

CITY OF QUINCY MULTI-HAZARD MITIGATION PLAN

5-YEAR UPDATE

Adopted April 2, 2019

Prepared for the City of Quincy by Tighe & Bond

FEMA

Volume 1

U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

APR 1 1 2019

Samantha C. Phillips, Director
Massachusetts Emergency Management Agency
400 Worcester Road
Framingham, MA 01702-5399

Dear Director Phillips:

The U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA) Region I Mitigation Division, Risk Analysis Branch has approved the City of Quincy Multi-Hazard Mitigation Plan Update effective **April 9, 2019** through **April 8, 2024** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

With this plan approval, the jurisdiction is eligible to apply to the Massachusetts Emergency Management Agency for mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated according to the specific eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in your community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

The plan must be updated and resubmitted to the FEMA Region I Mitigation Division for approval every five years to remain eligible for FEMA mitigation grant funding.

Thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please contact Melissa Surette at (617) 956-7559 or Melissa.Surette@fema.dhs.gov.

Sincerely,

Paul F. Ford
Acting Regional Administrator

PFF: ms

cc: Sarah White, State Hazard Mitigation Officer, MEMA
Jeffrey Zukowski, Hazard Mitigation Planner, MEMA
Beth Dubrawski, Hazard Mitigation Contract Specialist, MEMA

INTRODUCED BY: **MAYOR THOMAS P. KOCH**

CITY OF QUINCY
IN COUNCIL

ORDER NO. 2019-053

ORDERED: March 18, 2019

BE IT ORDAINED that the City Council having convened in a regularly scheduled public meeting at which this matter was duly noticed and considered, the City Council hereby adopts the Hazard Mitigation Plan attached hereto for the City of Quincy.

PASSED TO BE ORDAINED: **April 1, 2019**

ATTEST: Nicole L. Crispo

CLERK OF COUNCIL

APPROVED: **April 2, 2019**

MAYOR

YEAS Cain, Croall, DiBona, Harris, Hughes, Liang, Mahoney, McCarthy, Palmucci
NAYS Cain, Croall, DiBona, Harris, Hughes, Liang, Mahoney, McCarthy, Palmucci

LOCAL MITIGATION PLAN REVIEW TOOL
City of Quincy, MA

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: City of Quincy, MA	**Title of Plan:** City of Quincy MA Multi-Hazard Mitigation Plan	**Date of Plan:** 12/14/18 **Plan adopted:**
Single or Multi-jurisdiction plan? Single-Jurisdiction	**New Plan or Plan Update?** Update	
Local Point of Contact: *Rob Stevens, AICP* *Deputy Planning Director* *617-376-1411* *rstevens@quincyma.gov*	**Local Point of Contact:** *Gabrielle Belfit, Contractor (Tighe & Bond)* *508-304-6362* *GCBelfit@tigheBond.com*	

State Reviewer: Sarah White, MEMA SHMO	**Title:** sarah.white@state.ma.us	**Date:** 01/02/2019

FEMA Reviewer: Gabriella Spitzer Brigitte Ndikum-Nyada Parker Moore	**Title:** CERC FEMA Community Planner FEMA Community Planning Specialist	**Date:** 1/17/2019 1/18/2019 4/9/2019
Date Received in FEMA Region I	01/02/2019, 4/8/2019	
Plan Not Approved		
Plan Approvable Pending Adoption	01/18/2019 *(expedited review due to pending grant app.)*	
Plan Adopted by Jurisdiction	4/2/2019	
Plan Approved	4/9/2019	

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Sec. 2, pp. 2-1 to 2-7	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Sec. 2, pp. 2-1 to 2-7	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Sec. 2, pp. 2-1 to 2-7	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	App. A, pdf pp. 3 to 5	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Sec. 8, p. 8-2	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Sec. 8, pp. 8-1 to 8-2	X	
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Sec. 3, pp. 3-1 to 3-88	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section	Met	Not Met
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Sec. 1, pp. 1-12 to 1-14; Sec. 3, pp. 3-4 to 3-88	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Sec. 3, pp. 3-4 to 3-88; Sec. 4, pp. 4-3 to 4-31; Sec. 5, pp. 5-1 to 5-33	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Sec. 3, pp. 3-12 to 3-13; Sec. 5, p. 5-5	X	
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Sec. 1.5, pp. 1-9 to 1-12; Sec. 6, pp. 6-1 to 6-13	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Sec. 6, pp. 6-6 to 6-8	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Sec. 7, pp. 7-1 to 7-4	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Sec. 7, pp. 7-4 to 7-18	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Sec. 7, pp. 7-4 to 7-18	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section	Met	Not Met
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Sec. 6, pp. 6-1 to 6-2; Sec. 7, pp. 7-17 to 7-18	X	
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Sec. 1, p. 1-5; Sec. 4, pp. 4-1 to 4-3; Sec. 5, pp. 5-11 to 5-12	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Sec. 1, pp. 1-15 to 1-16; Sec. 7, pp. 7-5 to 7-10	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Sec. 7, p. 7-19	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Sec. 9, p. 9-2	X	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))			
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section	Met	Not Met
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 2:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Strengths:

- The planning process is well documented and includes a detailed schedule of the events and meetings that contributed to development of the plan.
- Community officials were effectively engaged in the planning process. Their feedback shaped the content of the plan.
- The outreach strategy was comprehensive, with a variety of opportunities for the public to participate.
- It must be noted that, the City of Quincy used the recommended revisions and comments from the 2012 HMP to improve this HMP Update. Well done.

Opportunities for Improvement:

- Provide more detail about what public and stakeholder feedback was received and how it was incorporated into the plan. Documenting feedback will be useful for evaluating the plan during future updates.
- Include detailed and specific information on continuous outreach to stakeholders and the public.

Element B: Hazard Identification and Risk Assessment

Strengths:

- Hazard profiles are well-defined, with detailed information about the context of the hazard and the risk it presents to the community. The section on the urban heat island effect and extreme heat adds important information for such an urbanized community.
- The plan does an excellent job of identifying how the probability or severity of future hazard events may change in the future due to changes in climate, population, or land use.
- Maps clearly highlight the areas and facilities that are most at risk, especially in section 4, where each section of the city is discussed.
- The community's greatest vulnerabilities are discussed in a clear, concise way that makes it easy to understand significant risks. The risk assessment lays the path for a successful analysis of mitigation actions.

Opportunities for Improvement:

- Consider consolidating the sections on wind hazards rather than spreading them out between the severe weather and tornadoes/thunderstorms sections.

Element C: Mitigation Strategy

Strengths:

- The plan provides a comprehensive, detailed description of the community's existing programs, plans, and policies that relate to mitigation.
- The plan's goals and mitigation actions are integrated with other community planning efforts.
- The plan includes specific, targeted mitigation actions that address the community's key vulnerabilities. Actions are detailed with information on funding, resources, timeframes, and responsible personnel.
- The plan includes of a variety of different types of mitigation actions (local plans and regulations, structure and infrastructure projects, natural system protections, and education and awareness programs).
- The plan indicates that the STAPLEE method was used to prioritize proposed mitigation actions.

Opportunities for Improvement:

- Further develop the analysis of how existing capabilities could be expanded. As part of the analysis, specify what is currently lacking (funding, personnel, equipment, regulations, authority, community consensus, etc.).
- Provide more details about what mitigation actions will entail and the tasks that will be involved.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Strengths:

- The plan does a great job and clearly describes the community's development changes since the last update.
- The plan includes a projection of planned and/or potential future development.
- Progress on mitigation actions is clear and comprehensive.
- Priorities in the plan recognize current conditions. They are reflective of the planning process, risk assessment, and mitigation strategy.

Opportunities for Improvement:

- Consider including a discussion of success stories, lessons learned, and how mitigation activities have increased the community's resilience and support other long-term community planning goals.

B. Resources for Implementing Your Approved Plan

The home for the online version of the 2018 SHMCAP as well as future updates can be accessed at http://resilientma.org/ and the State's climate action page at https://www.mass.gov/topics/climate-action

Technical Assistance:

FEMA

- FEMA Climate Change: Provides resources that address climate change.
- FEMA Hazard Mitigation Planning Online Webliography: This compilation of government and private online sites is a useful source of information for developing and implementing hazard mitigation programs and plans in New England.
- FEMA Library: FEMA publications can be downloaded from the library website. These resources may be especially useful in public information and outreach programs. Topics include building and construction techniques, NFIP policies, and integrating historic preservation and cultural resource protection with mitigation.
- FEMA RiskMAP: Technical assistance is available through RiskMAP to assist communities in identifying, selecting, and implementing activities to support mitigation planning and risk reduction. Attend RiskMAP discovery meetings that may be scheduled in the state, especially any in neighboring communities with shared watersheds boundaries.

Other Federal

- EPA Resilience and Adaptation in New England (RAINE): A collection of vulnerability, resilience and adaptation reports, plans, and webpages at the state, regional, and community levels. Communities can use the RAINE database to learn from nearby communities about building resiliency and adapting to climate change.
- EPA Soak Up the Rain: Soak Up the Rain is a public outreach campaign focused on stormwater quality and flooding. The website contains helpful resources for public outreach and easy implementation projects for individuals and communities.
- NOAA C-CAP Land Cover Atlas: This interactive mapping tool allows communities to see their land uses, how they have changed over time, and what impact those changes may be having on resilience.
- NOAA Sea Grant: Sea Grant's mission is to provide integrated research, communication, education, extension and legal programs to coastal communities that lead to the responsible use of the nation's ocean, coastal and Great Lakes resources through informed personal, policy and management decisions. Examples of the resources available help communities plan, adapt, and recovery are the Community Resilience Map of Projects and the National Sea Grant Resilience Toolkit
- NOAA Sea Level Rise Viewer and Union for Concerned Scientists Inundation Mapper: These interactive mapping tools help coastal communities understand how their hazard risks may be changing. The "Preparing for Impacts" section of the inundation mapper addresses policy responses to protect communities.
- NOAA U.S. Climate Resilience Toolkit: This resource provides scientific tools, information, and expertise to help manage climate-related risks and improve resilience to extreme events. The "Steps to Resilience" tool may be especially helpful in mitigation planning and implementation.

State

Massachusetts Emergency Management Agency: The Massachusetts State Hazard Mitigation

Officer (SHMO) and State Mitigation Planner(s) can provide guidance regarding grants, technical assistance, available publications, and training opportunities.

- Massachusetts Departments of Conservation and Recreation and Environmental Protection can provide technical assistance and resources to communities seeking to implement their hazard mitigation plans.
- MA Mapping Portal: Interactive mapping tool with downloadable data)

Not for Profit

- Kresge Foundation Online Library: Reports and documents on increasing urban resilience, among other topics.
- Naturally Resilient Communities: A collaboration of organizations put together this guide to nature-based solutions and case studies so that communities can learn which nature-based solutions can work for them.
- Rockefeller Foundation Resilient Cities: Helping cities, organizations, and communities better prepare for, respond to, and transform from disruption.

Funding Sources:

- Massachusetts Coastal Resilience Grant Program: Funding for coastal communities to address coastal flooding, erosion, and sea level rise.
- Massachusetts Municipal Vulnerability Preparedness program: Provides support for communities to plan for climate change and resilience and implement priority projects.
- Massachusetts Water Quality Grants: Clean water grants that can be used for river restoration or other kinds of hazard mitigation implementation projects.
- Federal Grants Resource Center and Grants.gov: Lists of grant opportunities from federal agencies (HUD, DOT/FHWA, EPA, etc.) to support rural development, sustainable communities and smart growth, climate change and adaptation, historic preservation, risk analyses, wildfire mitigation, conservation, Federal Highways pilot projects, etc.
- FEMA Hazard Mitigation Assistance (HMA): FEMA's Hazard Mitigation Assistance provides funding for projects under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). States, federally recognized tribes, local governments, and some not for profit organizations are eligible applicants.
- GrantWatch: The website posts current foundation, local, state, and federal grants on one website, making it easy to consider a variety of sources for grants, guidance, and partnerships. Grants listed include The Partnership for Resilient Communities, the Institute for Sustainable Communities, the Rockefeller Foundation Resilience, The Nature Conservancy, The Kresge Climate-Resilient Initiative, the Threshold Foundation's Thriving Resilient Communities funding, the RAND Corporation, and ICLEI Local Governments for Sustainability.
- USDA Natural Resource Conservation Service (NRCS) and Rural Development Grants: NRCS provides conservation technical assistance, financial assistance, and conservation innovation grants. USDA Rural Development operates over fifty financial assistance programs for a variety of rural applications.

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Acknowledgements and Credits

This Hazard Mitigation Plan(HMP)-5-year update was prepared for the City of Quincy under the direction of the Massachusetts Emergency Management Agency (MEMA) and the Massachusetts Department of Conservation and Recreation (DCR). The HMP-update was funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Grant Program.

Massachusetts Emergency Management Agency- Kurt Schwartz, Director

Department of Conservation and Recreation- Leo Roy, Commissioner

Massachusetts Office of Coastal Zone Management- Bruce Carlisle, Director

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Cover Image Source: Boston Herald

EXECUTIVE SUMMARY

Hazard Mitigation planning is a proactive effort to identify actions that can be taken to reduce the dangers to life and property from natural hazard events. In the communities of the Boston region of Massachusetts, hazard mitigation planning tends to focus most on flooding, the most likely natural hazard to impact these communities. The Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA funding for hazard mitigation grants, to adopt a local multi-hazard mitigation plan and update this plan in five-year intervals.

The 5-year update for Quincy Hazard Mitigation Plan was prepared with funding from FEMA under the Pre-Disaster Mitigation Grant (PDM) Program. The planning process included updating the plan to reflect the new Massachusetts State Hazard Mitigation Plan and incorporating a variety of natural hazard risk and vulnerability assessments into the plan including future impacts due to climate change. The City of Quincy recognized climate change as a factor that will affect weather patterns, flooding extent, habitat and species distribution, an ultimately impact the ability to recover from disaster and risk to the economy of Quincy. The 5-year update was completed during a year that experienced record setting flood events and extensive damages to coastal properties. These unfortunate events highlighted the importance developing a Hazard Mitigation Plan, including providing opportunities for community engagement, a platform to better understanding changing climate impacts on the Cities resources and providing a systematic plan for funding hazard mitigation projects for Quincy City officials

Several notable changes to the 5-year update include:

- Completely revised goals and objectives for Quincy Hazard Mitigation Planning
- Expansion of natural hazard risk to include climate change
- Online community engagement tools: community assets viewer and flood observation tool
- Geographic planning area-based mapping and vulnerability assessment data
- Widely vetted and systematically prioritized mitigation strategies

A resiliency vision for Quincy includes empowering the residents, business community and City Leaders to make near, mid and long-term changes that will reduce future climate change impacts, protect its vital community assets, and adapt to changes already occurring. The mitigation actions included in the 2019 Hazard Mitigation Plan complement and support this resiliency vision.

SECTION 1

INTRODUCTION

Section 1 Introduction

Planning Requirements under the Federal Disaster Mitigation Act

The Federal Disaster Mitigation Act, adopted in 2000, requires that after November 1, 2004, all municipalities that wish to continue to be eligible to receive Federal Emergency Management Agency (FEMA) funding for hazard mitigation grants must adopt a local Hazard Mitigation Plan (HMP) and update the plan every 5-years. This planning requirement does not affect federally authorized disaster assistance funding and is exempt from this requirement.

A1 b

The City of Quincy has received grant funding from FEMA under the Pre-Disaster Mitigation (PDM) Program to complete the 5-year update of this HMP. The federal hazard mitigation planning and grant programs are administered in Massachusetts by the Massachusetts Emergency Management Agency (MEMA) in partnership with the Department of Conservation and Recreation (DCR).

The single jurisdiction local HMP for Quincy produced under this grant is designed to meet the requirements of the Disaster Mitigation Act, following guidance provided in FEMA's Local Mitigation Planning Handbook (March 2013) and FEMA's Local Mitigation Plan Review Guide (October 1, 2011). Where text in the Hazard Mitigation Plan meets an element identified in the Review Guide, it is called out in a blue box in the margins.

What is Hazard Mitigation?

The purpose of hazard mitigation is to reduce loss from current and future natural hazards. Storms and other natural disasters such as floods, earthquakes, and hurricanes can cause loss of life, damage to buildings and infrastructure, and negatively affect a community's economic, social, and environmental well-being. Quincy has developed the HMP as a means to permanently reduce or alleviate the losses of life, injuries, and damage to property resulting from natural hazards through adopting long-term strategies. These long-term strategies address not only municipal infrastructure but also societal, economic, and environmental assets of Quincy through planning, policy changes, programs, projects, educational outreach, and other activities. The desired outcome of implementing the HMP will be creating a more resilient community that is better prepared prior to a natural disaster and can recover more quickly after one occurs.

1.1 COMMUNITY PROFILE

The City of Quincy is a vibrant and diverse coastal community, located immediately south of Boston in Norfolk county. The City occupies 16.7 square miles and is bounded on the north by the Neponset River and the City of Boston; on the east by Quincy Bay; on the south by the Town of Braintree, the Town of Weymouth, and the Fore River; and on the west by the Blue Hills Reservation, the Town of Milton and the Town of Randolph. Quincy's coastline is 27 miles long and encompasses two peninsulas that extend into Quincy Bay.

The major geographic areas of Quincy are indicated on Map 1A. The delineations are primarily based on watershed boundaries and then further refined to include coastal flooding patterns. The geographic areas serve as planning boundaries throughout the HMP, allowing areas to be compared and contrasted.

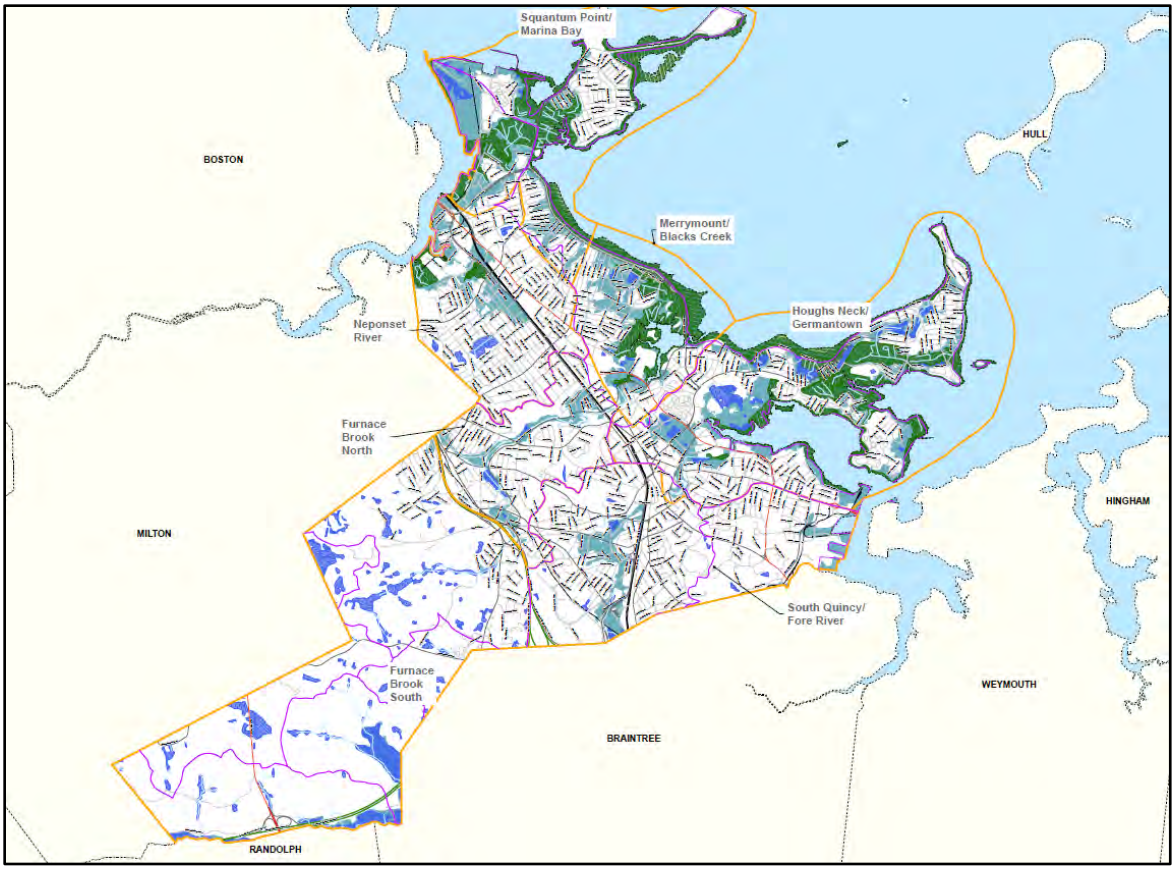


Figure 1.1: Quincy Massachusetts, Hazard Mitigation Planning Areas.

In addition to the extensive shoreline, the City of Quincy contains other bodies of water, including Furnace Brook, Town Brook, Town River, and Blacks Creek. Quincy's coastline and multiple inland water bodies provide an abundance of natural resources in the area and opportunities for economic development, including fisheries, shipbuilding, and marine transportation. The Fore River Shipyard located in South Quincy has been designated as a maritime industrial working port of regional significance, protected by the State as part of the Weymouth (Fore River) Designated Port Area. This area has the potential for additional growth as one of the last remaining large marine-related sites in the state. Quincy's coastline and inland water bodies, however, also increase the City's vulnerability to natural hazards. FEMA's Flood Hazard Zones mapping indicates flood hazards for parts of Quincy, including along its coastline, rivers, and estuarine wetlands. The areas with the greatest risk of flooding include Marina Bay in North Quincy, Merrymount Park near Blacks Creek and Quincy Bay, the beginning of Houghs Neck, and areas near Town River.

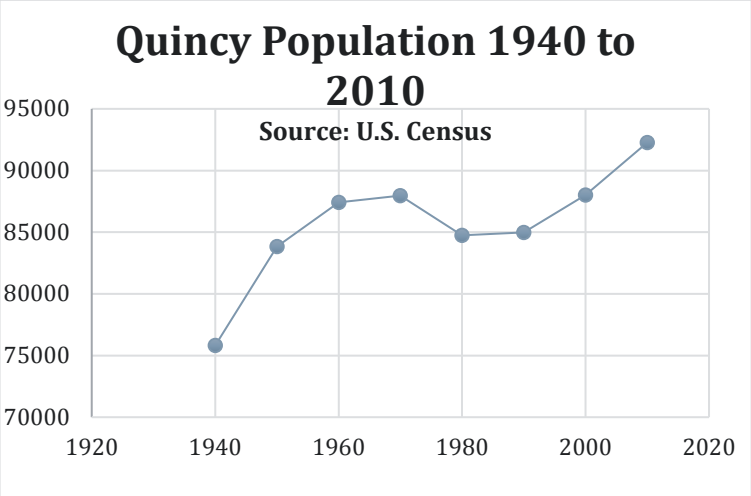
Interstate 93 and state highway 3A traverse Quincy from north to south. Highway 93 divides the City between the more urbanized and populated eastern region with the inland, less urbanized western region, while Route 3A crosses the eastern region, closer to the coast. In addition to the highways, the Metropolitan Boston Transit Authority (MBTA) red line subway connects Quincy to the rest of the Boston metropolitan area along the Braintree line: North Quincy, Wollaston, Quincy Center, and Quincy Adams. Quincy Center Station also serves a commuter rail station for the three rail lines emanating from southeastern Massachusetts: Greenbush, Kingston/Plymouth, and Middleborough/Lakeville. In the western part of the city is the Division of

Conservation and Recreation (DCR) managed Blue Hills Reservation, which is shared by the City of Quincy as well as by the Towns of Dedham, Milton, and Randolph. The 7,000-acre Blue Hills Reservation is the largest tract of open space in the Metropolitan Boston Area.

The City of Quincy is governed by a Mayor and City Council, in what is known as a "Plan A" form of government. The Mayor is elected by city residents for a four-year term. The City Council consists of nine members elected for two-year terms, three elected at-large and one for each of the City's six wards. The City of Quincy maintains a website at www.quincyma.gov.

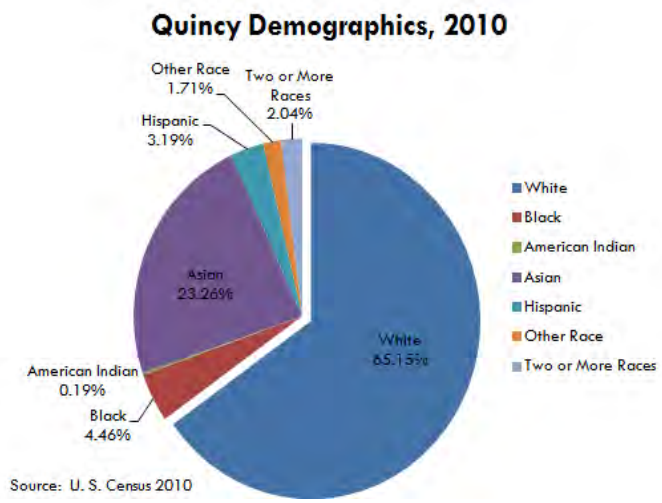
1.2 QUINCY DEMOGRAPHICS

Quincy is the eighth largest city in Massachusetts - with a population estimate in July 2017 of 94,166 people according to the US Census. Quincy has regained and added population after a brief period of population loss in the 1970's. Projections from the Metropolitan Area Planning Council (2014) have Quincy growing to over 106,865 persons by 2030 under its Stronger Region Scenario where housing production keeps pace with demand.



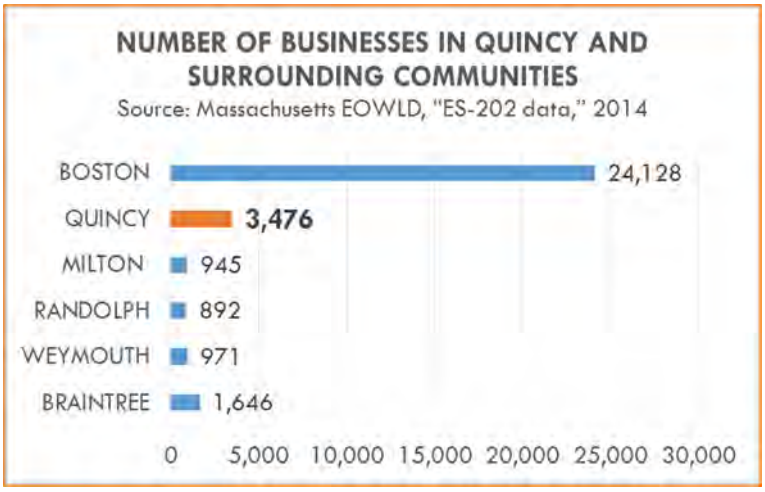
The fastest growing age cohorts in Quincy are 50 to 69 years with total increase of 4,736 persons between 2000 and 2010. So-called Baby Boomers, this groups needs will drive growth and development in Quincy for many years to come. The age cohorts likely to form new households – 25 to 44 - decreased by 1,525 persons (5%) between 2000 and 2010, likely reflecting relatively high housing costs in Quincy. The under 5 population in Quincy increased 10% between 2000 and 2010.

Quincy has become increasingly diverse in recent decades with a 17% decrease in the white-only population since 2000. The Asian population continues to grow and is estimated at 26,154 persons as per the 2012-2016 American Community Survey or 28% of Quincy's overall population. Chinese ancestry (67%), Asian Indian (13%) and Vietnamese (11%) are the largest Asian subpopulations. Quincy has the second largest Chinese population in Massachusetts, after Boston. Quincy's growing diversity is also inclusive of increases in the African American and Hispanic populations, both of which have more than doubled since 2000. According to the City of Quincy Demographic & Census Data report from May 2013, the highest minority populations were located in the North Quincy, Montclair, and Adams Shore & Germantown neighborhoods, each with at least 50% non-white population.



1.3 QUINCY'S ECONOMY

Quincy has a larger economic base relative to Braintree (twice the size), as well as its other neighbors of Milton, Randolph and Weymouth (3-4 times larger.)[1] However, Quincy's economy is smaller than that of Boston.[2] In 2014, Quincy had 3,476 businesses employing approximately 48,000 individuals. When measured by the number of jobs, the top four industry sectors are finance (25% of all jobs); education and health services (24%); professional and business services (12%); and transportation and utilities (12%).[3]



The City principally has four distinct commercial areas located in the following neighborhoods:

1. ***Marina Bay (Anchored by Commander Shea Boulevard.)*** Marina Bay is comprised of a mixed-use "New Urbanist" development that includes condominiums, office complexes, restaurants, and a 685-slip marina at the mouth of the Neponset River into Dorchester Bay. This area also includes the Boston Scientific Corporation's prominent distribution warehouse and the Atria Marina Place assisted living facility (each employing between 50 and 100 individuals).

[1] Braintree: 27,733 employees; Milton: 5,936 employees; Randolph: 8,713 employees; Weymouth: 18,422 employees.
[2] Boston employs over 12 times the number of employees than Quincy (595, 527 versus 48,077), and approximately 7 times the number of businesses (24,128 versus 3,476). Source: Massachusetts EOWLD, "ES-202 data," 2014
[3] Source: Massachusetts EOWLD, "ES-202 data," 2013

2. **North Quincy (Adjacent to the MBTA Red Line station and Newport Avenue.)** This commercial district is home to one of the six largest employers in Quincy: Granite Telecommunications, who employees over 1,000 individuals. Other notable employers include Blue Cross Blue Shield of Massachusetts and the State Street Corporation.

3. **Quincy Center (Bordered by the MBTA Red Line station, Hancock and Coddington Streets.**) Of the five largest employers in Quincy, two are located within this commercial district: Fallon Ambulance Services, and Stop & Shop Supermarket. Two of the City's largest employers are located just southwest of the Center within the Crown Colony/State Street business area: Boston Financial Data Services and the Patriot Ledger newspaper company.

4. **Fore River Shipyard (Delineated by the Fore River and East Howard Street.)** This area has been designated as a maritime industrial working port of regional significance, protected by the State as part of the Weymouth (Fore River) Designated Port Area. There are several large employers in this commercial/industrial district: Bluefin Robotics Corporation, Fore River Recycling, Cashman Dredging, Dan Quirk Autos and Twin Rivers Technologies. These businesses combined employ over 1,000 individuals. Other noteworthy businesses include the Citgo Petroleum Corporation (oil tank farm), the Sprague Energy (oil and natural gas tanks and terminal), and the United States Naval Shipbuilding Museum.

The State of Massachusetts Executive Office of Workforce and Labor Development provides long-term industry employment projections statewide and for sixteen Workforce Development Areas (WDA). Employment is projected for approximately 80 industries, based upon the North American Industry Classification System (3-digit code), over the 2014-2024 timeframe.

Quincy Growth and Development

D1 a

The City's three traditional commercial districts, North Quincy, Wollaston and Quincy Center, are located along the north-south MBTA rail line. Each district has taken advantage of the presence of passenger rail service serving as public transportation hubs. However, the decline of both the quarrying and shipbuilding industries gave way to modern auto-centric development patterns. Locations with close access to I-93 became highly desirable as they were easy accessible to employees outside of Quincy who drive to work.

At the start of the 21st Century, like other developed urban areas, the City of Quincy experienced an increased interest in private investment. Quincy's location adjacent to Boston, its transportation networks, and quality of life, make it very attractive to many who want to live and work in an urban area. Much growth has occurred within infill and redevelopment sites near MBTA stations, however; steady development has been prevalent throughout the City. Over $600 million in new residential and commercial development projects have created approximately 2,000 residential units and over 180,000 square feet of commercial space across the City, as described in the spring 2015 Quincy Economic Development Snapshot. Since the 1970s, most residential development has been multi-family. The residential development patterns between 2000 and 2009 show that 93% of new residential units have been multi-family. Eighty percent of the residential developments are in structures that house eight or more units.

1.4 QUINCY'S NATURAL ENVIRONMENT



Photo 1.1: Wollaston Beach provides scenic views of the Boston skyline and Boston Harbor Islands.

Quincy's natural environment provides a unique landscape for a suburb of Boston. The twenty-seven miles of coastline include three natural peninsulas and eleven public beaches extending out into Quincy Bay. Two inland streams along with expansive wetlands and salt marshes, provide stormwater drainage as well as habitats for many species of plants and animals. The thick woods, hills, trails, and ponds of the Blue Hills Reservation adds a contrasting natural setting to the Southwestern corridor of the City.

1.4.1 WATER RESOURCES

According to FEMA special flood hazard area zone definitions, Quincy is susceptible to flooding along its coastline, rivers, and estuarine wetlands. The areas with the most concentrated risk are Marina Bay in North Quincy, Merrymount Park (located adjacent to Blacks Creek and Quincy Bay), the beginning of Houghs Neck, and land near Town River. See **Section 3** for more discussion on FEMA Flood Hazard Zones.

The Wollaston Beach Reservation dominates the coastline of Quincy Bay. The reservation underwent a major restoration through the efforts of the DCR, coupled with City improvements to sewer and drain lines. Walking, jogging, bicycling, rollerblading and passive recreational enjoyment are all major activities along the shoreline. During the warmer months, people enjoy swimming, volleyball, boating, clamming, and fishing in the waters of Quincy Bay. It is one of the most used public spaces in the City. The Wollaston Beach Task Force and the Mayor's Beaches and Coastal Commission will help make Wollaston an excellent, clean, family-friendly beach. Wollaston Beach is part of the EPA's Flagship Beaches program.



Photo 1.2: Quincy offers recreational opportunities along the waterfront.

Quincy has a variety of wetland types. Large swaths of salt marsh are located between Marina Bay and Squantum, Merrymount Park, and where Germantown and Houghs Neck meet. Wooded marshes are scattered throughout the Blues Hills Reservation and next to Granite Links golf course, and the Hobart Street Woods between the North Quincy and Wollaston redline stops. Marsh/Bog areas spot the Blue Hills, Broad Meadows Marsh, and parts of Houghs Neck. Beach/Dune areas line about half of the coastline. Manet Lake in Houghs Neck is a marshy, wetland area. Sailor's Pond and Butler's Pond are both valuable fresh water habitats that

support plant, fish, and bird habitats. The Department of Public Works has undertaken the goal of maintaining Butler's and Sailor's Ponds as vibrant, healthy ecosystems.

The Neponset and Fore Rivers are valuable waterways that have helped shape Quincy's boundaries. The Fore River has always been a major site for industrial shipbuilding, while the Neponset River flows through many communities before reaching Quincy and emptying into Boston Harbor. It is a well-preserved natural habitat for many plant and animal species. Efforts by watershed protection advocates have helped the Neponset River remain clean and welcoming to wildlife and recreationists.



Photo 1.3: Aerial view of the Fore River Shipyard, the primary industry in Quincy for many years.

1.4.2 AQUATIC RESOURCES

As shown on the overview Map-1, Quincy is comprised of nine watershed sub-basins. The "Weymouth and Weir River Basin 2004 Water Quality Assessment Report" by the Massachusetts Executive Office of Energy and Environmental Affairs yields additional information about Quincy's watersheds. It details the bodies of water in the city, problems facing them, and the state of aquatic life in each. The four major surface waterways are described in more detail below.

Town Brook

Town Brook originates in Braintree as a tributary to the Old Quincy Reservoir and flows through the City, finally discharging into the Town River estuary. It has a complicated history. The original brook system has been altered (channeled, moved, and culverted) over time, commencing in the late 1800's and continuing to the present day. To date, the majority of Town Brook in Quincy is underground and mostly culverted. Wetland resource areas presently associated with the Brook that are protected under the Massachusetts Wetlands Protection Act regulations (M.G.L. c. 131, § 40; & 310 CMR 10.00) include Riverfront Area and Bank along the open channel sections and Land Under Water Bodies and Waterways that underlie Anadromous or Catadromous Fish Runs. Culverted sections of the brook have been designed to convey the 100-year flood and 500-year flood by the U.S. Army Corps of Engineers (ACOE). Currently, the Brook regulates stormflow via weirs at the Center Street junction box and a deep rock tunnel inlet constructed by ACOE off of Burgin Parkway.

Given the highly urbanized nature of the Brook's historic catchment area (watershed) and its extensive alteration, it experiences "flashy" flows. In other words, the Brook rapidly collects flows that are channelized within the steep slopes of its primarily engineered banks, resulting in flood peaks soon after a precipitation event. Aquatic life within the Brook was documented in the 2003 DEP Weir River Watershed Water Quality Report[4] as impaired, evidenced by smelt egg mortality in 2008. The smelt that live and spawn in the brook are the primary food source of the Atlantic cod, a focal point of the New England fishing industry. The City of Quincy recently partnered with the Massachusetts Department of Environmental Protection (MA DEP) and the Massachusetts Division of Marine Fisheries (DMF), to monitor and preserve smelt habitat in the brook. The City values the ecological importance of the brook and has made efforts over the past decade to improve its functionality. The Town Brook Enhancement project of 2013 daylighted portions of the brook via the removal of above-ground obstructions and uncovering culverted sections within the Downtown area; and introduced low flow channel and vegetated wetland island environmental engineering elements.

Neponset River

The Neponset River Estuary Area of Critical Environmental Concern (ACEC) is approximately 1,300 acres in size and is located primarily in Quincy (470 acres), as well as in Boston (435 acres) and Milton (355 acres). The ACEC boundary is based on the Wetlands Protection Act Regulations (wetlands resource areas and a 100-foot buffer) plus adjacent public open space and historic districts. The ACEC begins at the Lower Mills Dam in Milton and Dorchester, which separates the coastal estuary from the inland fresh water portion of the Neponset, and extends to the mouth of the



Photo 1.4: Town Book showing typical flows and a flood event.

[4] Department of Environmental Protection Weir River Watershed Water Quality Assessment 2003.

river at Squantum Point in Quincy. The central resource features of the Neponset River Estuary ACEC are the Neponset River and portions of its tributaries, the estuary, salt marshes, floodplains, fishery habitat, and diverse wildlife habitat. Substantial soft-shell clam beds are located at the mouth of the River near Squantum Point. This area also provides habitat for a tremendous diversity of bird species and is one of the most important wildlife habitats in the urbanized Boston area.

Weymouth Fore River

Historic observations by DMF indicate the Weymouth Fore River was one of the largest smelt runs in Massachusetts supporting a large recreational fishery in Quincy Bay. The Fore River remains one of the largest smelt runs in Massachusetts with relatively higher catches of American eel and Atlantic cod. However, due to the industrialized nature of the former Fore River Shipyard area, polychlorinated biphenyls (PCBs) are still present in fish samples within the Weymouth Fore River; specifically within the headwaters at the Route 3a Bridge to the mouth of the River between Shipyard and Germantown Points.[5] The River has also tested positive for traces of fecal coliform from urban stormwater, which has impacted the past shell fishing industry in the estuary.

Furnace Brook

Furnace Brook originates near Chickatawbut Road in the Blue Hills Reservation and travels approximately four miles through West Quincy to Black's Creek. As noted in the City's 2012 Open Space and Recreation Plan, Furnace Brook serves as the primary storm water conveyance for the watershed area. Furnace Brook is culverted underground upstream of Quarry Street and daylights near the Bernazzani Elementary School. The Massachusetts Bays Program identifies Furnace Brook as habitat for rainbow smelt. According to the MA DEP 2004 Water quality assessment, the spawning habitat is degraded due to urban stormwater influences, sedimentation, and excessive periphyton growth. The City, in its HMP, has identified areas adjacent to Furnace Brook as susceptible to frequent and, at times, intense flooding and notes that tidal conditions at Black's Creek can exacerbate flooding. The HMP recommends inspection and cleaning of the culverts to assess their condition and avoid clogging. These are critical pieces of information to consider with respect to the potential resiliency of the stormwater system under climate conditions, as further discussed in the vulnerabilities section.

1.5 QUINCY INFRASTRUCTURE

Transportation Systems

The Southeast Expressway runs through West Quincy, and several urban arterial roadways crisscross the City including Route 3A, Route 53, Furnace Brook Parkway, Quincy Shore Drive, and Newport Avenue. The roadway network provides excellent service to the City's many neighborhoods and business districts but it is also required to handle the burden of commuter traffic traveling to and from job centers in the City of Boston.

The MBTA provides public transportation service to Quincy through four MBTA rail stations and ferry terminal. Formerly the Old Colony Rail Line, the MBTA provides Red Line subway service to four stops in the

[5] U.S. Environmental Protection Agency, 2014 Waterbody Report for Town River Bay, Segment MA74-15.

City: North Quincy, Wollaston, Quincy Center, and Quincy Adams stations. Commuter Rail provides service to the Quincy Center station. The Quincy Center MBTA station also provides bus service to many parts of the City and beyond. It has 15 routes that stop at Quincy Center, and still others at the other Red Line stations. In 2018, the Wollaston Station was closed for repairs and shuttle service provided between North Quincy and the Braintree MBTA station,

Year-round commuter ferry service was provided from the Fore River Shipyard to Hull, Logan International Airport, and downtown Boston but was cancelled by the MBTA in 2014 as a result of structural deficiencies with the pier in Quincy. The City has sponsored interim Ferry service from Squantum Point Park to Boston's Fan Pier, and hopes to expand the Squantum Point pier to allow for year round ferry service.

With its extensive coastline of twenty-seven miles, Quincy is also able to offer significant port facilities on the Town and Fore rivers, Quincy Bay and Marina Bay.

The City continues to implement measures to facilitate walking and bicycling. In 2018, the City furthered these efforts by adopting a Complete Streets Policy, a guiding philosophy of improving infrastructure to provide safe and accessible travel options for people of all ages, abilities and modes of travel, including walking, bicycling, driving and using public transit. With the adoption of this policy, Quincy will continue to emphasize improvements at locations identified as priorities through both professional assessment and stages of public forum. The goal of Complete Streets is to design roadways with all users in mind, making non-motorized transportation more convenient, more attractive and safer. Beginning in 2013, the Mayor's Bicycle Commission and Planning Department worked with the Metropolitan Area Planning Council (MAPC) on the City of Quincy Bicycle and Pedestrian Network Plan which was completed in January 2014. The Mayor's Bicycle Commission has been working with the Department of Public Works and the Traffic, Parking, Alarm and Lighting (TPAL) Department to implement recommendations found in the plan.

Stormwater / Drainage System

The City of Quincy is charged with operating and maintaining the drainage system to protect public health and property and preserve water quality for recreation and wildlife habitat. Historically, the primary goals of managing stormwater runoff were to prevent immediate threats to life and property due to flooding and to maintain safe and passable streets. However, in the last decade, federal and state regulations have imposed increasingly stringent and onerous requirements on communities to locally manage stormwater runoff to also address the serious adverse impacts that increased runoff quantity, temperature, and the nutrients, bacteria, sediment, and other pollutants carried by this runoff are having on the local waterbodies. Quincy manages stormwater with multiple objectives, including maintaining existing infrastructure to reduce flooding risks, improving water quality and stream ecology, and complying with regulatory requirements. The City completed a City-wide Conceptual Stormwater and Flooding Report to assist in the understanding and prioritization of stormwater projects and system rehabilitation. The City is continuing to address stormwater issues as part of its ongoing EPA National Pollution Discharge Elimination Systems - Municipal Separate Storm Sewer System (NPDES MS4) permit requirements.

Coastal Protection Systems

The City's coastal protection system is comprised of coastal beaches and wetlands, tide gates, seawalls, and stone revetment. The City maintains over 80 tide gates to prevent coastal storm surge from backflowing to upland areas. The City has approximately 11.7 miles of seawall structures; 5.60 miles of sea wall are owned by the City, 0.72 miles are privately owned, 3.20 miles are owned by the Commonwealth of Massachusetts, and 2.17 miles are owned by the City of Boston.



Photo 1.5: Revetment on Houghs Neck.

The City's seawall structures are typically comprised of some combination of stone revetment slope and concrete or stone seawall. The most common type of seawall around Quincy is made of precast concrete seawall units, set on stone rubble mounds with an exposed revetment face. The precast concrete and stone seawalls typically maintain their stability due to their mass (i.e. gravity structures) based on historical documents from the City. The stone seawalls are sometimes placed with mortar. Less common walls types include construction with steel sheet piles and timber.

A common design consists of a precast concrete seawall on a dry set rubble stone mound, with exposed stone revetment face on the seaward side. Revetment stone was often placed on a 2:1 slope (horizontal: vertical) at varying depths. Revetment stone protects the shoreline and seawall structures against scour due to wave energy and is most effective when placed in an irregular porous manner.

The Quincy shorelines also often contain groins and jetties constructed of stone, but these primarily function to retain beach sand in specific areas, rather than directly protecting the shoreline.



Photo 1.6: Houghs Neck Seawall at High Tide.

Water and Wastewater

The City of Quincy relies on the Massachusetts Water Resource Authority (MWRA) for all of its drinking water and wastewater disposal. The Water, Sewer and Drain Division are responsible for water distribution, sewer and drain line management to the commercial and residential communities of the City. The City maintains 230 miles of water distribution mains, 205 miles of sanitary sewers mains and 3000+ manholes and 150 miles of drain pipes and 9,329 catch basins and other drain assets. In addition to ensuring clean water for all, City maintenance results in efficient and consistent water and sewer service and effective flood prevention.

In 2013, Quincy invested $1.5-million in water system pipeline improvements along Adams Street, Belmont Street and Albatross Road, completed an $8-million dollar fixed base AMR meter replacement project and upgraded many of the water pump stations. These improvements will enable Quincy to continue to provide quality water distribution and fire protection by allowing operators to remotely monitor and adjust components of the distribution system. The water and wastewater systems in Quincy Center are also being updated in conjunction with the ongoing redevelopment projects.

The City operates an aggressive Inflow and Infiltration (I/I) removal program to reduce the amount of ocean and storm water entering the sewer system and causing capacity losses and increased MWRA treatment costs. The City is 99% sewered, so the potential savings from the inspection are significant. In recent years, this I/I program identified leaks in coastal sewers that were subsequently repaired and have already prevented over 1 million gallons of ocean water from entering the sewers each day.



