting program	DPW	City/State Grants/Federal Grants	$150,000	Short Term 1 year
33	Convert City garage to secure storage for Health Dept.	DPW/Health Dept.	City/State Grants/Federal Grants	$50,000	Short Term 1 year
33	Develop and adopt an MOU with Seacoast Public Health Network	EMD/EMC/ Health Dept.	City/State Grants/Federal Grants	$10,000	Short Term 1 year
32	Purchase cots and trailers for Health Dept.	EMD/EMC/ Health Dept.	City/State Grants/Federal Grants	$250,000	Short Term 1 year
31	Partner with State, Seacoast municipalities, Red Cross to identify regional shelter location	EMD/EMC	City/State Grants/Federal Grants	$50,000	Long Term 3-5 years
30	Purchase and install sign indicating evacuation routes	DPW	City/State Grants/Federal Grants	$10,000	Short Term 1 year

Score	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Timeframe
30	Study improvement of water transmission from Bellamy Reservoir	DPW	City/State Grants/Federal Grants	$28M	Long Term 3-5 years
29	Purchase fixed electronic variable message boards	EMD/EMC/DPW	City/State Grants/Federal Grants	$200,00	Short Term 1 year

CHAPTER X- INCORPORATING, MONITORING, EVALUATING, AND UPDATING THE PLAN

Incorporating the Plan into Existing Planning Mechanisms

Upon review and approval by FEMA and the State of New Hampshire Homeland Security and Emergency Management, the Hazard Mitigation Plan Update 2024 will be adopted by the Portsmouth City Council as a standalone document and as an appendix of the City's Emergency Operations Plan (EOP). The Plan Update will be consulted during updates to the Master Plan and Capital Improvement Plan (CIP). The Planning Board is responsible for updating the Master Plan and CIP and will review the Action Plan during each update. The Planning Board in conjunction with Emergency Management Director and Emergency Management Coordinator will determine what items can and should be added to the CIP based on the City's annual budget and sources of other funding. Considerations about future land use and proximity to current and potential hazard areas need to be inherently part of the planning process. NH RSA 674:2 III (e) gives cities the authority to include a natural hazards section, which documents the physical characteristics, severity, and extent of any potential natural hazards to the community, within the framework of a Master Plan.

Monitoring, Evaluating and Updating the Plan

Recognizing that many mitigation projects are ongoing, and that while in the implementation stage communities may suffer budget cuts, experience staff turnover, or projects may fail altogether, a good plan needs to provide for periodic monitoring and evaluation of its successes and failures and allow for updates of the Plan where necessary.

To track progress and update the Mitigation Strategies identified in the Action Plan, the Hazard Mitigation Committee shall remain active and will revisit the Plan annually and after each natural hazard event. These reviews will assess the Plan's effectiveness, accuracy, and completeness in achieving its stated purpose and goals. Plan reviews will also address the recommended improvements to the Plan as contained in the FEMA plan review checklist and any weaknesses the City identified that the Plan did not adequately address. Plan reviews will also incorporate any new information based on changing conditions in land use, hazard types, vulnerable populations, and climate change. The Emergency Management Director and Emergency Management Coordinator are responsible for initiating these reviews and will involve appropriate stakeholders via public meetings, presentations to governing bodies, neighborhood-specific meetings, climate change planning forums, and soliciting feedback via the City's website and social media accounts. The Plan will also be thoroughly updated every five years.

In keeping with the process of adopting the 2024 Plan Update, a public meeting to receive public comment on Plan maintenance and updating will be held during any review of the Plan. This publicly noticed meeting will allow for members of the community not involved in developing the Plan to provide input and comments each time the Plan is revised. The final revised Plan will

be adopted by the City Council appropriately, at a second publicly noticed meeting, and posted on the City website to enable public review.

Changes should be made to the Plan to accommodate for projects that have failed or are not considered feasible after a review of their consistency with STAPLEE, the timeframe, the community's priorities, and funding resources. Priorities that were not ranked highly initially, but identified as potential mitigation strategies, should be reviewed during the monitoring and update of this Plan to determine feasibility of future implementation.

Appendix A - Summary of Hazard Mitigation Strategies

https://www.fema.gov/node/mitigation-ideas-resource-reducing-risk-natural-hazards

I. RIVERINE AND COASTAL FLOOD MITIGATION

A. PREVENTION - Prevention measures are intended to keep the problem from occurring in the first place, and/or keep it from getting worse. Future development should not increase flood damage. Building, zoning, planning, and/or code enforcement officials usually administer preventative measures.

- **Planning and Zoning -** Land use plans are put in place to guide future development, recommending where - and where not - development should occur. Sensitive and vulnerable lands can be designated for uses that would not be incompatible with occasional flood events - such as parks or wildlife refuges. A Capital Improvements Program can recommend the setting aside of funds for public acquisition of these designated lands. The zoning ordinance can regulate development in these sensitive areas by limiting or preventing some or all development - for example, by designating floodplain overlay, conservation, or agricultural districts.

- **Open Space Preservation -** Preserving open space is the best way to prevent flooding and flood damage. Open space preservation should not, however, be limited to the flood plain, since other areas within the watershed may contribute to controlling the runoff that exacerbates flooding. Land Use and Capital Improvement Plans should identify areas to be preserved by acquisition and other means, such as purchasing easements. Aside from outright purchase, open space can also be protected through maintenance agreements with the landowners, or by requiring developers to dedicate land for flood flow, drainage and storage.

- **Floodplain Development Regulations -** Floodplain development regulations typically do not prohibit development in the special flood hazard area, but they do impose construction standards on what is built there. The intent is to protect roads and structures from flood damage and to prevent development from aggravating the flood potential. Floodplain development regulations are generally incorporated into subdivision regulations, building codes, and floodplain ordinances, which either stand-alone or are contained within a zoning ordinance.

  Subdivision Regulations: These regulations govern how land will be divided into separate lots or sites. They should require that any flood hazard areas be shown on the plat, and that every lot has a buildable area that is above the base flood elevation.

  Building Codes: Standards can be incorporated into building codes that address flood proofing for all new and improved or repaired buildings.

  Floodplain Ordinances: Communities that participate in the National Flood Insurance Program are required to adopt the minimum floodplain management regulations, as developed by FEMA. The regulations set minimum standards for subdivision regulations and building codes. Communities may adopt more stringent standards than those set forth by FEMA.

- **Stormwater Management -** Development outside of a floodplain can contribute significantly to flooding by covering impervious surfaces, which increases storm water runoff. Storm water management is usually addressed in subdivision regulations. Developers are typically required to build retention or detention basins to minimize any increase in runoff caused by new or expanded

impervious surfaces, or new drainage systems. Generally, there is a prohibition against storm water leaving the site at a rate higher than it did before the development. One technique is to use wet basins as part of the landscaping plan of a development. It might even be possible to site these basins based on a watershed analysis. Since detention only controls the runoff rates and not volumes, other measures must be employed for storm water infiltration - for example, swales, infiltration trenches, vegetative filter strips, and permeable paving blocks.