Photo 1.7: Extensive repairs made to the sewage system during the construction of Walter Hannon Parkway.

1.6 FEDERAL/STATE DISASTER DECLARATIONS

Quincy has experienced 18 natural hazard incidents that triggered federal or state disaster declarations since 1991, listed in **Table 1.1**. Most events involved flooding.

Table 1.1
Federal and State Disaster Declarations 1991-2018

Disaster Name (Date of Event)	Type of Federal Assistance Provided	Declared Areas in Massachusetts
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk Statewide Hazard Mitigation
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants FEMA Individual Household Program Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk Statewide Hazard Mitigation
Nor'easter- Winter Coastal Storm (December 1992)	FEMA Public Assistance Project Grants FEMA Individual Household Program	Counties of Barnstable, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, Worcester
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	Statewide
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	Statewide
October Flood (October 1996)	FEMA Public Assistance Project Grants FEMA Individual Household Program Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Plymouth, Norfolk, Suffolk Statewide Hazard Mitigation
June Flood (June 1998)	FEMA Individual Household Program Hazard Mitigation Grant Program Community Development Block Grant- HUD	Counties of Bristol, Essex, Middlesex, Plymouth, Norfolk, Suffolk, Worcester Statewide Hazard Mitigation
March Flood (March 2001)	FEMA Individual Household Program Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Plymouth, Norfolk, Suffolk, Worcester Statewide Hazard Mitigation
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	Statewide
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide Hazard Mitigation
April Nor'easter (April 15-27, 2007)	Hazard Mitigation Grant Program	Statewide Hazard Mitigation

Disaster Name (Date of Event)	Type of Federal Assistance Provided	Declared Areas in Massachusetts
Flooding (March 2010)	FEMA Public Assistance FEMA Individual and Household Programs SBA Loans Project Grants/Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Plymouth, Norfolk, Suffolk, Worcester Statewide Hazard Mitigation
Nor'easter (January 11-12, 2011)	FEMA Public Assistance Grants Hazard Mitigation Grant Program	Counties of Berkshire, Essex, Hampshire, Middlesex, Norfolk and Suffolk Statewide Hazard Mitigation
Tropical Storm Irene (August 27-28, 2011)	FEMA Public Assistance Grants Hazard Mitigation Grant Program	Counties of Franklin and Berkshire Statewide Hazard Mitigation
"Snowtober" October 29-30, 2011	FEMA Public Assistance Grants Hazard Mitigation Grant Program	Counties of Berkshire, Franklin, Hampshire, Hampden, Worcester and Middlesex Statewide Hazard Mitigation
Hurricane Sandy October 27- Nov 8, 2012	FEMA Public Assistance Grants /Hazard Mitigation Grant Program	Counties of Bristol, Plymouth, Barnstable, Dukes and Nantucket Statewide Hazard Mitigation
Winter Storm Nemo February 8-10, 2013	FEMA Public Assistance Grants Hazard Mitigation Grant Program	Statewide
Winter Storm Juno January 26-29, 2015	FEMA Public Assistance Grants Hazard Mitigation Grant Program	Counties of Worcester, Middlesex, Essex, Suffolk, Norfolk, Bristol, Plymouth, Barnstable, Dukes and Nantucket Statewide Hazard Mitigation
Winter Storm Riley March 2-3, 2018	FEMA Public Assistance Grants Hazard Mitigation Grant Program	Counties of, Essex, Norfolk, Bristol, Plymouth, Barnstable, and Nantucket. Statewide Hazard Mitigation
Winter Storm Skylar March 14-15, 2018	FEMA Public Assistance Grants Hazard Mitigation Grant Program	Counties of Worcester, Middlesex, Essex, Suffolk, and Norfolk, Statewide Hazard Mitigation

Quincy's Recent Mitigation Efforts

Since the development of the 2013 HMP, the City of Quincy has led and participated in various resiliency efforts to support the Hazard Mitigation Plan goals and objectives. The City of Quincy received a Coastal Community Resilience Grant from the Office of Coastal Zone Management (CZM) and District Local Technical Assistance through the Metropolitan Area Planning Council (MAPC) to develop the Climate Vulnerability Assessment (VA). This analysis was summarized in the October 2016 draft "Resilient Quincy Plan" included in Appendix B. A total of $120,000 was awarded for the project, with $75,000 from the CZM grant, $45,000 from the MAPC. The aim of the effort was to focus on identifying unique zones throughout Quincy that share common characteristics and assess the systems of society and how they are currently performing and whether they a prepared to meet future environmental change. The draft Resilient Quincy Plan was never formally adopted by the City, but analysis from that plan was used to support development of the Quincy 5-year update.

Public outreach and new partnerships were developed as a result of the Climate VA project. Public outreach consisted of two public workshops, a community survey, and educational materials made available at several community events. Furthermore, city staff from the 2013 HMP working group reconvened to serve as the Climate VA working group. The working group then appeared before the Planning Board, the Zoning Board of Appeals, and the Conservation Commission to provide information on the VA and to garner feedback from members.

In addition to the outreach efforts from the Climate VA project, further outreach success was realized through a unique Academic-Public-Municipal Partnership with Boston University, MAPC, and the City of Quincy. City Planning and Urban Affairs graduate students at Boston University participated in a project that also evaluated Quincy's climate vulnerability and mitigation efforts. A major component of the project was a focus on the Germantown neighborhood, one of the more vulnerable neighborhoods in Quincy. The pilot program included surveys, conducted at community centers and online, as well as interviews with residents, community leaders, and key city employees.

Aside from funded projects, Quincy has worked to correct updated maps from FEMA that significantly affect some residents. In June 2014, FEMA released updated mapping that added 1,400 properties in Quincy to flood zones and re-mapped 2,700 other properties into higher risk flood zones. These updates caused many homeowners with federally backed mortgages to purchase flood insurance for the first time. Within days of the new maps being released, the City filed a map revision letter to FEMA to challenge the updates. Surveying and engineering efforts from Woodard & Curran on behalf of the community, were used to prove that portions of the maps were flawed. As a result of the letter filed, flood insurance requirements were eliminated for 600 properties and reduced for an additional 1,000 properties. The Blacks Creek area, for example, was downgraded from Zone V to Zone A, reducing insurance premiums by at least $2,560.

The City of Quincy was also represented in the Metro Mayors Coalition Summit and the Metro Boston Climate Preparedness Taskforce. The taskforce aims to address various resiliency strategies, including prevention, protection, mitigation, response, and recovery. The collaboration of multiple municipalities within Greater Boston strengthens the mission and the regional efforts.

Most recently, Quincy received funding from FEMA, administered by the Massachusetts Emergency Management Agency (MEMA), to complete the 5-year update of the 2013 HMP. The new HMP will incorporate new hazard mitigation analysis and the information from the "Resilient Quincy Plan". Updating the HMP will

maintain Quincy's eligibility for future mitigation grant funding. $55,400 have been allocated to the HMP update project, with $18,000 from the FEMA/MEMA grant and $37,400 from local contributions.

Map 1.1
Sub Drainage Basins

Squantum Point/
Marina Bay

Merrymount/
Blacks Creek

Houghs Neck/
Germantown

Neponset
River

Furnace
Brook
North

Furnace
Brook
South

South Quincy/
Fore River

BOSTON

HULL

MILTON

HINGHAM

WEYMOUTH

BRAINTREE

RANDOLPH

LEGEND

- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Track or Trail
- Train
- Inland Wetlands
- Coastal Wetlands
- Planning Areas
- Sub Drainage Basins
- 100 Year Flood Zone
- Waterbodies
- Town Boundary

LOCUS MAP



0 1,750 3,500
Feet

1:21,000

NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

Drainage Basins

Quincy, Massachusetts

September 2018

Tighe&Bond
Engineers | Environmental Specialists

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SECTION 2

THE PLANNING PROCESS

Quincy has worked over the past two years with residents, businesses, City staff and City Councilors on several planning initiatives that culminated in developing the 2019 Quincy Hazard Mitigation Plan. Throughout the planning process the planning team has sought input from the community and provided opportunities to educate residents about the risk and vulnerability related to natural hazards and to build support for policies and mitigation actions that reduce future losses from natural hazards. Section 2 provides documentation on the Hazard Mitigation Planning Team and the public outreach process used to develop the 2019 Multi-Hazard Mitigation Plan.

Section 2 The Planning Process

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To develop this HMP, the City of Quincy used a planning process framework consistent with FEMA's hazard mitigation planning guidance, also focusing on local needs and priorities, and maintaining a regional perspective on natural hazard events. The process included the following main steps:

1. **Identifying and Mapping the Hazards** – The City used data from federal, state, and locally developed data to identify hazards that impact Quincy. A profile of each hazard was developed including previous occurrences, magnitude and severity of the hazard, and probability for future occurrences. Maps were created to show areas affected by the identified natural hazards and were used as the basis for developing the risk assessment. Under the Quincy Resilient Plan, the City completed analysis and mapping of flooding impacts due to climate change. The **Natural Hazards Risk Assessment** is included in **Section 3**.

2. **Assessing the Critical Community Assets and Potential Damages** – Critical community assets including municipal facilities, infrastructure, vulnerable populations, economic, and natural resources were located and compared with hazard data to identify those that may be vulnerable to hazards. Quincy developed estimates of the potential impacts of certain hazard events on the community including flooding, flooding impacts due to future climate change, earthquakes, and hurricane winds. Further discussion is included in the **Asset Inventory** in Section 4 **and the Vulnerability Assessment** in Section 5.

3. **Reviewing Existing Mitigation** – Quincy has implemented many mitigation strategies including floodplain zoning, wetland protection, coastal fortification and other measures as well as enforcing the State Building Code. All current municipal mitigation measures were documented and discussed as part of the **Capabilities Assessment** in Section 6.

4. **Developing Mitigation Strategies** – The City worked with a designated planning group, local stakeholders, and their consultants to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessment, and exiting mitigation measures to determine where additional work is needed to reduce potential future damages from hazard events. The **Mitigation Strategy** discussed in Section 7 includes goals and objectives, mitigation actions, and an implementation strategy.

5. **Implementing and Updating the Plan** – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a 5-year basis making preparation for the next Plan update an important on-going activity. A schedule for implementation, **Plan Evaluation and Maintenance** is included in Section 8.

6. **Plan Approval and Adoption** – Once a final draft of the HMP update is complete it is sent to MEMA for the state level review and pending the completion of any revisions, it is sent to FEMA for approval.

THE PLANNING PROCESS

Once FEMA approves the Plan, FEMA issues a conditional approval pending adoption of the Plan by the City of Quincy Mayor. The **Plan Approval Process** is included in Section 9.

The steps included public participation as an important component of the process, providing critical information about the local occurrence of hazards, a discussion on regional issues, and to build support for hazard mitigation activities.

Public participation was accomplished with the assistance of MAPC. In addition, the City identified other interested stakeholders including neighboring communities and solicited their input for the HMP. Quincy held two public meetings open to the general public to present and discuss aspects of the Hazard Mitigation Plan 5-year Update.

2.1 THE PLANNING TEAM

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The Hazard Mitigation Advisory Group, listed in **Table 2.1,** was assembled at the start of the HMP 5-year update project to solicit input from multiple departments in Quincy. The advisory group met on December 12, 2017 to kick-off the HMP planning process. The meeting was led by Robert Stevens, Deputy Planning Director, and the City's consultant, Tighe & Bond. Presentations served to outline the HMP project, to discuss new HMP goals, and to provide guidance for department representatives on project responsibilities.

A smaller Hazard Mitigation Working Group was also assembled, with members from the advisory group. Members of the working group are shown in **Table 2.1** in bold text. The working group includes representatives from various Quincy departments who will be actively engaged in the HMP project by reviewing drafts and helping to guide HMP project efforts.

Table 2.1
Hazard Mitigation Advisory Group

Name	Title	Department
Mayor Thomas Koch	Mayor	Mayor's Office
James Fatseas	Planning Director	Planning
Robert Stevens	Deputy Planning Director	Planning
Sean Glennon	Community Development Director	Planning
Liz Manning	Principal Planner	Planning
Al Grazioso	Commissioner	DPW
Paul Costello	City Engineer	Engineering Department
Cheung Tsang	Engineer, CRS Coordinator	Engineering Department
John Sullivan	Waste/Recycle	DPW
Peter Hoyt	Sr. Civil Engineer	Water/Sewer Dept.
Mark Vialpando	General Foreman	Water/Sewer Dept.
Chris Cassani	Director	Traffic, Parking, Alarm and Lighting
Paul Hines	Commissioner	Public Buildings

Name	Title	Department
Gary Cunniff	Head Engineer	Public Buildings
Shelly Dein	Sustainability Director	Public Buildings
Drew Scheele	Commissioner	Health Department
Cindy DeCristofaro	Chief Sanitarian	Health Department
Ruth Jones	Director of Nursing	Health Department
Paul Franz	Acting Director	Park & Forestry Department
Lisa Aimola	Director of Community Preservation	Park & Forestry Department
Jay Duca	Director	Inspectional Services Department
Rob Conlon	Inspector	Inspectional Services Department
Capt. Rich Bryan	Emergency Management	Fire Department
Lt. Robert Gillan	Marine Unit	Police Department
Tom Clasby	Director	Elder Services
Brian Glavin	Director	IT
Colleen Healy	Chief Assessor	Assessors
Capt. Rick McCusker	Police Captain	Police Department
Lisa Aimola	Communications Director	Mayor's Office
Nathan Robinson	Housing Program Manager	Planning & Community Development
Rich DiCristofaro	Superintendent	Public Schools

Names in **bold** are members of the Hazard Mitigation Working Group.

2.2 OUTREACH STRATEGY

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The City of Quincy included a robust public outreach strategy under the Climate VA project, the HMP update, and other climate resiliency efforts. Outreach efforts included working group and community meetings, visioning charrettes, public surveys, and multi-media outreach including articles and press releases.

Climate Vulnerability Assessment Meetings and Public Forums

A3 a b

The Climate Vulnerability Assessment project to develop the Resilient Quincy Plan involved multiple internal meetings and public forums. The MAPC organized a kick-off meeting with the project team to start the project, as well as seven monthly team check-in meetings with the MAPC, City, and the Woods Hole Group to discuss the project status and organization. The City of Quincy organized three Municipal Working Group meetings to discuss climate change and to receive buy-in on the VA and adaptation strategies from various city departments.

The MAPC and the City worked together to organize various outreach events/public forums, including a focus group with community leaders, a visioning charrette with property owners, four neighborhood meetings with community members, and two targeted stakeholder meetings with community leaders. Additionally, the planning department presented a Quincy Climate Planning Update presentation on the Climate VA project at

two public city-wide meetings – the Zoning Board of Appeals Public Hearing and the Quincy Conservation Commission Public Meeting. The Quincy Climate Vulnerability Assessment is included in Appendix B.

Climate Change Resiliency Meetings and Efforts

In addition to the Climate Vulnerability Assessment, City leaders engaged in multiple other climate resiliency efforts. City leaders attended the Metro Boston Climate Preparedness Summit at the University of Massachusetts – Boston, where local and state leaders/politicians presented on climate change and resiliency efforts. City leaders also participate in the Metro Boston Climate Preparedness Taskforce, a collaborative effort that addresses vulnerabilities in the Boston Metro region. The Taskforce coordinates a regional and cross-governmental effort to protect critical infrastructure and other vital resources and systems as well as making policy recommendations.

City officials also participated in the Commission for Environmental Cooperation (CEC) 2015 Meeting, a two-day event featuring presentations from regulatory, NGO, Academic, and Municipal leaders from around the world. Following the meeting was a council public meeting and a council town hall to discuss CEC efforts and climate change adaptation.

On May 14, 2016, the City of Quincy hosted the Coastal Adaptation Charette, a public forum about coastal planning. The event took place at Quincy High School and focused on communicating the City's resiliency efforts to the local community.

Public Surveys and Interviews

The Boston University City Planning and Urban Affairs graduate students who participated in the climate vulnerability and mitigation project conducted surveys Citywide and interviews of Quincy residents, community leaders, and city employees. A pilot program focusing on Germantown included online and in-person surveys, as well as interviews.

Hazard Mitigation Plan Update Meetings and Outreach

Meetings and public outreach efforts specifically targeting the HMP 5-year update were included in 2017 and 2018. The HMP 5-year update kick-off meeting was held on December 12, 2017 to present the plan update scope, schedule and goals to the Advisory Group. The HMP update included additional planning meetings in September 2018 and a November public community meeting. Outreach materials are included in **Appendix C**.

Table 2.2 summarizes the meetings and public forums conducted through the Climate VA project, the HMP update, and other resiliency efforts.

Table 2.2
Schedule of Meetings and Public Forums

Meeting Date	Topic	Audience / Purpose
May 13, 2015	Metro Boston Climate Preparedness Summit	Presentations by state and city leaders on climate change and climate change preparedness efforts
June 11, 2015	Metro Boston Climate Preparedness Taskforce	Presentations by state and city leaders on climate change preparedness efforts
July 28, 2015	Commission for Environmental Cooperation 2015 Meeting	2-day meeting with presentations, Council Public Meeting and Council Town Hall
December 2015	Climate Vulnerability Assessment Kick-off	MAPC and Project Team
December, 2015	Climate VA Team Meeting #1	MAPC, City, Working Group/updates and organization
December 16, 2015	Climate VA Municipal Working Group Meeting #1	City Departments/Climate change education, VA buy-in, adaptation strategies
January, 2016	Climate VA Team Meeting #2	MAPC, City, Working Group/updates and organization
February, 2016	Climate VA Team Meeting #3	MAPC, City, Working Group/updates and organization
March, 2016	Climate VA Municipal Working Group Meeting #2	City Departments/Climate change education, VA buy-in, adaptation strategies
March, 2016	Climate VA Team Meeting #4	MAPC, City, Working Group/updates and organization
April, 2016	Climate VA Team Meeting #5	MAPC, City, Working Group/updates and organization
March/April, 2016	Climate VA Focus Group	Community Leaders/Coastal Mapping
April 20, 2016	Visioning Charette	Property Owners, Designers, Developers, City Staff/Climate Change Impacts, Climate VA discussions
April 26, 2016	Quincy Climate Planning Update presentation	Public Hearing from Zoning Board of Appeals
April 27, 2016	Climate VA Municipal Working Group Meeting #3	City Departments/Climate change education, VA buy-in, adaptation strategies
May, 2016	Neighborhood Meeting #1	Community members/hydrodynamic modeling
May, 2016	Neighborhood Meeting #2	Community members/hydrodynamic modeling
May, 2016	Climate VA Team Meeting #6	MAPC, City, Working Group/updates and organization

Meeting Date	Topic	Audience / Purpose
May, 2016	Targeted Stakeholder Meeting #1	Community Leaders/Discuss Goals Objective development, draft recs and plan
May 4, 2016	Quincy Climate Planning Update presentation	Quincy Conservation Commission public meeting
May 14, 2016	Coastal Adaptation Charette	Public Forum to discuss Resilient Quincy
June, 2016	Neighborhood Meeting #3	Community members/hydrodynamic modeling
June, 2016	Neighborhood Meeting #4	Community members/hydrodynamic modeling
June, 2016	Climate VA Team Meeting #7	MAPC, City, Working Group/updates and organization
June, 2016	Targeted Stakeholder Meeting #2	Community Leaders/Discuss Goals Objective development, draft recs and plan
December 12, 2017	RPWG Meeting #1	Hazard Mitigation Working Group/Goal Setting and Capabilities Update
September 18, 2018	RPWG Meeting #2	RPWG/Discussion of prioritizing Mitigation Actions
December 5, 2018	Community Public Meeting	Planning Board – Present Final Draft

2.3 AVAILABLE DOCUMENTS

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See Appendix A for a list of all reports, plans, studies, and technical information that was used in the development of the HMP 5-year Update. Information that was used to develop key findings is cited directly in the document.

2.4 DISCLAIMER

The information in this plan related to potential extent of inundation due to climate change is based on publicly available data and best available science and is subject to change as new data become available. Information is being provided only to help understand extent of possible future risk, and not for the purposes of construction regulations, flood insurance, or other insurance requirements. The information and maps included in this HMP are for planning purpose only, they are not adequate for legal boundary definition, regulatory interpretation, actual hazard assessment, or parcel level analysis. The presentation of the material in this Plan does not imply the expression of any opinion whatsoever on the part of the City concerning the accuracy of information or extent of the potential inundation areas.

2.5 REVIEW TOOL DESCRIPTION

FEMA developed a "Local Mitigation Review Guide" to help Federal, State and Local official assess Local Hazard Mitigation Plans and make sure they will meet the requirements of the Stafford Act and Title 44 Code

of Federal Regulations (CFR) 201.6. The most recent version of this guide (October 1, 2011) was used in updating the Quincy Hazard Mitigation Plan. Where text in the Hazard Mitigation Plan meets an element identified in the Review Guide, it is called out in a blue box in the margins.

SECTION 3

NATURAL HAZARDS (RISK ASSESSMENT)

Quincy is vulnerable to a wide range of natural hazards that may damage property and threaten life. As suggested by FEMA Hazard Mitigation Plan Guidance, the City has evaluated the full range of natural hazards identified in the 2018 Massachusetts State Hazard Plan and evaluated how those hazards apply to Quincy. Quincy also chose to evaluate flooding impacts due to climate change including sea level rise and storm surge and extreme precipitation. Section 3 provides a review of the 16 state identified hazards that have impacted the City in the past or might impact it in the future.

Section 3 Natural Hazards (Risk Assessments)

3.1 HAZARDS IDENTIFICATION

State Hazards

The 2013 Massachusetts Hazard Mitigation Plan (State Plan) provides an in-depth overview of natural hazards in Massachusetts. The State Plan identifies 11 natural hazards that have an impact or have a history of impacting communities in the Commonwealth of Massachusetts. These hazards are as follows:

- Flood
- Coastal Erosion
- Severe Winter Weather (includes snow, blizzards and ice storms)
- Nor'easters
- Severe Weather (includes high winds, tornadoes, thunderstorms, extreme temperatures and drought)
- Hurricane and Tropical Storms
- Dam Failure
- Fire (urban and wildland)
- Landslides
- Tsunami
- Earthquake

The 2018 State Hazard Mitigation Plan further develops our understanding by differentiating types of hydrologic hazards to include coastal, inland flooding, dam failure and drought, eliminated urban fire, and added invasive species for a total of 16 natural hazards for this HMP. Quincy benefited by the state effort by aligning the approach.

Selection of Hazards that affect the City of Quincy

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As suggested under FEMA planning guidance, the Planning Team reviewed the full range of natural hazards identified in the Massachusetts State Plan and identified natural hazards that have impacted Quincy in the past or could impact Quincy in the future. The hazards selection for Quincy was made using local expertise from the Planning Team, information from the Quincy Resilience Plan, and other sources.

The City of Quincy has elected to include all 16 hazards from the 2018 State Plan as the basis for evaluating hazards for the Quincy Hazard Mitigation Plan (HMP) 5-year update. Climate change impacts are integrated into the natural hazard elements where appropriate, consistent with the strategy used in the 2018 State Hazard Plan.

Table 3.1 includes list of all hazards selected by the City for inclusion in the Quincy HMP update. The table indicates the history and possibility for future occurrence of each hazard, current frequency and geographical

extent, severity of hazard impact, and results of a hazard index rating based on a scale of 1 (highest risk) through 5 (lowest risk).

The definition of geographical extent, probability of occurrence, frequency, geographical extent, and impact severity are provided in **Table 3.2**.

B3 a

Table 3.1
Relevant Natural Hazards for the City of Quincy

Type of Natural Hazard	History of Occurrence in Quincy	Hazard Probability	Hazard Frequency	Geographic Extent	Severity of Impact	Hazard Risk Ranking
Hydrological Hazards						
Coastal Flood	Yes	4	3	2	2	1
Inland Flood	Yes	4	3	2	1	1
Dam or Culvert Failure	Yes	2	1	1	3	3
Drought	Yes	3	1	3	1	2
Atmospheric Hazards						
Extreme Temperature	Yes	3	2	3	1	2
Hurricanes/Tropical Storms	Yes	3	2	3	2	2
Nor'easters	Yes	4	3	3	1	1
Other Severe Weather- High Winds and Thunder Storms	Yes	4	3	2	1	2
Severe Winter Storm- Snow, Ice and Blizzard	Yes	4	3	3	2	1
Tornadoes	Yes	2	1	1	2	4
Geological Hazards						
Coastal Erosion	Yes	3	4	3	3	1
Earthquake	No	2	1	2	4	2
Landslide	No	1	1	1	1	5
Tsunami	No	1	0	3	4	3
Other Hazards						
Wildfires	Yes	2	2	1	1	4
Invasive Species	Yes	4	3	1	1	3

The hazard risk rankings were calculated by assigning points to each hazard (see **Table 3.2**) and totaling the scores. A score of 11-12 ranked as #1, 9-10 as #2, 7-8 as #3, 5-6 as #4, and 3-4 as #5, with #1 as the highest hazard risk and # 5 the lowest hazard risk for the City of Quincy.

The highest ranked natural hazards for Quincy include Coastal and Inland Flooding, Nor'easters, Coastal Erosion and Severe Winter Weather.

Table 3.2

Hazard Profile Definitions [6]

Points		Description
Hazard Probability (Possible occurrence in the future)		
1	Unlikely	Less than a 1% probability over the next 100 years
2	Possible	1-10% probability in the next year or at least one chance in the next 100 years
3	Likely	10-100% probability in the next year or at least one chance in the next 10 years
4	Highly Likely	Near 100% probability in the next year
Hazard Frequency		
0	Very Low	Events that occur less frequently than once in 1,000 years (less than 0.1% per year).
1	Low	Events that occur from once in 100 years to once in 1,000 years (0.1% - 1% per year).
2	Medium	Events that occur from once in 10 years to once in 100 years (1% - 10% per year).
3	High	Events that occur more frequently than once in 10 years (greater than 10% per year).
Geographical Extent (Area Impacted by a Given Natural Hazard)		
1	Small	Less than 10% of the City affected
2	Medium	10-50% of the City affected
3	Large	More than 50% of the City affected
Severity of Impact from Hazard		
1	Minor	Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e one or two communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.
2	Serious	Scattered major property damage (more than 10% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services briefly interrupted up to 1 day; some minor injuries.
3	Extensive	Consistent major property damage (more than 25%); major damage public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and possible fatalities.
4	Catastrophic	Property and public infrastructure destroyed (more than 50%); essential service stopped for 30 days or more, multiple injuries and fatalities.

[6] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Quincy Climate Change Projections

Climate change projections for Quincy were reviewed using multiple sources including the 2017 Quincy Resilient Plan(QRP) and data from the Northeast Climate Science Center (NCSC) at the University of Massachusetts Amherst developed for inclusion in the 2018 State HMP Plan.

Researchers from the Northeast Climate Science Center (NCSC) at the University of Massachusetts Amherst developed downscaled projections for changes in temperature, precipitation, and sea level rise for the Commonwealth of Massachusetts. The Executive Office of Energy and Environmental Affairs (EEA) has provided support for these projections to enable municipalities, industry, organizations, state government and other interested parties to utilize a standard, peer-reviewed set of climate change projections that show how the climate is likely to change in Massachusetts through the end of this century. These projections will also be incorporated into the 2018 State HMP. To ensure consistency with the State HMP, Quincy has adopted data developed for the Boston Harbor region from the State-wide climate change projections (2018, NCSC and EEA[7]). Climate change for each natural hazard risk is discussed within the hazards profiles below.

3.2 HAZARD PROFILES

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B2 a b c.

Hazard profiles are provided in **Sections 3.3.1** to **3.6.2** of each of the 16 natural hazards that could impact Quincy in the future or have impacted the City in the past. Each hazard profile includes a definition and description of the hazard, previous occurrence and extent, local areas of impact, and probability for future occurrence. A discussion of previous occurrences includes historic data. Evaluation of the extent or severity of the hazard includes the measuring scale for a specific hazard. Locally identified areas of impact include maps showing the areas identified by the hazard whenever possible. The probability of future occurrences is based on best available science and historic events using the hazard probability scale provided in **Table 3.2**.

For each natural hazard, the major vulnerability issues for four key sectors are summarized. The key sectors or categories of community assets include:

- Special populations and places (vulnerable populations and cultural assets)
- Built environment (municipal buildings and critical infrastructure)
- Natural environment
- Economy

Resources used are referenced as footnotes for each hazard profile that follows.

3.3 HYDROLOGIC HAZARDS

Floods are the most common type of hydrologic hazard in the City of Quincy. Flood hazard includes coastal and inland flooding as the direct result of coastal storms, Nor'easters, heavy rains, poor urban drainage, tropical storms, hurricanes and drainage impeded by storm surge. Flooding also occurs from dam or culvert failures or high tides that may or may not be associated with a storm event. At the other end of the spectrum, drought impacts are included as a hydrologic hazard for the City of Quincy, primarily based on the negative impacts to regional water supplies.

[7] EEA, 12/1/2017 Statewide and Major Basins Climate Projections Final, 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan Natural Hazards Risk Assessment.

3.3.1 COASTAL AND INLAND FLOODING

Coastal Flooding includes storm surge, shallow coastal flooding, and sea level rise. Flooding in the coastal areas primarily occurs due to large storm surge, wind/wave setup or storm-generated waves. Drainage outfalls into coastal waters are frequently backwatered by high tides and storm surge, often inhibiting drainage systems. The impacted areas and the resulting damages depend on the direction of wind and movement from the pending storm, area configurations, physiographic characteristics and effectiveness of the flooding protection works including seawalls, revetments, tide gates, drainage check valves and structure elevation.

- **Storm surge** may occur multiple times per year causing flooding in coastal areas. Storm surge is a rise of the sea caused by low atmospheric pressure and/or water pushed toward the shore by strong winds and waves during a storm, over and above predicted astronomical tides. When a storm surge coincides with a high tide, this is called a storm tide[8]. The height of the storm surge is affected by many variables, including atmospheric pressure, wind direction, wave setup, storm size and duration, storm intensity, storm track and speed, the presence of waves, water depths, fetch and shoreline configuration (Source: FEMA). Nor'easters and hurricanes are the most common types of storms that generate enough energy to create significant storm surge heights. Runoff, atmospheric pressure and wind setup cause lower magnitude tidal surges on a frequent basis.
- **Shallow coastal flooding** occurs several times a year during astronomical high tides (also known as King Tides, or perigean spring tide) and can be several feet higher than normal tides. A coastal storm is not necessary for shallow coastal flooding to occur, but onshore winds and/or low atmospheric pressure coinciding with a King Tide can dramatically increase the level of flooding. This type of coastal flooding is predicted, primarily driven by the lunar cycle over an 18.6-year epoch.
- **Sea level rise flooding** impacts will occur several times per day as a result of predicted rise in sea level. The rise is primarily caused by a change in the volume of the Earth's oceans due to temperature increase (thermal expansion), melting of the glaciers and ice sheets (deglaciation), land subsidence, ocean circulation and climate change. Sea level rise is not consistent and has a multidecadal oscillation connected to changes in atmospheric pressure, winds and ocean circulation. Relative sea level rise includes vertical land motion including glacial isostatic adjustment, crustal movement, regional land subsidence and localized land subsidence. Relative sea level rise over almost 100 years for the Boston tide gauge is 2.8 mm/yr., including vertical local land subsidence of -0.84 mm/yr.[9] This amount of local land subsidence for the Boston tide gauge, may not be applicable to Quincy.

Inland or Riverine Flooding occurs where the rate of precipitation from a severe storm like a Nor'easter or tropical storm causes a large amount of rain in a short period of time, overwhelming the capacity of natural or constructed drainage systems causing overflows.

Urban drainage occurs in flat areas where runoff or rain collects and cannot drain. Poor drainage after flood events is usually associated with poorly infiltrating soils and undersized stormwater conveyance, including channelized streambeds and culverts that do not have adequate capacity to handle runoff from larger storm events. Most of the systems in Quincy were designed to handle the amount of water expected during a 10-year storm event. Larger storm events and other sources of water including snow melt and high groundwater

[8] NOAA, National Hurricane Center (http://www.nhc.noaa.gov/surge/)
[9] https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8443970

can overload the system and result in backups, flooding streets and properties. Areas where both coastal and inland flooding occur may be especially hard hit when storm surge, high tides and stream discharge coincide in the same storm and high tides backwater the inland drainage networks.

FEMA Flood Hazard Areas

Areas at risk of flooding are mapped by FEMA as part of the National Flood Insurance Program (NFIP) established in 1968 to reduce the nation's flood losses via local floodplain management practices. A floodplain is defined by the NFIP as any land area susceptible to being inundated by floodwaters from any source[10]. FEMA's flood maps, the Flood Insurance Rate Maps (FIRM) delineate flood zones that are defined according to varying risk of, or potential for, flooding due to the land area's characteristics (proximity to a waterbody, topography/slope) and current waterbody conditions (water/sea levels, wave action, historic storm experience).

The frequency and severity of flooding are measured based on the probability that a certain river discharge (flow) or coastal flood level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different flooding levels. For example, the 100-year flood has a 1-percent chance of being equaled or exceeded in any given year. The 100-year flood, or 1% chance annual flood is **not** inherently a flood that will occur once every 100 years.

The 100-year flood is used by the NFIP to guide floodplain management and determine the need for flood insurance. The term "500-year flood" or 0.2% annual chance flood, is the flood that has a 0.2-percent chance of being equaled or exceeded each year.

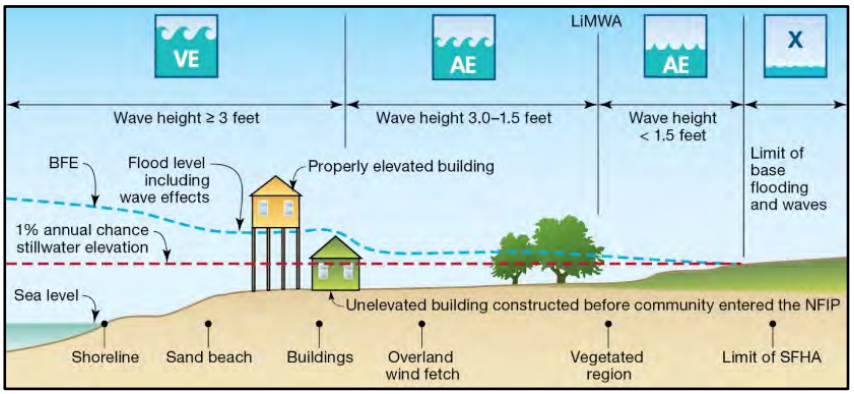


Figure 3.1: Profile of the FEMA flood zones along the coast

Figure 3.1 and **Figure 3.2** describes the different FEMA flood zones along the coast of Quincy.

The 100- year floodplains and areas subject to coastal storm surge (VE, AE and A) are shown as high-risk areas or Special Flood Hazard Areas. **Table 3.3** describes the risk associated with each zone.

[10] https://www.fema.gov/national-flood-insurance-program/definitions

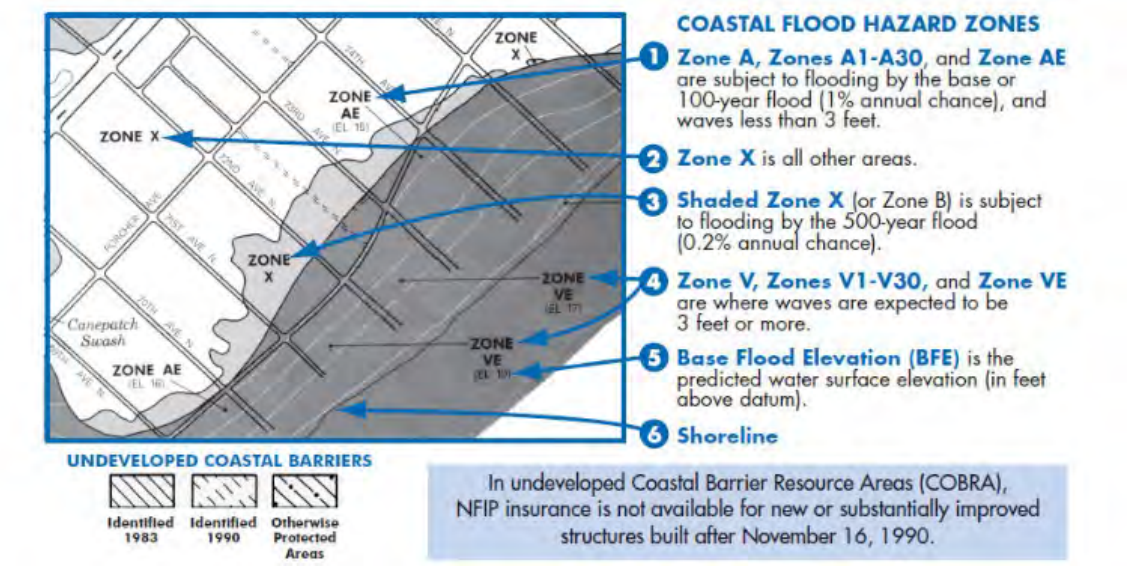


Figure 3.2: Description of FEMA flood zones along the coast

Table 3.3

Definitions of FEMA Flood Zones

Risk Type	Zone	Description
Low Risk	X (unshaded)	Area of minimal flood hazard
Moderate Risk	X (shaded)	0.2 % Annual Chance Flood
High Risk	A	1% Annual Chance Flood *Inland floodplains that do not have a base flood elevation (BFE)*
High Risk	AE	1% Annual Chance Flood *Special flood hazard area with determined BFE & wave height is <3 feet*
High Risk - Coastal	VE	1% Annual Chance Flood *Velocity Zone with determined BFE & wave height is >3 feet*

Previous Occurrence and Extent of City-Wide Flooding (Coastal and Inland)

Flooding was the most prevalent serious natural hazard identified by local officials in Quincy's 2013 Plan, and continues to be the biggest natural disaster that impacts the City today. In the past 10 years alone, Norfolk County has experienced 21 coastal flooding events[11].

The most notable coastal events include the Great Hurricane of September 1938 (a Category 3 hurricane), the Blizzard of 1978 (the most devastating Nor'easter in Massachusetts history)[12], the "No-name" or "Perfect Storm" in October 1991 (a Nor'easter that coincided with an astronomical high tide) and the December 1992 Nor'easter. More recently, Winter Storms Greyson and Riley impacted the area with record setting high tides due to coinciding storm surge and astronomical high tide conditions. **Table 3.4** summarizes these historic flooding events.

[11] NOAA Storm Event Data base (https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=25%2CMASSACHUSETTS)
[12] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Table 3.4
Historic Flooding Events and Local Impacts for Quincy

Date	Type of Event	Local Impacts
September 21, 1938	The Great New England Hurricane - Cat 3	10-17 inches of rainfall and up to 20-foot storm surge was recorded.
September 15, 1944	The Great Atlantic Hurricane - Cat 1	11 inches of rain and up to 70-foot waves reported.
August 31, 1954	Hurricane Carol - Cat 2, followed by Edna	2 hurricanes struck within 12 days with 7 inches of rain causes stream flooding and streets washed out.
September 12, 1960	Hurricane Donna - Cat 2	10-20 inches of rain and 5-10-foot storm surge. Wettest tropical cyclone to impact New England.
March 1972	Severe Storms and Flooding	No information available
February 1978	The Blizzard of '78	Most devastating Nor'easter in Massachusetts history. Set high water mark of 15.25 feet above Mean Lower Low Water in Boston Harbor- 30-foot waves recorded off shore. 30 inches snowfall, with 20-foot drifts recorded. **24 repetitive loss claims in Quincy.**
January 21-25, 1979	Nor'easter	Extreme high tides concurrent with storm surge produced major coastal flooding **.17 Repetitive Loss Claims in Quincy.**
January 2, 1987	Storm Surge and Flooding	Extreme high tides concurrent with storm surge produced major coastal flooding. **22 Repetitive Loss Claims in Quincy.**
August 19-21, 1991	Hurricane Bob - Cat 3	4-7 inches of rain, and storm surge impacts.
October 15-18, 1991	"The No-Name Storm" or "Perfect Storm" Nor'easter	25-foot waves on top of 4-foot high tide. Many coastal roads were washed out. **69 Repetitive Loss Claims in Quincy.**
December 11-13, 1992	Nor'easter	Highest water levels 1 foot below record of 1978 (25 ft. dunes wiped out in Ipswich) and 6 inches of rain. **68 Repetitive Loss Claims in Quincy.**
September 18, 1996	Nor'easter	5 inches of rain in a 24 to 35-hour period, water rose up to four feet deep in Quincy. **6 Repetitive Loss Claims in Quincy.**
October 20-21, 1996	Severe storms and flooding	13 inches of rainfall in Norfolk County (7.89 in Boston). **16 Repetitive Loss Claims in Quincy.**
June 13-18, 1998	Heavy rain and flooding	Flash flooding from June 12-14, over 8 inches fell in under 12 hours. **4 Repetitive Loss Claims in Quincy.**
March 21-22, 2001	Nor'easter	High tides ran 2-3 feet above normal along east facing coastline. **6 Repetitive Loss Claims in Quincy.**

Date	Type of Event	Local Impacts
February 2003	Presidents Day Storm	Astronomical high tide coincided with 15-foot seas to cause flooding along most of eastern Massachusetts coastline. 27.5 inches of snow recorded at Logan Airport. no flooding?
May 25, 2005	Nor'easter	Unusually late and long nor'easter with 45-55 mph winds, heavy rainfall and coastal flooding. **15 Repetitive Loss Claims in Quincy.**
October 15, 2005	Flooding	Extreme rainfall and flooding from slow moving system. **30 Repetitive Loss Claims in Quincy**
May 9-16, 2006	"Mother's Day Flood"	Extreme rainfall >12 inches. **6 Repetitive Loss Claims in Quincy.**
April 15-20, 2007	"Patriot's Day Storm" Nor'easter	Worst coastal flooding coincided with evening high tide on April 17 (3.6 inches recorded at Logan Airport). **2 Repetitive Loss Claim in Quincy.**
March 12-16, 2010	Nor'easter	Record breaking rainfall (7.06 inches at Logan Airport) coastal flooding, and 70 mph winds. **52 Repetitive Loss Claims in Quincy.**
December 26-27, 2010	Nor'easter	Snow, high winds, and major coastal flooding with early morning high tide. **20 Repetitive Loss Claims in Quincy.**
October 29-30, 2012	Nor'easter	Rare October snow storm, icing, high winds **1 Repetitive Loss Claim in Quincy**
February 8-10, 2013	Winter Storm Nemo - Nor'easter	24.9 inches of snow in Boston, hurricane-force winds, and 4.2 feet of storm surge. **9 Repetitive Loss Claims in Quincy**
October 23, 2014	Extreme Precipitation	Soaking rain and strong winds clogged storm drains with leaves, flooded roadways and caused coastal flooding. **3 Repetitive Loss Claims in Quincy**
January 26-28, 2015	Winter Storm Juno	24 inches of snow fell in Boston with 4 feet of storm surge and high winds. **2 Repetitive Loss Claims in Quincy**
February 8, 2016	Winter Storm Flooding	Blizzard and coastal flooding. **2 Repetitive Loss Claims in Quincy**
January 4, 2018	Winter Storm Grayson- Nor'easter and Flooding	A nor'easter peak winds coinciding with high tides exceeded 1978 Boston high tide record resulted in widespread coastal flooding. **Repetitive Loss information not available yet**

Date	Type of Event	Local Impacts
March 2-3, 2018	Winter Storm Riley- Nor'easter and Flooding	A long -lasting nor'easter sustained high winds coinciding with multiple astronomical high tides and soaking rains resulted in widespread coastal flooding, emergency evacuations, power outages and structural damage. The tide was the 3rd highest recorded in Massachusetts. A State of Emergency was declared on March 3rd. **FEMA Disaster DR-4372 declared on June 25, 2018**.
March-14-15, 2018	Winter Storm Skylar- Nor'easter and Flooding	The third March nor'easter to hit Massachusetts brought over 14 inches of snow and coastal flooding.

Locally Identified Areas of Impact

Currently, coastal storms present a threat to development along the 25 miles of Quincy's coastline due to storm surges that overtop coastal structures and natural shorelines, resulting in coastal flooding. Hurricanes typically do not penetrate the Quincy shore as it is protected by adjacent coastal barrier landmasses including the Town of Hull and the Boston Harbor Islands. Nor'easters pose the biggest threat to Quincy and other east facing communities on Boston Harbor and Massachusetts Bay. Damage from nor'easters is exacerbated when combined with spring tides and when they extend across multiple high tides.

Flooding in upland areas occur during heavy rains. The excessive stormwater runoff floods low-lying areas and surcharges the existing inadequate or malfunctioning drainage systems. Much of the City's drainage system was built in the early 1900s' and sizing has not kept up with development. This results in malfunctioning facilities and/or inadequate system discharges capacities. (This accounts for approximately 95% of the non-coastal flooding problems.)

Areas located where both coastal and inland flooding occur are especially impacted when storm surge, high tides, and stream discharge coincide in the same storm and high tides result in backups of water into the inland drainage networks. Tide gates have been installed in over 80 locations to address this issue and prevent the backflow from rising tides and storm surge to upland areas via the storm drainage system.

In February 2018, City officials reviewed areas of flooding concern in the 2013 HMP. Nearly $17M in drainage improvements were completed in the last 5-years resolving many problematic areas. A revised list of areas of local flooding concern are provided in **Table 3.5**. The FEMA Flood Zones and areas of flooding concern are shown on **Map 3.1** (numbering is the same as Table 3.5).

Table 3.5
Locally Identified Areas of Flooding (2018)

1	Bigelow Street, Miller Stile Road	Poor drainage in this area leads to flooding during rainfall events. Bigelow Street Relief Conduit proposed.
2	Butler Road Pond near Merrymount Road	This low-lying area floods due to insufficient inlet capacity
3	Carlisle Street, Tirrell St, Bay State Road	Flooding in this area is related to inadequate outlet elevation.
4	Farrington Street, Hobart Street, Arlington Street, North Central Avenue	Inadequate outlet elevation and flat pipes
5	Furnace Brook	This includes a large area that tends to flood due to Furnace Brook. Flooding in this area can be compounded by tidal backflow that reduces the drainage capacity of the creek. Multiple projects are required for the drainage improvements including an upgrade to the tide gate for Blacks Creek by Quincy Shore Drive.
6	Glendale Road, Presidents Lane	Flooding from Furnace Brook. Pipe inlet modification needed.
7	Glendale & Sturtevant Roads	Flooding related to Furnace Brook. Pipe inlet modification needed.
8	Goddard Street, Independence Avenue	Increase maintenance and add infrastructure
9	John Street, Division Street	Flooding issues in this area related to an undersized stormwater pump station. Pump station upgrade and pipe inspection cleaning needed.
10	Lenox Street	This is a low-lying area prone to flooding during rainfall events.
11	Packard's Lane, Quarry Street	Incomplete development
12	Penns Hill, Faxon Park	Undersized pipe capacity. *Project for improvements was submitted to Army Corps of Engineers in 2011.*
13	Adams Shore- Terne Rd, Shelton Rd, Post Island Rd, Heron Road	Low lying area is prone to coastal flooding. Seawall improvements are proposed. Area of Major Repetitive Losses
14	Rockland Street, Spring Street, Edgewater Drive, Rock Island Road	Low lying area is prone to coastal flooding. Area of Major Repetitive Losses
15	Sachem Street near Quincy Shore Drive, Copley Street	Flooding due to Sachem Brook tide gate corrosion. Wollaston Beach drainage work is proposed.
16	Shennen Street, Parkhurst, Bayswater Rd–Parkhurst Marsh Restoration	Flooding in this area is related to tide gate corrosion and inadequate pipe size.
17	Merrymount- Shore Avenue, Chickatabot Rd, Norton Rd.	This is a low-lying area prone to flooding during rainfall and coastal flood events. Undersized inlet capacity identified. Area of Major Repetitive Losses
18	The Strand	Flooding due to tidal action and local runoff (see improvements for Sachem Street near Quincy Shore Drive)

19	Newport Ave Extension: Sagamore Creek Tide Gate	Sagamore Creek Tide Gate no longer addresses storm impacts. Storm surge backflows to culvert and flood low lying neighborhood
20	Town Brook Flood System	Major inadequacies discovered in 2017 ACOE inspection. System in need of immediate repairs or system may not function during next significant flood event
21	Sea Street at Malvern and Newton, Manet Ave, Brinsley Road,	Flooding due to tide gate corrosion and coastal flooding
22	St Mary's Cemetery	Inadequate capacity in adjacent Brook - Brook restoration proposed.
23	Cunningham Park	Brook release causes flooding- retention structure needed
24	Sheldon Street	Inadequate pipe capacity. Flow diversion and long-term capacity/ expansion recommended
25	St. Ann's Road	Inadequate pipe capacity and absence of infrastructure in nearby intersection
26	Adams Street, Alrick Rd, Ballou St, Furnace Brook Parkway and O'Connell Neighborhood	Inadequate pipe capacity. Pumping system to Adams St proposed but failed FEMA Benefit Cost Analysis. Area of minor repetitive losses
27	Beale Street and Wollaston Center	Undersized pipe capacity downstream
28	Quarry Hill	Insufficient retention- Quincy needs to enforce site permits
29	Squantum- East Squantum St, Bayside Road, Essex Street, Deerfield St, Heath St, and Dorchester St	Low lying areas prone to coastal flooding including the tidal creek abutting Mosswetusset Hummock
30	Cunningham Brook	Inadequate pipe capacity on both easterly and westerly sides of the Expressway and inadequate capacity of Furnace Brook.
31	Hayward Creek	Inadequate pipe capacity.

Repetitive Loss Structures

B4 a

The frequency and locations of flood hazard events in Quincy can be estimated based on the reported loss occurrences for repetitive loss properties and from local knowledge of flood hazard areas.

As defined by the Community Rating System (CRS) of the NFIP, a repetitive loss property[13] is any property which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978. A severe repetitive loss property is any NFIP-insured property that has met at least one of the following paid flood loss criteria since 1978, regardless of ownership:

- Four or more separate claim payments of more than $5,000 each (including building and contents payments); or

[13] For more information on repetitive losses see http://www.fema.gov/business/nfip/replps.shtm

- Two or more separate claim payments (building payments only) where the total of the payments exceeds the current value of the property.

As shown in **Figure 3.3**, the majority of repetitive and severe repetitive loss properties are location in eastern Massachusetts. Quincy has the fifth highest number of repetitive loss properties in the Commonwealth. Based on repetitive loss claim information from 1979 to November 2017, Quincy had174 repetitive loss structures including 145 single family homes, 25 multifamily homes and 4 non-residential properties. These 174 properties experienced a total of 540 losses between 1978 and 2017. Damage claims over this period totaled $4,662,212. There are 10 severe repetitive loss properties, with a combined total of 59 losses.

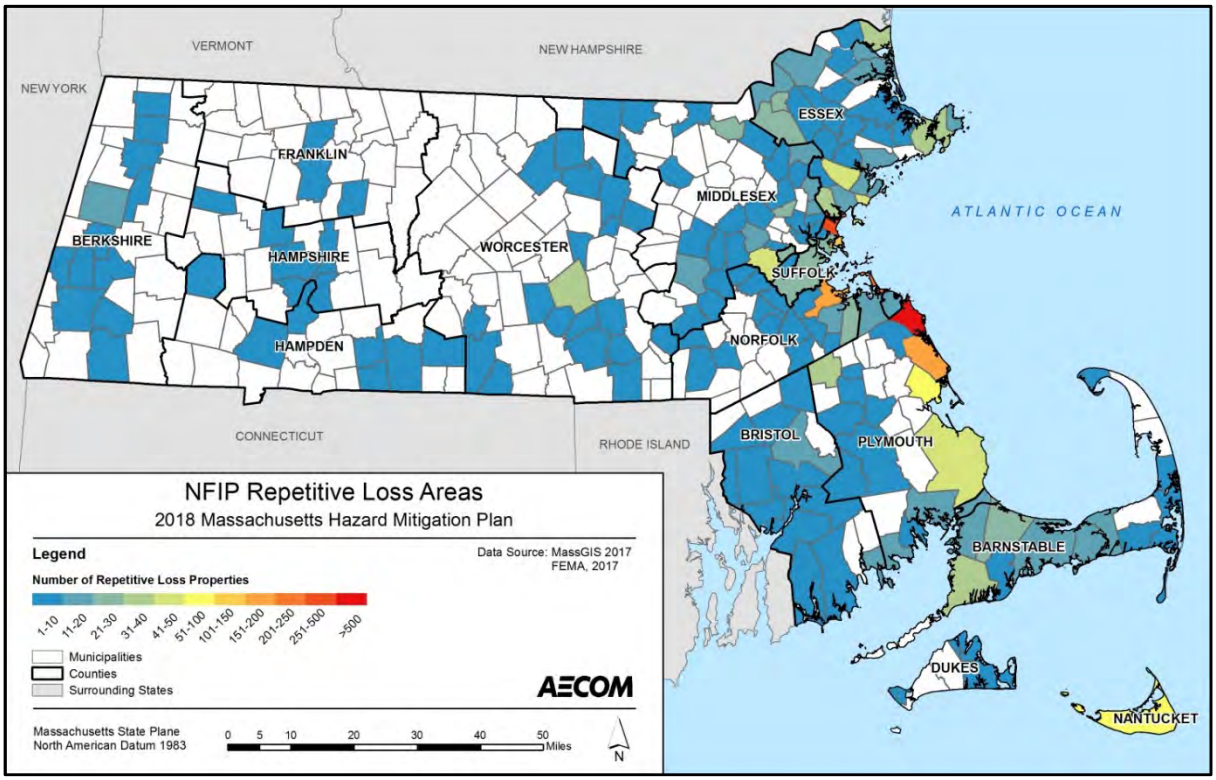


Figure 3.3: Statewide comparison of NFIP Repetitive Loss Areas

149 of the City's repetitive loss properties are located within designated 100-year flood zones, 4 are located between the 100 and 500-year flood zone boundary and 21 are located outside of the 500-year flood zone. The location of repetitive loss properties in Quincy are shown on **Map 3.2** and **Maps 3.2 A-G.**

A review of the repetitive loss data shows that flooding occurs most often in low areas along the coast and along Furnace Brook. Storms in 1978, 1979, 1987, 1991, 1992, 1996, 1998, 2005, 2006, 2010 and 2018 all led to extensive flood insurance claims in Quincy.

Probability of Future Occurrence

The potential effects of climate change significantly impact both inland and coastal flooding due to sea level rise and the increased frequency of severe storm events including nor'easters and hurricanes. Global climate change models suggest that Boston may experience between 0.5 and 4.0 feet of sea level rise by 2100[14]. The

[14] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Planning Team has determined that it is **HIGHLY LIKELY** that flooding will impact the City of Quincy in the future. The City has implemented both structural and non-structural measures to withstand coastal storms. The shoreline has been fortified in locations with revetment and seawalls and tide gates and the City is enforcing the State Code in flood prone areas (100-year floodplain as shown on the FIRM)

Despite these best efforts, a storm with sufficient magnitude could result in damages far greater than any the City has known, impacting the economy, natural resources, cultural and historic assets, and buildings and structures. Therefore, it is in the best interest of the City and residents to understand how climate change may influence flooding for both coastal and inland areas and begin proactive planning to adapt or mitigate these impacts.

A more detailed discussion of flooding risk with climate change is provided in the following section.

Coastal Flooding with Climate Change

Projected sea level rise and storm surge will intensify flooding concerns along the Quincy shoreline in the future. To provide a comprehensive understanding of Quincy's potential coastal flooding risk due to climate change, the most recently available Massachusetts projections are compared in this section. Methods include projections from the National Climate Assessment (NCA)[15], Massachusetts Office of Coastal Zone Management (CZM) in 2013[16], the Quincy Resilient Plan (QRP) in 2016[17] and the State-Wide Climate Data released by the National Climate Science Center (NCSC) in 2017[18].

Sea level refers to the height of the ocean's surface; it is used as the basis for determining land elevation. Mean sea level is an average measurement of the water's surface elevation, accounting for the tidal fluctuations that occur daily and over the course of a tidal epoch, including storm surges and sea level rise. Tide gauges can be used to measure and track mean sea level over time. For Quincy, the nearest tide gage with a long term sea level rise calculation is located in Boston (#8443970). **Figure 3.4**. illustrates annual sea level rise measurements at this tide gauge from 1920-2018 showing approximately a 0.3 meter (11 inch) rise over the 21st century. At this time, recorded tide data is not showing an acceleration in the rate of sea level rise as projected to occur over the next several decades.

15 Global Sea Level Rise Scenarios for the United States National Climate Assessment, December 2012 (http://www.cpo.noaa.gov/sites/cpo/Reports/2012/NOAA_SLR_r3.pdf)
16 Massachusetts Office of Coastal Zone Management (CZM), Sea Level Rise: Understanding and Applying Trends and Future Scenarios for Analysis and Planning, December 2013 (http://www.mass.gov/eea/docs/czm/stormsmart/slr-guidance-2013.pdf)
17 2017 Draft Quincy Resilient Plan, Climate Change Cause and Effect
18 EEA, 12/21/2017 Statewide and Major Basins Climate Projections Final

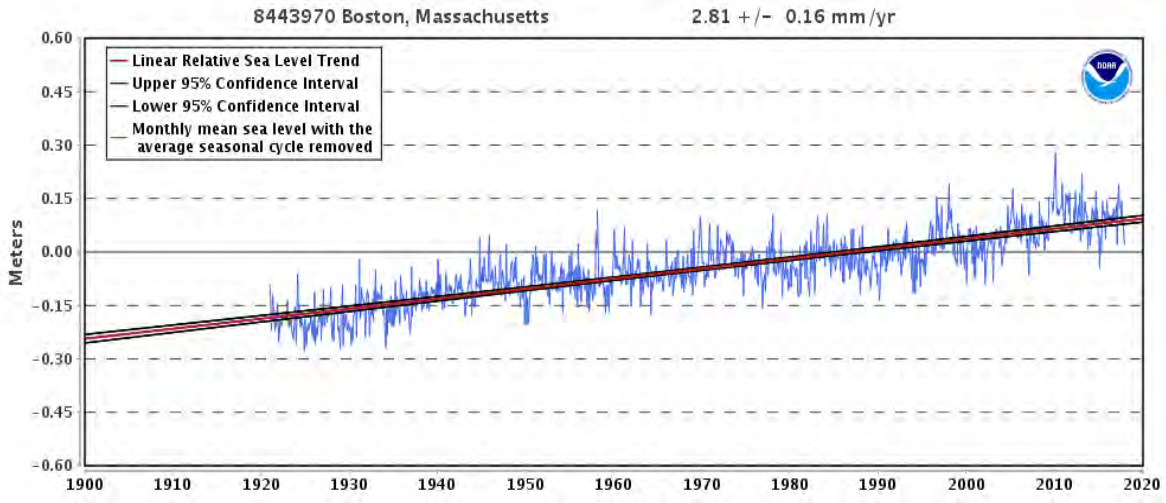


Figure 3.4: Boston Harbor Tide Gauge 1920-2018

Sea level rise has been estimated for Quincy from four sources.

1. The National Climate Assessment (NCA) provides future projections for global sea level rise out to the year 2100, as shown in **Figure 3.5**[19]. Global sea level rise is projected by the NCA to accelerate to varying degrees based on a range of greenhouse gas emission levels, described by representative Concentration Pathways(RCPs). RCPs are concentrations of greenhouse gases and pollutants resulting from human activities, including changes in land use. The four RCP scenarios are based on socio-economic assumptions as follows[20]:

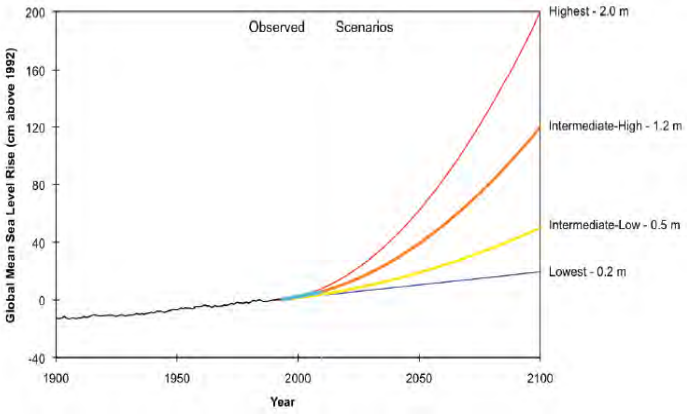


Figure 3.5: NCA global sea level rise projections Paris et al. (2012)

   - RCP 8.5 – **Highest emissions:** A future with no policy changes to reduce emissions with increasing greenhouse gas emissions that lead to high greenhouse gas concentrations over time.
   - RCP 6 – **Intermediate high emissions:** Stabilization of radiative forcing shortly after year 2100, via the application of a range of energy efficiency technologies and strategies that reduce greenhouse gas emissions.
   - RCP 4.5 – **Intermediate low emissions:** Stabilization of radiative forcing shortly after year 2100, consistent with a future with relatively ambitious emissions reductions.

19 Global Sea Level Rise Scenarios for the United States National Climate Assessment, December 2012 (http://www.cpo.noaa.gov/sites/cpo/Reports/2012/NOAA_SLR_r3.pdf))
20 2017 Draft Quincy Resilient Plan, Climate Change Cause and Effect

- RCP 2.6 – **Lowest emissions:** Ambitious GHG emissions reductions resulting in a reduced radiative forcing.

NCA projections from the 2012 assessment range from a low of 0.3 feet by 2025 to a high of 7.4 feet by 2100. Of note, these are global sea level rise projections, that may not be representative of relative sea level rise in Quincy.

2. In 2013, the Massachusetts Office of Coastal Zone Management (CZM)[21] prepared regional sea level rise projections based upon the 2012 NCA four Global Sea Level Rise Scenarios. The CZM projections include adjustments to the NCA global scenarios account for local vertical land movement (-0.8 ± 0.3 mm/yr.).[22]. MA CZM estimated that the rate of change in Mean Sea Level Rise for Boston Harbor ranges from a low of 0.2 feet by 2025 to a high of 5.3 feet by 2100.

3. The City of Quincy received data output from a hydrodynamic model[23]: Boston Harbor Flood Risk Model (BH-FRM), which was initially prepared to assess the vulnerabilities of the Central Artery Tunnel system. This model was run for the City of Quincy to provide projections of the future extent and probability of coastal flood inundation along its shoreline. The model was based upon the 2012 NCA global SLR scenarios, in which 2030 and 2070 scenarios assume the highest RCP emissions trajectory (while the 2100 scenario assumes an intermediate high trajectory). The model includes storm surge and combines the Advanced Circulation Model and the Simulating Waves Nearshore Model that provides the probability of a range of storm types, such as Hurricanes and Nor'easters, and associated flooding conditions. This model was prepared for a very high risk underground, below sea level tunnel system in Boston. The assumptions used to estimate relative sea level, including subsidence at the Boston Tide gauge and the choice for emissions scenario may be overly robust for Quincy.

4. In December 2017, EEA in collaboration with the NCSC released state-wide climate projections. The methodology for developing these projections closely follows the approach applied to Boston Harbor for *Climate Ready Boston,*[24] and a recent analysis for the State of California.[25] The analysis consists of a probabilistic assessment of future sea level at each tide gauge location and following two possible future greenhouse gas emissions scenarios: medium (RCP4.5) and high (RCP8.5).[26] Relative Sea Level (RSL) is the local difference in elevation between the sea surface and land surface. A multi-year reference time period for RSL was used to minimize biases caused by tidal, seasonal, and interannual climate variability, following the common practice of using a 19-year tidal datum epoch[27] centered on 2000 as the 'zero' reference for changes in RSL.[28] Estimates of relative sea-level at site-specific

[21] Massachusetts Office of Coastal Zone Management (CZM), Sea Level Rise: Understanding and Applying Trends and Future Scenarios for Analysis and Planning, December 2013 (http://www.mass.gov/eea/docs/czm/stormsmart/slr-guidance-2013.pdf)
[22] Matching Mean Sea Level Rise Projections to Local Elevation Datums 20 and the U.S. Army Corps of Engineers.
[23] MassDOT-FHWA, Pilot Project Report: Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options for the Central Artery, June 2015
[24] Douglas, E., P. Kirshen, R. Hannigan, R. Herst, A. Palardy, R. DeConto, D. FitzGerald, C. Hay, Z. Hughes, A. Kemp, R. Kopp, B. Anderson, Z. Kuang, S. Ravela, J. Woodruff, M. Barlow, M. Collins, A. DeGaetano, C. A. Schlosser, A. Ganguly, E. Kodra, and M. Ruth (2016), Climate Change and Sea Level Rise Projections for Boston: the Boston Research Advisory Group Report, 54 pp. pp., Climate Ready Boston, Boston, MA.
[25] Griggs, G., Arvai, J., Cayan, D., DeConto, R., Fox, J., Fricker, H. A., Kopp, R. E., Tebaldi, C., Whiteman, E.A. and the California Ocean Protection Council Science Advisory Team Working Group (2017), Rising Seas in California: An Update on Sea-Level Rise Science. California, Ocean Science Trust, April 2017.
[26] Van Vuuren, D. P., Edmonds, J., Kainuma, M., Riahi, K., Thomson, A., Hibbard, K.,Lamarque, J.-F. (2011), The representative concentration pathways: an overview. *Climatic Change*, 109, 5-31.
[27] A tidal datum epoch is a 19-year period over which tidal height observations are taken and reduced to obtain mean values in order to establish the various datums (e.g., mean higher high water, etc.)(NOAA Tides and Currents).
[28] e.g., Sweet, W. V., R. E. Kopp, C. P. Weaver, J. Obeysekera, R. M. Horton, E. R. Thieler and C. Zervas (2017), Global and Regional Sea Level Rise Scenarios for the United States. NOAA Technical Report NOS CO-OPS 083.

locations and at individual years requires the consideration of processes not explicitly considered in the analysis.

Figure 3.6 shows projection curves are given for the medium (RCP 4.5) and high (RCP 8.5) emissions scenarios, at multiple levels of likelihood, in feet relative to mean sea level in 2000. These projections of sea level rise do not include potential contributions from significant losses of the Antarctic ice sheet.

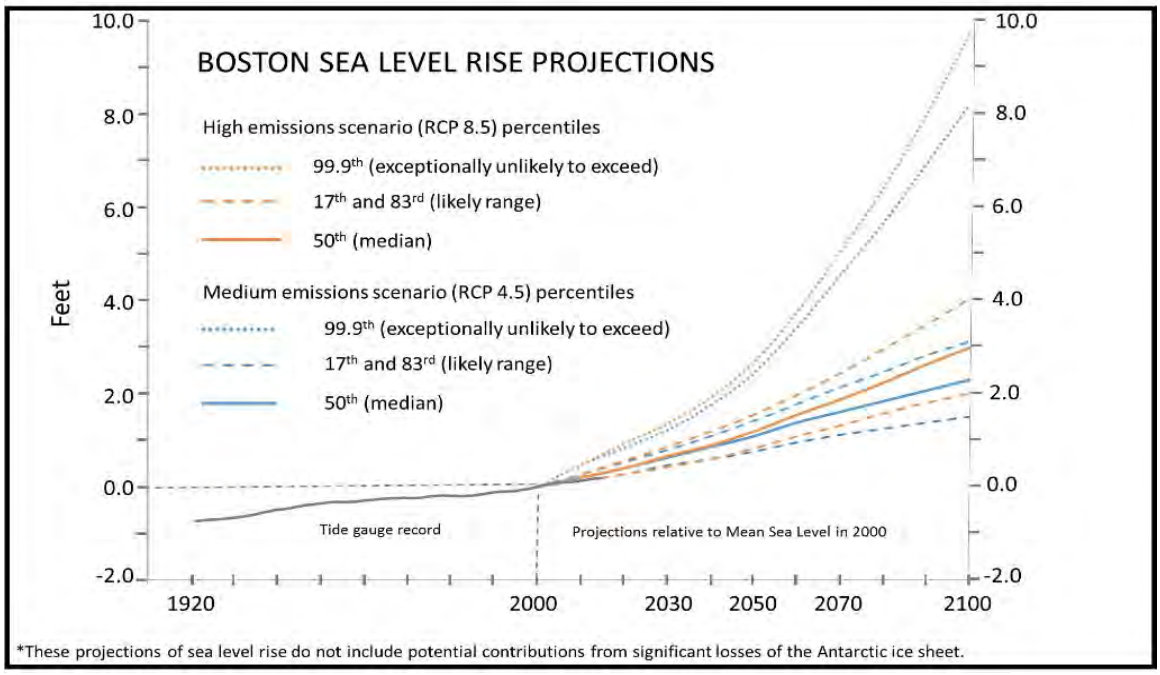


Figure 3.6: Sea level rise projections at the Boston tide gauge.

Table 3.6 quantifies sea level rise projections at the Boston tide gauge for 2030, 2050, 2070 and 2100. Projections are given for the medium (RCP 4.5) and high (RCP 8.5) emissions scenarios, including median probability (50% probability that SLR will exceed the value), the likely range that SLR will between (66% probability of occurrence) and the most extreme predicted value (99.9th percentile) in feet relative to mean sea level in 2000.

Table 3.6
Sea level rise projections at the Boston tide gauge

BOSTON		Median (50th percentile) 50% probability SLR exceeds	Likely Range (17th-83rd percentiles) 66% probability that SLR is between…	99.9th Percentile Value Exceptionally unlikely that SLR will exceed
Emissions Scenarios: Medium (RCP 4.5); High (RCP 8.5)		Feet (relative to Mean Sea Level in 2000)		
2030	Med	0.6	0.5-0.8	1.2
	High	0.7	0.4-0.9	1.3
2050	Med	1.1	0.8-1.4	2.4
	High	1.2	0.8-1.5	2.7
2070	Med	1.6	1.1-2.1	4.5
	High	1.9	1.3-2.4	5.0
2100	Med	2.3	1.5-3.1	8.2
	High	3.0	2.0-4.0	9.7

The comparison of sea level rise projections for the Greater Boston Harbor region from the NCA, CZM and EEA methodologies described above is shown in **Table 3.7**

Table 3.7
Greater Boston Harbor: Range of Predicted Sea Level Rise (in Feet)

	2025-2030			2038-2050			2063-2070			2088-2100		
Emissions Scenario	NCA	CZM	EEA	NCA	CZM	EEA	NCA	CZM	EEA	NCA	CZM	EEA
Highest (RCP 8.5)	0.3-0.7	0.5	0.7	0.7-1.5	1.08	1.2	1.5-3.1	2.8	1.9	3.2-7.4	5.3	3
Intermediate High (RCP 6)	n/a	0.4	n/a	n/a	0.7	n/a	n/a	1.8	n/a	n/a	3.3	n/a
Intermediate Low (RCP 4.5)	0.3-0.7	0.2	0.6	0.7-1.4	0.4	1.1	1.3-2.6	0.92	1.6	2.4-5.1	1.5	2.3
Lowest (RCP 2.6)	0.3-0.7	0.2	n/a	0.6-1.4	0.3	n/a	1.1-2.3	0.50	n/a	1.8-3.8	0.71	n/a

Recommendations

Due to the significant uncertainty involved in modeling future climate change, an approach to predict future risk is proposed based on recent sea level rise projections from the NECSC report (2018). **Table 3.8** provides the NECSC recommended sea level rise projections for near, mid, and long-term scenarios for the medium emission scenario (RCP 4.5). The medium emission scenario was selected because it is a reasonable compromise between the low and high emission scenarios. The NECSC median values are recommended for use when evaluating future flooding scenarios, although the likely range is provided for reference. The uncertainty regarding projections approaching 2100 becomes so high that they can be considered unreliable, so the 2070 scenario was used as a long-term projection. Due to the significant uncertainty in these projections, and lack of observed sea level rise acceleration in tide gauge data necessary to reach these sea level rise projections, this topic needs to be revisited in the 2023 HMP plan update, as well as future HMP Plan updates, using the best available science at that time.

Table 3.8

Recommended approach for sea level rise estimates for projecting future coastal flooding risk in Quincy MA[1]

Time Period	Sea Level Rise Projection[2] (Feet)	Likely Range[3] (Feet)
Base (2000)	0	n/a
Near Term (2030)	0.6	0.5-0.8
Mid Term (2050)	1.1	0.8-1.4
Long Term (2070)	1.6	1.3-2.4

[1] Scenarios and values are from Table 6 of the NECSC (2018)

[2] Recommended increase for future flood risk analyses using the median or 50% percentile

[3] NECSC defined the likely range as the 66-percent confidence limits (between the 17th and 83rd percentiles)

Local Impacts of Rising Sea Level

The impact of rising sea levels depends on local factors and geographies. The local impacts from sea level rise along the Quincy coast will be influenced by regional ocean currents, wind patterns, land and shore land elevations, geomorphic processes such as land subsidence and accretion rates (sinking and accumulation of sediment), and tidal zones. For low elevation coastal areas, even a rise of less than a foot of sea level can produce significant new risks for development and infrastructure like the electrical grid and storm and waste water systems near the shore. Sea level rise will exacerbate many other existing coastal hazards, like severe storms and storm surge, tidal inundation, drainage and salt water intrusion.

With rising relative sea levels, more regular flooding of developed and natural low-lying coastal areas is expected to occur due to more frequent tidal inundation. There will be increased erosion of existing coastal landforms (e.g., beaches and dunes). Damage to coastal engineering structures (e.g., seawalls) and more frequent flooding of roads, utilities, coastal properties and neighborhoods will occur as relative sea level rise increases.

As water levels rise, coastal storm surge events will cause inundation of larger areas, and will occur more frequently. Storm surges can damage or destroy coastal engineering structures, critical infrastructure such as water and waste water treatment plants, transportation systems, electrical distribution systems, critical public facilities (i.e., police headquarters, fire stations, public works facility and public buildings used for emergency shelters) and damage private property. Sea level rise has the potential to significantly impact

coastal property values and shift tax burden to inland properties. Based on typical 30-year mortgages, the adverse property value impacts should be anticipated many years ahead of mapped coastal flooding.

Salt-water intrusion, or the increased penetration of salt-water into estuarine habitats, such as salt marshes and freshwater wetlands, could alter the composition of the plant species and affect the wildlife that depend on these ecosystems. Water resources (such as drinking water) could also be impacted by salt-water intrusion and by the corrosion of important infrastructure.

Impacts on Quincy Key Sectors

COASTAL FLOODING EXPOSURE AND VULNERABILITY BY KEY SECTOR[29]	
BUILT ENVIRONMENT	Quincy critical facilities, including police stations, fire stations, schools, hospitals, and evacuation routes are located within the coastal flood zone. Many of the coastal shoreline protection structures are many decades into their intended design lives and now face significant permitting limitations on repair or reconstruction, such that their effectiveness will be reduced.
NATURAL RESOURCES AND ENVIRONMENT	Coastal flooding is a natural element of the coastal environment. However, both increased storm-related flooding and sea level rise represent threats to coastal natural resources, as many coastal habitats are dependent on specific inundation frequencies. These habitats, and the species that rely on them, will be threatened by sea level rise.
ECONOMY	Due to concentration of development in the coastal zone, economic exposure from this hazard is high. This damage will likely include both direct impacts, such as damage to homes and government buildings, as well as lost tourism revenue and impact to local businesses. Damage to coastal property values and tax base should be expected ahead of mapped projected coastal flooding.
VULNERABLE POPULATIONS	Acute coastal flooding events are generally associated with large storms that can be predicted well in advance. Therefore, populations that are particularly vulnerable to this hazard include those without reliable access to emergency information and those who face challenges in evacuating when needed.

Inland Flooding with Climate Change

Precipitation and temperature changes due to climate change are key factors that will impact inland flooding in the future. These changes have the potential to modify the current floodplain, impacting areas of Quincy that have not flooded in the past. .According to the Northeast Climate Impacts Assessment report of 2007, annual precipitation levels are expected to increase across New England by as much as fourteen percent (14%) by the end of this century, with an estimated thirty percent (30%) increase in precipitation during winter months. NECSC includes future annual precipitation statistics for the Boston Harbor Basin, increasing from the current 46.1 inches to as much as 50.7 inches per year by the 2030s, and as much as 55.1 inches per year by 2100[30].

[29] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[30] Northeast Climate Science Center (NECSC) "Massachusetts Climate Change Projections - Statewide and for Major River Basins" for the Massachusetts Executive Office of Energy and Environmental Affairs, January 2018 (http://www.massclimatechange.org/.)

The climate projections suggest that the frequency of high-intensity or extreme rainfall events will trend upward. As shown in **Figure 3.7**, the amount of precipitation released by storms in the northeast has increased by 71% from the baseline level (recorded 1901-1960) and present-day levels (measured 2001-2012)[31].

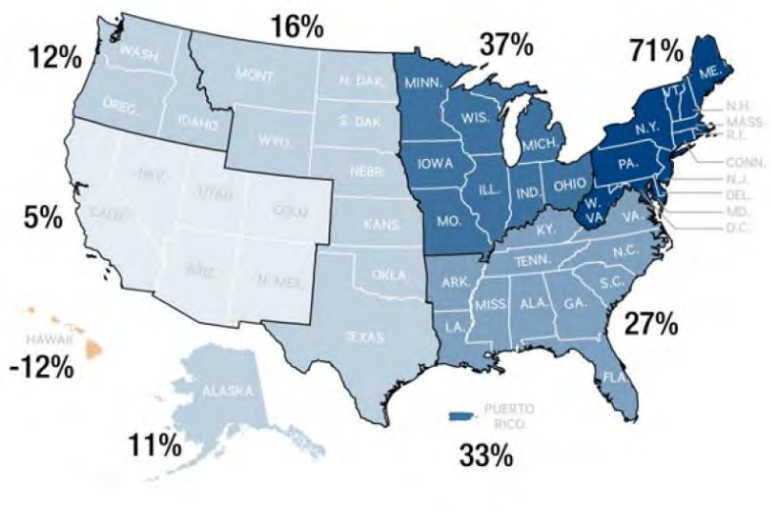


Figure 3.7: Nation-wide comparison of increase in extreme precipitation

Source: NCA 2014

Overall, it is anticipated that the severity of flood-inducing weather events and storms will increase, with events that produce sufficient precipitation to present a risk of flooding likely increasing. A single intense downpour can cause flooding and widespread damage to property and critical infrastructure. The coast will experience the greatest increase in high-intensity rainfall days.

The number of days each year with extreme precipitation are also anticipated to increase over time (**Table 3.9**)

Table 3.9

Projected Annual Frequency of Future Extreme Precipitation Events in the Boston Harbor Region

	2030s	2050	2070	2100
Number of Days >1" precipitation	9.43 – 11.22	9.84 – 12.11	10.06 – 12.23	10.34 – 13.49
Number of Days >2" precipitation	1.32 – 1.85	1.37 – 2.01	1.38 – 2.15	1.54 – 2.46
Number of Days >4" precipitation	0.05 - .23	0.07 – 0.21	0.05 – 0.24	0.050 – 0.28

Source: NECSC, 2017

[31] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Extreme Precipitation Impact on Engineering Design

Estimating changes in the expected intensity of future rainfall events is constantly evolving, with technological advancements, increases in available precipitation records, and climate change models. Utilizing rainfall values that reflect the changing climate are important in engineering design. Accounting for extreme precipitation is necessary to design adequate capacity in drainage system and provide sufficient structural elevation to avoid flooding. Coastal communities such as Quincy need to utilize the best available science to accommodate future extreme precipitation in planning and design.

There is a variety of opinions on the definition of "extreme precipitation", and which precipitation metric to compare over time. Rainfall can be compared using statistical thresholds (e.g. 95th percentile), absolute thresholds (e.g. greater than 1 inch) and return intervals (e.g. 100-year storm), all of which can be applied over a range of time scales from minutes to years.[32]

The "design storm" approach is a practical way to compare extreme precipitation amounts that is consistent with values used for engineering design. Rainfall amounts are compared over time periods based on storms of a similar size and duration called recurrence intervals or "return period", typically ranging from a 2-year to 100-year storm event. For example, a 2-year storm event has a 1 in 2 chance of occurring in a given year of a 50% probability. A 100-year storm event has a 1 in 100 chance of occurrence in a given year, or a 1% probability. A "design storm" is based on the historical precipitation records for a particular return interval and duration of the storm event such as a 2-year, 24-hour storm.

To assist the City in planning for climate change, methods to calculate future design storm events for a variety of recurrence intervals were reviewed. Available data included a review of data from the National Oceanic and Atmosphere Administration (NOAA) Atlas 14, Climate Change and Sea Level Rise Projections for Boston by the Boston Research Advisory Group (BRAG), and the 2017 NCSC state-wide precipitation climate change data.

The National Oceanic and Atmosphere Administration (NOAA) Atlas 14 has been used for a number of years as an improved source of extreme precipitation. The Atlas was completed in 2016 and is the most current rainfall intensity dataset in Massachusetts. **Table 3.10** shows the 24-hour rainfall depths for Quincy Massachusetts using NOAA Atlas 14.

Table 3.10
Quincy Massachusetts 24-hour Rainfall Depth Estimates Using NOAA Atlas 14 and NRCC Extreme Precipitation Tables

Recurrence Interval Storm Event	NOAA 24 hour Rainfall Depth for Quincy Massachusetts (inch)
2-year	3.36
10-year	5.23
25-year	6.39
50-year	7.29
100-year	8.19

[32] Boston Research Advisory Group, Draft Climate Change and Sea Level Rise Projections for Boston, January 18, 2016.

The Climate Change and Sea Level Rise Projections for Boston by the Boston Research Advisory Group(BRAG)[33] Climate Ready Boston provided estimates for increases in the 10-, 25-, and 100-year recurrence interval 24-hour storm intensities for Cambridge, Massachusetts, in 2030 and 2070.

Table 3.11 summarizes the BRAG results and provides linearly interpolated estimates for rainfall depths in 2015 and 2050. The percent increase for each of the years was computed comparted to the 2015 values (available from NOAA Atlas 14). These values are consistent with values reported by the Horsley Witten Group in a report for the Massachusetts Office of Coastal Zone Management[34], which projected an increase of 5 to 10 percent by 2030, and an increase of 10 to 19 percent by 2060.

Table 3.11

Projected increase in 10-, 25-, and 100-year recurrence interval storm event 24-hour rainfall depth (inches) (BRAG, 2016).

Recurrence Interval Storm Event	Projected Year				
	2000	2015[1]	2030 (Near Term)	2050[1] (Mid Term)	2070 (Long Term)
10-year	4.9	5.3	5.6	6.0	6.4
25-year	6.2	6.9	7.3	7.8	8.2
100-year	8.9	9.7	10.2	11.0	11.7
Percent Increase from 2015 Estimate[3]			7%	10%	20%

[1]Rainfall depth interpolated

[2]Rainfall depth extrapolated

The percent increases provided in **Table 3.11** can be used with the reported rainfall depths in NOAA Atlas 14 to estimate rainfall depths for future scenarios. **Table 3.12** summarizes these predictions, although climate change science is evolving rapidly, and these estimates should be updated as future studies are performed.

Table 3.12

Projected 24-hour rainfall depths for Quincy Massachusetts for existing, near term, mid-term, and long-term conditions based on data from Boston Research Advisory Group (2016).

Recurrence Interval Storm Event	24-hour Rainfall Depth for Quincy Massachusetts (inch)			
	NOAA Atlas 14 Existing	Near Term Estimate	Mid Term Estimate	Long Term Estimate
2-year	3.36	3.6	4.0	4.7
10-year	5.23	5.6	6.2	7.4
25-year	6.39	6.8	7.5	9.0
50-year	7.29	7.8	8.6	10.3
100-year	8.19	8.8	9.6	11.6

[33] Boston Research Advisory Group, "Climate Ready Boston Climate Change and Sea Level Rise Projections for Boston", June 2016.
[34] Horsley Witten Group, "Assessment of Climate Change Impacts on Stormwater BMPs and Recommended BMP Design Considerations in Coastal Communities" for the Massachusetts Office of Coastal Zone Management, December 2015.

Implications for Inland Flooding with Climate Change

Rainfall is expected to increase in spring and winter months particularly in Massachusetts, with increasing consecutive dry days in summer and fall. More total rainfall can have an impact on the frequency of minor but disruptive flooding events, especially in areas where storm water infrastructure has not been adequately sized to accommodate higher levels.

More intense downpours often lead to inland flooding as soils become saturated and stop absorbing more water, river flows rise, and the capacity of urban storm water systems is exceeded. Flooding may occur as a result of heavy rainfall, frozen ground, snowmelt, or coastal flooding associated with high wind and wave action, but precipitation is the strongest driver of flooding in Massachusetts. Winter flooding is also common in the state, particularly when the ground is frozen. Quincy experienced 27 flood-related disaster declarations from 1954 to 2017 with many of these falling in winter, or early spring, or during recent hurricanes.

Inland flooding is also impacted by the relationship between coastal ecosystems and inland river systems. For instance, increases in stream flow and velocity will result in erosion and flooding within coastal estuaries, and increased coastal storm surge will backwater stream discharge, exacerbating inland flooding. Both the Neponset River and Weymouth Fore Rivers carry abundant sediment and deposit it in Quincy Bay. This sediment must be periodically dredged or it adds to the "bottleneck" effect at the mouth of the rivers.

Quincy's current FEMA Flood Insurance Maps provide an important baseline for gaging the extent of future flood condition, however it is important to note that FEMA defined floodplain areas are based on historic and existing conditions; but do not include future or projected climate conditions. **Figure 3.8** show current flood-prone areas (the 1% chance annual flood or 100-year floodplain).



Figure 3.8: FEMA Flood Zones

This floodplain will expand in the future as extreme precipitation, sea level rise, and storm surge impact inland and coastal flood levels.

Recommendations to account for floodplain expansion due to climate change

Hydrologic modeling to predict inland floodplain expansion is a useful tool that could help the City understand where future inland flooding may occur. At this time, the available flood models within the Neponset River and Weymouth Fore River Watersheds are not adequately detailed to evaluate any future expansion scenarios. The BRAG report developed general floodplain expansion projections for the Greater Boston Harbor area to determine the range of potential increase in river flooding. Results from their analysis indicate a 20-50% increase in the 2% chance storm floodplain, and a 15-70% increase in the 1% chance storm floodplain, between 2055 and 2085. These flooding projections include much uncertainty due to limitations associated with climate model simulation of extreme precipitation, downscaling, and flood modeling. For instance, according to the BRAG report, "rain on frozen ground without significant snow cover is an important flood generating process in New England, yet the relative importance of that process compared to rain on saturated soils is unknown."[35]According to the BRAG findings report, river flooding projections should be treated with caution, due to said limitations.

In the future the City may wish to keep updated on modeling under development that will be useful to prepare an analysis of riverine flooding within developed areas, particularly for critical transportation corridors such as Furnace Brook.[36] As an interim measure, utilizing more robust design storm values as recommended in **Table 3.12** will provide additional capacity to accommodate anticipated extreme precipitation events going forward.

Impacts on Quincy's Key Sectors

INLAND FLOOD EXPOSURE AND VULNERABILITY BY KEY SECTOR[37]	
BUILT ENVIRONMENT	Flooding can also wash out sections of roadways and bridges, as well as cause extensive damage to public utilities and disruptions to the delivery of services.
NATURAL RESOURCES AND ENVIRONMENT	Severe floods cause a wide range of environmental impacts. Animals can lose their habitats if habitat elements are swept away or destroyed. Riverbank and soil erosion transform existing habitats and deposit sediment in downstream areas. If high levels of nutrients are present in the soil, this can also lead to eutrophication in downstream ecosystems.
ECONOMY	Economic losses due to a flood include, but are not limited to damages to buildings (and their contents) and infrastructure, agricultural losses, business interruption (including loss of wages), impacts on tourism, and tax base.
VULNERABLE POPULATIONS	Populations that are particularly vulnerable to this hazard include the economically disadvantaged, who may face greater difficulty in evacuating, and individuals with medical needs who may have not be able to receive required medical care either during evacuation or if isolated by flooded infrastructure.

[35] Climate Ready Boston, Boston Research Advisory Group Report. June 1, 2016.
[36] MAPC is currently developing a methodology for riverine floodplain analysis suitable for scenario planning by municipalities.
[37] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

3.3.2 DAM AND CULVERT FAILURE

Dams

A dam is an artificial barrier that has the ability to impound water for the purpose of storage or control of water. Dam failure is a catastrophic type of failure characterized by a sudden, rapid, and uncontrolled release of impounded water. Dam failure can occur as a result of structural failure, independent of a hazard event, or as the result of the impacts of a hazard event such as flooding associated with storms or an earthquake. In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage if there are people or buildings downstream. The number of fatalities from a dam failure depends on the amount of warning provided to the population and the number of people in the area in the path of the dam's floodwaters. Dam failure in general is infrequent but has the potential for severe impacts. An issue for dams in Massachusetts is that many were built in the 19th century without the benefits of modern engineering or construction oversight.

The Massachusetts DCR has three hazard classifications for dams:

High Hazard:	Dams located where failure or mis-operation will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).
Significant Hazard:	Dams located where failure or mis-operation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities.
Low Hazard:	Dams located where failure or mis-operation may cause minimal property damage to others. Loss of life is not expected.

In general, DCR requires that dams that are rated as low hazard be inspected every ten years while dams that are rated as significant hazards must be inspected every five years.

Culverts

A culvert is defined as a structural opening under a roadway that allows water to pass from one side of a roadway to the other. A culvert can impound water similar to a dam under certain flood conditions, and if conditions are extreme, culverts can fail, causing road and property damage. A culvert can fail under the following conditions:

- clogged with debris and sediment, invasive species and other vegetation
- buildup of stormwater or on the upstream side of the culvert, stormwater exceeding the capacity of the culvert
- loss of structural integrity
- culvert and road are washed out during a heavy rain or from snowmelt
- soil around the culvert erodes, and without support, the culvert will buckle or sag and the culvert will collapse

Tide Gates

A tide gate functions as a type of dam within a culvert. Tide gates are constructed as valves or flaps, that close during incoming (flood) tides to prevent tidal water from moving upland. They open during outgoing (ebb) tides to allow water to flow through the culvert and into the receiving waterbody. Tide gates can malfunction due to jamming by debris, deterioration of the gate, or poor design. A malfunctioning tide gate results in changes to the stream channel (scour), elevating upstream temperatures, inland flooding, and alterations to water chemistry. Tide gates also act as barriers to fish passage.

Previous Occurrence and Extent

The Department of Conservation and Recreation (DCR) Office of Dam Safety lists 2 dams in Quincy, both located in the Blue Hills Reservation.

Blue Hills Reservoir Dam – DCR lists the Blue Hills Reservoir Dam as a High Hazard Dam. This is a concrete core wall-type dam and is owned by DCR. An emergency action plan has been developed with specific procedures to be taken in the event of a dam failure. The area of the reservoir was significantly decreased in 2010 through an MWRA program to eliminate open distribution storage reservoirs. The east end of the reservoir was replaced with two 10-million gallon buried drinking water storage tanks. The old dam was replaced with a new earthen dam with a grassed emergency spillway, improving safety.

St. Moritz Pond Dam – The St. Moritz Pond Dam is listed as a Non-Jurisdictional Dam and as such is not subject to state inspection requirements. This is an earthen- type dam.

Quincy has an extensive stormwater drainage system involving hundreds of culverts including long stretches of natural stream drainage that was encased in conduit in the 1900's to allow more dense urban development. Over 80 tide gates are part of this drainage system. The City has mapped over 90% of the system. The City is systematically inspecting the system including evaluating the capacity and condition of the culverts and tide gates that are often found to be corroded or undersized, restricting storm flows. **Map 3.3** and **Maps 3.3 A-G** depicts the location of dams, culverts and tide gates.

Locally Identified Areas of Impact

Many areas in Quincy are impacted by poorly functioning culverts and tide gates.