- **Drainage System Maintenance -** Ongoing maintenance of channel and detention basins is necessary if these facilities are to function effectively and efficiently over time. A maintenance program should include regulations that prevent dumping in or altering watercourses or storage basins; regrading and filling should also be regulated. Any maintenance program should include a public education component, so that the public becomes aware of the reasons for the regulations. Many people do not realize the consequences of filling a ditch or wetland or regrading their yard without concern for runoff patterns.

B. PROPERTY PROTECTION - Property protection measures are used to modify buildings subject to flood damage, rather than to keep floodwaters away. These may be less expensive to implement, as they are often carried out on a cost-sharing basis. In addition, many of these measures do not affect a building's appearance or use, which makes them particularly suitable for historical sites and landmarks.

- **Relocation -** Moving structures out of the floodplain is the surest and safest way to protect against damage. Relocation is expensive, however, so this approach will probably not be used except in extreme circumstances. Communities that have areas subject to severe storm surges, ice jams, etc. might want to consider establishing a relocation program, incorporating available assistance.

- **Acquisition -** Acquisition by a governmental entity of land in a floodplain serves two main purposes: (1) it ensures that the problem of structures in the floodplain will be addressed; and (2) it has the potential to convert problem areas into community assets, with accompanying environmental benefits. Acquisition is more cost effective than relocation in those areas that are subject to storm surges, ice jams, or flash flooding. Acquisition, followed by demolition, is the most appropriate strategy for those buildings that are simply too expensive to move, as well as for dilapidated structures that are not worth saving or protecting. Relocation can be expensive; however, there are government grants and loans that can be applied toward such efforts.

- **Building Elevation -** Elevating a building above the base flood elevation is the best on-site protection strategy. The building could be raised to allow water to run underneath it, or fill could be brought in to elevate the site on which the building sits. This approach is cheaper than relocation and tends to be less disruptive to a neighborhood. Elevation is required by law for new and substantially improved residences in a floodplain and is commonly practiced in flood hazard areas nationwide.

- **Floodproofing -** If a building cannot be relocated or elevated, it may be floodproofed. This approach works well in areas of low flood threat. Flood proofing can be accomplished through barriers to flooding, or by treatment to the structure itself.

Barriers: Levees, floodwalls, and berms can keep floodwaters from reaching a building. These are useful, however, only in areas subject to shallow flooding.

Dry Flood proofing: This method seals a building against the water by coating the walls with waterproofing compounds or plastic sheeting. Openings, such doors, windows, etc. are closed either permanently with removable shields or with sandbags.

Wet Flood proofing: This technique is usually considered a last resort measure since water is intentionally allowed into the building to minimize pressure on the structure. Approaches range from moving valuable items to higher floors to rebuilding the floodable area. An advantage over other approaches is that simply by moving household goods out of the range of floodwaters, thousands of dollars can be saved in damages.

- **Sewer Backup Protection -** Storm water overloads can cause backup into basements through sanitary sewer lines. Houses that have any kind of connection to a sanitary sewer system - whether it is downspouts, footing drain tile, and/or sump pumps, can be flooded during a heavy rain event. To prevent this, there should be no such connections to the system, and all rain and ground water should be directed onto the ground, away from the building. Other protections include:

  Floor drain plugs and floor drain standpipe, which keep water from flowing out of the lowest opening in the house.

  Overhead sewer - keeps water in the sewer line during a backup.

  Backup valve - allows sewage to flow out while preventing backups from flowing into the house.

- **Insurance -** Above and beyond standard homeowner insurance, there is other coverage a homeowner can purchase to protect against flood hazard. Two of the most common are National Flood Insurance and basement backup insurance.

  National Flood Insurance: When a community participates in the National Flood Insurance Program, any local insurance agent can sell separate flood insurance policies under rules and rates set by FEMA. Rates do not change after claims are paid because they are set on a national basis.

  Basement Backup Insurance: National Flood Insurance offers an additional deductible for seepage and sewer backup, provided there is a general condition of flooding in the area that was the proximate cause of the basement getting wet. Most exclude damage from surface flooding that would be covered by the NFIP.

C. NATURAL RESOURCE PROTECTION - Preserving or restoring natural areas or the natural functions of floodplain and watershed areas provide the benefits of eliminating or minimizing losses from floods, as well as improving water quality and wildlife habitats. Parks, recreation, or conservation agencies usually implement such activities. Protection can also be provided through various zoning measures that are specifically designed to protect natural resources.

- **Wetlands Protection -** Wetlands can store large amounts of floodwater, slowing and reducing downstream flows, and filtering the water. Any development that is proposed in a wetland is regulated by either federal and/or state agencies. Depending on the location, the project might fall under the jurisdiction of the U.S. Army Corps of Engineers, which in turn, calls upon several other agencies to review the proposal. In New Hampshire, the N.H. Wetlands Board must approve any project that impacts a wetland. And many communities in New Hampshire also have local wetland ordinances. Generally, the goal is to protect wetlands by preventing development that would adversely affect them. Mitigation techniques are often employed, which might consist of creating a wetland on another site to replace what would be lost through the development. This is not an ideal practice, however, since it takes many years for a new wetland to achieve the same level of quality as an existing one.

- **Erosion and Sedimentation Control -** Controlling erosion and sediment runoff during construction and on farmland is important, since eroding soil will typically end up in downstream waterways. And, because sediment tends to settle where the water flow is slower, it will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters. Practices to reduce erosion and sedimentation have two principal components: (1) minimize erosion with vegetation and (2) capture sediment before it leaves the site. Slowing the runoff increases infiltration into the soil, thereby controlling the loss of topsoil from erosion and the resulting sedimentation. Runoff can be slowed by vegetation, terraces, contour strip farming, no-till farm practices, and impoundments (such as sediment basins, farm ponds, and wetlands).

- **Best Management Practices -** Best Management Practices (BMPs) are measures that reduce nonpoint source pollutants that enter waterways. Nonpoint source pollutants are carried by storm water to waterways, and include such things as lawn fertilizers, pesticides, farm chemicals, and oils from street surfaces and industrial sites. BMPs can be incorporated into many aspects of new developments and ongoing land use practices. In New Hampshire, the Department of Environmental Services has developed best management practices for a range of activities, from farming to earth excavations.

D. EMERGENCY SERVICES - Emergency services protect people during and after a flood. Many communities in New Hampshire have emergency management programs in place, administered by an emergency management director (very often the local police or fire chief).

- **Flood Warning -** On large rivers, the National Weather Service handles early recognition. Communities on smaller rivers must develop their own warning systems. Warnings may be disseminated in a variety of ways, such as sirens, radio, television, mobile public-address systems, or door-to-door contact. It seems that multiple or redundant systems are the most effective, giving people more than one opportunity to be warned.

- **Flood Response -** Flood response refers to actions that are designed to prevent or reduce damage or injury, once a flood threat is recognized. Such actions and the appropriate parties include activating the emergency operations center (emergency director), sandbagging designated areas (public works department), closing streets and bridges (police department), shutting off power to threatened areas (utilities), releasing children from school (school

district), ordering an evacuation (selectmen/city council/emergency director), opening evacuation shelters (churches, schools, Red Cross, municipal facilities).

These actions should be part of a flood response plan, which should be developed in coordination with the persons and agencies that share the responsibilities. Drills and exercises should be conducted so that the key participants know what they are supposed to do.

- **Critical Facilities Protection -** Protecting critical facilities is vital, since expending efforts on these facilities can draw workers and resources away from protecting other parts of the community. Buildings or locations vital to the flood response effort:

  - emergency operations centers
  - police and fire stations
  - hospitals
  - highway garage
  - selected roads and bridges
  - evacuation routes
  - buildings or locations that, if flooded, would create secondary disasters
  - hazardous materials facilities
  - water/wastewater treatment plants
  - schools
  - nursing homes

  All such facilities should have their own flood response plan that is coordinated with the community's plan. Nursing homes, other public health facilities, and schools will typically be required by the state to have emergency response plans in place.

- **Health and Safety Maintenance -** The flood response plan should identify appropriate measures to prevent danger to health and safety. Such measures include:

  - patrolling evacuated areas to prevent looting
  - providing safe drinking water
  - vaccinating residents for tetanus
  - clearing streets
  - cleaning up debris

  The plan should also identify which agencies will be responsible for carrying out the identified measures. A public information program can be helpful to educate residents on the benefits of taking health and safety precautions.

Structural Projects - Structural projects are used to prevent floodwater from reaching properties. These are all man-made structures and can be grouped into the six types of discussed below. The shortcomings of structural approaches are that they can be very expensive**,** they disturb the land, disrupt natural water flows, and destroy natural habitats**,** they are built to an anticipated flood event, and may be exceeded by a greater-than-expected flood**,** and they can create a false sense of security.

Reservoirs - Reservoirs control flooding by holding water behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate the river downstream can handle.

Reservoirs are suitable for protecting existing development, and they may be the only flood control measure that can protect development close to a watercourse. They are most efficient in deeper valleys or on smaller rivers where there is less water to store. Reservoirs might consist of man-made holes dug to hold the approximate amount of floodwaters, or even abandoned quarries. As with other structural projects, reservoirs:

- are expensive
- occupy a lot of land
- require periodic maintenance
- may fail to prevent damage from floods that exceed their design levels
- may eliminate the natural and beneficial functions of the floodplain

Reservoirs should only be used after a thorough watershed analysis that identifies the most appropriate location and ensures that they would not cause flooding somewhere else. Because they are so expensive and usually involve more than one community, they are typically implemented with the help of state or federal agencies, such as the Army Corps of Engineers.

Levees/Floodwalls - Probably the best know structural flood control measure is either a levee (a barrier of earth) or a floodwall made of steel or concrete erected between the watercourse and the land. If space is a consideration, floodwalls are typically used, since levees need more space. Levees and floodwalls should be set back out of the floodway, so that they will not divert floodwater onto other properties.

Diversions - A diversion is simply a new channel that sends floodwater to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the stream spills over the diversion channel or tunnel, which carries the excess water to the receiving lake or river.

Diversions are limited by topography; they won't work everywhere. Unless the receiving water body is relatively close to the flood prone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel is needed. In either case, care must be taken to ensure that the diversion does not create a flooding problem somewhere else.

Channel Modifications - Channel modifications include making a channel wider, deeper, smoother, or straighter. These techniques will result in more water being carried away, but, as with other techniques mentioned, it is important to ensure that the modifications do not create or increase a flooding problem downstream.

Dredging: Dredging is often cost-prohibitive because the dredged material must be disposed of somewhere else, and the stream will usually fill back in with sediment. Dredging is usually undertaken only on larger rivers, and then only to maintain a navigation channel.

Drainage modifications: These include man-made ditches and storm sewers that help drain areas where the surface drainage system is inadequate or where underground drainage ways may be safer or more attractive. These approaches are usually designed to carry the runoff from smaller, more frequent storms.

Storm Sewers - Mitigation techniques for storm sewers include installing new sewers, enlarging small pipes, street improvements, and preventing back flow. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving body of water can absorb the increased flows without increased flooding.

In many developments, streets are used as part of the drainage system, to carry or hold water from larger, less frequent storms. The streets collect runoff and convey it to a receiving sewer, ditch, or stream. Allowing water to stand in the streets and then draining it slowly can be a more effective and less expensive measure than enlarging sewers and ditches.

Public Information - Public information activities are intended to advise property owners, potential property owners, and visitors about the hazards associated with a property, ways to protect people and property from these hazards, and the natural and beneficial functions of a floodplain.

- **Map Information -** Flood maps developed by FEMA outline the boundaries of the flood hazard areas. These maps can be used by anyone interested in a property to determine if it is flood prone. These maps are available from FEMA, the NH Office of Emergency Management, the NH Office of State Planning, or your regional planning commission.

Outreach Projects - Outreach projects are proactive; they give the public information even if they have not asked for it. Outreach projects are designed to encourage people to seek out more information and take steps to protect themselves and their properties. Examples of outreach activities include:

- Mass mailings or newsletters and e-newsletters to all residents
- Posting resource information on town website and social media accounts
- Notices directed to floodplain residents
- Displays in public buildings, malls, etc.
- Newspaper articles and special sections
- Radio and TV news releases and interview shows
- A local flood proofing video for cable TV programs and to loan to organizations
- A detailed property owner handbook tailored for local conditions
- Presentations at meetings of neighborhood groups

Research has shown that outreach programs work, although awareness is not enough. People need to know what they can do about the hazards, so projects should include information on protection measures. Research also shows that locally designed and run programs are much more effective than national advertising.

Real Estate Disclosure - Disclosure of information regarding flood-prone properties is important if potential buyers are to be able to mitigate damage. Federally regulated lending institutions are required to advise applicants that a property is in a floodplain. However, this requirement needs to be met only

five days prior to closing, and by that time, the applicant is typically committed to the purchase. State laws and local real estate practice can help by making this information available to prospective buyers early in the process.

Library - Your local library can serve as a repository for pertinent information on flooding and flood protection. Some libraries also maintain their own public information campaigns, augmenting the activities of the various governmental agencies involved in flood mitigation.

Technical Assistance - Certain types of technical assistance are available from the NFIP Coordinator, FEMA, and the Natural Resources Conservation District. Community officials can also set up a service delivery program to provide one-on-one sessions with property owners. An example of technical assistance is the flood audit, in which a specialist visits a property. Following the visit, the owner is provided with a written report, detailing the past and potential flood depths, and recommending alternative protection measures.

Environmental Education - Education can be a great mitigating tool, if people can learn what not to do before damage occurs. And the sooner the education begins, the better. Environmental education programs for children can be taught in the schools, park and recreation departments, conservation associations, or youth organizations. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river. Education programs do not have to be limited to children. Adults can benefit from knowledge of flooding and mitigation measures. And decision-makers, armed with this knowledge, can make a difference in their communities.