Probability of Future Occurrence

Climate change is likely to increase the severity of extreme precipitation events, increasing the probability that dams and culverts will exceed their capacity, and that tide gates will create backwater flooding. The Planning Team determined that based on past history of culvert and tide gate failure events it is **LIKELY** that this natural hazard risk will impact the planning area in the future.

Impacts on Quincy's Key Sectors

DAM AND CULVERT FAILURE EXPOSURE AND VULNERABILITY BY KEY SECTOR[38]	
BUILT ENVIRONMENT	Flood waters from dam and culvert failure may potentially cut off evacuation routes, limit emergency access, and create isolation issues. Utilities such as overhead power lines, cable and phone lines in the inundation zone are also vulnerable.
NATURAL RESOURCES AND ENVIRONMENT	Following a dam failure, the impounded reservoir would experience a reduction water levels, displacing aquatic organisms and exposing the benthic community to air. Downstream, habitat impacts would likely include direct mortality of flora and fauna, toppling of trees and removal of soil and inhibition of plant respiration in areas that remain flooded for long periods of time.
ECONOMY	In addition to buildings and infrastructure in the inundation area, any habitat or agricultural operations in the area would also be exposed to this hazard, which could cause extensive economic damage if crops were ruined.
VULNERABLE POPULATIONS	Given the relatively short warning time associated with dam failure, culvert or tide gate failure, any population that is exposed inundation and cannot rapidly evacuate would be considered vulnerable. This population includes households without vehicles, the elderly and young children who may be unable to get themselves out of the inundation area.

3.3.3 DROUGHT

Drought is a period characterized by long durations of below normal precipitation.[39] Drought conditions typically last a season or more and result in water shortages, causing adverse impacts on vegetation, animals, and people. A drought may also increase the probability of a wildfire occurring.

Drought characteristics vary significantly from one region to another, since it is relative to the normal precipitation in that area. Drought is a temporary aberration, and is different from aridity, which is a permanent feature of climate in areas where low precipitation is normal, such as in a desert.

Previous Occurrence and Extent

The entire planning area can be affected by drought, impacting local water resources often requiring voluntary or required water-use restrictions. In Massachusetts, drought is defined by a combined look at several indices, as defined by the Massachusetts Drought Management Plan (the Plan) (EEA and MEMA, 2013). The indices are

1.1 Standardized Precipitation Index for 3-,6-, and 12-month time periods
1.2 Precipitation as a percent of normal (or historic average) for 2-, 3-,6-, and 12-month time periods
1.3 Crop Moisture Index
1.4 Keetch-Byram Drought Index (KBDI)
1.5 Groundwater Levels
1.6 Stream Flow
1.7 Reservoir Levels

[38] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[39] NOAA May 2008, Drought Public Fact Sheet (http://www.nws.noaa.gov/om/brochures/climate/DroughtPublic2.pdf)

These indices are analyzed on a monthly basis to generate a hydrological conditions report and used to determine the onset, severity and end of droughts. Five levels of increasing drought severity are defined in the Plan – Normal, Advisory, Watch, Warning and Emergency. The drought levels are associated with state actions as outlined in the Plan. Recommendations of drought levels are made by the Drought Management Task Force (DMTF) to the Secretary of Energy and Environmental Affairs (EEA) who declares the drought level from each region of the state.

While drought does involve multiple indices, historic multi-year droughts were identified by the USGS by analyzing annual and cumulative departures from long-term average streamflow at gauging stations across Massachusetts. Streamflow deficits were analyzed and recurrence intervals computed for selected droughts. The droughts of 1929-32, 1939-44, 1961-69, and 1980-83 stand out as particularly significant because of their severity and areal extent. The severest drought on record in the Northeastern United States was during 1961 through 1969. Water supplies and agriculture were affected because of the severity and long duration of the drought.[40] More recently drought periods include 10 months of drought in 2002 and 10 months of drought from June 2017 through March 2017[41]. An overview of drought-prone regions in the Commonwealth is provided in **Figures 3.9** and **3.10**[42].

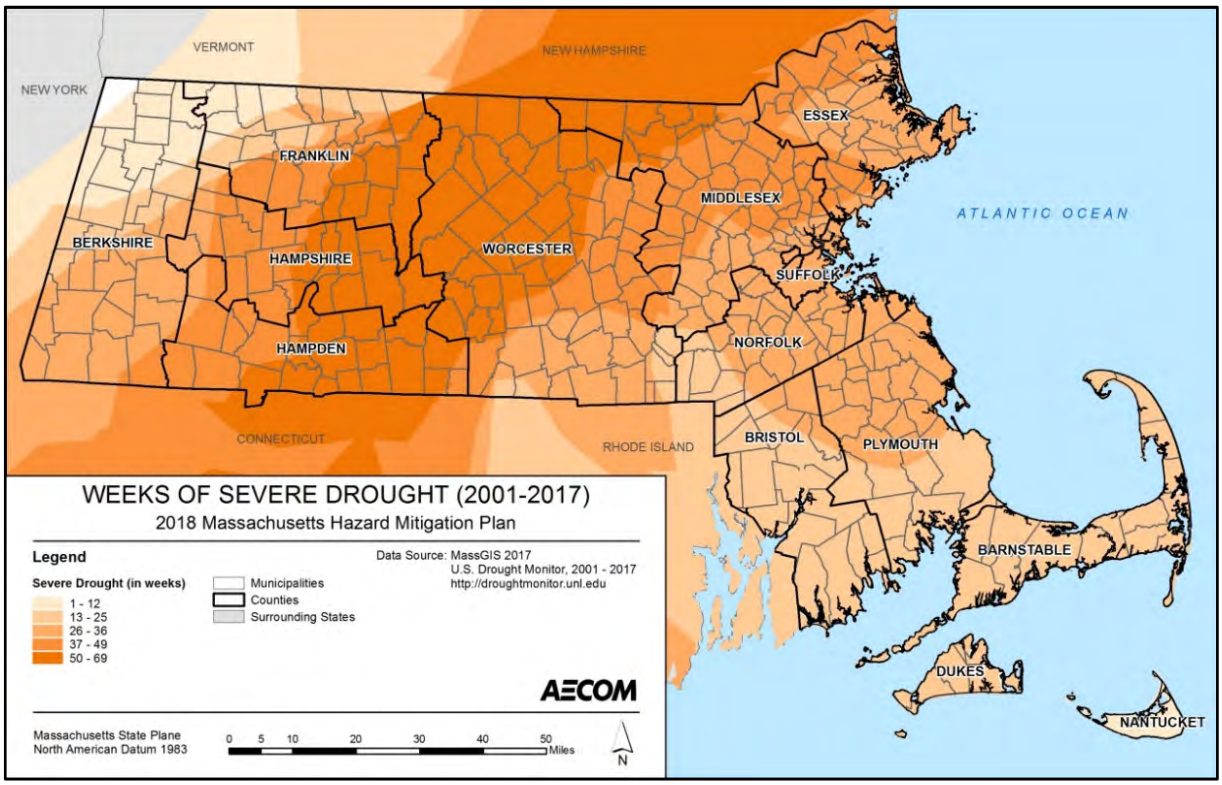


Figure 3.9: Weeks of Severe Drought (2001-2017)

[40] U.S. Geological Survey Water-Supply Paper 2375 National Water Summary 1988-89--Floods and Droughts: Massachusetts Floods and Droughts
[41] http://www.mass.gov/eea/wrc/droughtplan.pdf
[42] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

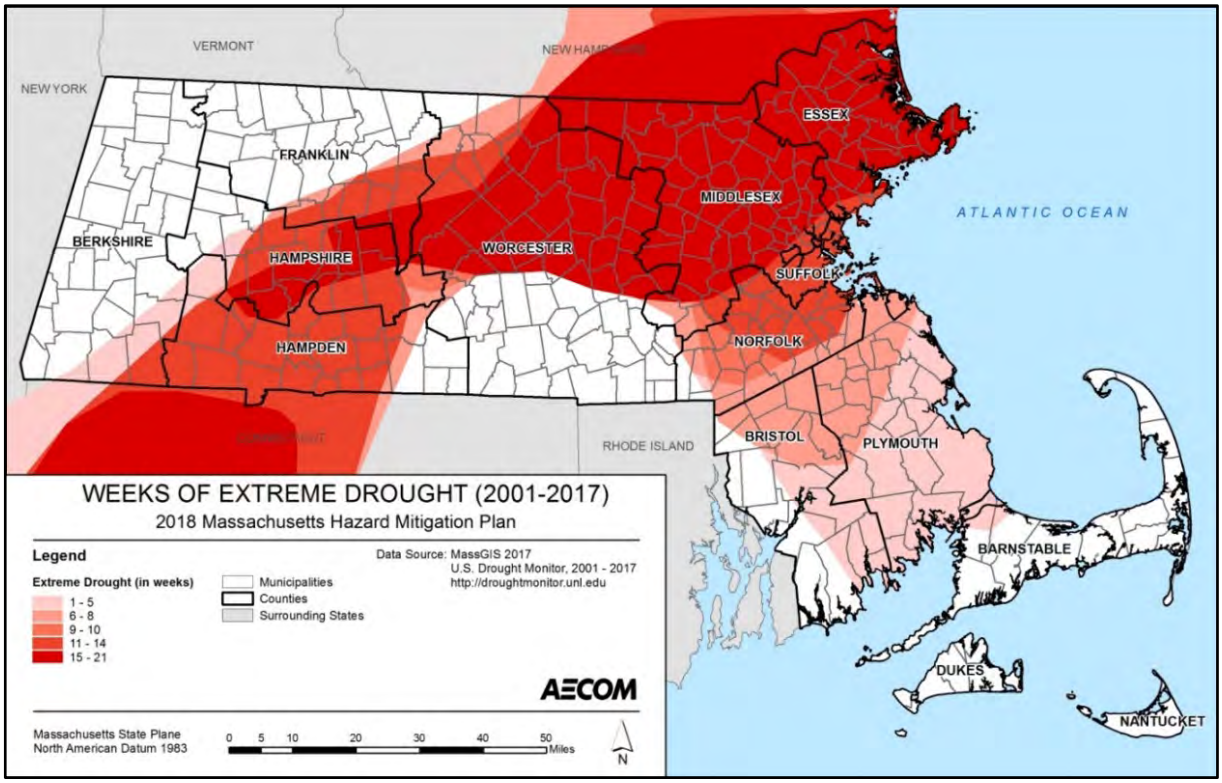


Figure 3.10: Weeks of Extreme Drought (2001-2017)
Source: U.S. Drought Monitor 2017

Droughts will create challenges for local water supply by reducing surface water storage and the recharge of groundwater supplies, including private wells. More frequent droughts could also exacerbate the impacts of flood events by damaging vegetation that could otherwise help mitigate flooding impacts. Droughts may also weaken tree root systems, making them more susceptible to toppling during high wind events.

Locally Identified Areas of Impact

The entire planning area can be affected by drought, impacting local water resources often requiring voluntary or required restrictions on water use. Quincy obtains 100% of its water supply from the Massachusetts Water Resource Authority, Quabbin Reservoir. The Massachusetts Office of the USGS provides local data to monitor streamflow and drought conditions across Massachusetts. The USGS maintains the statistics and streamflow information on their Water Watch website,[43] and the DCR Water Resource Commission issues monthly reports of hydrologic conditions[44] Data obtained from Logan Airport and a USGS stream gauge located on Town Brook[45] provides information on local conditions for Quincy that are interpreted by the USGS and DCR to establish the local water conditions.

[43] http://newengland.water.usgs.gov/drought/index.html
[44] https://www.mass.gov/drought-management
[45]https://waterdata.usgs.gov/ma/nwis/uv?site_no=01105585

Probability of Future Occurrence

The Drought Management Plan conducted an extensive review of precipitation indices since the beginning of data collection in 1850. The probability of each drought level, as identified in the Plan, is shown in **Table 3.13.**

Table 3.13
Frequency of Drought Events

Drought Level	Frequency Since 1850	Probability of Occurrence in a Given Month
Drought Emergency	5 occurrences	2% chance
Drought Warning	5 occurrences	2% chance
Drought Watch	46 occurrences	8% chance

Source: EEA and MEMA 2013

Drought with Climate Change

Although research suggests that the overall amount of precipitation is likely to increase under climate change, the length of time between rain events is also expected to increase. Prolonged dry periods increase the probability of drought conditions occurring.

Table 3.14 indicates how much these durations are likely to increase according to the "high" and "low" limits of the NECSC data. This data suggests that the average time between rain events is likely to remain fairly constant; however, individual drought events could still increase in frequency and severity. The eastern portion of the Commonwealth experiences longer dry periods than the western portion, and this trend is likely to continue in the future.

Table 3.14
Continuous Dry Days by Planning Year

Planning Year	2030	2050	2070	2100*
Projected Range of Consecutive Dry Days	12.5 - 20.6	12.2 - 19.1	11.0 - 19.8	12.3 – 21.7

*Because the study generated 5-year averages for future conditions, "2100" values from this study are derived from the period centered around 2095, the further year available. This practice is generally considered to provide a useful approximation for conditions this far in the future.

Source: NECSC, 2017

The Planning Team determined that based on past history of drought events and climate change data provided by the NECSC, it is **LIKELY** that drought will impact the planning area in the future.

Impacts on Quincy's Key Sectors

DROUGHT EXPOSURE AND VULNERABILTY BY KEY SECTOR[46]	
BUILT ENVIRONMENT	Drought impacts on elements of the built environment are limited, except to the extent that drought conditions increase the risk of wildfires.
NATURAL RESOURCES AND ENVIRONMENT	Prolonged droughts can have severe impacts on ecosystems and natural resources, as most organisms require water throughout their life cycle. Forests managed for timber or other economic uses could experience reduced growth rates or mortality during periods of drought.
ECONOMY	The economic impacts of drought can be significant in the agriculture, recreation, forestry, and energy sectors. Crop failure can also result in an increase in food prices, placing economic stress on a broader portion of the economy.
VULNERABLE POPULATIONS	Citizens with a private water supply, such as a well, are more vulnerable to drought than those who receive water through a public provider. Drought can also increase the concentration of airborne pollutants, presenting a health hazard for those with respiratory health conditions like asthma.

[46] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

3.4 ATMOSPHERIC HAZARDS

EXTREME TEMPERATURES

Extreme temperatures are defined as temperatures that are far outside the normal ranges for the season in a specific area. Extreme cold events are characterized in a temperate zone by the air temperature dropping to approximately 0 ºF or below. Extreme heat is identified as the number of days with a maximum temperature greater than or equal to 90ºF and greater than or equal to 100ºF.

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures can be measured through the Wind Chill Temperature Index (**Figure 3.11**). Wind Chill Temperature is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body loses heat at a faster rate, causing the skin's temperature to drop.

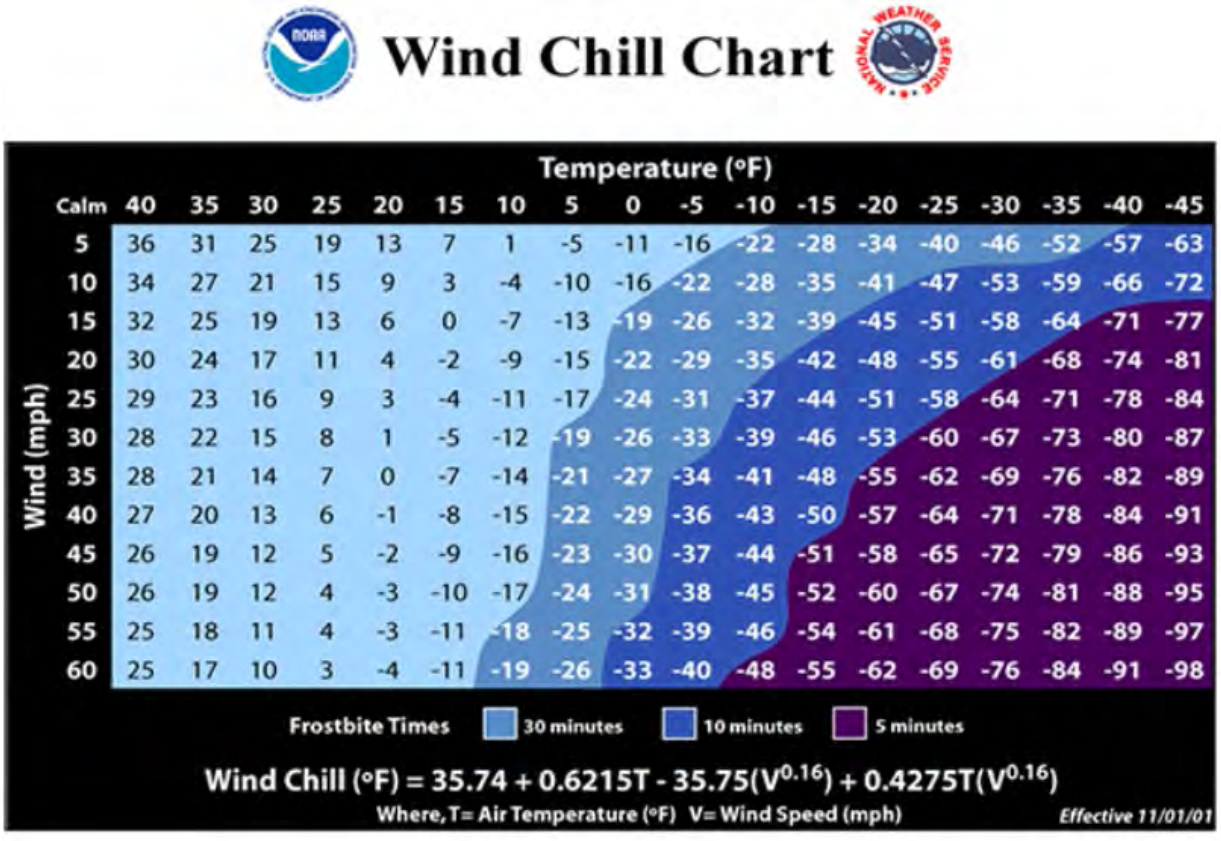


Figure 3.11: NOAA Wind Chill Index

Source: http://www.nws.noaa.gov/om/cold/wind_chill.shtml

When winter temperatures drop significantly below normal, staying warm and safe can become a challenge. Extremely cold temperatures often accompany a winter storm, which may also cause power failures, icy roads and saltwater freezing in coastal bays and harbors.

Cold weather also can present hazards indoors. Many homes will be too cold, either due to a power failure or because the heating system is not adequate for the weather. Exposure to cold temperatures, whether indoors or outside, can cause other serious or life-threatening health problems. The use of space heaters and fireplaces to stay warm, and/or the use of generators and candles in power outages, increases the risks of residential fires and carbon monoxide poisoning.

Extreme Heat

The extent of extreme heat is documented by the National Weather Service (NWS) Heat Index. The NWS issues a Heat Advisory when the Heat Index is forecast to reach 100-104°F for 2 or more hours. The NWS issues an Excessive Heat Warning if the Heat Index is forecast to reach 105+ °F for 2 or more hours. The Heat Index describes a temperature that the body feels, and is based both on temperature and relative humidity (**Figure 3.12**). A heat wave is defined as 3 or more days of temperatures 90°F or above.

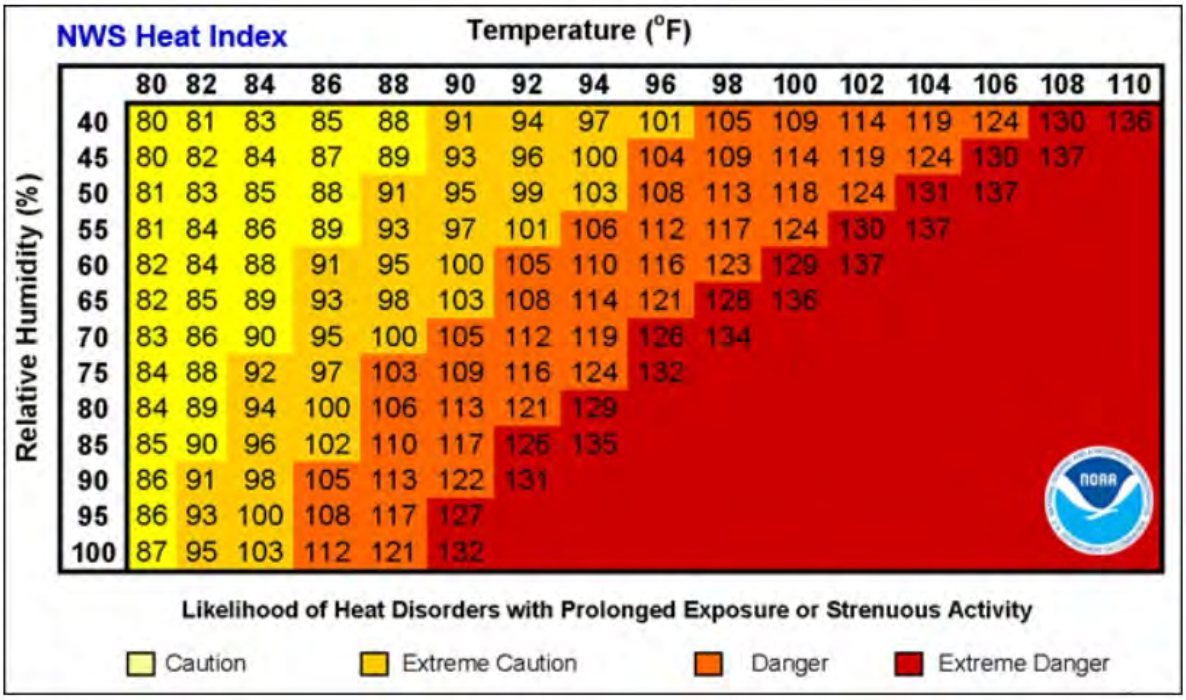


Figure 3.12: NOAA Heat Index

Source: http://www.nws.noaa.gov/om/heat/heat_index.shtml

Extreme heat is currently the leading weather-related cause of death in the United States.[47] Prolonged exposure to high temperatures can cause heat-related illnesses, such as heat cramps, heat syncope, heat exhaustion, heat stroke, and death. Heat exhaustion is the most common heat-related illness and if untreated, it may progress to heat stroke. Additionally, heat is expected to contribute to the exacerbation of chronic health conditions.[48] In particular, hyperthermia—elevated body temperature due to failed thermoregulation

[47] Luber, G., & McGeehin, M. (2008b). Climate change and extreme heat events. American Journal of Preventive Medicine, 35(5), 429–435. http://doi.org/10.1016/j.amepre.2008.08.021

[48] Kravchenko, J., Abernethy, A. P., Fawzy, M., & Lyerly, H. K. (2013). Minimization of heat wave morbidity and mortality. American Journal of Preventive Medicine, 44(3), 274–282. http://doi.org/10.1016/j.amepre.2012.11.015

can be caused by heat stroke — is a contributing factor to cardiovascular, metabolic, and other causes of death.[49]

Those at particularly high risk of adverse health effects from extreme heat exposure are older adults, children, those living alone and/or with chronic illnesses, urban residents, minorities, lower income families, people with less education, and people without access to air conditioning. In addition, people with chronic mental disorders or pre-existing medical conditions (e.g., cardiovascular disease, obesity, diabetes, neurologic or psychiatric disease), and those participating in outdoor manual labor or sports in hot weather also are at increased risk for heat-related illness.[50] Extreme heat adversely impacts utility companies that may struggle meet the extra demand created by operation of air conditioners. Brown outs may result in secondary impacts to vulnerable populations.

Previous Occurrence and Extent

According to NOAA NCDC data, the entire area is vulnerable to extreme temperatures. For the past decade, Massachusetts has been reporting 2 to 4ºF warmer than the 20th Century Average.[51] **Figure 3.13** depicts the trend of maximum high summer temperatures and minimum low winter temperatures from 1895 to 2015.

According to the Northeast Regional Climate Center at Cornell University, 2012 was the warmest year in the US to date, and the third hottest summer. Extreme heat for Norfolk County is most common in July with the record high of 103ºF set in July 2011. Extreme cold temperatures are most common in January-February with the lowest recorded temperatures being -14ºF in February 1943.

[49] O'Neill, M. S., & Ebi, K. L. (2009). Temperature Extremes and Health: Impacts of Climate Variability and Change in the United States. Journal of Occupational and Environmental Medicine, 51(1), 13–25. http://doi.org/10.1097/JOM.0b013e318173et22

[50] Holstein, J., Canouï-Poitrine, F., Neumann, A., Lepage, E., & Spira, A. (2005). Were less disabled patients the most affected by 2003 heat wave in nursing homes in Paris, France? Journal of Public Health (Oxford, England), 27(4), 359–365.

[51] https://www.ncdc.noaa.gov/temp-and-precip/state-temps/

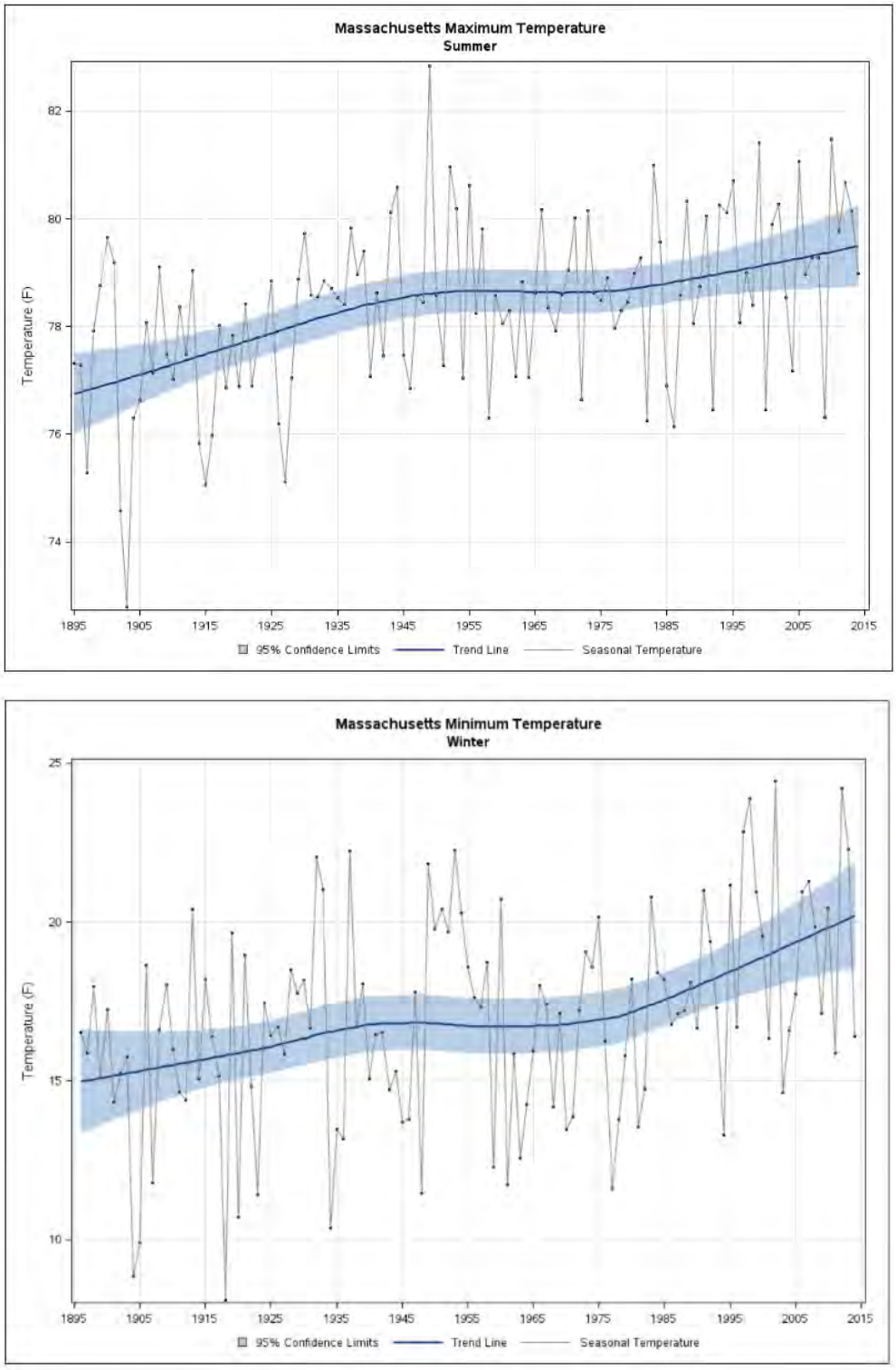


Figure 3.13: Maximum Summer (top) and Minimum Winter (bottom) Monthly Temperatures in Massachusetts (1895-2016)

Table 3.15 shows the recent history of extreme temperatures for Quincy, using data for Logan Airport, downloaded from the NOAA National Centers for Environmental Information.[52] A total of 156 days were reported with temperatures above or equal to 90ºF with no days above or equal to 100ºF. A total of 24 days were reported with temperatures less than or equal to 5ºF with 6 days less than or equal to 0ºF.

Table 3.15
Extreme Temperatures for Quincy 2007-2017

Year	Number of days≥90	Number of days≥100	Number of days ≤5 degrees	Number of days ≤0 degrees
2007	18		2	
2008	8			
2009	6			
2010	25			
2011	13		2	1
2012	12			
2013	18		1	
2014	8		3	
2015	14		10	3
2016	22		3	2
2017	12		3	
TOTAL	156	0	24	6

According to the NOAA'S National Climatic Data Center, the following extreme heat and extreme cold events were reported for Norfolk County between January 1, 1950 and November 1, 2016:

- May 9, 2000 Blue Hill Observatory set record high temperature of 93 ºF
- May 3, 2001 Logan Airport set a record high temperature of 92 ºF and earliest heat wave on record in greater Boston.
- July 22, 2011 Logan Airport recorded 103 ºF with heat index of 105-107 ºF over 3 hours
- February 14, 2016 Logan Airport reported wind chills as low as -36ºF
- February 15-16, 2016. Beverly Airport reported wind chills as low as -28 ºF

Locally Identified Areas of Impact

Extreme heat expected to occur within the City of Quincy, particularly surrounding highly impervious areas. The entire planning area is at risk for impacts due to extreme temperatures.

Probability of Future Occurrence

The IPCC forecasts temperatures continuing to increase worldwide during the 21st century due to the GHG emission trajectory we are on. The latest scenarios from the 2015 United Nations Paris Climate Summit for

[52] https://www.ncdc.noaa.gov/cdo-web/

average temperature changes across all RCP greenhouse gas emissions scenarios show a continuation of increased global temperatures. The average temperature in Massachusetts between 1961 and 1990 has been approximately 46.4 degrees Fahrenheit (°F). By mid-century this is anticipated to increase by approximately four to five degrees (3.6 to 5.4°F). By the latter part of the 21st century (2100) average temperatures are expected to increase by five to nine degrees (5.4 to 9°F).

The Resilient Quincy report used the BRAG consensus report for Quincy specific future temperature projections. The current annual average temperature in the greater Boston Harbor area was calculated as approximately 50°F.[53] The BRAG's draft findings show annual temperatures increasing from this baseline by 3 to 9 degrees Fahrenheit between 2030 and 2100. The total number of extremely hot days is expected to increase by the end of the 21st century, from the present average of 11days over 90°-to over 30 days above 90°.

More recent Massachusetts Statewide Climate Projections (NESCE 2017) shown in **Table 3.16** are consistent with the findings that Quincy is expected to experience increased average temperatures throughout the 21st century. Maximum and minimum temperatures are also expected to increase throughout the end of the century. These increased temperature trends are expected for annual and seasonal projections.

Table 3.16

Seasonal and Annual Temperature Projections for Boston Harbor Basin Region

Boston Harbor Basin		Observed Baseline 1971-2000 (°F)	Projected Change in 2030s (°F)	Mid-Century Projected Change in 2050s (°F)	Projected Change in 2070s (°F)	End of Century Projected Change in 2090s (°F)
Average Temperature	Annual	50.13	+2.07 to +3.99	+2.73 to +6.07	+3.18 to +8.92	+3.46 to +10.84
	Winter	29.84	+2.17 to +4.55	+2.87 to +6.89	+3.50 to +8.88	+3.87 to +10.34
	Spring	47.65	+1.69 to +3.44	+2.34 to +5.41	+2.58 to +8.02	+3.13 to +9.79
	Summer	70.07	+1.79 to +3.95	+2.34 to +6.52	+2.78 to +9.77	+3.39 to +12.11
	Fall	52.58	+2.03 to +4.69	+3.52 to +6.53	+3.30 to +9.31	+3.78 to +11.60
Maximum Temperature	Annual	59.55	+1.90 to +3.85	+2.56 to +6.00	+2.92 to +8.94	+3.19 to +10.74
	Winter	38.38	+1.85 to +4.32	+2.46 to +6.44	+3.02 to +8.26	+3.42 to +9.56
	Spring	57.46	+1.50 to +3.39	+2.03 to +5.42	+2.56 to +8.23	+3.08 to +9.66
	Summer	80.04	+1.69 to +3.99	+2.23 to +6.41	+2.70 to +9.90	+3.22 to +12.21
	Fall	61.93	+2.09 to +4.52	+3.30 to +6.66	+3.21 to +9.40	+3.63 to +11.78
Minimum Temperature	Annual	40.7	+2.17 to +4.24	+2.91 to +6.22	+3.45 to +8.91	+3.75 to +10.95
	Winter	21.31	+2.45 to +5.00	+3.24 to +7.34	+4.04 to +9.47	+4.33 to +10.91
	Spring	37.84	+1.75 to +3.47	+2.64 to +5.71	+2.62 to +7.81	+3.25 to +9.76
	Summer	60.11	+1.89 to +3.94	+2.44 to +6.76	+2.85 to +9.63	+3.56 to +12.02
	Fall	43.22	+1.99 to +4.81	+3.49 to +6.45	+3.39 to +9.29	+3.92 to +11.41

Source: NESCS, 2017

[53] Cash, D. et al. (2011). Massachusetts climate change adaptation report. Executive Office of Energy and Environmental Affairs and the Adaptation Advisory Committee.

Increases in temperature within urban areas such as Quincy are expected to be more dramatic due to less available shade and a higher fraction of dark, absorbing surfaces (impervious surfaces). This phenomenon has been termed "urban heat island effect." The Resilient Quincy Plan analyzed land surface photography layered with extreme temperature to illustrate these impacts. The resulting image correlated with the concentration of impervious surfaces such as black tar rooftops, asphalt, or concrete pavement. The areas of Quincy most likely to experience this urban heat island effect impact are shown in **Figure 3.14** with the darkest red color. These "hot spots" are harder to cool down at night and may compromise infrastructure and building material

Based on historic data and local projections, the Planning Team determined that it is **LIKELY** that extreme temperatures will impact the planning area.

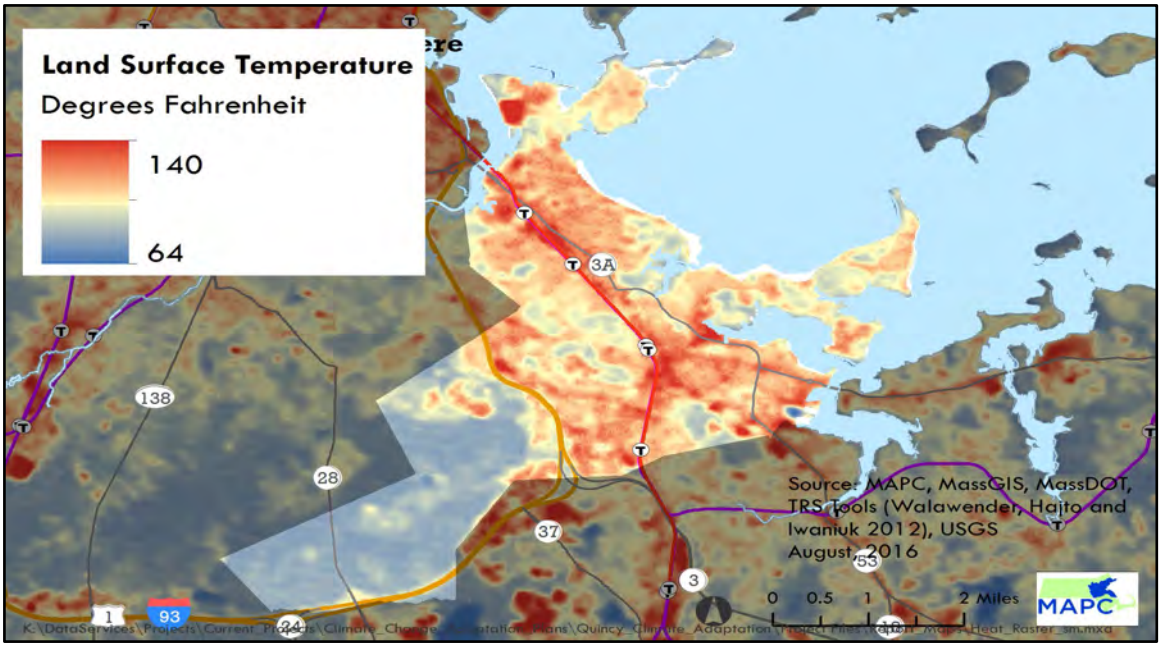


Figure 3.14: Areas experiencing urban heat island effect in Quincy

Impacts on Quincy's Key Sectors

AVERAGE AND EXTREME TEMPERATURE EXPOSURE AND VULNERABILITY BY KEY SECTOR[54]	
BUILT ENVIRONMENT	Extreme heat events can sometimes cause short periods of utility failure due to increased usage from air conditioners and other appliances. Heavy snowfall and ice storms, associated with extreme cold temperature events, can also cause power interruption. Backup power is recommended for critical facilities and infrastructure.
NATURAL RESOURCES AND ENVIRONMENT	Because the species that exist in a given area are designed to survive within a specific temperature range, extreme temperatures events can place significant stress both on individual species and ecosystems. Warming temperatures across the globe force species poleward, or upward in elevation, while species that cannot relocate fast enough face local extinction.
ECONOMY	Extreme temperature events can have significant economic impacts, including loss of business function and damage/loss of inventory. The agricultural industry is the industry most at risk in terms of economic impact and damage due to extreme temperature and drought events.
VULNERABLE POPULATIONS	Populations that are most at risk to extreme cold and heat events include individuals aged over 65, infants and young children, individuals who are physically ill, low-income individuals who cannot afford proper heating and cooling, and those whose jobs involve exposure to extreme temperature events.

3.4.2 SEVERE WEATHER-WIND RELATED HAZARDS

Severe weather wind related hazards include hurricanes, tropical storms, and tornadoes as well as high winds during severe rainstorms and thunderstorms. The typical wind speed in Quincy range from 11-14 miles per hours over the course of the year, with peak gusts over 80 mph.[55] The prevailing wind direction is north-northwest, and the highest wind speeds occur January through March. **Figure 3.15** shows the average monthly wind speed for the contiguous US for March based on wind conditions in the lower troposphere.[56] The coastal areas, including Norfolk County, have the highest average wind speeds in the contiguous US.

High winds can occur as an isolated event or accompany other weather events such as:

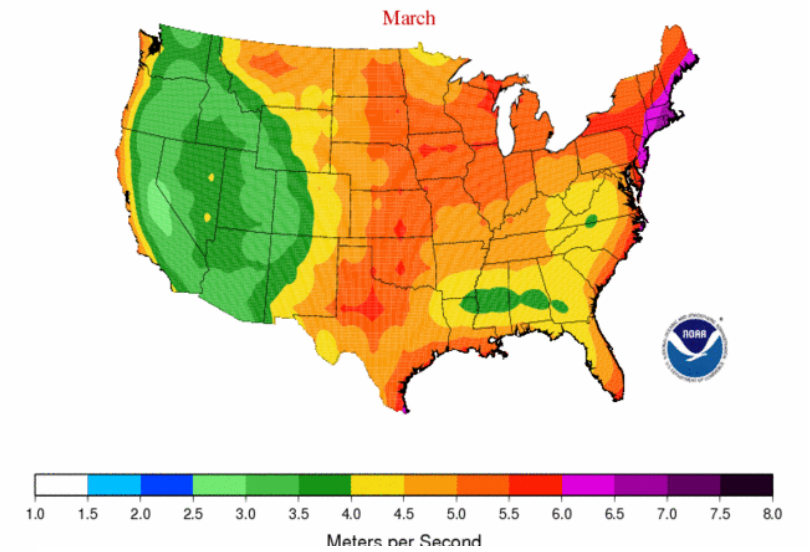


Figure 3.15: March Average Wind Speeds in the Lower Troposphere (1971-2000)

[54] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[55] NOAA Climatic Wind Data for the United States 1930-1996- Data for Boston
[56] https://www.ncdc.noaa.gov/societal-impacts/wind/w-mean/201603

- Before and after frontal systems
- Hurricanes and tropical storms
- Severe thunder and lightning storms
- Tornadoes
- Nor'easters

National wind zone designations were developed by FEMA based on 40 years of tornado history and 100 years of hurricane history. As shown in **Figure 3.16**, Norfolk County lies within Zone II with maximum winds of 160 mph. Quincy is also within the Hurricane-Susceptible Region along with the entire East Coast and Gulf of Mexico.[57]

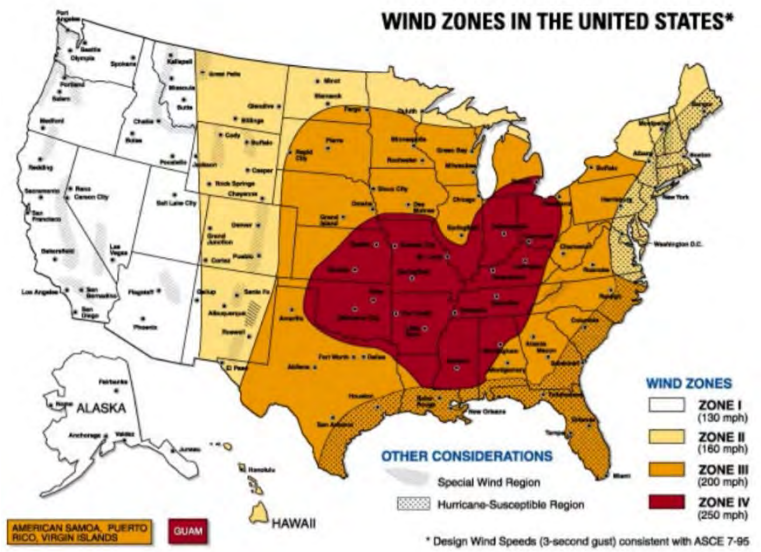


Figure 3.16: Wind Zones in the United States

Table 3.17 includes the high wind warning categories issued by the NWS for both non-tropical and tropical events. Winds measuring under 30 mph are not considered to be hazardous under most conditions.[58]

Table 3.17
NWS High Wind Warning

Type of Warning	Wind Speeds
Non-tropical event over land:	
Wind Advisory	Sustained winds of 31-39 mph for at least 1 hour, or any gust 46 to 57 mph
High Wind Warning	Sustained winds 40+ mph or any gust 58+ mph
Non-tropical event over water:	
Small Craft Advisory	Sustained winds 25-33 knots (29-38 mph)
Gale Warning	Sustained winds 24-47 knots (28-54 mph)
Storm Warning	Sustained winds 48 to 63 knots (55-73 mph)
Hurricane Force Winds	Sustained winds 64+ knots (74+ mph)
Tropical storm events (inland or coastal):	
Tropical Storm Warning	Sustained winds 39 to 73 mph
Hurricane warning	Sustained winds of 74+ mph

57 FEMA Taking Shelter from the Storm: Building a Safe Room Inside Your House. https://www.fema.gov/pdf/library/ism2_s1.pdf
58 2013 State Hazard Mitigation Plan

Effects from high winds can include downed trees and/or power lines, damage to structures, etc. This is especially true after periods of heavy snow, rain or prolonged drought due to the weakening of tree branches and roots. High winds can cause scattered power outages and are a hazard for the boating, shipping, and aviation industry sectors. More specific discussion on severe weather high wind events impacting Quincy follows in **Sections 3.4.3** Hurricanes and Tropical Storms and **3.4.4** Nor'easters.

3.4.3 HURRICANES/ TROPICAL STORMS

A tropical cyclone is a rotating, organized system of clouds and thunderstorms that originate over tropical or subtropical water. The 4 types of tropical cyclones are classified as follows:

- **Tropical Depression:** A tropical cyclone with maximum sustained winds of 38 mph (33 knots) or less.
- **Tropical Storm:** A tropical cyclone with maximum sustained winds of 39 to 73 mph (34 to 63 knots).
- **Hurricane:** A tropical cyclone with maximum sustained winds of 74 mph (64 knots) or higher.
- **Major Hurricane:** A tropical cyclone with maximum sustained winds of 111 mph (96 knots) or higher, corresponding to a Category 3, 4 or 5 on the Saffir-Simpson Hurricane Wind Scale.

Hurricanes are characterized by high winds and extratropical moisture resulting in torrential rainfall, especially if the storm is slow moving. The rotational nature of hurricanes often results in winds changing direction as the storm passes, altering wave generation and surge setup. A hurricane is strongest as it travels over the ocean and is particularly destructive to coastal property as storms hit the land. In the Atlantic Basin, the hurricane season runs from June 1 to November 30 with peak activity occurring in early to mid-September.[59]

Hurricanes are classified by the Saffir-Simson Scale, which categorizes intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential. **Table 3.18** shows the wind speeds, surges, and range of damage caused by different hurricane categories:

Table 3.18
Saffir/Simson Scale to Measure Hurricane Intensity

Scale No. (Category)	Winds (mph)	Surge (ft.)	Potential Damage
1	74-95	4-5	Minimal
2	96-110	6-8	Moderate
3	111-130	9-12	Extensive
4	131-155	13-18	Extreme
5	>155	>18	Catastrophic

[59] National Hurricane Center Educational Resources http://www.nhc.noaa.gov/climo/

Previous Occurrence and Extent

The National Hurricane Center has created maps showing the tracks of all known North Atlantic hurricanes and major hurricanes including what counties were stuck. **Figure 3.17** shows that 5 hurricanes have struck in Norfolk County between 1900 and 2010. The return period for a hurricane (greater than 64 knots) passing within 50 nautical miles of Norfolk County is 30 years.[60] Put another way, a 30-year return period means that on average during the previous 100 years, a Category 3 or greater hurricane passed within 50 nautical miles (58 miles) about 3 times.