II. EARTHQUAKES

- **PREVENTIVE -** Planning/zoning to keep critical facilities away from fault lines.
  Planning, zoning and building codes to avoid areas below steep slopes or soils subject to liquefaction.
  Building codes to prohibit loose masonry, overhangs, etc.
- **PROPERTY PROTECTION:**
  Acquire and clear hazard areas.
  Retrofitting to add braces, remove overhangs.
  Apply mylar to windows and glass surfaces to protect from shattering glass.
  Tie down major appliances provide flexible utility connections.
  Earthquake insurance riders.
- **EMERGENCY SERVICES -** Earthquake response plans to account for secondary problems, such as fires and hazardous materials spills.
  Slope stabilization.

III. DAM FAILURE

- **PREVENTIVE:**
  Dam failure inundation maps.
  Planning/zoning/open space preservation to keep area clear.
  Building codes with flood elevation based on dam failure.
  Dam safety inspections.
  Draining the reservoir when conditions appear unsafe.

- **PROPERTY PROTECTION -** Acquisition of buildings in the path of a dam breach flood. Flood insurance.
- **EMERGENCY SERVICES -** Dam conditioning monitoring; warning and evacuation plans based on dam failure.
- **EMERGENCY SERVICES -** Dam improvements, spillway enlargements. Remove unsafe dams.

IV. WILDFIRES AND CONFLAGRATION

- **PREVENTIVE:**
  Zoning districts reflect fire risk zones.
  Planning and zoning to restrict development in areas near fire protection and water resources.
  Requiring new subdivisions to space buildings, provide firebreaks, on-site water storage, wide roads multiple accesses.
  Building code standards for roof materials, spark arrestors.
  Maintenance programs to clear dead and dry bush, trees.
  Regulation of open fires.
- **PROPERTY PROTECTION:**
  Retrofitting of roofs and adding spark arrestors.
  Landscaping to keep bushes and trees away from structures.
  Insurance rates based on distance from fire protection.
- **NATURAL RESOURCE PROTECTION -** Prohibit development in high-risk areas.
- **EMERGENCY SERVICES -** Fire Fighting

V. WINTER STORMS, HURRICANES, AND HIGH WIND EVENTS

- **PREVENTIVE -** Building code standards for light frame construction, especially for wind-resistant roofs.
- **PROPERTY PROTECTION:**
  Storm shutters and windows
  Hurricane straps on roofs and overhangs
  Seal outside and inside of storm windows and check steals in spring and fall.
  Family and/or company severe weather action plan & drills - include a NOAA weather radio, designate a shelter area or location, keep a disaster supply kit, including stored food and water, keep snow removal equipment in good repair; have extra shovels, sand, rock, salt and gas, know how to turn off water, gas, and electricity at home or work
- **NATURAL RESOURCE PROTECTION -** Maintenance program for trimming tree and shrubs
- **EMERGENCY SERVICES -** Early warning systems/NOAA Weather Radio Evacuation Plans

VI. DROUGHT

- **PREVENTITVE –** Assess vulnerability to drought risk, develop criteria for drought-related actions.
- **PROPERTY PROTECTION -** Regularly check for leaks to minimize water supply losses
- **NATURAL RESOURCE PROTECTION** – Require water conservation during drought emergencies
- **EMERGENCY SERVICES** – Monitor drought conditions

VII. EXTREME TEMPERATURES

- **PREVENTITIVE**:
  Increase awareness of extreme temperature risk and safety through public education and outreach
  Reduce urban heat island effect by increasing tree plantings
  Assist vulnerable populations
- **PROPERTY PROTECTION**:
  Educate residents on how to protect pipes from freezing
  Add building insulation to walls ant attics
- **NATURAL RESOURCE PROTECTION** – Monitor drought conditions during periods of extreme heat
- **EMERGENCY SERVICES** – Identify at-risk populations, establish and promote accessible heating and cooling centers

VIII. CLIMATE CHANGE – see strategies listed above

IX. INFECTIOUS DISEASE - https://www.fema.gov/sites/default/files/2020-07/fema_r2_guide-to-connecting-mitigation-public-health_booklet.pdf

- **PREVENTATIVE** – Combine risk awareness and emergency preparedness campaigns with public health campaigns
- **PROPERTY PROTECTION** – Zoning changes to enable safe and flexible use of public spaces
- **NATURAL RESOURCE PROTECTION** – Maintain public open spaces to provide safe recreational opportunities
- **EMERGENCY SERVICES** – Collaborate with health services and mental health providers

Appendix B – Technical and Financial Assistance for Hazard Mitigation

Local Municipalities must have a FEMA-approved Hazard Mitigation Plan to be eligible for Hazard Mitigation Assistance Grants. Consult with your NH Homeland Security and Emergency Management Field Representative about active funding opportunities.

HAZARD MITIGATION GRANT PROGRAM (HMGP) - Authorized under Section 404 of the Stafford Act, the Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster.
Hazard Mitigation Grant Program funding is only available in States following a Presidential disaster declaration. Eligible applicants are:

- State and local governments
- Indian tribes or other tribal organizations
- Certain private non-profit organization

Individual homeowners and businesses may not apply directly to the program; however, a community may apply on their behalf. HMGP funds may be used to fund projects that will reduce or eliminate the losses from future disasters. Projects must provide a long-term solution to a problem, for example, elevation of a home to reduce the risk of flood damage as opposed to buying sandbags and pumps to fight the flood. In addition, a project's potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage.

PRE-DISASTER MITIGATION GRANTS PROGRAM – The Pre-Disaster Mitigation Grants Program provides technical and financial assistance to States and local governments for cost-effective pre-disaster hazard mitigation activities that complement a comprehensive mitigation program, and reduce injuries, loss of life, and damage and destruction of property. FEMA provides grants to States and Federally recognized Indian tribal governments that, in turn, provide sub-grants to local governments (to include Indian Tribal governments) for mitigation activities such as planning, and the implementation of projects identified through the evaluation of natural hazards.

FLOOD MITIGATION ASSISTANCE (FMA) PROGRAM - FEMA provides funding to assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP). There are three types of grants available under FMA: Planning, Project, and Technical Assistance Grants. FMA Planning Grants are available to States and communities to prepare Flood Mitigation Plans. NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project Grants. FMA Project Grants are available to States and NFIP participating communities to implement measures to reduce flood losses. Ten percent of the Project Grant is made available to States as a Technical Assistance

Grant. These funds may be used by the State to help administer the program. Communities receiving FMA Planning and Project Grants must participate in the NFIP.

EMERGENCY MANAGEMENT PERFORMANCE GRANT

GUIDELINES - Emergency Management Performance Grant (EMPG Program) funding is available to local communities and eligible Agencies for projects that fall in FOUR general areas of Emergency Management: Planning activities; Training activities; Drills and Exercises; and Emergency Management Administration. Contact Heather Dunkerley at NHHSEM,

The following list of possible projects and activities is meant to guide you in selecting projects for an EMA Grant Submission. This list of suggested projects is not intended to be all-inclusive. Local communities or agencies may have other specific projects and activities that reflect local needs based on local capability assessments and local hazards.