Within the last 25 years, hurricanes and tropical storms that have impacted Massachusetts include Hurricane Irene (Category 2, 2011), Earl (Category 4, 2010), and Bob (Category 2, 1991); and Tropical Storms Sandy (2012), Bill (2009), Hanna (2008), and Beryl (2006).[61] Hurricane Gloria, a Category 3 hurricane, was the most severe to have impacted Quincy, with sustained winds of 115 mph and up to 12 feet of storm surge.

While historic records include 28 tropical storms and hurricanes for New England, only 4 events have resulted in FEMA hurricane-related disasters for Norfolk County as listed in **Table 3.19**.



Figure 3.17: Hurricane strikes by county (1900-2010)

Table 3.19
FEMA Hurricane-Related Declared Disasters Impacting Norfolk County

FEMA Disaster #	Name	Date	Category
DR-751	Hurricane Gloria	9/27/1985	Cat 3
DR-914	Hurricane Bob	8/19/1991	Cat 2
EM-3315	Hurricanes Earl	9/1/-9/4/2010	Cat 4

[60] National Hurricane Center http://www.nhc.noaa.gov/climo/
[61] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

FEMA Disaster #	Name	Date	Category
EM-3350	Hurricane Sandy	10/27- 11/8/12	

Source: FEMA

Locally Identified Areas of Impact

Based on past history, the Planning Team determined the entire planning area is at risk for impacts due to hurricanes and tropical storms.

Probability of Future Occurrence

According to the 2018 State Hazard Mitigation Plan and NOAA Hurricane Research Division, the Commonwealth has a 6 to 30 percent chance of a tropical storm or hurricane affecting the area each year. The probability increases moving from the northwest corner of the state to the southeast, with the highest probability along the coast, specifically Cape Cod and the Islands. New England averages about one hurricane per decade, but there is some evidence that more and stronger hurricanes occur when Atlantic Sea-Surface-Temperatures are warm. While the science of global warming and hurricanes is evolving, present research calls for slightly stronger and wetter storms, but changes in frequency are unknown. Based on the past regional and local history of tropical cyclones, the Planning Team determined that it is **LIKELY** that a hurricane or tropical storm will impact the area in the future**.**

Impacts on Quincy's Key Sectors

HURRICANE EXPOSURE AND VULNERABILITY BY KEY SECTOR[62]	
BUILT ENVIRONMENT	Hurricane flooding can also wash out sections of roadways and bridges, as well as cause extensive damage to public utilities and disruptions to the delivery of services. Hurricane wind can down trees and powerlines and damage buildings.
NATURAL RESOURCES AND ENVIRONMENT	As the storm is occurring, flooding, or wind – or water-borne detritus can cause mortality to animals if it strikes them or transports them to a non-suitable habitat. In the longer term, environmental impacts can occur as a result of riverbed scour, fallen trees, or contamination of ecosystems by transported pollutants.
ECONOMY	Hurricanes and severe winter storms, can greatly impact the economy, including loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss, road repair, and rental loss due to the repair/replacement of buildings.
VULNERABLE POPULATIONS	Of the population exposed, the most vulnerable include the economically disadvantaged and population over the age of 65. Economically disadvantaged populations are more likely to evaluate the economic impact of evacuating, and individuals over 65 are more likely to face physical challenges in evacuating or to require medical care while evacuated.

3.4.4 NOR'EASTERS

Nor'easters are a ferocious type of northeastern coastal storm that typically occur in the winter months. The storm's name refers to the continuous strong northeasterly winds blowing in a large counter-clockwise

[62] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

circulation pattern around a low-pressure center, resulting in heavy snow and rain, gale force winds, rough seas, and coastal flooding that often cause shoreline erosion. The radius of these storms can extend up to 1,000 miles.[63] Impacts along the coast are typically worse than inland locations due to the additional moisture picked up from the ocean. Nor'easters may be especially damaging because they can sit stationary for several days, affecting multiple tidal cycles and producing extended periods of heavy precipitation, resulting in increased flooding, shoreline erosion, and damage to coastal infrastructure.

There is no widely used scale to classify Nor'easters, but a combination of scales including the Beaufort Scale for wind speed, Regional Snowfall Index for snowfall, and precipitation associated with a historic recurrence interval (i.e. 100-year rainfall) can be combined to evaluate the magnitude of the storm. For Quincy, precipitation amounts of 8.7 inches are associated with a 100-year storm event (1% chance of occurring in any one year). Winter and spring flooding from Nor'easters may be exacerbated due to snow melt and frozen ground conditions. The severity of a nor'easter also depends on the time of occurrence relative to the lunar tide cycles (spring or neap tides) and during what tide stage the maximum storm surge occurs at (high tide or low tide). Depending on the metric used to measure the storm, assigned severity may also take into account the storm's societal and economic impacts.

The level of damage in a hurricane is often more severe than a Nor'easter, but historically Massachusetts has suffered more damage from Nor'easters because of the greater frequency of these coastal storms (1 to 2 per year). As another comparison, the duration of high surge and winds in a hurricane is 6 to 12 hours while a Nor'easter can last from 12 hours to 3 days.

Nor'easters are not typically named the way that hurricanes are by the National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service (NWS), though locally coined names have been used. For example, Winter Storm Juno and Winter Storm Nemo were named by the Weather Channel in 2014 and 2015.[64] The unofficial storm naming is controversial with meteorologists because winter storms can reform more than once, making naming hard and redundant. Naming a storm may bring more attention to the event and help people with advance emergency preparations.

Previous Occurrence and Extent

Norfolk County has received the second highest number of FEMA disaster declarations due to Nor'easters in Massachusetts second only to Essex county. Since 1954, there have been 8 Nor'easters of significant magnitude to trigger federal disaster funds (**Table 3.20**). In the winter of 2018 three nor'easters dubbed Grayson (January 4), Riley (March 2-3) and Skylar (March 13-14) slammed the coast of Quincy. These storms produced two of the three highest water levels ever measured in Boston Harbor, and both of them produced widespread damage in Quincy, with many water rescues carried out along the Hough's Neck and Adams Shore neighborhoods.

Grayson: 4.88' above MHHW (mean higher high water) at Boston gage, **highest on record**; previous record 4.82' on 2/7/1978 during the infamous Blizzard of '78

Riley: 4.4' above MHHW, **third highest on record**, behind only the Blizzard of '78 and ahead of the 3.92' observed on 1/2/1987.

[63] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[64] https://en.wikipedia.org/wiki/Winter_storm_naming_in_the_United_States



Photo 3.1: Flooding on East Squantum Street from Winter Storm Riley. (*Image credit: Stan Grossfeld/ The Boston Globe via Getty Images*)

Table 3.20
FEMA Nor'easter Related Disaster Declarations (1954-2018)

Disaster #	Dates	Unofficial Storm Name	Impact
DR-4214	January 26-29,2015	"Winter Storm Juno"	Severe winter storm, snowstorm, flooding
DR-4110	February 8-10, 2013	"Winter Storm Nemo"	Severe winter storm, snowstorm and flooding
EM-3343	October 29-30, 2011	"Snowtober"	Severe Storm
DR-1959	January 11-12, 2011	Nor'easter	Severe winter storm and snowstorm
DR-1614	October 7-16, 2005	Nor'easter	Severe storms and flooding
DR-975	December 11-13-, 1992	Nor'easter	Winter coastal storm
DR-920	December 30-November 2, 1991	"Perfect Storm"	Severe coastal storms
DR-546	February 6-8, 1978	"Blizzard of '78"	Coastal storms, flood, ice, snow
DR-4372	March 2-3, 2018	Winter Storm Riley	Severe winter storm and flooding
DR-4379	March 13-14, 2018	Winter Storm Skylar	Severe winter storm, snowstorm and flooding

Locally Identified Areas of Impact

The entire planning area is at risk for impacts due to Nor'easters. Quincy's overall vulnerability for Nor'easters is similar to severe winter weather and flooding.

Probability of Future Occurrence

Nor'easters may occur at any time of the year, however, they are most common from September to April. Based on the historical record of the top winter storm events from 1953 to 2011, Nor'easters have an average frequency of 1 or 2 per year. However, as recently as 2010, Norfolk County experienced 4 Nor'easters in 1 year. Nor'easters are likely to become more intense in the future due to potential effects of climate change including increased snowfall, sea level rise, storm surge and a concentration of storm events in the coldest winter months. Nor'easters along the coast coinciding with astronomical high tides will result in increased flooding and more significant structural damages as sea level continue to rise.

Increased sea surface temperature in the Atlantic Ocean will cause air moving north over this ocean to hold more moisture. As a result, when these fronts meet cold air systems moving from the north, an even greater amount of rain and snow than normal can be anticipated to fall on Massachusetts. Although no one storm can be linked directly to climate change, the severity of rain and snow events has increased dramatically in recent years.

Sea level rise is also likely to exacerbate the impacts of nor'easters, because as coastal erosion increases beachfront homes will have less of a buffer against storm surge.

Based on the historic record of Nor'easters impacting Quincy and the future predictions for increased severity and intensity of Nor'easters, the Planning Team determined that is **HIGHLY LIKELY** that a Nor'easter will impact the planning area in the future. The City must also consider the cumulative impact of back to back storms on the City's ability to deal with storm related impacts.

Impacts on Quincy's Key Sectors

NOR'EASTER EXPOSURE AND VULNERABILITY BY KEY SECTOR[65]	
BUILT ENVIRONMENT	Flooding can also wash out sections of roadways and bridges, as well as cause extensive damage to public utilities and disruptions to the delivery of services. Wind can take down power lines, disrupting power service and damage buildings.
NATURAL RESOURCES AND ENVIRONMENT	The environmental impacts of nor'easters are similar to those of hurricanes and severe winter storms. They often involve flood and wind damage, can cause direct mortality to individuals, and transform habitats.
ECONOMY	Nor'easter events, similar to hurricanes and severe winter storms, can greatly impact the economy, including loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss, road repair, and rental loss due to the repair/replacement of buildings.
VULNERABLE POPULATIONS	Of the population exposed, the most vulnerable include the economically disadvantaged and population over the age of 65. Economically disadvantaged populations are more likely to evaluate the economic impact of evacuating, and individuals over 65 are more likely to face physical challenges in evacuating or to require medical care while evacuated.

[65] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

3.4.5 SEVERE WINTER STORMS: SNOW AND BLIZZARD

Severe Winter Weather includes snow storms, blizzards, and ice storms. A winter storm occurs when there is significant precipitation during periods of low temperatures. Winter storms are a combination of hazards because they often involve wind, ice, and heavy snow fall. Winter storms can occur from early autumn to late spring and include any of the following events:[66]

- Blizzards
- Blowing Snow
- Snow Squalls
- Snow Showers
- Snow Flurries
- Ice pellets and sleet
- Icing
- Coastal flooding
- Ice jams and flow
- Snow melt

Impacts from winter weather – in addition to non-passable streets and sidewalks – include downed power lines causing loss of electric power service, catch basins being buried and sometimes clogged, water service pipes bursting, and shut-off valves being buried (more common when cold and windy), fire hydrants being buried by snow, older water mains bursting, and dangerous icicles/ice dams forming on buildings. Snow can also block building ventilation, increasing the risk of indoor carbon monoxide poisoning and place a heavy load on roofs potentially causing roof damage or collapse.

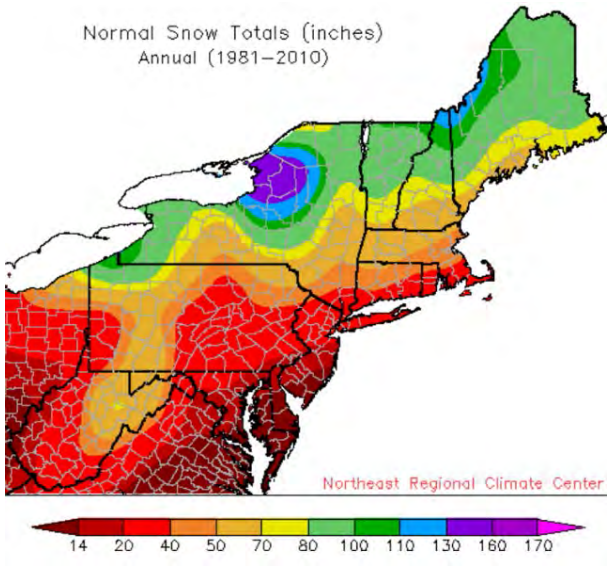


Figure 3.18: Annual Snow Totals

Previous Occurrence and Extent

Snow and other forms of winter precipitation occur frequently in Quincy, with a normal 30-year average between 40-50 inches per year as shown in **Figure 3.18**.[67]

The most significant winter storm in recent history was the "Blizzard of 1978," which resulted in over three feet of snowfall and high winds that caused multiple day closures of roadways, businesses, and schools. More recently, the Blizzard of 2015, also known as Winter Storm Juno, deposited 22.1 inches of snow at Logan Airport. According to a National Weather Service summary, the blizzard lasted for almost three days, with wind gusts of 50 to 65 mph. Coastal flooding south of Boston created severe erosion comparable to the Blizzard of 1978.[68] Additional snowfall in February 2015 resulted in breaking the annual snowfall record for Quincy.

Federally-declared disasters from winter storm events in Norfolk County are provided in **Table 3.21**.

[66] http://www.nws.noaa.gov/om/winter/index.shtml
[67] http://www.nrcc.cornell.edu/regional/climatenorms/climatenorms.html
[68] http://www.mass.gov/governor/docs/news/emergency-declaration-request-enclosures.pdf

Table 3.21
FEMA Winter Storm related disaster declarations (1978-2018)

Number	Disaster Type	Incident Period
DR-546	Coastal storms, flood, ice, snow	February 6-8, 1978
DR-975	Winter coastal storm	December 11-13, 1992
EM-3103	Blizzard, high winds and record snowfall	March 16, 1993
DR-1090	Blizzard	January 7-13, 1996
EM-3175	Severe Snowstorm	February 17-18, 2003
EM-3191	Severe Snowstorm	December 6-5, 2003
EM-3201	Severe Snowstorm	January 22-23, 2005
DR-4110	Severe winter storm, snowstorm and flooding	February 8-10, 2013
DR-4214	Severe winter storm, snowstorm and flooding	January 26-29, 2015
DR-4372	Severe winter storm, snowstorm and flooding	March 2-3, 2018
DR-4379	Severe winter storm, snowstorm and flooding	March 13-14, 2018

According to NESIS data, 59 winter storms rated as "notable" or higher have occurred since 1953. Therefore, although there is significant interannual variability in the frequency and severity of winter storms, this hazard should be expected to occur every winter. [69]

Locally Identified Areas of Impact

The entire planning area is at risk for severe winter weather. During these events, the areas along the shoreline may experience higher snow accumulations and higher winds than other areas of Quincy due to the additional ocean moisture.

Quincy's overall vulnerability to winter weather is primarily related to restrictions to travel on roadways and mass transit, inaccessible or icy sidewalks, temporary road closures, school closures, and potential restrictions on emergency vehicle access. Other vulnerabilities include power outages due to fallen trees and utility lines, and damage to structures due to heavy snow loads.

Probability of Future Occurrence

Based on the record of previous occurrences, winter storm events in Quincy are high frequency events as defined by the 2018 Draft Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in five years (greater than 20% per year). Climate change impacts are predicted to increase the severity of winter storms because changing circulation patterns and warming ocean water allowing additional moisture to fuel the storm to greater intensity. Based on the past record, the Planning Team concludes that it is **HIGHLY LIKELY** that severe winter weather will impact Quincy in the future.

[69] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Impacts on Quincy's Key Sectors

SEVERE WINTER STORM EXPOSURE AND VULNERABILITY BY KEY SECTOR[70]	
BUILT ENVIRONMENT	All elements of the built environment in Quincy are exposed to the severe winter weather hazard.
NATURAL RESOURCES AND ENVIRONMENT	Winter storms are a natural part of the Massachusetts climate, and native ecosystems and species are well-adapted to these events. However, more extreme winter storms can result in direct mortality, habitat modification, and flooding when snow and ice melt, especially in areas with high road salt applications.
ECONOMY	Potential impacts from winter storms include loss of utilities, interruption of transportation corridors, loss of business function and loss of income during business closures. The cost of snow and ice removal and repair of roads from the freeze/thaw process can also strain local financial resources.
VULNERABLE POPULATIONS	Populations over 65 are considered most susceptible due to their increased risk of injury and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice, or related to power failures. Residents with low incomes may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply).

3.4.6 TORNADOES, HIGH WINDS AND THUNDERSTORMS

Tornadoes

A tornado is a violently rotating column of air extending from a cumuliform cloud, such as a thunderstorm, to the ground. Tornadoes are not always visible as funnel clouds because they may appear nearly transparent until they pick up dust and debris. The average tornado moves from southwest to northeast, but they can move in any direction and can suddenly change direction. The average speed of a tornado is 30 mph, but they can be stationary or move as fast as 70 mph. The strongest tornadoes have rotating winds of more than 200 mph.[71] **Table 3.22** shows the Enhanced Fujita Tornado Damage Scale developed by T. Theodore Fujita.[72]

Table 3.22
Enhanced Fujita Scale Levels and Description of Damage

EF-Scale Number	Intensity Phrase	3-Second Gust (MPH)	Type of Damage Done
EF0	Gale	65-85	Some damage to chimneys; breaks branches off trees; shallow rooted trees pushed over; sign boards damaged
EF1	Moderate	86-110	Peels surfaces off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
EF2	Significant	111-135	Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Severe	136-165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.

[70] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[71] Thunderstorms, Tornadoes, Lightning: Nature's Past Violent Storms, A Preparedness Guide, US Department of Commerce, NOAA, and the National Weather Service
[72] http://www.spc.noaa.gov/efscale/

EF-Scale Number	Intensity Phrase	3-Second Gust (MPH)	Type of Damage Done
EF4	Devastating	166-200	Well-constructed houses leveled; structures with weak foundations blown off some distances; cars thrown and large missiles generated.

Thunderstorms

A thunderstorm is a storm with lightning and thunder produced by a cumulonimbus cloud, usually producing gusty winds, heavy rain, and sometimes hail. The NWS classifies a thunderstorm as 'severe' when it produces damaging wind gusts in excess of 58 mph (50 knots), hail that is 1 inch in diameter or larger (quarter size), or a tornado (NWS, 2013).

Three basic ingredients are required for a thunderstorm to form:[16]

- moisture to form clouds and rain
- rising unstable air warm air that can rise rapidly
- lift- caused by cold or warm fronts, sea breezes, mountains, or the sun's heat

While less severe than other types of storms, a thunderstorm can lead to localized damage and represents a hazard risk for all communities in Massachusetts. An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe thunderstorms (**Figure 3.19**).

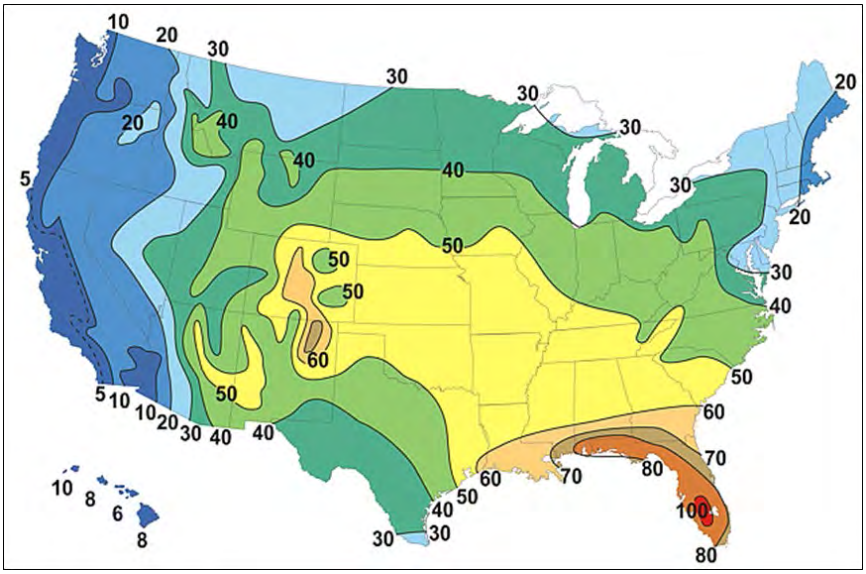


Figure 3.19: Annual Average Number of Thunderstorm Days in the U.S
Source: NOAA NWS

Thunderstorms have masses of air, an updraft (rising air), and a downdraft (sinking air). A strong downdraft, also known as a downburst, can cause tremendous wind damage similar to a tornado. Damage from hail and lightning are secondary impacts to thunderstorms. Hail can cause damage to vehicles and crops especially when the hail stones are large in diameter.

Previous Occurrence and Extent

According to the NOAA National Climatic Data Center (NCDC), Norfolk County experienced the following events between January 1, 1950 and December 1, 2017:

- 10 days with reported Tornado (EF0-F3 magnitude, 1 death and 21injuries, $4.100M property damage)
- 40 days with reported Lightning (12 injuries, $6.622M property damage)
- 46 days with reported Hail (0-2-inch diameter, no property damage)
- 144 days of reported High/Strong Wind (up to 72 knots, 2 injuries, $7.313 M property damage)
- 88 days of reported Thunderstorm Wind (up to 60 knots, $.064M property damage

Locally Identified Areas of Impact

Based on local experience and NOAA weather records, the entire planning area has experienced severe weather events due to wind, including lightning, hail, strong winds, thunderstorms and tornadoes. There are no reports of tornadoes in Quincy, but of the 10 reported events in Norfolk County, 3 were reported in Norwood (1956, 1973 and 1989) and 1 reported in Newton resulted in a fatality (1972).

Probability of Future Occurrence

Based on the past regional and local history of severe weather wind events, the Planning Team determined that it is **HIGHLY LIKELY** that a weather event due to wind, including lightning, hail, strong winds, and thunderstorms will impact the area in the future**.** The planning team thinks that it is **LIKELY** that a weather event due to tornadoes will impact the area in the future

Impacts on Quincy's Key Sectors

TORNADO EXPOSURE AND VULNERABILITY BY KEY SECTOR[73]	
NATURAL RESOURCES AND ENVIRONMENT	Direct impacts may occur to flora and fauna small enough to be transported by the tornado. Even if the winds are not sufficient to transport trees and other large plants, they may still uproot them. Material transported by tornados can also cause environmental havoc in surrounding areas, particularly of contaminating materials are introduced into the atmosphere or local water supplies.
ECONOMY	Tornado events are typically localized; however, in those areas, economic impacts can be significant. Types of impacts may include loss of business function, water supply system damage, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Recovery and clean-up can also be costly.
VULNERABLE POPULATIONS	Vulnerable populations include all those who may have difficulty evacuating, including car-free households, individuals over 65, and households with young children. Individuals with limited internet or phone access may not be aware of impending tornado warnings. The potential insufficiency of older or less stable housing to offer adequate shelter from tornados is also a concern.

[73] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

3.5 GEOLOGIC HAZARDS

3.5.1 COASTAL EROSION

Coastal shorelines, especially beaches, dunes, and banks, change constantly in response to wind, waves, tides, and other factors including seasonal variation, sea level rise, and human alterations to the shoreline system.[74] Every day, wind, waves and currents move sand, pebbles, and other materials along the shore or out to sea. This dynamic and continuous process of erosion, transport, and accretion shape the coastal shoreline, creating and feeding beaches and dunes. The natural tendency is for shorelines to try and align to prevailing wave trains and straighten out, eroding points and depositing sediment into coves. Shorelines also change seasonally, tending to accrete onto beaches gradually during the summer months under relatively low energy waves and erode beaches and form offshore bars during the winter when sediments are moved offshore by high energy storm waves, such as those generated by Nor'easters. Coastal erosion is a natural process, but it also causes damage to coastal property, infrastructure, and may have an adverse impact on beaches and coastal habitat.

Shoreline changes can be monitored over short-term and long-term time scales. Monitoring shoreline change on a relatively short period of record does not always reflect longer term change and season change can misrepresent long-term erosion rates.

[74] Report of the Massachusetts Coastal Erosion Control Commission, 12/2015 http://www.mass.gov/eea/waste-mgnt-recycling/coasts-and-oceans/erosion-commission-report.html

Previous Occurrence and Extent

The Massachusetts Office of Coastal Zone Management's (CZM's) Shoreline Change Project was used to illustrate how the shoreline of Massachusetts, in the area of Quincy, has shifted between the mid-1800's and 2009 (**Figure 3.20**). Using data from historical and modern sources, up to 8 shorelines depicting the local high-water line (i.e., the landward limit of wave runup at the time of local high tide) were generated with transects at 50-meter (approximately 164-feet) intervals along the ocean-facing shore. The results of the

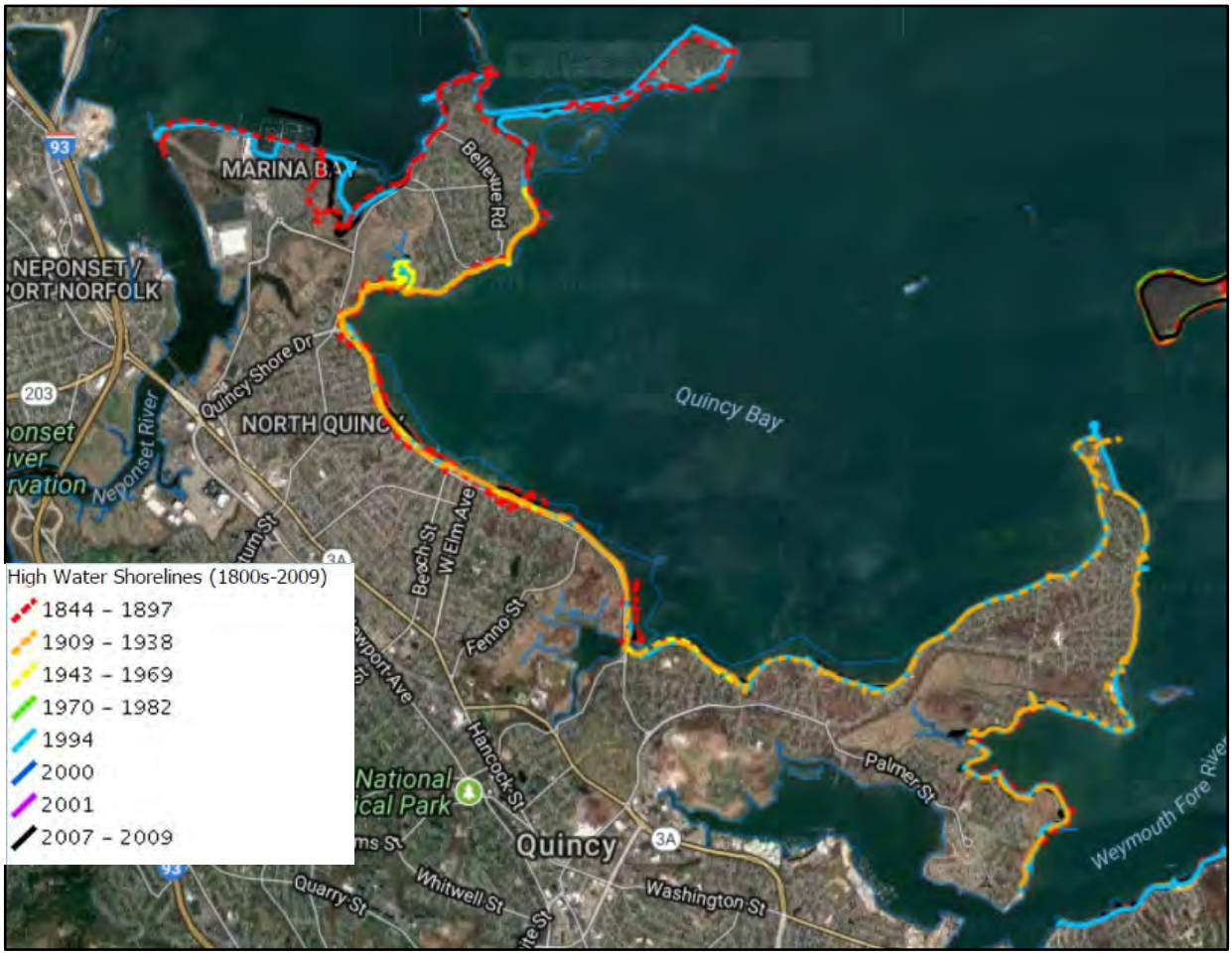


Figure 3.20: Shoreline Change Quincy, MA

Shoreline Project can be viewed online at the Massachusetts Office of Geographic Information (MassGIS) website "Massachusetts Shoreline Change Browser."[75]

The average shoreline change rates for Quincy are as follows, where positive values indicate accretion and negative values indicate erosion:[6]

- Short -Term Rate (approximately 30 years): -0.2 ± 3.4 ft./year
- Long-Term Rate (approximately 150 years): 0.0 ± 1.0 ft./year

[75] http://maps.massgis.state.ma.us/map_ol/czm_shorelines.php

These rates, using the high tide line, which here is mostly armored, are not representative of tidal zone beach erosion and the observed migration of sediments and loss of many beaches with localized "cove" deposition. Archive drawings and aerial photographs for Quincy document failed beach nourishments and migration/erosion of beaches into former mud flat and salt marsh coves. Additional information provided by the Massachusetts Coastal Erosion Commission shown in **Figure 3.21** shows the coastal landforms, habitats, developed lands, and hardened coastal structures identified along the immediate, exposed shoreline in Quincy.

Classes were identified for every 50 meters of shoreline and summarized by percentage of total assessed shoreline for the community. Residential structures were located along approximately 60% of the shoreline. Bulkhead/seawall and revetment were located on approximately 62% of the upper bank of the shoreline, many built by the State and maintained by the City. Beaches dominated the coastal intertidal landforms, found along 70% of the shoreline, with salt marsh along 35% of the shore and dunes making up less than 10%.[6]Information on the location and condition of specific municipal coastal structures was provided by the Massachusetts Coastal Infrastructure Inventory and Assessment Project by the Massachusetts Department of

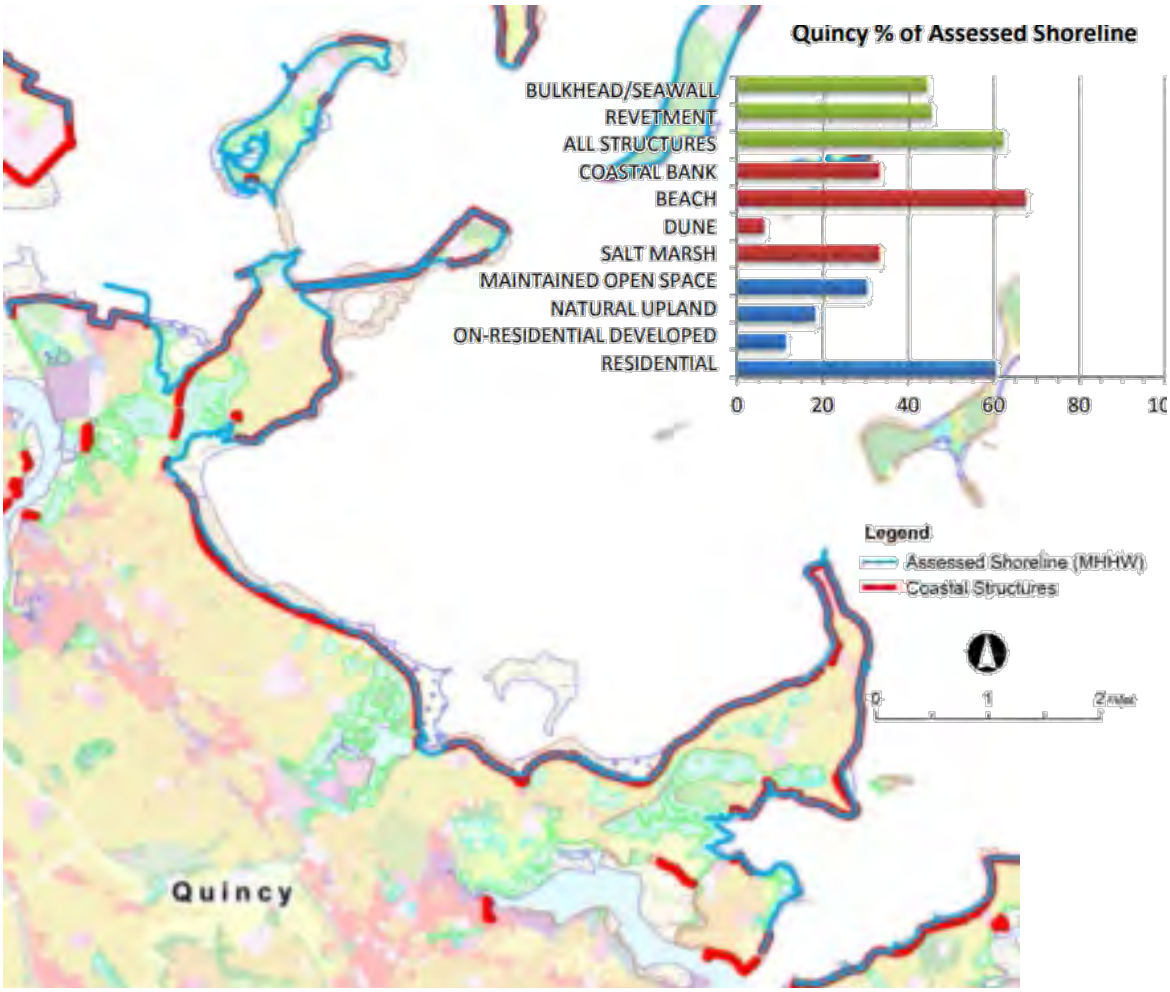


Figure 3.21: Quincy Shoreline Characterization

Conservation and Recreation Office of Waterways.[76] Based on the 2009 report, there were a total of 39 structures including bulkhead, seawall and revetment for a total length of 40,820 feet. **Table 3.23** describes the seawall inventory rating system. The report summary of condition includes 6 structures at A Rating or "Excellent conditions", 18 structures were rated at B Rating or "Good conditions," 12 at C Rating or "fair" conditions, 2 at D Rating or "poor condition" and 1 at F Rating "critical condition." The report estimates a total of $46 million to bring all the coastal structures to "A" Rating.

Table 3.23
Seawall Inventory Ratings

Condition Rating		Level of Action Required
A	Excellent	None
B	Good	Minor
C	Fair	Moderate
D	Poor	Major
F	Critical	Immediate

Priority Rating		Level of Action Required
I	None	Long Term Planning Considerations
II	Low	Future Project Consideration
III	Moderate	Consider for Active Project Improvement Listing
IV	High	Consider for Next Project Construction Listing
V	Immediate/Highest	Consider For Immediate Action Due to Public Safety and Welfare Issues

Infrastructure Rating	Level of Action Required
U	Near Critical Utilities
R	Near Critical Roads
B	Near Critical Buildings

City-wide Assessment

In 2012, Quincy completed an independent City-wide assessment of seawall structures, including 53 individual sections of wall. For consistency, the same seawall rating system was utilized. The structural assessment identified deficiencies in 43 individual wall sections including loss of backfill, wall subsidence due to structurally deficient wall sections, cracking, and loss of revetment. Additionally, the heights of the seawalls were found to be below the updated base flood elevations released by FEMA in 2015. Additional undermining of the seawall may result in a collapse of the wall structures and subsequent damage to public infrastructure, public access, and property. The 2012 seawall assessment estimated repairs which totaled just under $13 million dollars. An update on the current status of completed, ongoing or planned repair or reconstruction projects for the various seawall sections is provided below.

[76] http://www.mass.gov/eea/docs/czm/stormsmart/seawalls/boston-harbor/quincy-weymouth.pdf

Adams Shore - Adams Shore, is a heavily populated residential neighborhood located on the northern shore line adjacent to Quincy Bay. It is bounded on the west by the Merrymount neighborhood and the east by Houghs Neck. It provides access to Houghs Neck via Sea and State Streets. There are approximately 1,370 linear feet of coastal structures which protect residences, roads, and utilities within Sea Street, providing services to the densely populated Houghs Neck. The structures within Adams Shore are made up of precast concrete blocks, granite blocks, cast-in-place concrete, stone revetment, and sheet pilings. The 2012 assessment recommended repairs for all four structures in Adams Shore. The seawall projects are currently in permitting phase with state funding from a FY2017 Executive Office of Energy and Environmental Affairs (EOEEA) Dam and Seawall Fund Grant Award. At the time of the grant application in 2016, estimated repairs were approximately $6 million.

Hough's Neck - Houghs Neck is on a peninsula located on the eastern shoreline of Quincy. Bordered by Hingham Bay to the east, Rock Island Cove to the south and Quincy Bay to the west. Houghs Neck, which includes the neighborhoods around Rock Island Road, is surrounded by 16,730 linear feet of coastal structures that are owned by the City. These structures are made up of precast concrete blocks, cast-in-place concrete, granite blocks, and stone revetment.

Seawalls located around Houghs Neck including Sea Street, Post Island, Shellton and Tern Roads were rated among those in poorest condition and highest need of replacement. The 2012 assessment recommended repairs for all seawall sections within Hough's Neck. The City completed the repairs for Edgewater drive in 2014 at a final cost of $2.1 million. Seawall projects for sections along Bayswater Drive and Manet Ave are currently in the design and permitting phase with state funding from a FY2018 Executive Office of Energy and Environmental Affairs (EOEEA) Dam and Seawall Fund Grant Award. The assessment completed in 2017 estimated remaining repairs costs at approximately $6 million.

Merrymount - Merrymount is a densely populated neighborhood that is bordered by Adams Shore to the east, Quincy Bay to the north, Quincy Center to the south, and Black's Creek to the west. There are approximately 1,385 linear feet of coastal structures around Merrymount that are owned by the City, constructed of pre-cast concrete blocks and the remaining seawall in this area is privately owned. Many of the seawalls that protect Merrymount are near the end of their 50-year design life and need repair and improvement to extend their service life. The 2012 assessment estimated repairs costs at approximately $700,000.

Germantown - Germantown is on a peninsula, which borders the Town River Bay, on the southern shoreline of Quincy. Germantown has a large public housing population located within approximately 900 Quincy Housing Authority operated units. It is accessible only by Palmer Street which is protected by a seawall approximately 1,175 feet in length. There are approximately 2,880 linear feet of coastal structures around Germantown that are owned by the City. The structures around Germantown protect critical utilities within Palmer Street that provide services to the peninsula. The structures are made up of precast concrete blocks, cast-in place concrete, and stone revetment. The 2012 assessment recommended repairs for all seawall sections in Germantown. The 2012 assessment estimated repairs costs at approximately $530,000.

North Quincy - North Quincy is bordered by Squantum and Marina Bay to the north, Montclair and Wollaston to the south, Quincy Bay to the east, and the Neponset River to the west. There are approximately 1,030 linear feet of stone revetment coastal structures around North Quincy that are owned by the City. The 2012 assessment estimated repairs costs at approximately $256,000.

Squantum - Squantum is the northernmost neighborhood of Quincy and is bordered by Dorchester Bay and Boston Harbor to the north, Moon Island and Quincy Bay to the east, Marina Bay to the west, and Quincy Bay and North Quincy to the south. It is accessible only by East Squantum Street which is protected by a coastal structure approximately 2,860 feet in length. There are 3,380 linear feet of coastal structures around Squantum that are owned by the City made up of precast concrete block and stone revetment. The 2012 assessment estimated repairs costs at approximately $543,00.

Town River Bay - The Town River Bay is located in the center of Quincy and is surrounded by Germantown to the east, Adams Shore to the north, Quincy Point to the south, and Quincy Center to the west. There are 2,770 linear feet of coastal structures along the Town River Bay that are owned by the City made up of precast concrete blocks, granite blocks, and stone revetment. The 2012 assessment recommended repairs for all 11 wall sections at a cost of $2.2 million.

Locally Identified Areas of Impact

Based on shoreline assessment data from the CZM Shoreline Change Project and Coastal Erosion Commission and recent seawall damages due to coastal erosion, the Planning Team concluded that the entire coastline of the planning area is vulnerable to coastal erosion. Many of the coastal residential properties abutting the shoreline have the highest real estate values for the City.

Probability of Future Occurrence

The Massachusetts Coastal Erosion Commission Report noted that changing climate conditions may accelerate coastal erosion due to increase in frequency and severity of coastal storms and sea level rise. For Quincy, where the majority of the shoreline is facing north and northeast, coastal erosion due to nor'easters and sea level rise is the biggest concern. The Planning Team determined that is **LIKELY** that coastal erosion will impact Quincy in the future.

Impacts on Quincy's Key Sectors

COASTAL EROSION EXPOSURE AND VULNERABILITY BY KEY SECTOR[77]	
BUILT ENVIRONMENT	All structures adjacent to the coast, especially those located in high-wave energy areas or those atop coastal bluffs, are exposed to the coastal erosion hazard. However, this exposure can be reduced by shoreline armoring, which is extensive in the Quincy coastal areas.
NATURAL RESOURCES AND ENVIRONMENT	Coastal erosion has numerous direct and indirect impacts on the local environment, including direct loss of habitat and mortality for animals that are not able to relocate. Remaining animals may suffer from crowding, increased competition or increased predation.
ECONOMY	The beaches, parks, and natural resources along the Massachusetts coast contribute greatly to the local economy, especially during the summer season where the population in coastal areas can more than double. Beach loss, if not mitigated, will likely result in significant impacts to these communities.
VULNERABLE POPULATIONS	Waterfront property owners whose properties are not sufficiently protected from the threat of coastal erosion are considered particularly vulnerable to this hazard.

3.5.2 EARTHQUAKE

An earthquake is the movement or trembling of the ground produced by a sudden displacement of rock in the Earth's crust. The theory of plate tectonics is commonly used to explain much of the earthquake activity in the world. The plates over the Earth are in constant slow motion and this movement can cause earthquakes, most frequently at the boundary of the plates.[78]

In general, magnitude measures the size of an earthquake, while intensity measures the effects, which vary according to how far you are from the earthquake and the soils you are on.[4] Two scales are frequently used to measure earthquakes: Richter Scale measures the amount of energy released by an earthquake, or its magnitude. The Richter Scale ranges from 3.5 to 8.0, where 3.4 may be felt but doesn't cause damage, to an 8 which includes Great Earthquakes, and serious damage over extremely large areas. The Modified Mercalli Intensity Scale measures the intensity or impact of an earthquake on people and the built environment, and the Scale ranges from a Level 1, where the earthquake is not felt except by very few under especially favorable circumstances to a X11, with total damage: where all works of construction are damaged or destroyed, lines of sight and level are distorted, and objects are thrown into the air.[4]

Earthquake hazards have multiple impacts beyond the obvious building collapse. Buildings may suffer structural damage that may or may not be readily apparent. Building code seismic requirements prescribe for a building structure that will protect life safety. Buildings constructed following the code will not likely collapse in an earthquake and would allow occupants to safely escape the structure. However, the still standing structure could possibly have sustained significant damage that may or may not be economically feasible to repair.

Earthquakes can cause major damage to roadways, making emergency response difficult. Water lines and gas lines can break, causing flooding and fires. Another potential vulnerability is equipment within structures. For example, a hospital may be structurally engineered to withstand an earthquake, but if the equipment

[77] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[78] Earthquake Causes and Characteristics, FEMA Emergency Management Institute Training Guide, https://training.fema.gov/emiweb/is/is8a/is8a-unit3.pdf

inside the building is not properly secured, the operations at the hospital could be severely impacted during an earthquake. Earthquakes can also trigger landslides.

Previous Occurrence and Extent

According to the State Hazard Mitigation Plan, New England experiences an average of 5 earthquakes per year. Between 1627 and 2008, 366 earthquakes were recorded in Massachusetts. Most earthquakes in the northeast region tend to be small in magnitude and cause little damage; however, between 1924 and 2012 there have been 104 earthquakes measured at a magnitude of 4.5 or greater on the Richter Scale. Due to the geologic composition and rock structure in the Northeast, seismic shaking for many of these larger earthquakes were felt throughout all of New England. Most of the earthquakes originated from the La Malbaie fault in Quebec or from the Cape Ann fault located off the coast of Rockport. The list below includes earthquakes that affected eastern Massachusetts:

- August 8, 1847: No data available on the extent of hazard.
- November 27, 1852: No data available on the extent of hazard.
- December 10, 1854: No data available on the extent of hazard.
- September 21, 1876: No data available on the extent of hazard.
- May 21, 1880: No data available on the extent of hazard.
- January 21, 1903: No data available on the extent of hazard.
- April 24, 1903: No data available on the extent of hazard.
- October 15, 1907: No data available on the extent of hazard.
- January 7, 1952: Earthquake occurred off of Cape Ann and the reported felt area extended from Providence, RI to Kennebunk, ME.
- April 24, 1925: No data available on the extent of hazard.
- January 28, 1940: No data available on the extent of hazard.
- October 16, 1963: Intensity VI, caused plaster to fall in a house, crack walls, dishes and windows.
- October 30, 1963: No data available on the extent of hazard.
- October 24, 1965: Slight damage to homes on Nantucket, house timbers creaked, doors, windows and dishes rattled.
- December 30, 2012: Magnitude 1.2 earthquake about 7 miles south of Gardner, MA. No extent data available.
- April 2012: A swarm of 12 or more earthquakes occurred off of the New England coast about 250 miles east of Boston. The largest of these earthquakes measured a magnitude of 4.4 on the Richter Scale. This swarm of earthquakes was of particular concern because of the major earthquake on the continental shelf further north in 1929 that produced a deadly and damaging tsunami in Nova Scotia.