Planning Activities may include:

- Develop a Hazard Mitigation Plan for your community.
- Prepare a hazard mitigation project proposal for submission to NHHSEM.
- Create, revise, or update Dam Emergency Action plans.
- Update your local Emergency Operations Plan (EOP). Consider updating a number of specific annexes each year to ensure that the entire plan is updated at least every four years.
- If applicable, develop or incorporate a regional HazMat Team Annex into your EOP.
- Develop an Anti-Terrorism Annex into your EOP.
- Develop a local/regional Debris Management Annex into your EOP.
- Develop and maintain pre-scripted requests for additional assistance (from local area public works, regional mutual aid, State resources, etc.) and local declarations of emergency.
- Develop and maintain written duties and responsibilities for EOC staff positions and agency representatives.
- Develop and maintain a list of private non-profit organizations within your local jurisdiction to ensure that these organizations are included in requests for public assistance funds.
- Prepare a submission for nomination as a “Project Impact” Community.

Training Activities may include:

- Staff members attend training courses at the Emergency Management Institute.
- Staff members attend a “field delivered” training course conducted by NHHSEM.
- Staff members attend other local, State, or nationally sponsored training events, which provides skills or knowledge relevant to emergency management.
- Staff members complete one or more FEMA Independent Study Courses.
- Identify and train a pre-identified local damage assessment team.

Drills and Exercises might include:

- Conduct multi-agency EOC Exercise (Tabletop or Functional) and forward an Exercise Evaluation Report, including after action reports, to NHHSEM (external evaluation of exercises is strongly encouraged). Drills or Exercises might involve any of the following scenarios:
    - Hurricane Exercise
    - Terrorism Exercise
    - Severe Storm Exercise
    - Communications Exercise
    - Mass Causality Exercise involving air, rail, or ship transportation accident

- Participate in multi-State or multi-Jurisdictional Exercise and forward Exercise Report to NHHSEM.
- HazMat Exercise with Regional HazMat Teams
- NHHSEM Communications Exercises
- Observe or evaluate State or local exercise outside your local jurisdiction.
- Assist local agencies and commercial enterprises (nursing homes, dams, prisons, schools, etc.) in developing, executing, and evaluating their exercise.
- Assist local hospitals in developing, executing and evaluating Mass Care, HazMat, Terrorism, and Special Events Exercises.
- Administrative Projects and Activities may include:
- Maintain an Emergency Operations Center (EOC) and alternate EOC capable of accommodating staff to respond to local emergencies.
- Establish and maintain a Call-Down List for EOC staff.
- Establish and maintain Emergency Response/Recovery Resource Lists.
- Develop or Update Emergency Management Mutual Aid Agreements with a focus on Damage Assessment, Debris Removal, and Resource Management.
- Develop and maintain written duties and responsibilities for EOC staff positions and agency representatives.
- Develop or Update Procedures for tracking of disaster-related expenses by local agencies.

FLOOD MITIGATION ASSISTANCE (FMA) PROGRAM - FMA was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA regulations can be found in 44 CFR Part 78. Funding for the program is provided through the National Flood Insurance Fund. FMA is funded at $20 million nationally. FMA provides funding to assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP).

There are three types of grants available under FMA: Planning, Project, and Technical Assistance Grants. FMA Planning Grants are available to States and communities to prepare Flood Mitigation Plans. NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project Grants. FMA Project Grants are available to States and NFIP participating communities to implement measures to reduce flood losses. Ten percent of the Project Grant is made available to States as a Technical Assistance Grant. These funds may be used by the State to help administer the program. Communities receiving FMA Planning and Project Grants must participate in the NFIP. A few examples of eligible FMA projects include: the elevation, acquisition, and relocation of NFIP-insured structures.

States are encouraged to prioritize FMA project grant applications that include repetitive loss properties. The FY 2001 FMA emphasis encourages States and communities to address target repetitive loss properties identified in the Agency's Repetitive Loss Strategy. These include structures with four or more losses, and structures with 2 or more losses where cumulative payments have exceeded the property value. State and communities are also encouraged to develop Plans that address the mitigation of these target repetitive loss properties.

Appendix C - Saffir/Simpson Hurricane Scale

This scale can be used to give an estimate of the potential property damage and flooding expected along the coast with a hurricane.

Category	Definition	Effects
One	Winds 74-95 mph	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal road flooding and minor pier damage
Two	Winds 96-110 mph	Some roofing material, door, and window damage buildings. Considerable damage to vegetation, mobile homes, and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of center. Small craft in unprotected anchorages break moorings.
Three	Winds 111-130 mph	Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain continuously lower than 5 feet ASL may be flooded inland 8 miles or more.
Four	Winds 131-155 mph	More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach. Major damage to lower floors of structures near the shore. Terrain continuously lower than 10 feet ASL may be flooded requiring massive evacuation of residential areas inland as far as 6 miles.
Five	Winds greater than 155 mph	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Major damage to lower floors of all structures located less than 15 feet ASL and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5 to 10 miles of the shoreline may be required.

Appendix D - Enhanced Fujita Tornado Damage Scale

The Enhanced Fujita Scale			
F-Scale Number	Potential Damage	Wind Speed	Type of Damage
F0	Light	65 – 85 mph	Little to no damage to man-made structures. Breaks branches off trees; pushes over shallow-rooted trees; damages signs
F1	Moderate	86 – 110 mph	Beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; Moderate damage.
F2	Considerable	111 – 135 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars from trains pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe	136 – 165 mph	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cards lifted and thrown.
F4	Devastating	166 – 200 mph	Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	Incredible	Over 200 mph	Strong frame houses leveled off foundations and carried considerable distances; automobile-sized missiles fly through the air in excess of 109 yards; trees debarked; steel reinforced concrete structures badly damaged. Complete devastation.

Appendix E - The Richter Magnitude Scale

Earthquake Severity

Magnitudes	Earthquake Effects
Less than 3.5	Generally, not felt but recorded.
3.5-5.4	Often felt, but rarely causes damage.
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0-7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

The Richter Magnitude Scale - Seismic waves are the vibrations from earthquakes that travel through the Earth; they are recorded on instruments called seismographs. Seismographs record a zig-zag trace that shows the varying amplitude of ground oscillations beneath the instrument. Sensitive seismographs, which greatly magnify these ground motions, can detect strong earthquakes from sources anywhere in the world. The time, locations, and magnitude of an earthquake can be determined from the data recorded by seismograph stations.

Earthquakes with magnitude of about 2.0 or less are usually call microearthquakes; they are not commonly felt by people and are generally recorded only on local seismographs. Events with magnitudes of about 4.5 or greater - there are several thousand such shocks annually - are strong enough to be recorded by sensitive seismographs all over the world. Great earthquakes, such as the 1964 Good Friday earthquake in Alaska, have magnitudes of 8.0 or higher. On average, one earthquake of such size occurs somewhere in the world each year. The Richter Scale has no upper limit. Recently, another scale called the moment magnitude scale has been devised for more precise study of great earthquakes. The Richter Scale is not used to express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does nothing more than frightens wildlife. Large-magnitude earthquakes that occur beneath the oceans may not even be felt by humans.