There have been no earthquake declared disasters for Massachusetts. There have been no recorded earthquake epicenters within Quincy and there have been no historical recorded effects on the City associated with earthquake impacts originating from outside of Quincy. FEMA has published maps with seismic design

categories (SDCs) for building design and construction professionals. Most of New England is classified as SDC "B," as areas that could experience shaking of moderate intensity.[79]

Locally Identified Areas of Impact

Based on mapping by FEMA, the entire planning area is at risk from impacts due to earthquakes.

Probability of Future Occurrence

Earthquakes cannot be predicted and may occur at any time of the day and any time of the year. However, for the purpose of this Plan, the USGS 2014 Seismic Hazard Map was used to review the probability of future occurrence as shown in **Figure 3.22**.[80]

The data is derived from seismic hazard curves and depict probabilistic ground motions with a 2 percent probability of exceedance in 50 years. For Quincy, moderate peak gravity acceleration from 14 to 20 percent is predicted.

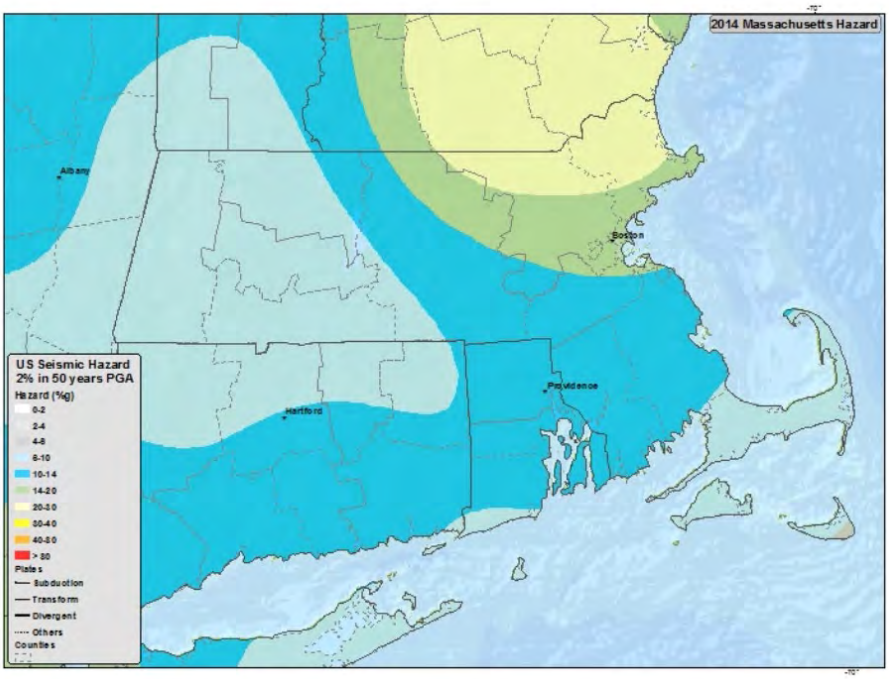


Figure 3.22: 2014 Seismic Hazard Map of New England

Quincy acknowledged that earthquakes were the hazard for which their community was least prepared. Although new construction under the most recent building codes (Massachusetts State Building Code, 9th Edition; International Building Code, IBC 2015: and Minimum Design Loads for Buildings and Other Structures, ASCE 7-15) will be built to seismic standards, much of the development in the City predates the most recent building code.

The Planning Team determined that it is **POSSIBLE** that an earthquake will impact Quincy in the future and therefore are including it in the Multi-Hazard Mitigation Plan.

[79] https://www.fema.gov/earthquake-hazard-maps
[80] https://earthquake.usgs.gov/hazards/hazmaps/conterminous/index.php#2016

Impacts on Quincy's Key Sectors

EARTHQUAKE EXPOSURE AND VULNERABILITY BY KEY SECTOR[81]	
BUILT ENVIRONMENT	In addition to direct impacts, earthquakes also present a risk associated with hazardous materials releases, which have the potential to impact a production or storage facility during transportation, or a result of pipeline damage. These events could cause widespread interruption of services, as well as air and water contamination.
NATURAL RESOURCES AND ENVIRONMENT	If strong shaking occurs in a forest, trees may fall – resulting not only in environmental impacts but also potential impact to any industries relying on that forest. If shaking occurs in a mountainous environment, cliffs may crumble and caves may collapse. Disrupting the physical foundation of the ecosystem can cause species displacement and modify the species balance in that ecosystem and leave the area more vulnerable to the spread of invasive species.
ECONOMY	Earthquake losses can include structural and non-structural damage to buildings (which could include damage to architectural components like ceilings and lights, or power systems), loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings.
VULNERABLE POPULATIONS	Socially vulnerable populations are the most likely groups to be affected by this hazard based on a number of factors, including their physical and financial ability to react or respond during a hazard, the location and construction quality of their housing, and the ability to be self-sustaining after an incident due to limited ability to stockpile supplies.

3.5.3 LANDSLIDE

Landslides encompass a wide variety of ground movements under the effect of gravity including rock falls, slope failures, and shallow debris flows. In the Commonwealth of Massachusetts, landslides are primarily caused by slope saturation by water, which increases the weight on the slope, as well as the pore pressure.[82] Increasing the pore pressure will decrease the cohesiveness of the soil, making the land more vulnerable to outside pressures (i.e. gravity). In Massachusetts, landslides are often caused by construction-related failures, undercut slopes, and water saturation.

- Construction-related failures are caused by construction activities that weaken the slope by increasing the steepness of the bank and decreasing supporting material along the bank.
- Undercut slopes occur when streams, tides, or other water movement cut into the toe of the slope, eventually undermining.
- Slope saturation on a slope occurs after high precipitation events and drastic water level changes that augments the weight on the slope and diminishes the slope's cohesiveness.

Landslide incidence is the number of landslides that have occurred in a given geographic area. High incidence means greater than 15 percent of a given area has been involved in landsliding, medium incidence means 1.5 to 15 percent of an area has been involved, and low-incidence means that less than 1.5 percent of an area has been involved. Quincy has a low incidence of landslides.

[81] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[82] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Previous Occurrence and Extent

Landslides tend to coincide with other natural disasters such as earthquakes and floods that exacerbate relief and reconstruction efforts. As a result, landslide frequency is related to the frequency of other hazards. There have been zero federally declared landslide disasters from 1954 to 2012.[83] According to the 2013 State Hazard Mitigation Plan, there are roughly 1 to 3 landslides events each year. There is no specific data on events in Quincy. City officials did not identify any problems with areas of geologic instability such as sinkholes or subsidence, or any past occurrences with landslides, sinkholes or subsidence.

Locally Identified Areas of Impact

The entire planning area is identified as low risk for landslides.

Probability of Future Occurrence

Since the majority of Quincy has low lying topography and the low incidences of landslides, the Planning Team determined that it is **UNLIKELY** that landslides will impact Quincy. Potential effects of climate change could increase the likelihood of landslides due to slope saturation with more frequent and intense storms, and reduced vegetation cover due to the increased frequency of drought events or increased urbanization.

Impacts on Quincy's Key Sectors

LANDSLIDE EXPOSURE AND VULNERABILITY BY KEY SECTOR[84]	
BUILT ENVIRONMENT	Landslides can cause damage to elements of the built environment and can interfere with travel if large enough to block or damage roads. Critical facilities in Quincy are located within unstable areas.
NATURAL RESOURCES AND ENVIRONMENT	Landslides can affect many facets of the environment, including the landscape itself, water quality, and habitat health. Transported soil may harm aquatic habitats, and mass movement of sediment may result in stripping of forests and other vegetated systems.
ECONOMY	Direct costs include the actual damage sustained by buildings, property, and infrastructure. Indirect costs from a large landslide event could include clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity.
VULNERABLE POPULATIONS	Populations who rely on potentially impacted roads for vital transportation needs are considered to be particularly vulnerable to this hazard.

[83] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[84] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

3.5.4 TSUNAMI

A tsunami is a series of traveling ocean waves of extremely long wavelength often caused by displacement of the ocean floor by seismic or volcanic activity or underwater landslides. The waves can move hundreds of miles per hour in open ocean and can come ashore as high as 100 feet or more.

Previous Occurrence and Extent

All coastal areas of Massachusetts are exposed to the threat of tsunamis. According to *U.S. States and Territories National Tsunami Hazard Assessment: Historical Record and Sources for Waves*, the U.S Atlantic coast and Gulf Coast have experienced very few tsunamis in the last 200 years. Only six tsunamis have been recorded in the other Gulf and East Coast states. There is no data for tsunami events in Quincy.

Locally Identified Areas of Impact

Based on the elevations of Quincy, most if not all of the planning area is at risk from impacts caused by a tsunami.

Probability of Future Occurrence

At the present time, it is unknown what the probability of a damaging tsunami along the Massachusetts coast would be. Potential effects of climate change including isostatic rebound and glacial earthquakes due to a warming climate may potentially trigger tsunamis. Based on the low frequency of tsunami events on the East Coast, the Planning Team determined that it is **UNLIKELY** that tsunamis will impact Quincy.

Impacts on Quincy's Key Sectors

TSUNAMI EXPOSURE AND VULNERABILITY BY KEY SECTOR[85]	
BUILT ENVIRONMENT	Roads are the primary resource for evacuation before and during a tsunami event. Road flooding during a tsunami is therefore the most important infrastructure component, although bridges, public transportation, utilities, and power generation facilities would also be exposed.
NATURAL RESOURCES AND ENVIRONMENT	The inundation of typical dry areas from a tsunami can reshape the topography both by scouring existing sediment and by depositing sediment from other locations. In addition to these typical impacts, tsunami can also uproot trees and other plants in its path, causing habitat loss in addition to direct mortality to animals in the area.
ECONOMY	A tsunami's negative impact on the economy is difficult to quantify. Losses would likely include general building stock damage, business interruption/closures, port closures, utility and transportation damage, and impacts on tourism and tax base to the commonwealth.
VULNERABLE POPULATIONS	The populations most vulnerable to the tsunami hazard include all the those in the tsunami exposure zone who would have difficulty receiving tsunami warnings or evacuating, including populations over 65, the disabled, families with young children, car-free households and communication-impaired individuals.

[85] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

3.6 OTHER HAZARDS

WILDFIRE

Fire needs the right combination of heat source, fuel, and oxygen in order to ignite and thrive. Availability of fuel, weather conditions, and terrain all dictate how a fire will behave. Fires are classified as disasters when they affect people or developed areas. Fires can start from a variety of natural or anthropogenic causes. Urban fires occur in developed landscapes, where a fire has the potential to spread from one structure to another.

A wildfire is any non-structural fire that occurs in the vegetative wildlands. The 3 major classes of wildfires are surface, ground, and crown fires. A surface fire creeps slowly on the forest floor, while killing or damaging trees. Often occurring during droughts, ground fires burn organic ground cover below the forest floor. Rapidly spreading due to wind, crown fires quickly jump along the treetops.

Major urban and wildfires often result from other hazards, such as storms, earthquakes, gas leaks, transportation accidents, hazardous material spills, criminal activity, or terrorism. In contrast, small structural fires occur frequently from mundane events.

Previous Occurrence and Extent

The wildfire season in Massachusetts typically begins in late March and usually culminates in early June, following the driest live fuel moisture periods of the year. Historically, April has the highest wildfire danger.[86]

Locally Identified Areas of Impact

The Quincy Fire Department responds to approximately 20 - 30 wildfires annually. Quincy's forested areas are primarily composed of pitch pine, mixed conifer, oak, and oak mixed, which are considered by the State fire officials to be the forest types at highest risk for wildfires. Much of Quincy's forested areas are wetlands, which has limited the ability of these fires to grow and spread.

Within the past year there were no wildfires that resulted in significant property damage. The most common cause of fires in Quincy is the careless disposal of smoking materials. Faxon Park, Blue Hills State Park and the Marsh Area by Doane Street were identified as having the highest potential for brush fires.

The Northeast Wildfire Risk Assessment Geospatial Work Group determined the wildfire risk based off of fuels, wildland-urban interface and topography, as shown in **Figure 3.23.**[87] Quincy includes areas of **high** risk, notably within the 4,000-acre Blue Hills Reservation. Based on this mapping, the planning area is at risk for wildfires.

[86] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan
[87] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

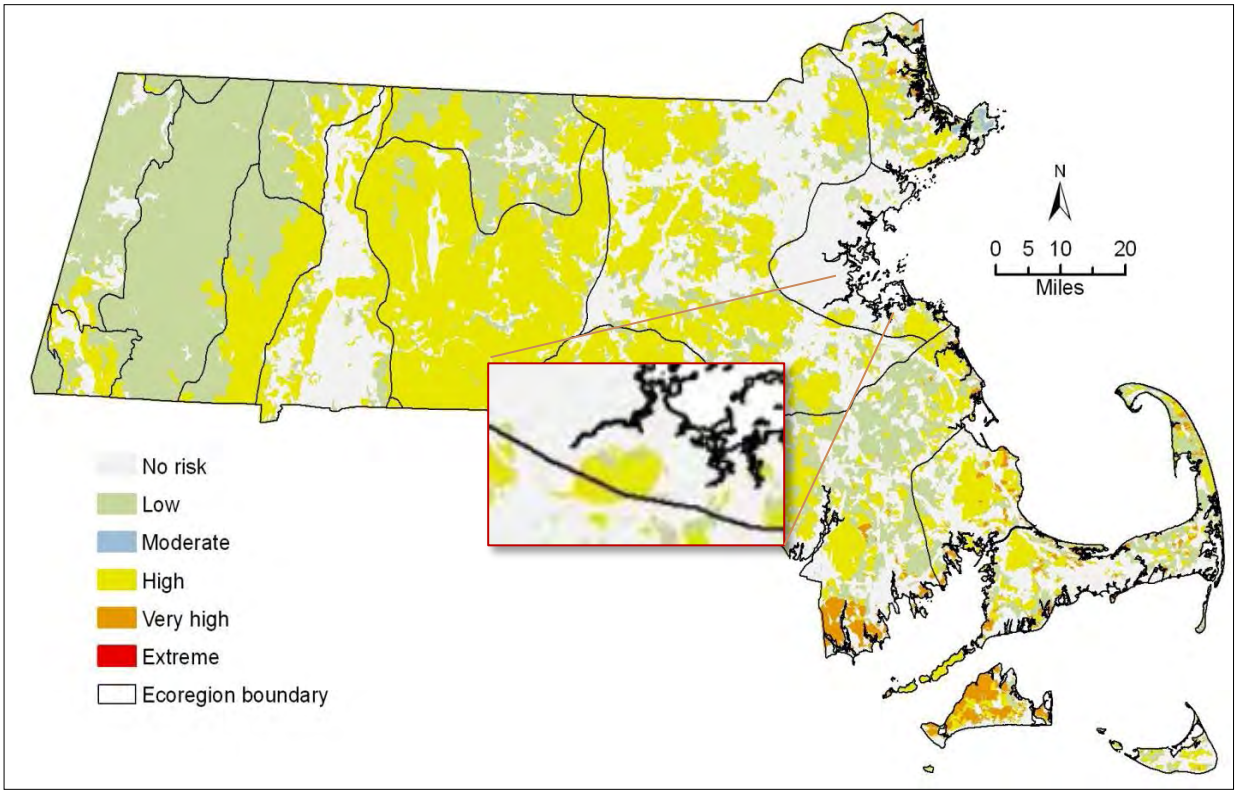


Figure 3.23: Wildfire Risk in Quincy, MA

Probability of Future Occurrence

It is difficult to predict the likelihood of wildfires given the complexity of predicting the factors leading to fires. Fires will continue to present a risk, and that risk is likely to increase with potential drought impacts of climate change. Periods of hot, dry weather and more frequent lighting strikes may increase wildfires. Research has found that the frequency of lightning strikes could increase by approximately 12 percent for every degree Celsius of warming. The Planning Team determined that it is **POSSIBLE** that a wildfire will impact the planning area based on the location of open space and past history of fires.

Impacts on Quincy's Key Sectors

WILDFIRE EXPOSURE AND VULNERABILITY BY KEY SECTOR[88]	
BUILT ENVIRONMENT	Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. They can also damage infrastructure elements such as power and communication lines.
NATURAL RESOURCES AND ENVIRONMENT	Fire serves important ecological purposes; however, it can also cause environmental impacts. In addition to direct mortality, wildfires and the ash they generate can distort the flow of nutrients through an ecosystem, reducing the biodiversity that can be supported.
ECONOMY	Wildfire events can have major economic impacts on a community, both from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism. Additionally, wildfires can require thousands of taxpayer dollars in fire response efforts.
VULNERABLE POPULATIONS	All residents whose homes are located in wildfire hazard areas are vulnerable to this hazard. Smoke and air pollution from the wildfires can also be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases.

[88] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

3.6.2 INVASIVE SPECIES

The Massachusetts Invasive Plant Advisory Group (MIPAG) defines invasive plants as "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems." [89] These species have biological traits that provide them with competitive advantages over native species, particularly because in a new habitat they are not restricted by the biological controls of their native habitat. As a result, these invasive species can monopolize natural communities, displacing many native species and causing widespread economic and environmental damage.

The Massachusetts Invasive Plant Advisory Group (MIPAG) recognized 69 species as "Invasive," "Likely Invasive," or "Potentially Invasive." In order to be considered "invasive," a plant species must meet the following criteria[90]:

- Be nonindigenous to Massachusetts.
- Have the biologic potential for rapid and widespread dispersion and establishment in minimally managed habitats.
- Have the biologic potential for dispersing over spatial gaps away from site of introduction.
- Have the biologic potential for existing in high numbers away from intensively managed artificial habitats.
- Be naturalized in Massachusetts (persists without cultivation in Massachusetts).
- Be widespread in Massachusetts, or at least common in a region or habitat type(s) in the state.
- Have many occurrences of numerous individuals in Massachusetts that have high numbers of individuals forming dense stands in minimally managed habitats.
- Be able to out-compete other species in the same natural plant community.
- Have the potential for rapid growth, high seed or propagule production and dissemination, and establishment in natural plant communities.

The damage rendered by invasive species is significant. The 2018 State Hazard Mitigation Plan sites an estimate that about 3 million acres within the United States (an area twice the size of Delaware) are lost each year to invasive plants. The massive scope of this hazard means that the entire Commonwealth experiences impacts from these species. Furthermore, the ability of invasive species to travel far distances (either via natural mechanisms or accidental human interference) allows these species to propagate rapidly over a large geographic area.[91]

Regulation on Invasive Species

Massachusetts has a variety of laws and regulations in place that attempt to mitigate the impacts of these species. The Department of Agricultural Resources (DAR) has added the plant species described to a list of noxious weeds regulated with prohibitions on importation, propagation, purchase and sale in the Commonwealth. Additionally, the Massachusetts Wetlands Protection Act (310 CMR 10.00) includes language

[89] https://www.massnrc.org/mipag/
[90] https://massnrc.org/mipag/docs/MIPAG_FINDINGS_FINAL_042005.pdf#page=6
[91] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

requiring all activities covered by the Act to account for, and take steps to prevent, the introduction or propagation of invasive species.

In 2000, Massachusetts passed an Aquatic Invasive Species Management Plan, making the Commonwealth eligible for federal funds to support and implement the plan through the federal Aquatic Nuisance Prevention and Control Act. The Commonwealth also has several resources pertaining to terrestrial invasive species, such as the Massachusetts Introduced Pest Outreach Project, although a strategic management plan has not yet been prepared for these species. More specific regulations are discussed below.

330 CMR 6.0(d) requires any seed mix containing restricted noxious weeds to specify the name and number per pound on the seed label. 339 CMR 9.0 restricts the transport of currant or gooseberry species in an attempt to prevent the spread of white pine blister rust.

There are also a number of state laws pertaining to invasive species. Chapters 128, 130, and 132 of Part I of the General Laws of the state include language addressing water chestnuts, green crabs, the Asian longhorn beetle and a number of other species. These laws also include language allowing orchards and gardens to be surveyed for invasive species, and for quarantines to be put into effect, at any time.

Locally Identified Areas of Impact- Flora

The 35 plant species listed on the MIPAG website as "Invasive" (last updated April 2016) are listed in **Table 3.24**.

Table 3.24
Invasive Species (Flora) in Massachusetts

Species	Common name
Acer platanoides	Norway maple
Acer pseudoplatanus	Sycamore maple
Aegopodium podagraria	Bishop's goutweed, bishop's weed; goutweed
Ailanthus altissima	Tree of heaven
Alliaria petiolata	Garlic mustard
Berberis thunbergii	Japanese barberry
Cabomba caroliniana	Carolina fanwort; fanwort
Celastrus orbiculatus	Oriental bittersweet; Asian or Asiatic bittersweet
Cynanchum louiseae	Black swallow-wort; Louise's swallow-wort
Elaeagnus umbellata	Autumn olive
Euonymus alatus	Winged euonymus, burning bush
Euphorbia esula	Leafy spurge; wolf's milk
Frangula alnus	European buckthorn, glossy buckthorn
Glaucium flavum	Sea or horned poppy, yellow hornpoppy
Hesperis matronalis	Dame's rocket

Species	Common name
Iris pseudacorus	Yellow iris
Lepidium latifolium	Broad-leaved pepperweed, tall pepperweed
Lonicera japonica	Japanese honeysuckle
Lonicera morrowii	Morrow's honeysuckle
Lonicera x bella [morrowii x tatarica]	Bell's honeysuckle
Lysimachia nummularia	Creeping jenny, moneywort
Lythrum salicaria	Purple loosestrife
Myriophyllum heterophyllum	Variable water-milfoil; two-leaved water-milfoil
Myriophyllum spicatum	Eurasian or European water-milfoil; spike water- milfoil
Phalaris arundinacea	Reed canary-grass
Phragmites australis	Common reed
Polygonum cuspidatum / Fallopia japonica	Japanese knotweed; Japanese or Mexican bamboo
Polygonum perfoliatum	Mile-a-minute vine or weed; Asiatic tearthumb
Potamogeton crispus	Crisped pondweed, curly pondweed
Ranunculus ficaria	Lesser celandine; fig buttercup
Rhamnus cathartica	Common buckthorn
Robinia pseudoacacia	Black locust
Rosa multiflora	Multiflora rose
Salix atrocinerea/Salix cinerea	Rusty Willow/Large Gray Willow complex
Trapa natans	Water chestnut

Source: Massachusetts DNR

Massachusetts has also implemented biological control programs aimed at controlling the invasive species purple loosestrife (*Lythrum salicaria*), mile-a-minute vine (*Persicaria perfoliata*), hemlock woolly adelgid (*Adelges tsugae*), and winter moth (*Operophtera brumata*).

The Quincy Parks Department has made substantial efforts to eradicate these and other invasive species

Locally Identified Areas of Impact- Fauna

According to the 2018 State Hazard Mitigation Plan, there are a number of animals that have disrupted natural systems and inflicted economic damage on the Commonwealth, as described in **Table 3.25**. Because of the rapidly evolving nature of the invasive species hazard, this list is subject to modification.

Table 3.25
Invasive Species (Fauna) in Massachusetts

Species	Common name
Lymantria dispar	Gypsy moth (insect)
Ophiostoma ulmi, Ophiostoma himal-ulmi, Ophiostoma novo-ulmi	Dutch elm disease (fungus)
Adelges tsugae	Hemlock woolly adelgid (insect)
Cryphonectria parasitica	Chestnut blight (fungus)
Anoplophora glabripennis	Asian long-horned beetle
Cronartium ribicola	White pine blister rust (fungus)
Carcinus maenus	European green crab (crab)
Hemigrapsis sanguineus	Asian shore crab
Membranipora mambranacea	Lace Bryozoan
Codium fragile ssp. fragile	Codium
Didemnum vexillum	Tunicate
Palaemon elegans	European Shrimp
Dreissena polymorpha	Zebra mussel

Sources: CZM 2002; Defenders of Wildlife; Gulf of Maine; EEA; EEA2

Over the years, a number of non-native species have been found in Quincy including Chinese soft shell turtles, red-eared sliders (a common aquarium pet) and European green crabs.

Probability of Future Occurrence

Because the presence of invasive species is ongoing, rather than a series of discrete events, it is difficult to quantify the frequency of these occurrences. However, increased rates of global trade and travel have created many new pathways for the dispersion of exotic species. A warming climate may place stress on colder-weather species, while allowing non-native species accustomed to warmer climates to spread northwards. Elevated atmospheric CO2 concentrations could reduce the ability of ecosystems to recover after a major disturbance, such as flood or fire. As a result, invasive species, which are often able to establish more rapidly following a disturbance, could have an increased probability of successful establishment or expansion. The Planning Team determined that it is **LIKELY** that invasive species will continue to impact the planning area in the future.

Impacts on Quincy's Key Sectors

INVASIVE SPECIES EXPOSURE AND VULNERABLITY BY KEY SECTOR[92]	
BUILT ENVIRONMENT	As described above, water bodies such as reservoirs could be exposed to the zebra mussel if it is introduced.
NATURAL RESOURCES AND ENVIRONMENT	Invasive species present a significant threat to the environment and natural resources present in Quincy. Research has found that competition or predation by alien species is the second most significant threat to biodiversity, only surpassed by direct habitat destruction or degradation.
ECONOMY	Invasive species are widely considered to be one of the most costly natural hazards in the United States, as invasive control efforts can be quite extensive and these species can damage crops, recreational amenities, and public goods such as water quality.
VULNERABLE POPULATIONS	Individuals who are particularly vulnerable to the economic impacts of this hazard would include all groups who depend on existing ecosystems for their economic success.

[92] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

BOSTON

MILTON

BRAINTREE

WEYMOUTH

CANTON

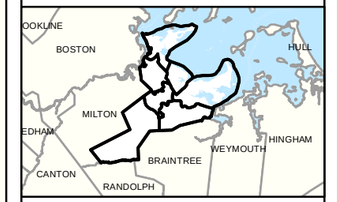
RANDOLPH

Map 3.1
FEMA Flood Zones and Areas of Flooding Concern

LEGEND

- Planning Areas
- Inland Wetlands
- Coastal Wetlands
- Areas of Localized Flooding
- 100 Year Flood Zone
- Waterbodies
- Town Boundary

LOCUS MAP



0 2,000 4,000
Feet

1:48,000

NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

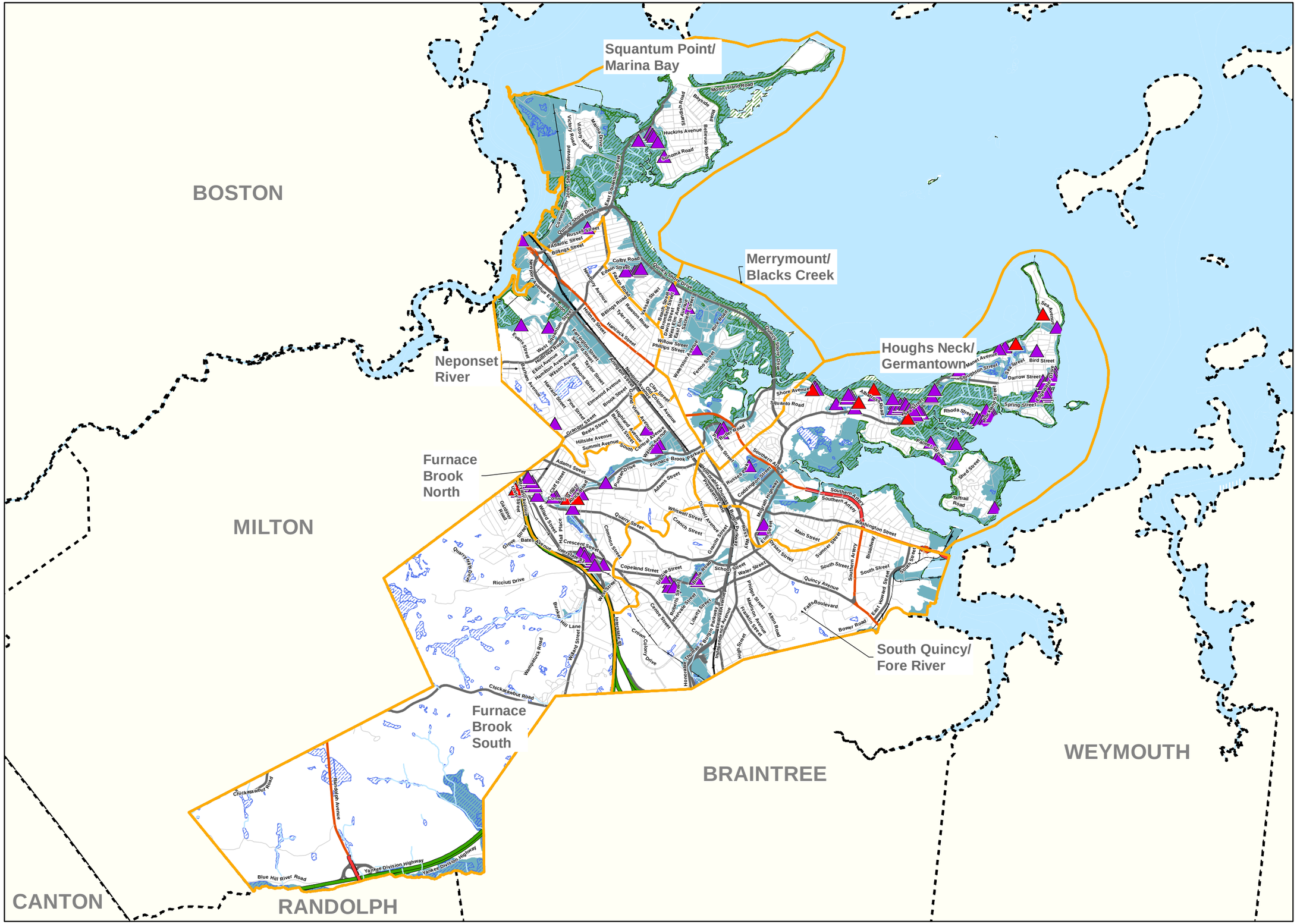
2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

Tighe&Bond
Engineers | Environmental Specialists

Map 3.2 FEMA Flood Zones and Repetitive Loss Properties



LEGEND

- Severe Repetitive Loss
- Repetitive Loss
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas
- Town Boundary

LOCUS MAP



N
W E
S

0 2,000 4,000
Feet

1:48,000

NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

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September 2018

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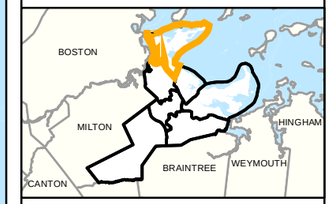
Map 3.2A FEMA Flood Zones and Repetitive Loss Properties

Squantum Point/ Marina Bay

LEGEND

- Severe Repetitive Loss
- Repetitive Loss
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas
- Town Boundary

LOCUS MAP



N

0 750 1,500

Feet

1:18,000

NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

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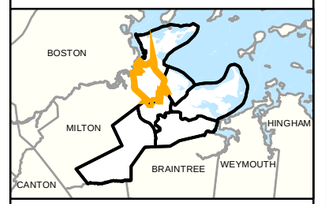
Map 3.2B FEMA Flood Zones and Repetitive Loss Properties

Neponset River

LEGEND

- Severe Repetitive Loss
- Repetitive Loss
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas
- Town Boundary

LOCUS MAP



N W E S

0 625 1,250

Feet

1:15,000

NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

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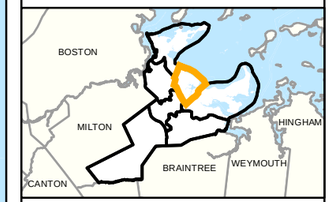
Map 3.2C FEMA Flood Zones and Repetitive Loss Properties

Merrymount/ Blacks Creek

LEGEND

- Severe Repetitive Loss
- Repetitive Loss
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas
- Town Boundary

LOCUS MAP



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NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

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Quincy, Massachusetts

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Map 3.2D FEMA Flood Zones and Repetitive Loss Properties

Furnace Brook North

MILTON

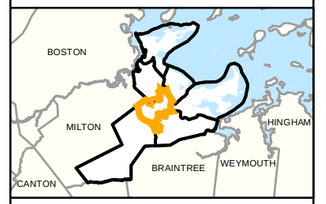
Furnace Brook

Furnace Brook

LEGEND

- Severe Repetitive Loss
- Repetitive Loss
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas
- Town Boundary

LOCUS MAP



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Quincy, Massachusetts

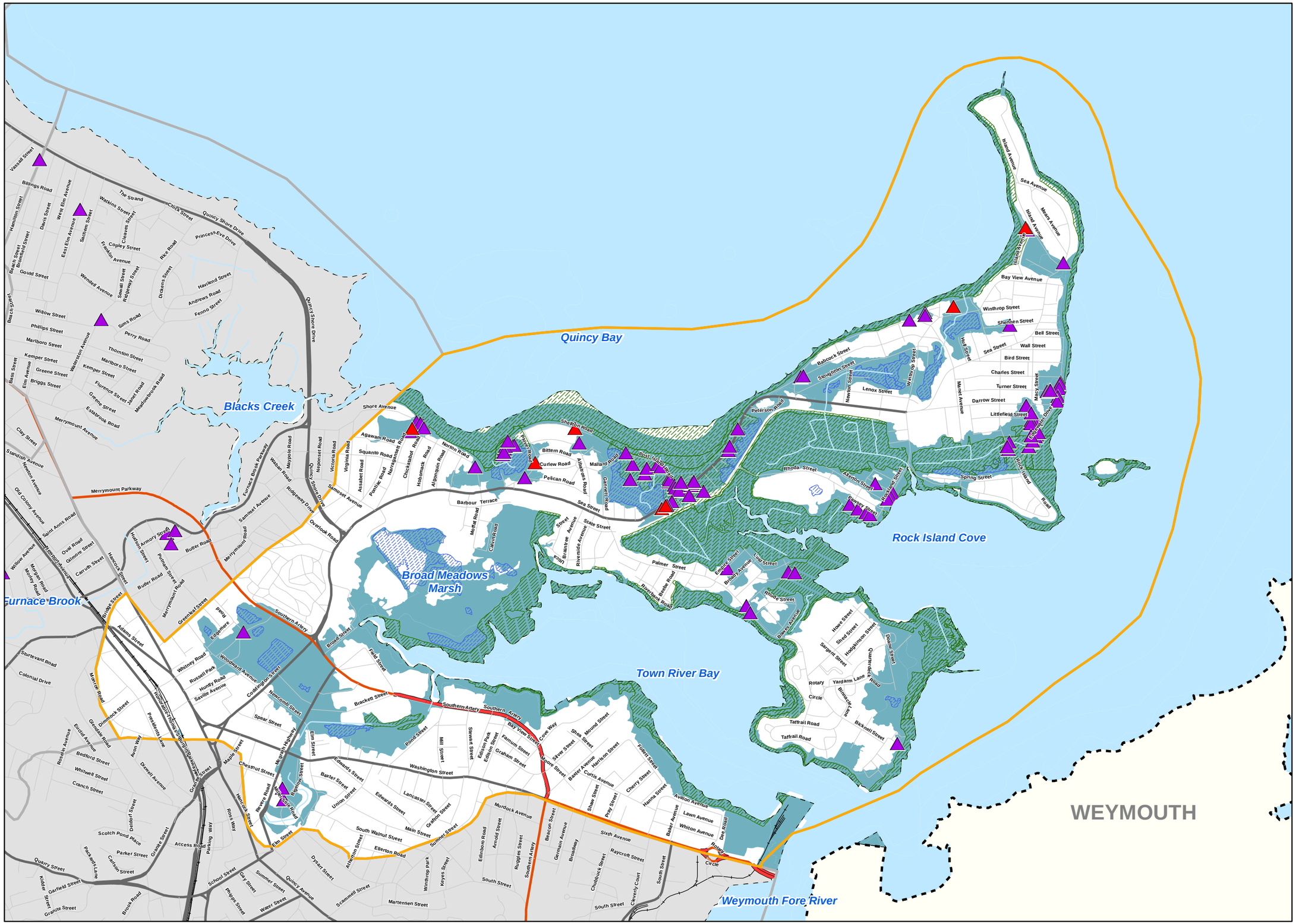
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Map 3.2E FEMA Flood Zones and Repetitive Loss Properties

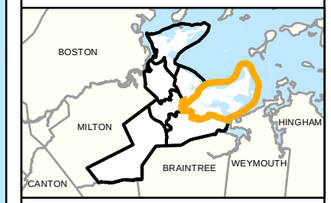
Houghs Neck/ Germantown



LEGEND

- Severe Repetitive Loss
- Repetitive Loss
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas
- Town Boundary

LOCUS MAP



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NOTES

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Quincy, Massachusetts

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Map 3.2F FEMA Flood Zones and Repetitive Loss Properties

Furnace Brook South

MILTON

BRAINTREE

RANDOLPH

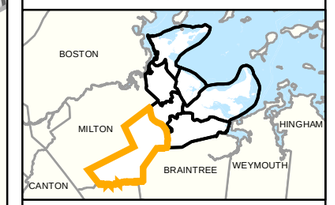
Furnace Brook

Town Brook

LEGEND

- Severe Repetitive Loss
- Repetitive Loss
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas
- Town Boundary

LOCUS MAP



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NOTES

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Quincy, Massachusetts

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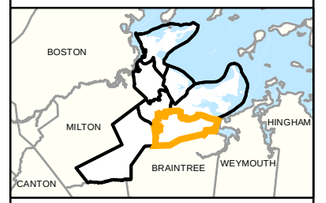
Map 3.2G FEMA Flood Zones and Repetitive Loss Properties

South Quincy/ Fore River

LEGEND

- Severe Repetitive Loss
- Repetitive Loss
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas
- Town Boundary

LOCUS MAP



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NOTES

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Quincy, Massachusetts

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Town River Bay

Weymouth Fore River

Town Brook

BRAINTREE

Map 3.3
Quincy Flood Mitigation (Dams, Culverts, Tidegates)

BOSTON

MILTON

BRAINTREE

WEYMOUTH

CANTON

RANDOLPH

Squantum Point/
Marina Bay

Merrymount/
Blacks Creek

Houghs Neck/
Germantown

Neponset
River

Furnace
Brook
North

Furnace
Brook
South

South Quincy/
Fore River

LEGEND

- Tide Gate
- Outfalls
- State Dam Locations
- Storm Drain Network
- Protected Open Space
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas

LOCUS MAP



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NOTES

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Quincy, Massachusetts

September 2018

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Map 3.3A
Quincy Flood Mitigation
(Dams, Culverts, Tidegates)
Squantum Point/ Marina Bay

LEGEND

- Tide Gate
- Outfalls
- State Dam Locations
- Storm Drain Network
- Protected Open Space
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas

LOCUS MAP



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NOTES

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Map 3.3B
Quincy Flood Mitigation
(Dams, Culverts, Tidegates)
Neponset River

BOSTON

MILTON

Quincy Bay

Blacks Creek

Furnace Brook

LEGEND

- Tide Gate
- Outfalls
- State Dam Locations
- Storm Drain Network
- Protected Open Space
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas

LOCUS MAP



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NOTES

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Quincy, Massachusetts

September 2018

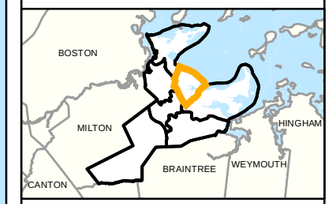
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Map 3.3C
Quincy Flood Mitigation
(Dams, Culverts, Tidegates)
Merrymount/ Blacks Creek

LEGEND

- Tide Gate
- Outfalls
- State Dam Locations
- Storm Drain Network
- Protected Open Space
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas

LOCUS MAP



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Quincy, Massachusetts

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Map 3.3D
Quincy Flood Mitigation
(Dams, Culverts, Tidegates)
Furnace Brook North

MILTON

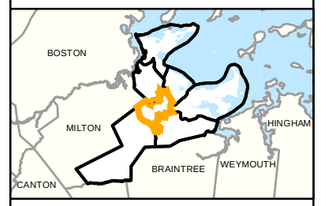
Furnace Brook

Furnace Brook

LEGEND

- Tide Gate
- Outfalls
- State Dam Locations
- Storm Drain Network
- Protected Open Space
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas

LOCUS MAP



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Quincy, Massachusetts

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Map 3.3E
Quincy Flood Mitigation
(Dams, Culverts, Tidegates)
Houghs Neck/ Germantown

LEGEND

- Tide Gate
- Outfalls
- State Dam Locations
- Storm Drain Network
- Protected Open Space
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas

LOCUS MAP



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2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

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Map 3.3F
Quincy Flood Mitigation
(Dams, Culverts, Tidegates)
Furnace Brook South

MILTON

BRAINTREE

RANDOLPH

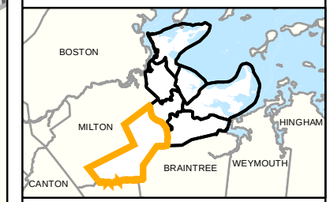
Furnace Brook

Town Brook

LEGEND

- Tide Gate
- Outfalls
- State Dam Locations
- Storm Drain Network
- Protected Open Space
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas

LOCUS MAP



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NOTES

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2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

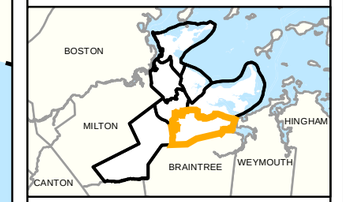
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Map 3.3G
Quincy Flood Mitigation
(Dams, Culverts, Tidegates)
South Quincy/ Fore River

LEGEND

- Tide Gate
- Outfalls
- State Dam Locations
- Storm Drain Network
- Protected Open Space
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies
- Planning Areas

LOCUS MAP



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NOTES

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Quincy, Massachusetts

September 2018

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SECTION 4

ASSET INVENTORY

In this Plan, community assets are locations and resources that are vital to the function and character of Quincy. A description of city-wide community assets characterizes the community, while an inventory of site specific community assets sets the stage for determining which assets are vulnerable to the impacts of natural hazards. Section 4 provides a detailed inventory of site specific community assets related to the built environment, vulnerable populations, cultural resources, natural resources and economic centers.

Section 4 Asset Inventory

Section 4 provides an inventory of the community assets that are important to the City of Quincy. The Section is broken up into three parts: a discussion of current and future land use trends, a description of the community assets categories used in the City HMP and the results of the Quincy Community Assets Inventory organized by the seven geographical planning areas within the City. Identifying the community assets allows the City to investigate how they will be impacted by the different natural hazards.

4.1 LAND USE TRENDS-FUTURE DEVELOPMENT

D1 a

Under current zoning, the City of Quincy is largely built out. Much of the land area is occupied by existing neighborhoods, commercial centers and corridors, conservation land, and undevelopable wetlands and floodplain areas. Despite being built-out, the development that is occurring in the City is largely redevelopment projects. This is evident by Quincy's current building boom.

The Quincy Planning Board has permitted 74 projects consisting of 3,945 units of housing from 2012 through October 2018. Of the 74 projects permitted, there were fifteen projects of 50 or more units that accounted for 20% of the projects and over 80% of the approved units or 3,243 units. Projects of 10-49 units comprised over 30% of the projects and 13% of units or 518 units. Projects of 9 or less units comprised 49% of projects and 4.7% of total units or 184 units. These projects range on the development spectrum from approved (and needing project financing and construction permits) to starting construction to fully constructed. There is also a significant pipeline of projects in the development review process seeking permitting approval from the Planning Board.

Regarding future development, the larger projects are mixed use and commercial redevelopments in downtown Quincy, in areas around each of the MBTA stations in North Quincy, Wollaston, Quincy Center and Quincy Adams, or areas of contiguous, large retail and office properties. There is also potential for smaller redevelopment projects on specific sites zoned for multi-family development within neighborhoods around the City.

The implication of these development trends regarding hazard mitigation is that a large portion of Quincy's development occurred prior to World War II and may not meet today's standards for hazard mitigation. Redevelopment resulting in new construction must meet the most recent code and regulatory updates for fire, flooding, wind hazards and seismic safety, therefore resulting in new development that is at a lower risk of being adversely impacted by hazard conditions.

Table 4.1 shows the acreage and percentage of total land in Quincy as based on 2011 and 2017 Assessor's data.

As shown in **Table 4.1**, there has been little change in the land use between 2011 and 2017 with approximately 75% of the land in Quincy already developed and almost half being used as residential areas. The next largest categories of land use in developed areas are state, federal, municipal and non-profit use and commercial use.

ASSET INVENTORY

Table 4.1
Change in Land Use Distribution 2011-2017

Land Use Type	2011		2017	
	Acres	%	Acres	%
Residential	3238	44%	3102	43%
Commercial	948	13%	733	10%
Industrial	189	3%	190	3%
Transportation	64	1%	70	1%
Undeveloped	1618	22%	1766	24%
Multi-Use	40	1%	35	<1%
State/Federal/Municipal/Nonprofit	1016	14%	1111	15%
Education	197	3%	203	3%

Potential Future Development

Areas that are likely to be developed or redeveloped in the future, defined for the purposes of this plan as a ten-year time horizon, are shown in **Table 4.2**.

Table 4.2
Areas Slated for Future Development within 10 years

Future Development	
56 Albertina Street	Marina Bay Residential Development (260 Victoria Road)
97 Atlantic Street	31-39 Newbury Street
23 Bailey Street	60 Newbury Street
18 Bates Avenue	North Quincy T Station
Chestnut Place	118 Old Colony Avenue
57R & 65 Cleverly Court	29 Packards Lane
60 Cleverly Court	Quincy Adams T Station
74 Crescent Street	Quincy Center Redevelopment Project
Crown Colony (Marriot Drive)	Quincy Medical Center
1 Edwin Street	Quincy Shipyard
52 Grafton Street	57 Quincy Shore Drive
151 Granite Street/7 Parker St	Squantum Elementary School
133-135 Hancock Street	131 Sumner Street
1500 Hancock Street	225 West Squantum Street
Highpoint Circle	R264 West Street
Holliston Street/Forest Avenue	37-45 Wren Terrace
12R & 29 Hoover Ave	Wollaston T Station
104-106 Intervale Ave	

Potential Future Development- Critical Areas around Neponset and Fore River

The Neponset River Estuary is designated by the Commonwealth as an Area of Critical Environmental Concern (ACEC). Any future development that may occur in this area will need to understand the historical land use patterns and infrastructure systems associated with the past Granite industry and account for the current stormwater and coastal infrastructure systems now in place. Future development will also need to incorporate current hazard mitigation standards into its design proposals.

The Weymouth Fore River is designated by the Commonwealth as a Designated Port Area (DPA). Presently there are a number of industrial uses located in Quincy, Braintree, and Weymouth including the former Fore River Shipyard, Twin Rivers technology, Citgo Petroleum Corporation (oil tank Farm), and the Fore River Energy Center (a 731 megawatt, natural gas power plant). Due to the large scale industrial nature of the current uses and their regional significance, the City will need to partner with the Commonwealth and neighboring communities to further analyze the potential impacts to this area as a result of natural hazards. Furthermore, all future development in the DPA, including the proposed Natural Gas Compressor Station to be located in the Town of Weymouth, will need to adhere to the highest level of hazard mitigation standards. Since the Proposed Weymouth Natural Gas Compressor Station is not a water dependent use, the City of Quincy does not support the proposed location for the facility directly adjacent to the Fore River where it will be impacted by coastal storm events and related storm surge as well as other anticipated sea level rise impacts. An alternate location for the proposed natural gas compressor station away from the coast and population centers should be pursued.

4.2 COMMUNITY ASSET INVENTORY

FEMA defines a community asset as anything that is important to the character and function of a community. Community assets can be split up into four different categories: People, Economy, Built Environment, and Natural Environment. The People category includes populations that are more vulnerable to disaster (e.g., elderly, children, visiting populations), densely populated areas, and societal assets such as cultural and historical resources. Economy is included because economic drivers are a major part of disaster recovery. Community assets in the Economy category can include major employers, commercial centers, and locations providing food, medical supplies and building materials. The Built Environment is the largest category and includes existing structures, infrastructure (transportation and utilities) and critical facilities important for disaster response and evacuation (e.g., police, fire stations and medical facilities). The Natural Environment category is meant to capture any natural resources important to the community's character, economy (tourism, recreation, and the protection of clean air and water), and ecosystem services (e.g., wetlands providing flood storage, coastal areas providing erosion control as a first line of defense from coastal storms).

Table 4.3 summarizes the community asset categories included in FEMA guidelines, relevant critical sectors within each category, and the general characteristics that describe why these assets are important to include in a hazard mitigation plan.

Table 4.3
Community Asset Categories and Characteristics

FEMA COMMUNITY ASSET CATEGORIES	CRITICAL SECTORS	CHARACTERISTICS OF COMMUNITY ASSETS
People- Societal Assets	Schools, Vulnerable Populations, Cultural and Historical Facilities	Areas of greater population density, or population with unique vulnerabilities or less able to respond and recover during a disaster.
Built Environment- Infrastructural Assets	Critical Municipal Facilities, Water, Wastewater, Energy, Stormwater, Transportation	Critical facilities necessary for a community's response to and recovery from emergencies, infrastructure critical for public health and safety, economic viability, or for critical facilities to operate.
Economic Assets	Seaport, Business District, Food and Medical Supplies, Building Supplies	Major employers, primary economic sectors and commercial centers where loss or inoperability would have severe impact on the community and ability to recover from a disaster.
Environmental Assets	Natural Resources	Areas that provide protective function to reduce magnitude of hazard impact and increase resiliency. Areas of sensitive habitat that are vulnerable to hazard events, protection of areas that are important to community objectives, such as the protection of sensitive habitat, provide socio-economic benefits, etc.

Each Community Asset group was further subdivided into 35 subtypes (e.g. churches, schools, pharmacies) to provide a more comprehensive picture of resources. In total, 260 site-specific community assets were identified within the four FEMA categories. The most prevalent subtype identified was religious institutions, followed by medical facilities, and buildings that house special needs populations.

Map 4 shows the location of all selected community assets. **Section 5 Vulnerability Risk Assessment** provides a discussion on **natural hazards that may impact** the community assets and their vulnerability.

4.3 GEOGRAPHIC PLANNING AREAS FOR ASSET INVENTORY

Quincy is classified as a regional urban center due to its high population density, large proportion of multifamily housing, and its moderate and high-density neighborhoods that surround a historically significant downtown.

Natural resources, along with much industrial economic activity, contributed to the development of distinct residential patterns throughout the City that endure today in Quincy's unique neighborhoods, as described in the subsequent sections.

ASSET INVENTORY

Seven geographic planning areas were delineated for the Hazard Mitigation Plan. The areas were primarily based on watershed boundaries and then further refined to include coastal flooding patterns. The geographic areas serve as planning boundaries allowing areas to be compared and contrasted, improving visual resolution and laying the foundation for mapping for vulnerability and mitigation strategies. Each geographic planning area is described below including a summary of community assets for each area.



Photo 4.1: Rockland Street Bridge on Houghs Neck

Map 4
Multi-Hazard Community Assets

LEGEND

Community Assets

- Built Environment
- Economy
- People
- Affordable Housing
- Natural Resources
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies

LOCUS MAP



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NOTES

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2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

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Squantum Point/ Marina Bay

Squantum Point and Marina Bay are located on the Squantum Peninsula, bordered on the north and the west by Dorchester Bay. Marina Bay is a planned development area comprised primarily of residential multi-unit condo buildings and large housing development clusters. Some commercial businesses line the coast, including marinas, restaurants, and retail. Squantum Point, a former luxury summer resort area, is now populated year-round via the conversion of summer cottages to permanent homes after a causeway was built to allow vehicle access. This area includes medium-density residential, multifamily residences and some commercial activity. Salt marshes line the border between Squantum Point and Marina Bay, but unlike Marina Bay, the coastline of Squantum is primarily lined by beaches. This area is home to one fire station, three medical facilities, one church, one school and 11 natural resource areas. Notable features include Moon Island, the Squantum Marshes, Squantum Point Park, Squaw Rock Park, Squantum Yacht Club and Marina Bay Conservation Area. The Squantum Point/ Marina Bay Community Assets are shown on **Map 4A** and a detailed list is provided in **Table 4.4**.

Table 4.4
Community Asset Summary for Squantum Point/ Marina Bay Planning Area

Built Environments		
ID	Name	Subtype
69	Quincy Fire Dept - Engine 7	Fire Station
243	Brewster Ambulance	Medical Facility
244	Alliance Health Marina Bay	Medical Facility
245	Atria Marina Bay	Medical Facility
107	Sewer Pump Station	MWRA
242	Quincy Public School Bus Barn	Transportation

Economy		
ID	**Name**	**Subtype**
252	Fallon Ambulance	Employer
149	Squantum Yacht Club	Marine Rescue
152	Marina Bay	Marine Rescue
151	CVS	Pharmacy
262	Ayers Towing	Towing Service

ASSET INVENTORY

People		
ID	**Name**	**Subtype**
1	Jack N' Jill Child Care at Marina Bay	Child Care
4	Childs View Daycare	Child Care
116	First Church Squantum	Church
221	Quincy Crisis Center Inc	Food Pantry
52	Myles Standish Cairn	Historic
53	Moswetuset Hummock	Historic
59	Former Squantum Airfield Site	Historic
2	Squantum Elementary	School - Special Needs
15	Kennedy Center, Council on Aging	Special Needs

Natural Resources	
ID	**Name**
13	Dickinson Waterfront
14	Don Kent Park
29	Marina Bay Conservation Area
32	Moon Island
34	Neponset River Reservation
35	Nickerson Beach
38	Orchard Beach
43	Quincy Shore Drive
54	Squantum Marshes
55	Squantum Point Park
56	Squaw Rock Park

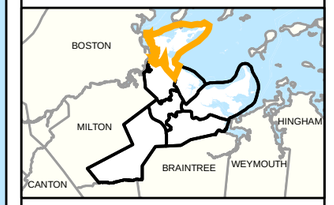
Map 4A
Squantum Point/ Marina Bay Community Assets

LEGEND

Community Assets

- Built Environment
- Economy
- People
- Affordable Housing
- Natural Resources
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies

LOCUS MAP



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NOTES

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Neponset River/ North Quincy

North Quincy and the Neponset River area are densely populated with an increasing number of multi-family homes along Newport Avenue and single-family residences along the northwest boundary of the city. Construction of single family homes began in the early 1900s and continued into the 1970s when the North Quincy Red Line subway station was constructed to service the residents and commuters to downtown Boston. Commercial activity has also expanded along Newport Ave, the Neponset River and Wollaston Beach. This area is home to two fire stations, two mortuaries, 11 churches, the Thomas Crane Public Library – Wollaston branch, seven schools and seven natural resource areas. Notable features include the North Quincy and Wollaston Train stations, the Neponset Bridge, Presidents Golf Course, Hobart Street Woods and Sherman Street Bog. The Neponset River/ North Quincy Community Assets are shown on **Map 4B** and a detailed list is provided in **Table 4.5.**

Table 4.5
Community Asset Summary for Neponset River/ North Quincy Planning Area

Built Environment		
ID	**Name**	**Subtype**
67	Quincy Fire Dept - Engine 2	Fire Station
68	Quincy Fire Dept - Engine 4	Fire Station
235	South Cove Health Center	Medical Facility
247	Manet Community Health Center - North Quincy	Medical Facility
61	Lydon Russell Funeral Home	Mortuary
66	Deware Funeral Home	Mortuary
111	Substation	MWRA
112	Substation	MWRA
115	Water Feed	MWRA
71	United States Post Office	Post Office
162	Neponset Bridge	Transportation
163	MBTA Bridge	Transportation
168	MBTA North Quincy Train Station	Transportation
169	MBTA Wollaston Train Station	Transportation

ASSET INVENTORY

Economy		
ID	**Name**	**Subtype**
249	Granite Telecommunications	Employer
263	State Street Bank and Trust Company	Financial Services
120	Stop & Shop	Food
228	New York Mart	Food
236	Big Y Supermarket	Food
237	Danny's Hardware	Hardware
121	Stop & Shop Pharmacy	Pharmacy
122	CVS	Pharmacy
238	Walgreens	Pharmacy

People		
ID	**Name**	**Subtype**
12	Fenno House	Assisted Living – Elder Care/Shelter
3	South Shore Day Care, Inc.-Quincy Pre-school	Child Care
9	Kids Connection Child Care	Child Care
10	Toddler Tech Preschool	Child Care
36	St. Chrysostom's Day Care	Child Care
117	Sacred Heart Church	Church
118	St Ann's Church	Church
222	Wollaston Lutheran Church	Church
229	Wollaston Methodist l	Church
231	Chinese Baptist Church	Church
232	Wollaston Evangelical	Church
233	First Baptist Church	Church
234	Wollaston Congregational	Church
241	Memorial Congregational	Church
246	Born Again Baptist	Church
248	Good Shepherd Lutheran Church	Church
239	North Quincy Community Center	Community Center
240	Boston Chinese Neighborhood Center	Community Center
230	Thomas Crane Public Library - Wollaston	Library

ASSET INVENTORY

People		
7	Francis W Parker Elementary	School
173	Sacred Heart Grammar School	School
5	Atlantic Middle School	School - Special Needs/Shelter
11	Montclair Elementary	School - Special Needs/Shelter
6	North Quincy High	School - Special Needs/Shelter
20	Wollaston Elementary School	School - Special Needs
23	Cornerstone Campus Preschool	Special Needs
64	Bright Horizons Children's Center	Special Needs
17	Twelve Step Education Program of New England, Inc.	Special Needs

Natural Resources	
ID	**Name**
20	Furnace Brook Golf Club
25	Hobart Street Woods
41	Presidents Golf Course
43	Quincy Shore Drive
50	Sherman Street Bog
58	Teel Field
12	Derubeis



Photo 4.2: South Cove Community Health Center

Map 4B
Neponset River
Community Assets

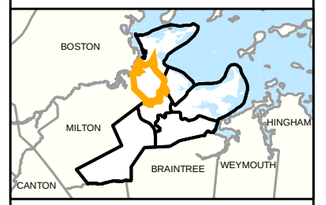
LEGEND

Community Assets

- Built Environment
- Economy
- People
- Affordable Housing

- Natural Resources
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies

LOCUS MAP



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W E
S

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NOTES

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Merrymount/ Blacks Creek

Merrymount and Blacks Creek are primarily residential, populated largely by single-family homes and bordered by Quincy Bay, Quincy Center and Adams Shore. This area was the initial site of Quincy's settlement and was home to a large Indian population until the Adams family acquired it and the area was subsequently developed in the early 1900s. The hilly terrain provides impressive vistas of surrounding bays and marshland making it a popular neighborhood for homebuyers. This area is home to three historic sites, the Dorothy Quincy Home, Josiah Quincy Home and Maypole Park, one school, two churches and eight natural resource areas. Notable features include the National Guard Armory, the Emergency Management Office, the Wollaston Yacht Club, Merrymount Park and Grossman Park. The Merrymount/Blacks Creek Community Assets are shown on **Map 4C** and a detailed list is provided in **Table 4.6.**

Table 4.6

Community Asset Summary for Merrymount Blacks Creek Planning Area

Built Environment		
ID	**Name**	**Subtype**
113	Telecom Switching Station	Communication Utilities
27	National Guard Armory	Federal Office
28	Emergency Management Office	Municipal
106	Sewer Pump Station	MWRA
60	United States Post Office - Wollaston	Post Office
170	MBTA Bus Barn	Transportation

Economy		
ID	**Name**	**Subtype**
150	Wollaston Yacht Club	Marine Rescue

People		
ID	**Name**	**Subtype**
119	Eastern Nazarene Church	Church
223	Union Congregational Church	Church
225	Willow Preschool	Day Care
184	Dorothy Quincy Home	Historic
224	Josiah Quincy House	Historic
55	Maypole Park	Historic
13	Beechwood Knoll Elementary	School
72	Eastern Nazarene College	Special Needs

Natural Resources	
ID	**Subtype**
10	Butlers Pond
14	Don Kent Park
15	Eastern Nazarene College Tennis Courts
21	Furnace Brook Parkway
24	Grossman Park - Blacks Creek
30	Merrymount Park
44	Quincy Shores Reservation
47	Sailors Home Pond



Photo 4.3: The Quincy Armory on Hancock Street

Map 4C
Merrymount/ Blacks Creek
Community Assets

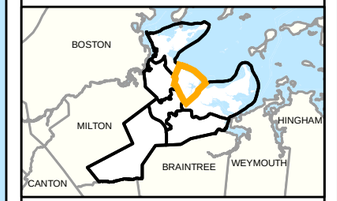
LEGEND

Community Assets

- Built Environment
- Economy
- People
- Affordable Housing

- Natural Resources
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies

LOCUS MAP



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NOTES

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Furnace Brook- North

The Furnace Brook North area borders Quincy center and the Milton town line. The neighborhoods adjacent to the city center have become home to more mixed-use development as the city has grown. Neighborhoods immediately adjacent to Furnace Brook and its wetlands, and residential open spaces, golf courses and playgrounds, are less densely populated and continue to decrease in density as you move towards the Blue Hill Reservation. This area is mostly populated by single and multi-family homes, with more apartment complexes and larger-scale developments closer to the Center. This area is home to one fire station, four medical facilities, two churches, four historic sites, two schools and two natural resource areas. Notable features include Adams National Historic Site, Adams National Peacefield, John Winthrop Blast Furnace, St. Mary's Church, Furnace Brook Golf Club and Furnace Brook Parkway. The Furnace Brook – North Community Assets are shown on **Map 4D** and a detailed list is provided in **Table 4.7.**

Table 4.7
Community Asset Summary for Furnace Brook -North Planning Area

Built Environment		
ID	**Name**	**Subtype**
86	Quincy Fire Dept - Engine 5	Fire Station
14	Gavin House	Medical Facility
48	Steward Health ER	Medical Facility
215	Compass Urgent Care Center	Medical Facility
62	Keohane Funeral Home	Mortuary
110	Substation	MWRA
114	Water Feed	MWRA

Economy		
ID	**Name**	**Subtype**
125	Home Depot	Hardware
216	Curry Hardware	Hardware
261	AAA Quincy	Insurance
123	Walgreens	Pharmacy
259	Blue Hills Towing	Towing Services
260	American Towing	Towing Services

ASSET INVENTORY

People		
ID	**Name**	**Subtype**
89	Jack N Jill Kindergarten & Child Care Center Inc	Child Care
124	St Mary's Church	Church
226	Restore Christian Church	Church
227	Campus Kinderhaus	Day Care
31	Adams National Historic Site	Historic
196	Adams National Park Peacefield	Historic
217	John Winthrop Blast Furnace	Historic
218	Hall Place Cemetery	Historic
198	Adams Montessori	School
22	Central Middle School	School
33	Charles A Bernazzani Elementary	School - Special Needs

Natural Resources	
ID	**Name**
20	Furnace Brook Golf Club
21	Furnace Brook Parkway

Map 4D
Furnace Brook North
Community Assets

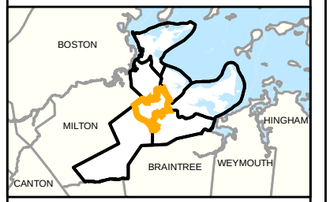
LEGEND

Community Assets

- Built Environment
- Economy
- People
- Affordable Housing

- Natural Resources
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies

LOCUS MAP



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NOTES

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Houghs Neck/Germantown

Houghs Neck and Germantown are located, respectively, along the eastern and southern shorelines of one of the first residential peninsulas established South of Boston. Houghs Neck is bordered by Hingham Bay to the east, Rock Island Cove to the south and Quincy Bay to the west and Germantown is bordered by the Town River Bay. This area is surrounded by numerous salt marshes, including a large swath of salt marsh where the two areas meet. Houghs Neck is now densely developed but was once deemed the "Flounder capital of the world" as the area used to be a popular recreational fishing spot for flounder and other fish such as haddock, striped bass, bluefish, and cod. However, fish stocks have been heavily impacted by a variety of human activities, including a loss of salt marsh habitat that provides important nursery and spawning areas. Germantown was settled as the home to shipbuilders and their families who were primarily of German heritage. The area includes Quincy Center, which has developed into the main retail center in Quincy and an area of increased mixed-use development as the City continues to grow. It is now home to several affordable housing complexes, with 900 units operated by the Quincy Housing Authority, in addition to numerous small-sized apartment buildings and single-family homes. This area is also home to the two fire stations, the Adams Shore and Thomas Crane Libraries, seven medical facilities including community health centers and nursing and rehab facilities, 12 churches, 11 schools and 27 natural resource areas including parks, beaches and salt marsh. Notable features located in this neighborhood also include the Naval Reserve Center, Department of Public Works, City Hall and Nut Island Transfer Station. The Houghs Neck/Germantown Community Assets are shown on **Map 4E** and a detailed list is provided in **Table 4.8.**

Table 4.8
Community Asset Summary for Houghs Neck/ Germantown Planning Area

Built Environment		
ID	**Name**	**Subtype**
21	Quincy Youth Arena	Cold Storage -Emergency Mortuary
26	Naval Reserve Center	Federal office
193	Congressman Lynch Quincy Office	Federal Office
16	Quincy Fire Dept - Engine 6	Fire Station
39	Quincy Fire Dept - Engine 8	Fire Station
32	Merrymount Manor Nursing Home	Medical Facility
47	Quincy Rehab & Nursing Center	Medical Facility
174	Manet Community Health Center -Houghs Neck	Medical Facility
183	Manet Community Health Center - Snug Harbor	Medical Facility
186	Harvard Vanguard Medical Associates	Medical Facility
202	South Cove Manor Nursing	Medical Facility
37	Wickens & Troupe	Mortuary

ASSET INVENTORY

Built Environment		
79	Sweeney Funeral Home	Mortuary
29	Department of Public Works	Municipal
99	Quincy City Hall	Municipal
100	Quincy City Hall Annex	Municipal
44	Quincy Public Schools Administration/ Planning and IT	Municipal
103	Nut Island Transfer Station	MWRA
104	Sewer Pump Station	MWRA
105	Sewer Pump Station	MWRA
108	Substation	MWRA
109	Substation	MWRA
35	Quincy Police Dept.	Police Station
54	Navy Security/police	Police Station
46	United States Post Office	Post Office
164	Algonquin Gas Pipeline	Power Utilities
140	Sprague Energy	Power Utilities
144	Quincy Oil/Sprague Energy	Power Utilities

Economy		
ID	**Name**	**Subtype**
141	Twin Rivers Tech.	Employer
266	Stop & Shop	Food
253	Quincy Mutual Fire Insurance	Insurance
139	Bay Point Marina	Marine Rescue
143	Town River Yacht Club	Marine Rescue
148	Quincy Yacht Club	Marine Rescue
145	CVS	Pharmacy

People		
ID	**Name**	**Subtype**
102	Riverbay Club	Assisted Living - Elder Housing
160	Mount Wollaston Cemetery	Cemetery
42	YMCA South Shore Child Care Program	Child Care
49	Salvation Army Sunshine Preschool	Child Care

ASSET INVENTORY

People		
41	United First Parish Church	Church
175	Houghs Neck Congregational	Church
176	Most Blessed Sacrament	Church
177	Seventh Day Adventist	Church
180	Our Lady of Good Counsel	Church
185	The River Church	Church
187	Bethany Congregational	Church
189	First Congregational Society	Church
211	Central Baptist Church	Church
187	Quincy Point Congregational Church	Church
195	Life Community Church	Church
41	Massachusetts Budhi Siksa	Church
182	Germantown Neighborhood Center	Community Center
200	Fore River Clubhouse	Community Center
199	Child's View Daycare	Day Care
195	Interfaith Social	Food Pantry
194	Quincy Historic Society	Historic
179	Adams Shore Library	Library
188	Thomas Crane Public Library Main Branch	Library
18	Atherton Hough Elementary	School
19	Merrymount Elementary	School - Special Needs/Shelter
24	Broad Meadows Middle	School - Special Needs/Shelter
25	New Concept Christian Day School	School - Special Needs
30	Woodward School for Girls	School - Special Needs
34	Snug Harbor Elementary School	School - Special Needs
40	Quincy High School	School - Special Needs
75	Point Webster Middle	School - Special Needs
76	Quincy Community Action Program Head Start	School - Special Needs/Shelter
101	Quincy College	School - Special Needs
181	Father Bills Place Homeless Shelter	Shelter
38	Snug Harbor Court	Special Needs
43	O'Brien Towers	Special Needs
45	Town Brook House	Special Needs
73	Pagnano Towers	Special Needs

ASSET INVENTORY

Natural Resources	
ID	**Name**
1	Allerton Playground
2	Arthur Boyson Park
3	Avalon Beach
4	Back Beach
5	Baker Beach Playground and Salt Marsh
6	Bayswater Boatyard
8	Boston Harbor Islands State Park
9	Broad Meadows/Broadmeadows School
16	Edgewater Drive Beach
17	Faxon Field/Faxon Park
18	Fire Station Beach
22	General Palmer Park
26	Joseph Street Salt Marsh
27	LaBrecque Field

Natural Resources	
ID	**Name**
28	Manet Lake
31	Monroe Playground
33	Mound Street Beach
36	Norton Road Beach
37	Nut Island
39	Perry Beach
40	Post Island Beach
44	Quincy Shores Reservation
45	Rhoda Beach
46	Rock Island Cove Marsh
53	Spring Street Salt Marsh
57	Taffrail Road Playground
59	Town Brook Flood Control



Photo 4.4: Quincy Youth Hockey Arena Houghs Neck

Map 4E
Houghs Neck/ Germantown Community Assets

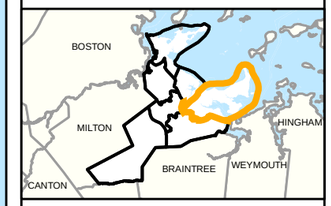
LEGEND

Community Assets

- Built Environment
- Economy
- People
- Affordable Housing

- Natural Resources
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies

LOCUS MAP



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NOTES

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Furnace Brook - South

The Furnace Brook - South area borders the Milton, Braintree and Randolph town lines and is home to little development and extensive areas of open space, namely the Blue Hills Reservation, a 6,000-acre state park, 2,400 acres of which are located in the City of Quincy and the Furnace Brook – South area. Blue Hills Reservation is home to wooded uplands, shrub swamps and meadows and provides valuable habitats for endangered or threatened species. This area also provides a multitude of open space and recreational opportunities in a predominantly urban environment. Notable features include the Pine Hill Cemetery, Granite Rail Incline, Furnace Brook Parkway and Granite Links Golf Course. The Furnace Brook – South Community Assets are shown on **Map 4F** and a detailed list is provided in **Table 4.9.**

Table 4.9
Community Asset Summary for Furnace Brook - South Planning Area

Built Environment		
ID	**Name**	**Subtype**
156	Shea Memorial Skate Rink	Cold Storage-Mortuary
127	Dirico Cell Tower	Communication Utilities
126	Verizon Microwave Cell Tower	Communication Utilities
96	Federal Communications Commission	Federal Office
166	Mass Water Dam	MWRA
157	Mass Water Reservoir	MWRA
153	Stand Pipe Ricciuti Drive	MWRA
154	Woodcliff Road Stand Pipe	MWRA
165	Algonquin Gas Pipeline	Power Utilities
220	HOV Lane	Transportation

Economy		
ID	**Name**	**Subtype**
264	National Fire Protection	Insurance

People		
ID	**Name**	**Subtype**
161	Pine Hill Cemetery	Cemetery
219	Granite Rail Incline	Historic

ASSET INVENTORY

Natural Resources	
ID	**Name**
7	Blue Hills Reservation
11	Cunningham Park
21	Furnace Brook Parkway
23	Granite Links Golf Course



Photo 4.5: Granite Rail Incline Historic Location

Map 4F
Furnace Brook South
Community Assets

MILTON

BRAINTREE

RANDOLPH

Furnace Brook

Town Brook

Adams Street
Wallace Road
Sherman Street
Robertson Street
Shirley Street
Campbell Street
Cliff Street
White Street
Connell Street
Arlick Road
Furnace Brook Parkway
Millis Drive
Joan Drive
Puritan Drive
Greenwold Road
Dewson Road
Adams Street
Colonial Drive
Hancock Street
Honorable Thomas S Burgin Parkway
Monroe Road
Dimmock Street
Euclid Avenue
Glendale Road
Bedford Street
Whitwell Street
Cranch Street
Dowell Avenue
Presidents Lane
Hillcrest Road
Hillcrest Terrace
Hillcrest Circle

South Quincy/Fore River

South Quincy and the Fore River area are home to a mix of industrial, commercial and large residential complexes. The Fore River area became a shipbuilding center beginning in the 1880s and was home to the second-largest shipbuilding crane in the world, used in the construction of hundreds of ships for both military and civilian clients. The Fore River Shipyard is still designated as a maritime industrial working port of regional significance, protected as part of the Weymouth (Fore River) Designated Port Area. This area is home to a variety of industrial activities including major employers in Quincy, such as Twin River Technologies, Fallon Ambulance, Arbella Insurance and the Stop and Shop Headquarters. This area is home to two fire stations, four medical facilities, two mortuaries, eight churches, eight historic sites, four assisted living elder homes, three schools and two natural resource areas. Notable features include Fore River Ship Yard, Adams Birthplaces and Hancock Cemetery. The South Quincy/Fore River Community Assets are shown on **MA 4G** and a detailed list is provided in **Table 4.10.**

Table 4.10
Community Asset Summary for South Quincy/Fore River Planning Area

Built Environment		
ID	**Name**	**Subtype**
74	Army Recruiting Station	Federal Office
78	Quincy Fire Dept - Engine 3	Fire Station
83	Quincy Fire Dept.	Fire Station
94	Quincy Mental Health Ctr	Medical Facility
95	John Adams Continuing Care Center	Medical Facility
209	Atrium At Faxon Woods	Medical Facility
213	Crown Colony Medical	Medical Facility/Shelter
91	Bolea Funeral Home	Mortuary
92	Bros. Funeral Home	Mortuary
137	MWRA Sludge Plant	MWRA
142	Sithe Energy in Weymouth	Power Utilities
138	Fore River Bridge	Transportation
147	Ship Yard Pier	Transportation
155	HOV Command Center	Transportation
158	MBTA Parking Garage and station	Transportation
171	MBTA Station and Garage	Transportation

ASSET INVENTORY

Economy		
ID	**Name**	**Subtype**
135	Walmart	Dry Goods
136	Walgreens	Dry Goods
146	Ship Yard	Dry Goods
192	Stop& Shop Headquarters	Employer
210	Fallon Ambulance	Employer
214	Arbella Insurance	Employer
250	Twin Rivers Technologies	Employer
258	Boston Financial Data	Financial Services
128	Star Market	Food
133	Kam Man Foods	Food
134	Roche Brothers	Food
206	Good Fortune Market	Food
159	Home Depot	Hardware
212	Lowes Home Improvement	Hardware
254	Reggie's Oil Services	Oil Services
257	Scott-Williams Inc	Oil Services
265	Burke Oil	Oil Services
129	Brooks Pharmacy	Pharmacy
256	Schlager's Automobile	Towing Services
255	Bogan Tree	Tree Removal Service

People		
ID	**Name**	**Subtype**
77	1000 Southern Artery Complex	Elder Housing
81	Senior Citizen's Housing	Assisted Living - Elder Housing
82	Senior Citizens Housing	Assisted Living - Elder Housing
84	Louis George Village	Assisted Living - Elder Housing
87	Drohan Apartments	Elder Housing
50	Community Care for Kids	Child Care
93	Amelio Della Chiesa Early Childhood Center	Child Care
167	Fort Square Presbyterian Day Care	Child Care

ASSET INVENTORY

People		
130	St Johns Church	Church
131	Salem Lutheran Church	Church
132	Fort Square Presbyterian Church	Church
197	High Rock Church	Church
205	Islamic Center of New England	Church
207	Ithna Asheri-Muslims Association	Church
211	Dhammakaya Meditation	Church
251	Way Of Hope Pentecostal	Church
178	QCAP Emergency Food Pantry	Food Pantry
51	Abigail Adams Cairn	Historic
56	Liberty Tree Park	Historic
57	Christ Church Burial Ground	Historic
58	U.S.S. Salem/U.S. Shipbuilding Museum	Historic
63	Granite Trust Company Building	Historic
65	Adams Office Building	Historic
191	Hancock Cemetery	Historic
208	Adams Birthplaces	Historic
70	Sterling Middle School	School
85	Clifford H Marshall Elem	School
88	Lincoln-Hancock Elementary School	School
90	Reay E Sterling Middle	Special Needs
80	Granite Place	Special Needs
97	Bright Horizon's Children's Center	Special Needs

Natural Resources	
ID	**Name**
17	Faxon Field/Faxon Park
59	Town Brook Flood Control



Photo 4.7: Fore River Ship Yard

Map 4G
South Quincy/ Fore River
Community Assets

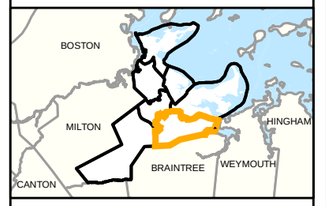
LEGEND

Community Assets

- Built Environment
- Economy
- People
- Affordable Housing

- Natural Resources
- Inland Wetlands
- Coastal Wetlands
- 100 Year Flood Zone
- Waterbodies

LOCUS MAP



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NOTES

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Town River Bay

Weymouth Fore River

Town Brook

BRAINTREE

SECTION 5

VULNERABILITY ASSESSMENT

A vulnerability assessment is a methodology to estimate the extent or magnitude of potential damages from natural hazards of varying types and intensities. For the Quincy Multi-Hazard Mitigation Plan, a variety of methodologies were used to evaluate hazards. Section 5 ties together the hazard profiles and asset inventories to estimate the potential losses that Quincy could experience from a natural hazard event. The results highlight the most significant risk and overall vulnerabilities of the community, which are subsequently used to develop the mitigation strategy.

Section 5 Vulnerability Assessment

5.1 VULNERABILITY ASSESSMENT OVERVIEW

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The purpose of the vulnerability assessment is to estimate the extent or magnitude of potential damages from natural hazards of varying types and intensities. Section 5 ties together the hazards identified in Section 3 and the community assets identified in Section 4 to estimate the potential losses that Quincy could experience during a natural hazard event. There are four assessments included in **Section 5** of the 2019 Quincy Hazard Mitigation Plan:

5. **HAZUS-Multi Hazards (MH) Assessment:** Hazus is a standardized hazard assessment methodology created by FEMA. This vulnerability assessment includes estimation of damages for hurricanes and earthquakes using HAZUS-MH software and is described in **Section 5.2**.

6. **Exposure Assessment of Parcels and Building Flood Risk**: This assessment was completed using GIS analysis for existing flooding and future flooding due to climate change for the entire City, based on geographical areas, referred to as "planning areas" (see **Section 3.2** for more detail), assessor's data, current FEMA FIRMs and data from the 2017 NOAA Sea level Rise Viewer. This assessment is described in **Section 5.3.1**.

7. **Vulnerability Assessment for Future Development:** This assessment was completed for areas slated for future development, identifying natural hazard risk from hurricanes, earthquakes, and flooding, and is further described in **Section 5.3.2.**

8. **Vulnerability of Community Assets**: This assessment was completed to determine whether critical facilities and other identified community assets could be exposed to flooding, surge, sea level rise and coastal erosion. The assessment looks at existing flood conditions based on approved FEMA FIRMS with 2017 and 2018 map revisions and future flood conditions due to climate change from sea level rise and storm surge for time periods 2030 and 2070 based on NOAA and modeling data from the Resilient Quincy Report and the Boston Harbor Model. This assessment is described in **Section 5.4**.

5.2 HAZUS-MH FOR HURRICANES AND EARTHQUAKES

Methodology

HAZUS-MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. For the purposes of this Plan, HAZUS-MH was used to estimate losses due to hurricane winds and earthquakes.

The following overview of HAZUS-MH is taken from the FEMA website:

"Hazus is a nationally applicable standardized methodology that estimates potential losses from earthquakes, hurricane winds, and floods. FEMA developed Hazus under contract with the National Institute of Building Sciences (NIBS).

Hazus uses state-of-the-art GIS software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of earthquakes, hurricane winds, and floods on populations.

Estimating losses is essential to decision-making at all levels of government, providing a basis for developing mitigation plans and policies, emergency preparedness and response, and recovery planning." [93]

There are three modules included with the HAZUS-MH Version 4.2 software: hurricane wind, flooding, and earthquakes, that reflects 2010 Census Data. There are also three levels at which HAZUS-MH can be run. Level 1 uses national baseline data and is the quickest way to begin the risk assessment process. The analysis in this Plan was completed using Level 1 data.

Level 1 relies upon default data on building types, utilities, transportation, etc. from national databases as well as census data. While the databases include a wealth of information on the community, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is "subject to a great deal of uncertainty."

However, for the purposes of this Plan, the analysis is useful. This Plan is attempting to only generally indicate the possible extent of damages due to certain types of natural disasters and to allow for a comparison between different types of disasters. Therefore, this analysis should be considered a starting point for understanding potential damages from the hazards.

Results - Hurricanes

For the purposes of this Plan, a Category 2 and a Category 4 storm were chosen to illustrate damages. The reason is to present more of a "worst case scenario" that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms. **Table 5.1** below presents estimated damages from hurricanes.

[93] For more information on the HAZUS-MH software, go to https://www.fema.gov/hazus.

Table 5.1
Estimated Damages from Hurricanes

	Category 2 (Carol peak gust 100)	Category 4 (Donna peak gust 152mph)
Building Characteristics		
Estimated total number of buildings	23,806	23,806
Estimated total building replacement value (Year 2010 $) (Millions of Dollars)	$12,418	$12,418
Building Damages		
# of buildings sustaining minor damage	928	2,541
# of buildings sustaining moderate damage	124	591
# of buildings sustaining severe damage	5	22
# of buildings destroyed	0	5
Population Needs		
# of households displaced	100	326
# of people seeking short-term public shelter	26	76
Debris		
Building debris generated (tons)	8,042	18,738
Tree debris generated (tons)	5,079	8,514
Value of Damages (Thousands of dollars)		
Total economic losses from property damage	**$79,985**	$181,432

*No Category 4 or 5 hurricanes have been recorded in New England. However, a Category 4 hurricane was included to help the community understand the impacts of a hurricane beyond what has historically occurred in New England.

Results - Earthquakes

The HAZUS earthquake module allows users to define a number of different types of earthquakes and to input a number of different parameters. The module is more useful where there is a great deal of data available on earthquakes. In New England, defining the parameters of a potential earthquake is much more difficult because there is little historical data. The earthquake module does offer the user the opportunity to select a number of historical earthquakes that occurred in Massachusetts. For the purposes of this Plan, two earthquakes were selected: an earthquake with a 5.1 magnitude and 10 fault depth and a 5.8 with 10 fault depth. **Table 5.2** below presents estimated damages from earthquakes.

Table 5.2
Estimated Damages from Earthquakes

	Magnitude 5.1	Magnitude 5.8
Building Characteristics		
Estimated total number of buildings	23,806	23,806
Estimated total building replacement value (Year 2010 $)(Millions of dollars)	$12,418	$12,418
Building Damages		
# of buildings with no damage	23,586	22,804
# of buildings sustaining slight damage	175	785
# of buildings sustaining moderate damage	40	191
# of buildings sustaining extensive damage	4	25
# of buildings completely damaged	0	2
Population Needs		
# of households displaced	10	59
# of people seeking short-term public shelter	5	30
Debris		
Debris generated (tons)	3,000	12,000
Value of Damages (Millions of dollars)		
Total property economic loss	**$5.98**	$37.00

5.3 EXPOSURE ASSESSMENT OF PARCEL AND BUILDING FLOOD RISK

An exposure assessment was used to estimate losses due to flooding. An exposure assessment is a geospatial evaluation where geographic areas and hazards are mapped together to show the physical relationship to one another. The geospatial relationship can also be used to quantify the number and value of parcels and structures within the hazard area to estimate losses. For flooding, a GIS-based exposure analysis was used to identify potential losses of developed properties that fall within Quincy's 100-year flood zones and areas that may become impacted in the next 25-30 years due to sea level rise, as defined in **Section 3.2.1**.

The analysis for current conditions was based on Quincy 2017 Assessor's data and the FEMA approved flood insurance rate maps (FIRMs) with 2017 and 2018 map revisions. Future flooding with climate change was evaluated using NOAA sea level rise data[94] for 1, 2 and 4 feet of sea level rise (relative to sea level in 2000), as an approximation of near-, mid -and long-term vulnerability likely to occur based on sea level rise alone and not considering any other storm surge impacts. This flooding scenario would be likely to occur daily at high tide.

To compare the results of the exposure assessment for different areas of the city, Quincy was split up into seven different geographic planning areas (see **Map 1.1**). The planning areas were determined by evaluating

94 https://coast.noaa.gov/digitalcoast/tools/slr.html

subwatershed areas, the FEMA 100-year flood zone, additional areas of local flooding identified by the City, (see **Table 3.5**), and locations of FEMA repetitive loss claims (**Map 3.2**). The seven planning area boundaries were then defined using roadways or parcel lines to capture flood sources. It is important to note that the boundaries are not strictly hydrologic or watershed-based but allow the City to compare areas affected by flooding from geographically similar sources.

The FEMA 100 -year flood zone was split into coastal and inland flood areas. The demarcation between the inland and the coastal zone was determined by utilizing the area of coastal inundation from the Quincy Coastal Climate Change Model (Boston Harbor Flood Model[95]). The most landward extent of the model was used as the boundary between coastal and inland flood areas for the purpose of this assessment.

The influence of the many tide gates, sea walls, seawall drain check valves, and other flood control structures such as the Blacks Creek tide gate and Town Brook deep rock tunnel currently in place were not evaluated in this planning level vulnerability assessment. If these structures were to fail, significant portions of the City would be impacted by flooding. Optimizing the design, operations and management of these flood control structures is a top priority for the City. Plans are underway to develop an integrated hydrologic model that will better account for the current and future extent of these potential impacts and the plans are described in **Section 7 Mitigation Strategies**.

Repetitive and Severe Repetitive Loss properties are an excellent indicator of exiting of flood risk. These locations are shown on **Map3.2A-D** and locations by planning area are summarized in **Table 5.3.**

Table 5.3

Repetitive and Severe Repetitive Loss Properties by Planning Area

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Planning Area	Repetitive Loss Properties	Severe Repetitive Loss Properties
Furnace Brook North	39	2
Furnace Brook South	2	1
Houghs Neck/ Germantown	101	7
Merrymount/ Blacks Creek	5	0
Neponset River	4	0
South Quincy/ Fore River	7	0
Squantum Point	16	0

The existing inundation analysis is presented in this **Section 5.3.1**, and the analysis for future flooding with climate change is presented in **Section 5.3.2**. The methodology for the analysis is presented below.

[95] MassDOT-FHWA, Pilot Project Report: Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options for the Central Artery, June 2015

5.3.1 EXISTING FLOOD VULNERABILITY ASSESSMENT METHODOLOGY

Assessor's data (2017) was extracted for developed parcels including fields for land use type, building and parcel value. Only developed parcels were included in the flooding analysis. It was assumed that unimproved parcels did not have the same risk of flooding as a developed parcel. The parcels were sorted based on the seven geographic areas. Attributes were then added to the data base to determine which developed parcels fell the 100-year FEMA flood zones for coastal (AE and VE) and inland (AE and AO) floodplain area, and the building values.

Parcel data were aggregated for each of the seven geographic planning areas, based on land use for the following categories: Developed Residential (including multi-family or mixed-use where residential was the predominant use), Developed Commercial/ Industrial (including mixed use where commercial use was predominant), and Municipal/Government/Non-Profit. The data presented in **Table 5.4** Inland Flood Hazard Areas and **Table 5.5** Coastal Flood Hazard Areas were handled in the following way:

To calculate the percentage of parcels in each hazard area, the number of parcels impacted by a selected flood zone was divided by the total number of developed parcels in that geographic area. The central point of the parcel determined which zone it fell in, not the actual building location.

Results

Out of a total of 19,603 developed parcels in Quincy about 20% (4,100) are located in the FEMA 100-year flood plain. 13% (2630) are in coastal floodplain areas and the remaining 7% (1456) are in inland floodplain areas.

Based on the building value of the developed property, estimated potential losses for inland and coastal flood areas are tabulated in **Tables 5.4 and 5.5** by geographic planning areas.

Inland flood areas are present in all of the planning areas, but most prevalent in Furnace Brook North. **Table 5.4** shows that 17% of developed parcels in the Furnace Brook North planning area (418 parcels out of a total of 2445) are within a riverine flood area.

7% of Quincy's developed parcels are located within inland or riverine 100-year flood hazard areas. This includes 1295 residential parcels, 120 commercial/industrial and 41 governments/non-profits parcels with a building value of $746,358 million dollars.

Coastal flood hazard areas are located in five of the seven planning areas. **Table 5.5** shows that the highest percent of impacted parcels are in the Merrymount/Black's Creek (66% of developed parcels), Hough's Neck/Germantown (29% of developed parcels) and Squantum Pont/ Marina Bay (26%) planning areas.

13% of Quincy's developed parcels are located within coastal 100-year flood hazard areas. In total, 2537 residential parcels, 74 commercial and 19 government/non-profits parcels are in the coastal flood hazard area with a total building value of over $1 billion dollars.

Table 5.4
Flooding Vulnerability within 1% Annual Chance Flood Zone Inland Areas - Building Values

Geographic Planning Area	Land Use	Number of Parcels			Value in Flood Hazard Area
		Number in Planning Area	Number in Flood Hazard Area	Percent in Flood Hazard Area	
Furnace Brook North	Residential	2312	394	17%	$105,474,900
	Com/Ind	115	19	17%	$15,011,600
	Gov't/Non-Profit	18	5	28%	$9,523,700
Furnace Brook South	Residential	877	40	5%	$8,290,000
	Com/Ind	18	0	-	$0
	Gov't/Non-Profit	4	1	25%	$1,547,500
Houghs Neck/Germantown	Residential	4062	223	5%	$54,089,200
	Com/Ind	191	14	7%	$8,253,600
	Gov't/Non-Profit	84	17	20%	$71,222,400
Merrymount/Blacks Creek	Residential	1796	77	4%	$23,434,400
	Com/Ind	26	0	-	$0
	Gov't/Non-Profit	27	3	11%	$4,591,900
Neponset River	Residential	3862	190	5%	$44,580,200
	Com/Ind	182	28	15%-	$89,124,500
	Gov't/Non-Profit	41	6	15%	$36,476,200
South Quincy/Fore River	Residential	3247	227	7%	$73,090,900
	Com/Ind	320	55	17%	$66,831,970
	Gov't/Non-Profit	50	7	14%	$47,582,800
Squantum Point/Marina Bay	Residential	2335	144	6%	$64,252,600
	Com/Ind	24	4	17%	$11,567,500
	Gov't/Non-Profit	12	2	17%	$11,412,500
TOTALS		**19603**	**1456**	**7%**	**$746,358,370**

Table 5.5

Flooding Vulnerability within 1% Annual Chance Flood Zone for Coastal Areas - Building Values

Geographic Planning Area	Land Use	Parcels			Building Value in Flood Hazard Area
		Number. in Planning Area	Number in Flood Hazard Area	Percent in Flood Hazard Area	
Furnace Brook North	Residential	2312	0	--	$0
	Com/Ind	115	0	--	$0
	Gov't/Non-Profit	18	0	--	$0
Furnace Brook South	Residential	877	0	--	$0
	Com/Ind	18	0	--	$0
	Gov't/Non-Profit	4	0	--	$0
Houghs Neck/Germantown	Residential	4062	1196	29%	$306,688,400
	Com/Ind	191	40	21%	$32,383,200
	Gov't/Non-Profit	84	11	13%	$99,776,900
Merrymount/Blacks Creek	Residential	1796	625	35%	$131,389,400
	Com/Ind	26	8	31%	$1,624,300
	Gov't/Non-Profit	27	13	48%	$47,888,100
Neponset River	Residential	3862	122	3%	$95,509,000
	Com/Ind	182	10	5%	$114,044,000
	Gov't/Non-Profit	41	1	2%	$34,835,500
South Quincy/Fore River	Residential	3247	0	--	$0
	Com/Ind	320	1	0.3%	$3,575,400
	Gov't/Non-Profit	50	1	2%	$12,972,100
Squantum Point/Marina Bay	Residential	2335	594	25%	$180,593,400
	Com/Ind	24	15	63%	$39,859,200
	Gov't/Non-Profit	12	6	50%	$5,858,100
TOTALS		**19603**	**2630**	**13%**	**$1,106,997,000**

5.3.2 FUTURE FLOOD INUNDATION AREAS

The potential for City-wide flooding due to sea level rise was evaluated using a GIS-based exposure analysis similar to the existing flood analysis described in **Section 5.3.1**. The future flood vulnerability assessment was only completed for developed parcels located in coastal flood zones based on the assumption that these parcels were most likely to be impacted by future seal level rise (SLR). SLR vulnerability for these parcels were evaluated using data provided by NOAA's Sea Level Rise Viewer.[96] NOAA Sea Level Rise maps define the inland extent and relative depth of inundation from 0 to 6 feet above mean higher high water (MHHW) due to sea level rise. The NOAA values for 1, 2 and 4 feet of sea level rise were chosen as mapping attributes to develop the future flood scenario. The 1 and 2-foot SLR values were chosen to align with the level of sea level rise that fall within the likely or 66% probability of occurrence range for the time periods 2030-2070 for Boston Harbor[97]. The recommendations for SLR projections are discussed in more detail in **Section 3.3.1** (see also **Table 3.6**). **Map 5.1** shows an example of the areas of inundation using the NOAA SLR values above MHHW in the Houghs Neck/ Germantown planning area, compared with FEMA 100-year Flood Zone and no sea level rise. It is important to note that MHHW is the average of highest daily tides, and therefore this sea level rise scenario shows areas that are expected to be inundated daily. 4 feet of SLR was included in the analysis to visualize a long term (2100) potentially worst case SLR scenario. As stated in **Section 3**, the uncertainty regarding projections approaching 2100 becomes so high that they can be considered unreliable.