Appendix F – Thunderstorm Criteria

Extreme Weather Madness
Thunderstorm Criteria

THUNDERSTORM TYPES	Rainfall Rate/hr	MAX WIND GUST	HAIL SIZE	PEAK TORNADO Possibility	LIGHTNING FREQUENCY (5 min Intervals)	Darkness Factor	STORM IMPACT
T-1 – Weak thunderstorms or Thundershowers	.03-.10	< 25 MPH	None	None	Only a few strikes during the storm.	Slightly Dark. Sunlight may be seen under the storm.	1. No damage. 2. Gusty winds at times.
T-2 – Moderate Thunderstorms.	.10"-.25"	25-40 MPH	None	None	Occasional 1-10	Moderately Dark. Heavy downpours may cause the need for car lights.	1. Heavy downpours. 2. Occasional lightning. 3. Gusty winds. 4. Very little damage. 5. Small tree branches may break 6. Lawn furniture moved around
T-3 – Heavy Thunderstorms 1. Singular or lines of storms.	.25"-.55"	40-57 MPH	1/4 " to ¾"	EF0	Occasional to Frequent 10-20	Dark. Car lights used. Visibility low in heavy rains. Cars may pull off the road.	1. Minor Damage. 2. Downpours that produce some flooding on streets. 3. Frequent lightning could cause house fires. 4. Hail occurs within the downpours. 5. Small branches are broken. 6. Shingles are blown off roofs.
T-4 – Intense Thunderstorms 1. Weaker supercells 2. Bow Echos or lines of Storms	.55" – 1.25"	58 to 70 MPH	1" to 1.5"	EF0 to EF2	Frequent 20-30	Very Dark. Car lights used. Some street lights come on.	1. Moderate Damage. 2. Heavy rains can cause flooding to streams and creeks. Roadway flooding. 3. Hail can cause dents on cars and cause crop damage. 3. Wind damage to trees and buildings. 4. Tornado damage. 5. Power outages
T-5 – Extreme Thunderstorms 1. Supercells with familty of tornadoes. 2. Derecho Windstorms	1.25" – 4"	Over 70 Mph	Over 1.5" to 4"	EF3 to EF5	Frequent to Continuous. > 30	Pitch Black. Street Lights come on. House lights maybe used	1. Severe Damage to Trees and Property. Damage is widespread. 2. Flooding rains. 3. Damaging hail. 4. Damaging wind gusts to trees and buildings. 5. Tornadoes F3-F5 or family of tornadoes can occur. Tornadoes can cause total devastation. 6. Widespread power outages.

Appendix G - Lightning Risk Definitions

Lightning Risk Definitions	
Low Risk	Thunderstorms are only expected to be isolated or widely scattered in coverage (20 Percent Chance). Atmospheric conditions do not support frequent cloud-to-ground lightning strikes.
Moderate Risk	Thunderstorms are forecast to be scattered in coverage (30-50 Percent Chance). Atmospheric conditions support frequent cloud-to-ground lightning strikes.
High Risk	Thunderstorms are forecast to be numerous or widespread in coverage (60-100 Percent Chance). Atmospheric conditions support continuous and intense cloud-to-ground lightning strikes.

Appendix H - Hail Size Description Chart

Hail Size Description Chart

Hailstone size	Measurement	
	in.	cm.
bb	< 1/4	< 0.64
pea	1/4	0.64
dime	7/10	1.8
penny	3/4	1.9
nickel	7/8	2.2
quarter	1	2.5
half dollar	1 1/4	3.2
golf ball	1 3/4	4.4
billiard ball	2 1/8	5.4
tennis ball	2 1/2	6.4
baseball	2 3/4	7.0
softball	3.8	9.7
Compact disc / DVD	4 3/4	12.1

Note: Hail size refers to the diameter of the hailstone.

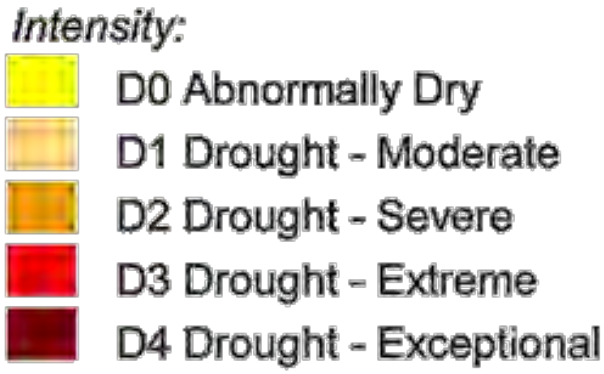
Appendix I - Sperry-Pitz Ice Accumulation Index

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
4	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Appendix J - NOAA U.S. Drought Monitor Scale



Appendix K - Class of Wildfire and Wildland Urban Zones

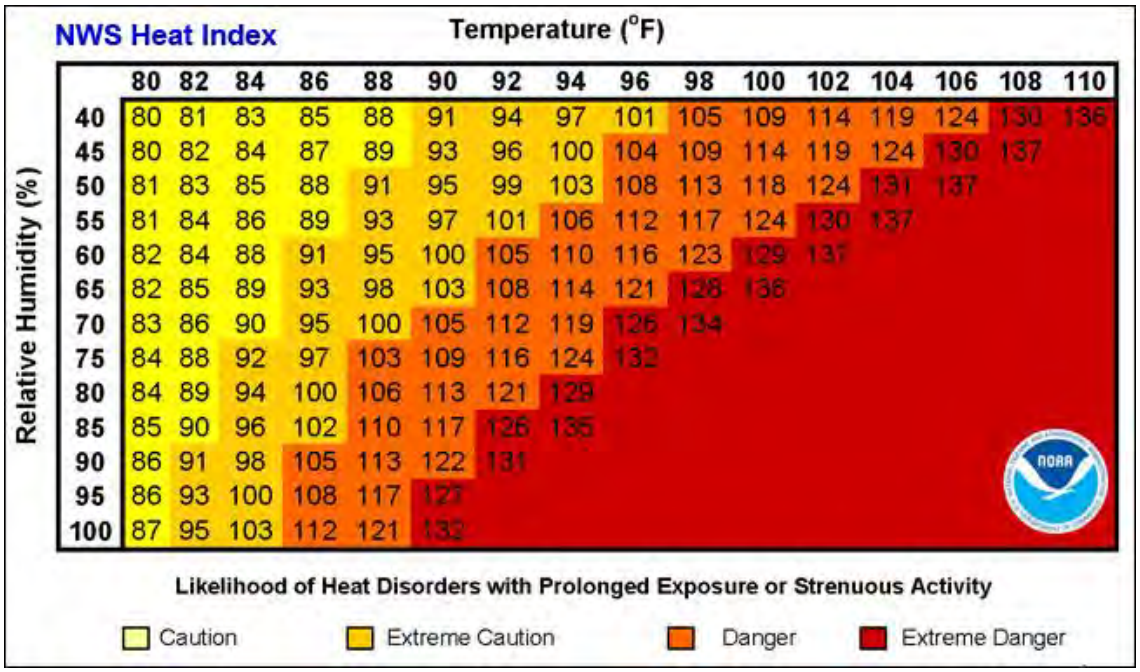
Size Class of Fire

- Class A - one-fourth acre or less;
- Class B - more than one-fourth acre, but less than 10 acres;
- Class C - 10 acres or more, but less than 100 acres;
- Class D - 100 acres or more, but less than 300 acres;
- Class E - 300 acres or more, but less than 1,000 acres;
- Class F - 1,000 acres or more, but less than 5,000 acres;
- Class G - 5,000 acres or more.

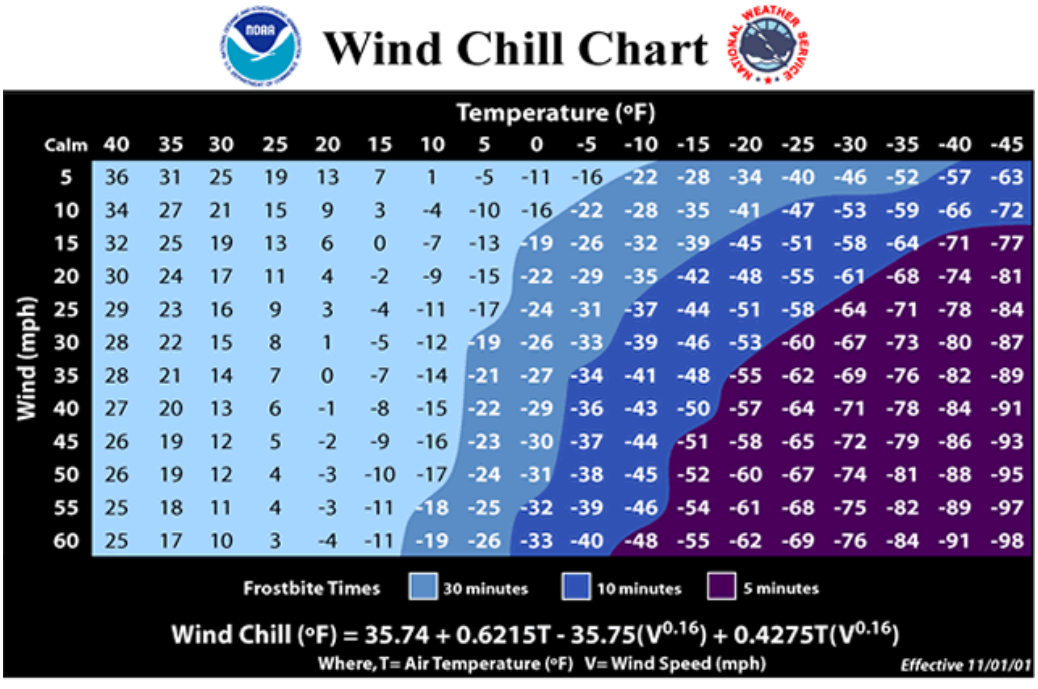
Table 4: E-Scale Building Construction Classes and Attributes

WUI scale	Building Construction Class	Ignition Vulnerabilities from Embers and Fire	Building Construction and Landscaping Attributes for Protection against Embers
E1 or F1	WUI 1	None	Normal Construction Requirements: - Maintained Landscaping - Local AHJ-Approved Access for firefighting equipment
E2 or F2	WUI 2	In this area, highly volatile fuels could be ignited by embers. Weathered, dry combustibles with large surface areas can become targets for ignition fro m embers.	Low Construction Hardening Requirements: - Treated combustibles allowed on structure - Attached treated combustibles allowed - Treated combustibles allowed around structure - Low flammability plants - Irrigated and well maintained Landscaping - Local AHJ-Approved Access for firefighting equipment
E3 or F3	WUI 3	Exposed combustibles are likely to ignite in this area from high ember flux or high heat flux	Intermediate Construction Hardening Requirements: - No exposed combustibles on structure - Combustibles placed well away from structure - Low flammability plants - Irrigated and well maintained landscaping - Local AHJ-Approved Access for firefighting equipment
E4 or F4	WUI 4	Ignition of combustibles from direct flame contact is likely.	High Construction Hardening Requirements: - No exposed combustibles - All vents, opening must be closed - Windows and doors must be covered with insulated non-combustible coverings. - Irrigated and well maintained low flammability landscaping - Local AHJ-Approved Access for firefighting equipment

Appendix L - Extreme Temperatures Heat Index



Appendix M – Wind Chill Chart



Appendix N - Definition of Infectious Diseases – Mayo Clinic

Infectious diseases are disorders caused by organisms — such as bacteria, viruses, fungi or parasites. Many organisms live in and on our bodies. They're normally harmless or even helpful. But under certain conditions, some organisms may cause disease.

Some infectious diseases can be passed from person to person. Some are transmitted by insects or other animals. And you may get others by consuming contaminated food or water or being exposed to organisms in the environment.

Signs and symptoms vary depending on the organism causing the infection, but often include fever and fatigue. Mild infections may respond to rest and home remedies, while some life-threatening infections may need hospitalization.

Many infectious diseases, such as measles and chickenpox, can be prevented by vaccines. Frequent and thorough hand-washing also helps protect you from most infectious diseases.

Appendix O - Documentation of Planning Process

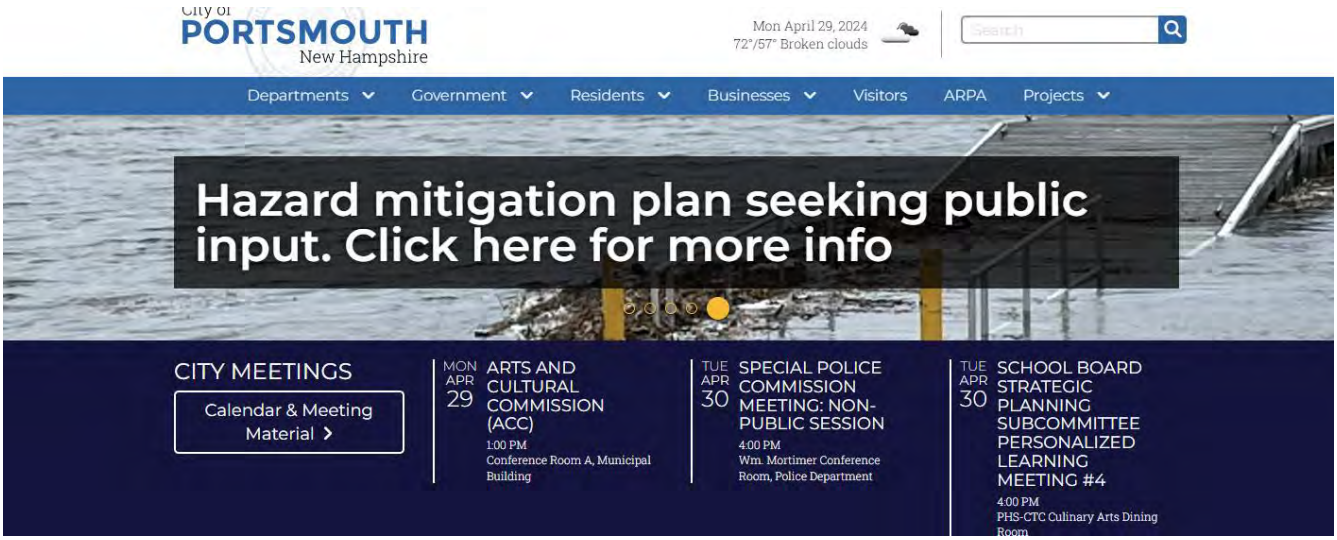
To initiate the Plan Update process, the City Manager/Emergency Management Director and Fire Chief/Emergency Management Coordinator invited Department Heads from all City departments to participate in the Plan Update, as well as representatives from the Portsmouth business community, academia, and organizations serving vulnerable populations. Plan Update development occurred at a very rapid pace due to funding delays and the existing Plan expiration deadline, with meetings held on April 18, 2024, and June 26, 2024. The Hazard Mitigation Committee included the individuals listed below.

Plan Update Committee Member Name	Plan Update Committee Member Title
Karen Conrad	City Manager/Emergency Management Director, City of Portsmouth
William McQuillen	Fire Chief/Emergency Management Coordinator, City of Portsmouth
Jason Gionet	Assistant Fire Chief, City of Portsmouth
Mark Newport	Police Chief, City of Portsmouth
Mike Maloney	Deputy Police Chief, City of Portsmouth
Peter Rice	Public Works Director, City of Portsmouth
Brian Goetz	Deputy Public Works Director, City of Portsmouth
Eric Eby	City Engineer, City of Portsmouth
Erich Fielder	Engineering Supervisor, City of Portsmouth
Peter Britz	Planning and Sustainability Director, City of Portsmouth
Kate Homet	Associate Environmental Planner, City of Portsmouth
Sean Clancy	Assistant City Manager for Economic and Community Development, City of Portsmouth
Kim McNamara	Health Officer, City of Portsmouth
Ellen Tully	Welfare Director, City of Portsmouth
Joanna Diemer	Administrative Assistant, City of Portsmouth
Monte Bohanan	Director of Communications, City of Portsmouth

Rockingham Planning Commission (RPC) staff worked with the Emergency Management Coordinator (EMC) to directly seek input from residents, including neighborhoods most impacted by flooding, local businesses, academia, organizations supporting socially vulnerable populations, and Emergency Management Directors in abutting communities. City officials maintain a list of businesses in Portsmouth and a list of human resource organizations serving socially vulnerable and underrepresented residents. The Assistant City Manager for Economic and Community Development works closely with the Chamber Collaborative of Greater Portsmouth to communicate with all local businesses and invited all businesses to participate in the Plan Update process and to review the draft Plan Update. The EMC and RPC reviewed the draft Plan Update with representatives serving vulnerable populations. Emergency Management Directors in the abutting communities were emailed the draft Plan Update and invited to comment. Individuals listed below were invited to participate in the Plan Update process and review the draft Plan Update.

Social Service Organization	Contact Person
Southern New Hampshire Services - Provides social service programs for economically disadvantaged elderly, youth, and other vulnerable populations in Rockingham and Hillsborough County.	Ryan Clouthier, Chief Operating Officer
Greater Seacoast Community Health/Families First Health and Support Center – Not-for-profit community health and family resource center	Jessica Garlough, Director of Family and Social Services
Seacoast Regional Public Health Network – Provides multiple public health services, including public health emergency preparedness	Julia Meuse, Public Health Network Manager Public Health Emergency Preparedness Coordinator
Portsmouth Housing Authority	Craig Welch, Executive Director
Academia	**Contact Person**
Portsmouth High School	Stefano Chinosi, Principal
Portsmouth Middle School	Phillip Davis, Principal
Dondero Elementary School	Katherine Callahan, Principal
Little Harbour Elementary School	Erin Lawson, Principal
New Franklin Elementary School	Joanne Simons, Principal
Robert J. Lister Academy	Steve Krzyzanowki, Program Director
Portsmouth School Department	Zach McLaughlin, Superintendent
Abutting Communities	**Contact Person**
Newington, New Hampshire	EJ Hoyt and Michael Bilodeau, Co-Emergency Management Directors
New Castle, New Hampshire	Ted Hartmann, Emergency Management Director
Greenland, New Hampshire	Dennis Cote, Emergency Management Director
Rye, New Hampshire	Kevin Walsh, Emergency Management Director
Kittery, Maine	Robert Richter, Emergency Management Director
Business Community	**Contact Person**
The Chamber Collaborative of Greater Portsmouth	Ben VanCamp, President

Public notices about the Plan Update meetings were posted on the Town website and social media accounts to inform viewers and followers about meetings and opportunities to comment on the Plan. Notice about the Plan Update process was also posted on the Rockingham Planning Commission's website and published in the RPC's monthly newsletter. The newsletter is distributed to local officials in the 27-town RPC region. All Plan Update meetings were open to the public. RPC staff facilitated the Plan Update Committee meetings, guided the plan update process, and prepared the Plan Update.



HAZARD MITIGATION PLAN PUBLIC INPUT INFO

The City of Portsmouth is updating its Natural Hazard Mitigation Plan. The Federal Emergency Management Agency (FEMA) requires every community to develop and maintain a Natural Hazard Mitigation Plan with the goal of increasing resiliency to natural hazards such as flooding, storm surge, extreme temperatures, wildfires, etc.

Community members are welcome to share information on how and where natural hazards impact the City, and their neighborhoods. Any input on how the City can be better prepared is welcomed.

In simple terms, What are the hazards? – past and potential future hazards. Identify existing mitigation strategies, planning future strategies and identifying what may need to be considered to improve preparedness, and aid in response and recovery capability.

Please contact Chief William McQuillen at **wjmcquillen@cityofportsmouth.com** or (603-427-1515) to share information or if you have questions about the Plan itself.

RPC Begins Updates to Hazard Mitigation Plans in Atkinson and Portsmouth

NH Homeland Security and Emergency Management has awarded FEMA grant funds to the RPC to work with the towns of Atkinson and Portsmouth on updates to their Hazard Mitigation Plans. These Plans will include actions to mitigate and reduce the risks and impacts of natural hazards on people and property. Residents, landowners, business owners, municipal officials and other members of the public are welcome to attend plan update meetings.

Please contact Theresa Walker, RPC Consulting Planner, for information on meeting dates, or to share comments or questions, theresawalker@comcast.net.

Appendix P – Plan Approval Letter from FEMA