It is also important to note that the NOAA data in the maps do not consider natural processes such as erosion, subsidence, or future construction. Inundation is shown as it would appear during MHHW—the average of the higher high-water height of each tidal day observed over the National Tidal Datum Epoch {~19 years} (excludes wind driven tides). The data, maps, and information provided should be used only as a screening-level tool. A more detailed analysis of each area is required to determine whether they flood given the chosen sea level rise (SLR) value.

Climate Change Flood Vulnerability Results

The estimated losses for locations that are impacted by SLR are tabulated in **Table 5.6** below.

Flooding within the 1, 2, and 4-foot flood zone includes areas of the City in almost all of the hazard areas except for Furnace Brook North and South, which include only inland flooding. Flooding impacts solely due to sea level rise impact 6% of all developed parcels in Quincy. This includes a total of 1,083 developed parcels that may be impacted by either 1, 2 or 4 feet of sea level rise according to the NOAA data. 187 parcels are impacted based on 1 foot of sea level rise and an additional 138 parcels are impacted with a 2-foot rise. Based on the NOAA SLR data an additional 758 parcels have a potential to be impacted with a 4-foot rise in sea level.

[96] https://coast.noaa.gov/digitalcoast/tools/slr.html
[97] EEA, Statewide and Major Basins Climate Projections Final 12.21.2017,tide

Table 5.6

Coastal Properties that may be impacted by SLR

Geographic Planning Area	Land Use	Number in Planning Area	Parcels in Coastal Flood Hazard Area subject to SLR			Percent in Flood Hazard Area
			1 Ft* SLR	2 Ft** SLR	4 Ft*** SLR	
Furnace Brook North	Residential	2312	0	0	0	0
	Com/Ind	115	0	0	0	0
	Gov't/Non-Profit	18	0	0	0	0
Furnace Brook South	Residential	877	0	0	0	0
	Com/Ind	18	0	0	0	0
	Gov't/Non-Profit	4	0	0	0	0
Houghs Neck/Germantown	Residential	4062	57	55	377	12%
	Com/Ind	191	2	0	12	7%
	Gov't/Non-Profit	84	0	1	5	7%
Merrymount/Blacks Creek	Residential	1796	114	76	152	19%
	Com/Ind	26	1	3	2	23%
	Gov't/Non-Profit	27	3	2	6	41%
Neponset River	Residential	3862	0	0	2	0%
	Com/Ind	182	1	0	2	2%
	Gov't/Non-Profit	41	0	0	0	0%
South Quincy/Fore River	Residential	3247	0	0	0	0%
	Com/Ind	320	0	0	1	0%
	Gov't/Non-Profit	50	0	0	0	0%
Squantum Point/Marina Bay	Residential	2335	7	0	196	9%
	Com/Ind	24	2	0	2	17%
	Gov't/Non-Profit	12	0	1	1	17%
Totals		19603	187	138	758	6%

*1-foot of SLR is included to approximate 2030 SLR conditions for planning purposes

**2-feet of SLR is included to approximate 2050-2070 SLR conditions for planning purposes

*** 4-feet of SLR is included as a worst cases scenario for 2100 planning purposes.

5.4 FUTURE DEVELOPMENT IN HAZARD AREAS

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The City of Quincy has identified parcels where development has been proposed, is underway or is expected to occur in the future. **Table 5.7** shows the relationship of these parcel to three of the mapped hazards. This information is provided so that planners can ensure that development proposals meet all floodplain zoning and that careful attention is paid to drainage issues.

Table 5.7

Natural Hazard Risk in Areas Slated for Future Development within 10 years

Area of Future Development	Earthquakes	Hurricanes	Flood Zone
56 Albertina Street	Yes	Yes	No
97 Atlantic Street	Yes	Yes	No
23 Bailey Street	Yes	Yes	No
18 Bates Avenue	Yes	Yes	No
Chestnut Place	Yes	Yes	No
57R & 65 Cleverly Court	Yes	Yes	No
60 Cleverly Court	Yes	Yes	No
74 Crescent Street	Yes	Yes	Yes
Crown Colony (Marriot Drive)	Yes	Yes	No
1 Edwin Street	Yes	Yes	No
52 Grafton Street	Yes	Yes	No
151 Granite Street/7 Parker St	Yes	Yes	No
133-135 Hancock Street	Yes	Yes	No
1500 Hancock Street	Yes	Yes	No
Highpoint Circle	Yes	Yes	No
Holliston Street/Forest Avenue	Yes	Yes	No
12R & 29 Hoover Ave	Yes	Yes	No
104-106 Intervale Ave	Yes	Yes	No
Marina Bay Residential Development (260 Victoria Road)	Yes	Yes	No
31-39 Newbury Street	Yes	Yes	Yes
60 Newbury Street	Yes	Yes	Yes
North Quincy T Station	Yes	Yes	Yes
118 Old Colony Avenue	Yes	Yes	No
29 Packards Lane	Yes	Yes	No
Quincy Adams T Station	Yes	Yes	Yes
Quincy Center Redevelopment Project	Yes	Yes	No
Quincy Medical Center	Yes	Yes	No
Quincy Shipyard	Yes	Yes	Yes

Area of Future Development	Earthquakes	Hurricanes	Flood Zone
57 Quincy Shore Drive	Yes	Yes	Yes
Squantum Elementary School	Yes	Yes	No
131 Sumner Street	Yes	Yes	No
225 West Squantum Street	Yes	Yes	No
R264 West Street	Yes	Yes	No
37-45 Wren Terrace	Yes	Yes	No
Wollaston T Station	Yes	Yes	No

5.5 IMPACTS TO COMMUNITY ASSETS

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Methodology

Two hundred and sixty community assets were identified by Quincy in **Section 4**. The assets were selected due to their importance to the character and function of the City of Quincy. Community assets include critical facilities or infrastructure, centers of economic importance, locations that serve vulnerable populations, area of unique cultural value or natural areas that provide a hazard mitigation-based ecological function. A vulnerability assessment for community assets was completed including both current flood impacts as well as future risk of flooding due to climate change.

Similar to the method used for parcel-based flood vulnerability, the assessment for community assets is based on whether the parcel was within the modeled area.

Present and Historic Risk

The first step in the analysis was to evaluate current and historic flood risk based on FEMA FIRM map locations. Out of the 260 assets, 55 were identified within the 100-year flood zone, 33 were in the coastal zone and 22 in inland flood zones. The specific flood zone and base flood elevation was determined for each of the 55 community assets and are included in **Tables 5.8** and **5.10.** An additional 17 community assets included in **Table 5.9** were outside of the FEMA 100-year flood zone, but within an area identified by the City with "historic and locally identified areas of flooding" (see **Table 3.5** and **Map 3.1** for more discussion).

Base flood elevations range from 10 to 49 feet NAVD88 for inland flood zones, and from 10 to 20 feet NAVD88 for coastal flood zones. Two assets located in the coastal flood zone were also included in locally identified areas of flooding (the two locations are noted below **Table 5.10**).

Table 5.8

Present and Future Flood Risk for Inland Community Assets

Planning Area	Community Asset #	Community Asset	Present and Historic Flood Risk		Future Flood Risk	
			FEMA 100-year Floodplain[1]		FEMA Base Flood Elevation plus 2 ft (NAVD88)	Other Flood Area*
			AE	Based Flood Elevation (NAVD 88)		
3	10	Toddler Tech Preschool	X-Inland	10	12	4
3	120	Stop & Shop	X-Inland	10	12	
3	121	Stop & Shop Pharmacy	X-Inland	10	12	
3	168	MBTA North Quincy Train Station	X-Inland	10	12	
3	240	Boston Chinese Neighborhood Center	X-Inland	10	12	
3	246	Born Again Baptist	X-Inland	10	12	19
3	249	Granite Telecommunications	X-Inland	10	12	
5	33	Charles A Bernazzani Elementary	X-Inland	34	36	5
5	110	Substation	X-Inland	49	51	5
5	123	Walgreens	X-Inland	38	40	5
5	215	Compass Urgent Care Center	X-Inland	49	51	5
5	217	John Winthrop Blast Furnace	X-Inland	44	46	5
5	260	American Towing	X-Inland	37	39	5
6	25	New Concept Christian Day School	X-Inland	12	14	
6	43	O'Brien Towers	X-Inland	12	14	
6	47	Quincy Rehab & Nursing Center	X-Inland	15	17	1
8	128	Star Market	X-Inland	28	30	
8	129	Brooks Pharmacy	X-Inland	28	30	
8	159	Home Depot	X-Inland	33	35	20
8	210	Fallon Ambulance	X-Inland	29	31	
8	211	Dhammakaya Meditation	X-Inland	29	31	
8	212	Lowes Home Improvement	X-Inland	33	35	

***Identified Area of Localized Flooding**

1 - Bigelow Street, Miller Stile Road

4 - Farrington Street, Hobart Street, Arlington Street, North Central Avenue

5 - Furnace Brook

19 - Newport Ave Extension: Sagamore Creek Tide Gate

20 - Town Brook Flood System

Table 5.9
Community Assets outside of FEMA Flood Areas but within Locally Identified Flood Areas

Community Asset #	Community Asset	Planning Area	Local Flood Area *
17	Twelve Step Education Program Of Ne, Inc.	Neponset River	4
68	Quincy Fire Dept - Engine 4	Neponset River	4
86	Quincy Fire Dept - Engine 5	Furnace Brook North	5
89	Jack N Jill Kindergarten & Child Care Ctr Inc	Furnace Brook North	5
114	Water Feed	Furnace Brook North	5
124	St Mary's Church	Furnace Brook North	5
218	Hall Place Cemetery	Furnace Brook North	5
261	AAA Quincy	Furnace Brook North	5
19	Merrymount Elementary	Houghs Neck/ Germantown	17
49	Salvation Army Sunshine Preschool	Houghs Neck/ Germantown	1
54	Navy Security/police	Houghs Neck/ Germantown	1
109	Substation	Houghs Neck/ Germantown	13
87	Drohan Apartments	South Quincy/ Fore River	5
92	Sweeney Bros. Home For Funerals	South Quincy/ Fore River	8
95	John Adams Continuing Care Center	South Quincy/ Fore River	12
158	MBTA Parking Garage and station	South Quincy/ Fore River	20
255	Bogan Tree	South Quincy/ Fore River	8

* Identified Area of Localized Flooding
1 - Bigelow Street, Miller Stile Road
4 - Farrington Street, Hobart Street, Arlington Street, North Central Avenue
5 - Furnace Brook
8 - Goddard Street/Independence Avenue
12 - Penns Hill/Faxon Park
13 - Post Island Road
17 - Shore Avenue/ Chickatabot Rd.
20 - Town Brook Flood System

Future Risk

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To estimate future risk due to climate change, two methods were used. For community assets located in inland flood areas, the method was limited to expanding the base flood elevation by two feet as a very general approximation of future flooding impacts. A discussion on the increase rainfall and flooding impacts due to climate change is included in **Section 3.4**.

For community assets located in coastal flood areas, the vulnerability assessment included two sources to provide a range of estimated flood depths and probability of occurrence from both NOAA SLR viewer and the Boston Harbor Model (BHM) 98. The ranges used are consistent with recommendations made in **Section 3** Risk Assessment and the Massachusetts Statewide and Major Basins Climate Projections for Boston Harbor99.

For estimates of SLR, applicable NOAA SLR values (i.e. 1-foot, 2-feet, and 4-feet) were be added to **Table 5.10**, to get an idea of daily flooding that might occur due to only sea level rise.

More detailed flood depth analysis was obtained using the Boston Harbor Model (BHM) flood inundation extent modeled for 2030 to represent future conditions. This assessment is based on the 1% annual chance of flooding likely to occur by the year 2030. The areas mapped by the BHM for 2030 are fairly consistent with the FEMA 100-year probability. **Map 5.2** is included to show the relationship of the 2030 BHM values with FEMA 100-year Flood Zone. Community Assets in the BHM inundation area were noted in the analysis including average flood depth of the parcel. The BHM2030 flood depth was calculated based the average flood depth within the parcel boundary of the Community Asset. This information is for planning purposes only. No determination of elevation of the building first floor relative to the flood water level were included.

For several of the community assets, a previous vulnerability assessment was included in the Resilient Quincy Report. This assessment includes a range of flood depth from 2030-2070 and are included in **Table 5.10** as a comparison on the variability of the use of the model data.

Vulnerability Assessment Disclaimers

1. The information in this plan related to potential extent of current inundation and future inundation due to climate change is based on publicly available data (see Bibliography) and is subject to change as new data become available.
2. The following disclaimers are included in this section to clarify the limitations of the Quincy Hazard Mitigation Vulnerability Assessment.
3. Information is being provided only to help understand extent of possible current and future risk, and not for the purposes of construction regulations, flood insurance, or other insurance requirements.

98 MassDOT-FHWA, Pilot Project Report: Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options for the Central Artery, June 2015
99 EEA, Statewide and Major Basins Climate Projections Final 12.21.2017,

4. Coastal flooding projections for the years ahead, including sea level rise, continue to evolve and become updated as more data are collected and evaluated. These observations, newer guidelines and recent journal research papers may not be reflected in current government policy guidance due to the lag in adopting best available science. Projections for flood levels in the future will need to be revised in the next 5-year update of this plan.
5. The information and maps included in this plan are for planning purpose only, they are not adequate for legal boundary definition, regulatory interpretation, design, actual hazard assessment, or parcel level analysis.
6. Additional site-specific study is necessary for design, permitting, or construction of mitigation measures.
7. The presentation of the material in this Plan does not imply the expression of any opinion whatsoever on the part of the City of Quincy or Tighe & Bond concerning the accuracy of information or extent of the potential inundation area.

Table 5.10

Present and Future Flood Risk for Coastal Community Assets

Planning Area	Community Asset #	Community Asset	Present and Historic Flood Risk				Future Flood Risk						Resilient Quincy Plan [4]
			FEMA 100-year Floodplain [1]				2030 Boston Harbor Model Inundation [2]	Potential Future Flooding (NOAA) [3]			FEMA Base Flood Elevation plus 2 ft (NAVD88)	Other Flood Area- See Table for Code	
			AO	AE	VE	Based Flood Elevation (NAVD 88)	Average Flood Depth (ft above LS)	1 ft	2 ft	4 ft			2030-2070 Flood Depth (ft above LS)
2	4	Child's View Day Care		X		12	0.0				14		
2	15	Quincy Health Dept & Council on Aging		X		11	2.4			X	13		
2	59	Former Squantum Airfield Site		X		11	3.1				13		
2	107	Sewer Pump Station		X		12	1.7			X	14		
2	151	CVS		X		11	0.5				13	29	
2	242	QPS Bus Barn		X		11	2.4		X		13		
2	243	Fallon Ambulance		X		10	0.1				12		0-1.3
2	252	Boston Scientific		X		11	5.4				13		
2	262	Ayers Towing		X		11	2.3			X	13		
2	149	Squantum Yacht Club			X	16	8.6*	X			18		0.9-3.7
2	152	Marina Bay			X	15	19.8**	X			17		
3	162	Neponset Bridge		X		12	NA	X			14		
3	163	MBTA Bridge		X		12	NA	X			14		
4	13	Beechwood Knoll Elementary		X		11	3.9				13		
4	119	Eastern Nazarene Church		X		11	0.8			X	13		
4	150	Wollaston Yacht Club			X	16	8.5*	X			18		.2-3 ft
6	24	Broad Meadows Middle		X		12	2.3				14		
6	39	Quincy Fire Dept - Engine 8		X		12	0.5				14		
6	40	Quincy High School		X		11	0.8				13		
6	42	YMCA South Shore Child Care Program		X		11	0.5				13		
6	104	Sewer Pump Station		X		14	0.1				16		.2-3 ft
6	105	Sewer Pump Station		X		12	2.8			X	14	13	
6	108	Substation		X		12	3.2				14		
6	140	Sprague Energy		X		13	2.5	X			15		2.1-4.8 ft
6	141	Twin Rivers Tech.		X		16	2.5				18		
6	143	Town River Yacht Club		X		14	2.4		X		16		
6	139	Bay Point Marina			X	14	0.9		X		16		0.9-3.6
6	144	Quincy Oil / Sprague Energy	X			depth 2 feet	1.7			X	NA		
6	148	Quincy Yacht Club			X	20	5.4	X			22		
8	58	U.S.S. Salem/U.S. Shipbuilding Museum			X	14	2.4	X			16		
8	137	MWRA Sludge Plant			X	14	4.7				16		0-2.8
8	138	Fore River Bridge			X	16	NA	X			18		
8	147	Ship Yard Pier			X	14	5.7	X			16		

Notes:

1) https://msc.fema.gov/

2) MassDOT-FHWA, Pilot Project Report: Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options for the Central Artery, June 2015

3) https://coast.noaa.gov/digitalcoast/tools/slr.htm

4) MAPC October, 2017 Resilient Quincy Plan, Draft Report

*Measured at pier

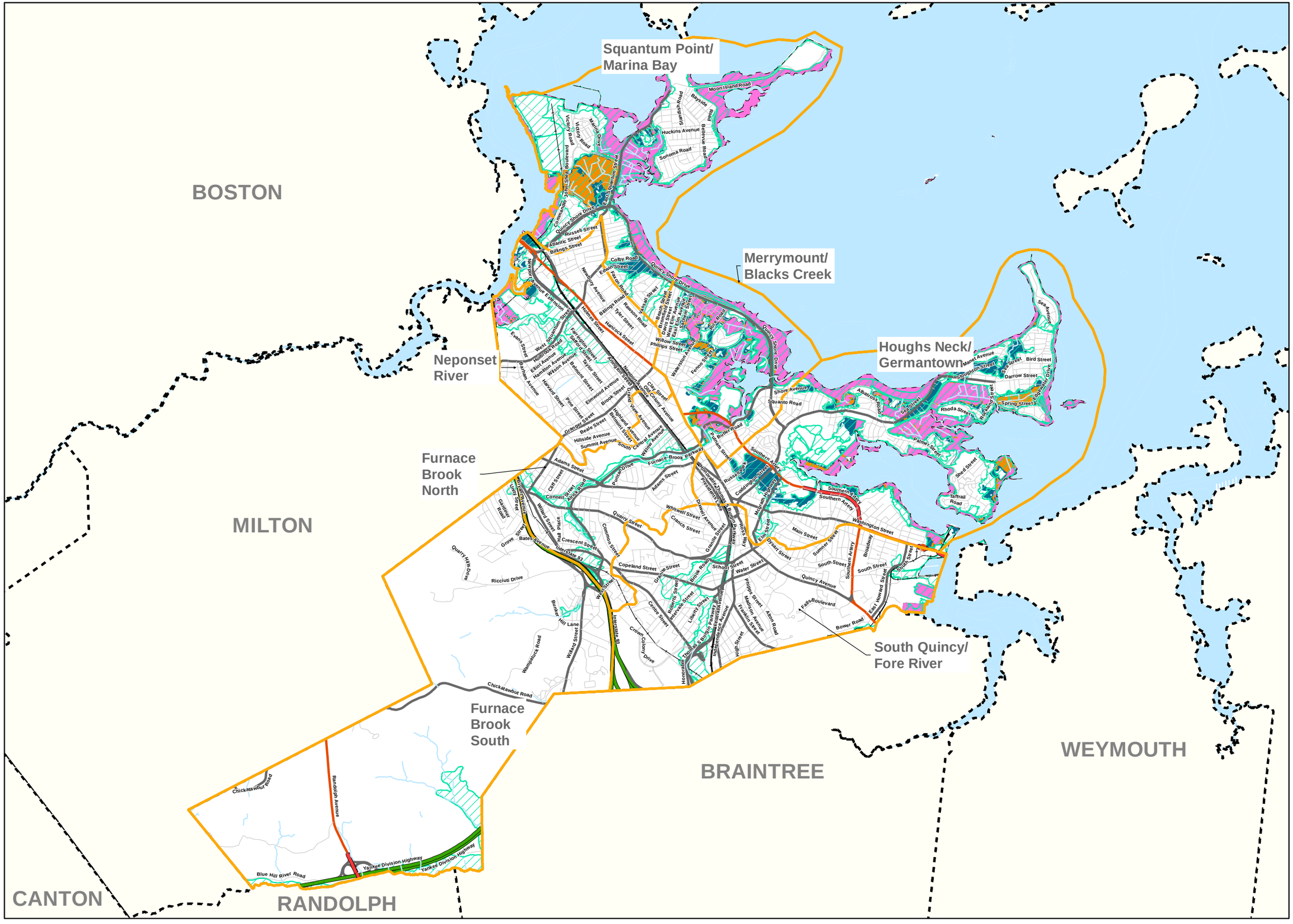
**Parcel includes waterfront

The following Community Assets were also Identified as being within Local Flood Areas:

CA#151 in LFA 29- East Squantum Street

CA#105 in LFA 13- Post Island Road

Map 5.1 FEMA Flood Zones and NOAA Sea Level Rise



LEGEND

- 100 Year Flood Zone
- Planning Areas
- NOAA SLR - 1ft
- NOAA SLR - 2ft
- NOAA SLR - 4ft
- Waterbodies
- Town Boundary
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N
W E
S

0 2,000 4,000
Feet

1:48,000

NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

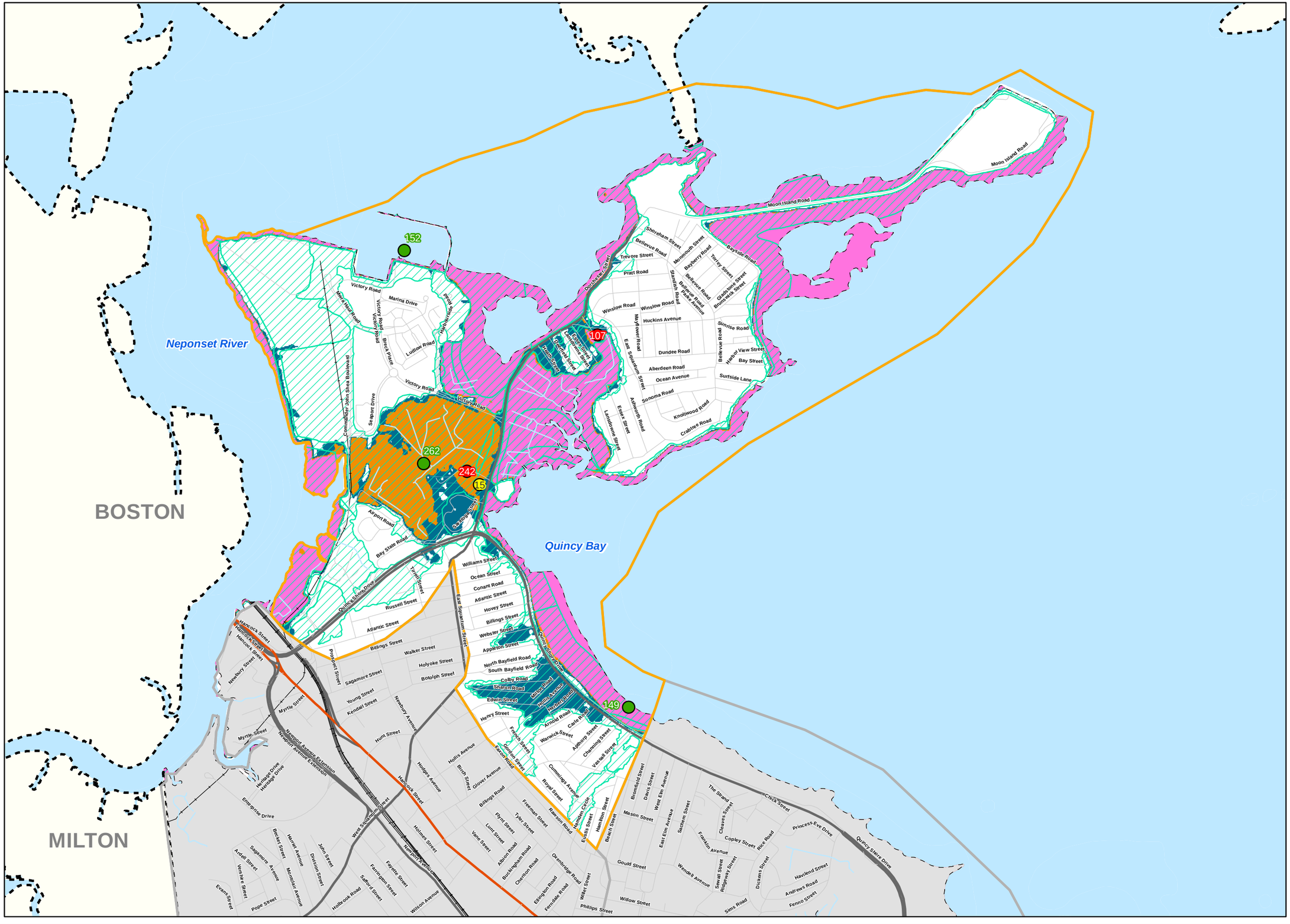
Tighe&Bond
Engineers | Environmental Specialists

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Q-0019

Map 5.1A FEMA Flood Zones and NOAA Sea Level Rise

Squantum Point/ Marina Bay

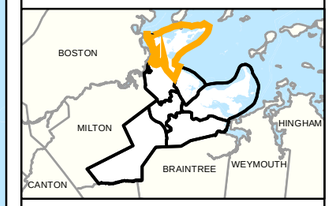


LEGEND

Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas
- NOAA SLR - 1ft
- NOAA SLR - 2ft
- NOAA SLR - 4ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N W E S

0 750 1,500

Feet

1:18,000

NOTES

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Quincy, Massachusetts

September 2018

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Map 5.1B FEMA Flood Zones and NOAA Sea Level Rise

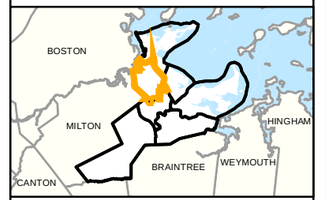
Neponset River

LEGEND

Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas
- NOAA SLR - 1ft
- NOAA SLR - 2ft
- NOAA SLR - 4ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N W E S

0 625 1,250

Feet

1:15,000

NOTES

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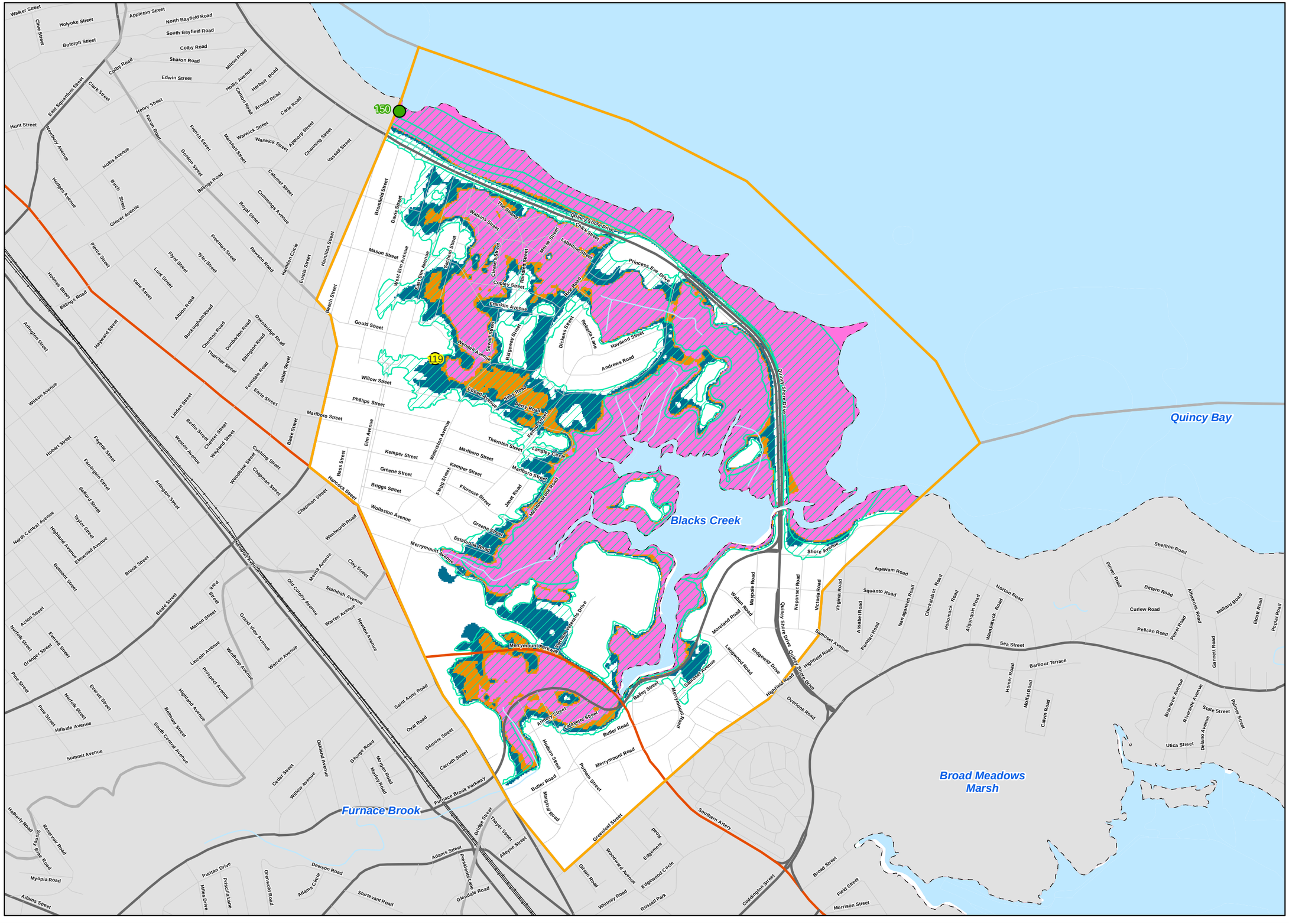
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Map 5.1C FEMA Flood Zones and NOAA Sea Level Rise

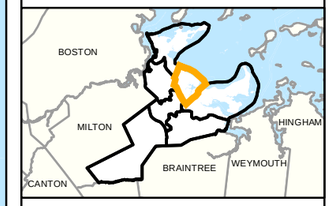
Merrymount/ Blacks Creek

LEGEND

Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas
- NOAA SLR - 1ft
- NOAA SLR - 2ft
- NOAA SLR - 4ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N W E S

0 500 1,000

Feet

1:12,000

NOTES

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Map 5.1D FEMA Flood Zones and NOAA Sea Level Rise

Furnace Brook North

MILTON

Furnace Brook

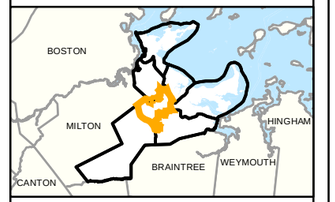
Furnace Brook

LEGEND

Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas
- NOAA SLR - 1ft
- NOAA SLR - 2ft
- NOAA SLR - 4ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N W E S

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Feet

1:12,000

NOTES

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Quincy, Massachusetts

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Map 5.1E FEMA Flood Zones and NOAA Sea Level Rise

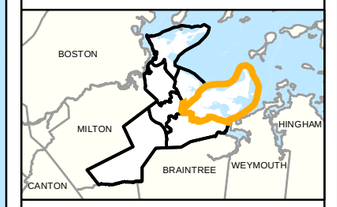
Houghs Neck/ Germantown

LEGEND

Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas
- NOAA SLR - 1ft
- NOAA SLR - 2ft
- NOAA SLR - 4ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N W E S

0 750 1,500

Feet

1:18,000

NOTES

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Quincy, Massachusetts

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Quincy Bay

Blacks Creek

Furnace Brook

Broad Meadows Marsh

Rock Island Cove

Town River Bay

Weymouth Fore River

WEYMOUTH

148 105 144 143 139 140

Map 5.1F FEMA Flood Zones and NOAA Sea Level Rise

Furnace Brook South

MILTON

BRAINTREE

RANDOLPH

Furnace Brook

Town Brook

Chickatawbut Road

Randolph Avenue

Yankee Division Highway

Blue Hill River Road

Quarry Hills Drive

Ricciuti Drive

Laurel Hill Lane

West Street

Wesson Avenue

Ames Street

Willard Street

Batterymarch Park

Purgatory Road

Furnace Brook Parkway

Adams Street

Wallace Road

Dewson Road

Hancock Street

Honorable Thomas S Burgin Parkway

Hilltop Street

Jenness Street

Churchill Road

Colonial Drive

Quarry Street

Curtis Street

Whitwell Street

Cranch Street

Bedford Street

Crescent Street

Copeland Street

Suomi Road

Parker Street

Granite Street

School Street

Arthur Street

Garfield Street

Town Hill Street

Water Street

Brook Road

Pleasant Street

Furnace Brook Rotary

Lyons Street

Station Street

Lincoln Heights Apartments

Bartlett Street

Nightingale Avenue

Brooks Avenue

Gilbert Street

Roberts Street

Granite Street

Kent Street

Bucksey Street

Smith Street

Miller Street

Bates Avenue

Mullin Avenue

Forest Avenue

Malvesti Way

Wren Terrace

Grove Street

Emerald Street

Grudley Street

Shawmut Street

Gardiner Road

Governors Road

Plymouth Avenue

Upton Street

Unity Street

Bryant Avenue

Willard Street

Hall Place

Harris Street

Common Street

Filbert Street

Cross Street

Joyce Road

Arlick Road

Connell Street

White Street

Cliff Street

Campbell Street

Shirley Street

Robertson Street

Stedman Street

Miles Drive

Joan Drive

Putnam Drive

Greenwood Road

Adams Street

Colonial Drive

Monroe Road

Dimmock Street

Euclid Avenue

Glendale Road

Dixwell Avenue

Presidents Lane

Honorable Thomas S Burgin Parkway

Penn Street

Quincy Street

Brook Road

Pleasant Street

Federal Avenue

Crown Colony Drive

Congress Street

Merrill Drive

Rodman Street

Trafford Street

Liberty Street

Columbia Street

Albertina Street

Branch Street

Centre Street

Chickatawbut Road

Randolph Avenue

Yankee Division Highway

Blue Hill River Road

BOSTON

MILTON

HINGHAM

BRAINTREE

WEYMOUTH

CANTON

N

W

E

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Feet

1:24,000

LEGEND

Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas
- NOAA SLR - 1ft
- NOAA SLR - 2ft
- NOAA SLR - 4ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP

NOTES

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2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

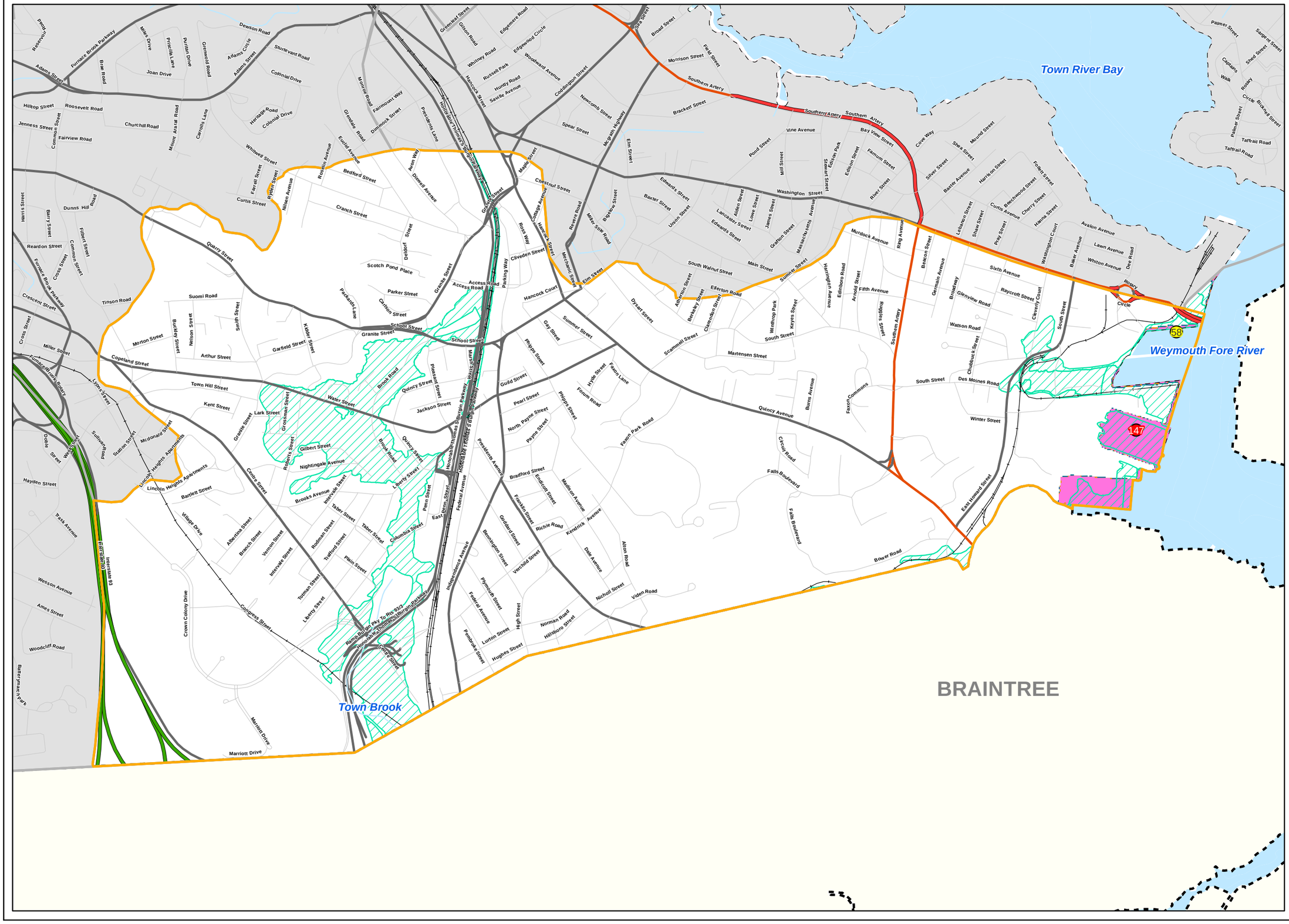
September 2018

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Map 5.1G FEMA Flood Zones and NOAA Sea Level Rise

South Quincy/ Fore River


Town River Bay
Weymouth Fore River
Town Brook
BRAINTREE
Southern Artery
Quincy Avenue
Washington Street
Granite Street
Hancock Street
Main Street
Summer Street
Elm Street
Quarry Street
Copeland Street
Morton Street
Granite Street
School Street
Parker Street
Access Road
Suomi Road
Tinson Road
Miller Street
Town Hill Street
Kent Street
Water Street
Lark Street
Jackson Street
Quincy Street
Brook Road
Pleasant Street
Arthur Street
Garfield Street
Kidder Street
Nelson Street
Smith Street
Buckley Street
Crescent Street
Reardon Street
Dunns Hill Road
Harris Street
Barry Street
Common Street
Cross Street
Filbert Street
Furnace Brook Parkway
Cranch Street
Curtis Street
Fairfield Street
Ryden Street
Nilsen Avenue
Roslindale Avenue
Euclid Avenue
Bedford Street
Dewell Avenue
Avon Way
Delbert Street
Scotch Pond Place
Packards Lane
Carlson Street
Clivedon Street
Parking Way
Rose Way
Michaels Street
Miller Stile Road
Revere Road
Baxter Street
Union Street
Edwards Street
Lancaster Street
Aldon Street
Love Street
James Street
Grafton Street
Massachusetts Avenue
Bigelow Street
Chestnut Street
College Avenue
Maple Street
Whitwell Street
Fairview Road
Churchill Road
Jenness Street
Hilltop Street
Roosevelt Road
Common Street
Mount Ararat Road
Carrolls Lane
Heritage Road
Colonial Drive
Glendale Road
Dimmock Street
Fairmount Way
Monroe Road
Presidents Lane
Hancock Street
Whitney Road
Russell Park
Hunty Road
Saville Avenue
Woodward Avenue
Edgewood Circle
Edgemere Road
Gilson Road
Greenleaf Street
Codennton Street
Newcomb Street
Spear Street
McGrath Highway
Elm Street
Pond Street
Hill Street
Stewart Street
Edison Street
Famum Street
River Street
Bay View Street
Cove Way
Vine Avenue
Bracket Street
Broad Street
Sea Street
Field Street
Morrison Street
Southern Artery
Silver Street
Shea Street
Mound Street
Baxter Avenue
Harris on Street
Curtis Avenue
Beechwood Street
Cherry Street
Foffet Street
Hanna Street
Washington Court
Prey Street
Lebanon Street
Shaw Street
Avalon Avenue
Lawn Avenue
Whiton Avenue
Dee Road
Baker Avenue
Rotary
Circle
Sixth Avenue
Raycroft Street
Clevedy Court
South Street
Glenview Road
Broadway
Germain Avenue
Beacon Street
Murdock Avenue
Rwg Avenue
Fifth Avenue
Watson Road
Des Moines Road
Chubbuck Street
Winter Street
Palmer Street
Sargent Street
Shed Street
Captains Walk
Rotary
Circle
Bicknell Street
Palmer Street
Taffrail Road
Taffrail Road
Harrington Avenue
Edinboro Road
Arnold Street
Ellerton Road
Ashton Street
Berkeley Street
Clarendon Street
Dyer Street
Winthrop Park
Keyes Street
Hughes Street
Southern Artery
Martensen Street
Scannell Street
Faxon Commons
Burns Avenue
Faxon Park Road
Cecil Road
Falls Boulevard
East Howard Street
Bower Road
Viden Road
Nichol Street
Allen Road
Dale Avenue
Kendrick Avenue
Richie Road
Franklin Street
Endicott Street
Madison Avenue
Bradford Street
Oakland Street
Vrechild Street
Bennington Street
Plymouth Street
Federal Avenue
Pembroke Street
Lurton Street
Hughes Street
High Street
Norman Road
Hillsboro Street
Independence Avenue
Federal Avenue
East Jerem. Street
Penn Street
Columbia Street
Taber Street
Trafford Street
Rodman Street
Plain Street
Intervale Street
Vernon Street
Branch Street
Allerims Street
Village Drive
Bartlett Street
Lincoln Heights Apartments
Centre Street
Brooks Avenue
Intervale Street
Liberty Street
Nightingale Avenue
Gilbert Street
Roberts Street
Grossman Street
Granite Street
Lark Street
Water Street
Quincy Street
Brook Road
Pleasant Street
Jackson Street
Guild Street
Pearl Street
North Payne Street
Payne Street
Phipps Street
Forum Road
Hyde Street
Fawn Lane
Gay Street
Summer Street
Phipps Street
Martin Street
Dyer Street
Scotch Pond Place
Packards Lane
Carlson Street
Granite Street
School Street
Parker Street
Access Road
Granite Street
Parking Way
Clivedon Street
Hancock Court
Michaels Street
Elm Street
Summer Street
Main Street
South Walnut Street
Ellerton Road
Ashton Street
Berkeley Street
Clarendon Street
Winthrop Park
Keyes Street
South Street
Martensen Street
Quincy Avenue
Burns Avenue
Faxon Commons

Map 5.2 FEMA Flood Zones and 2030 Boston Harbor Model

BOSTON

MILTON

CANTON

RANDOLPH

BRAINTREE

WEYMOUTH

Squantum Point/
Marina Bay

Merrymount/
Blacks Creek

Houghs Neck/
Germantown

South Quincy/
Fore River

Furnace
Brook
North

Furnace
Brook
South

Neponset
River

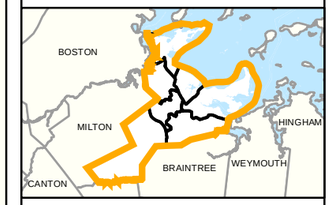
LEGEND

- 100 Year Flood Zone
- Planning Areas
- Waterbodies
- Town Boundary

2030_BH-FRM Flood Depth 1%

- 1ft or Less
- 1 - 2 ft
- 2 - 3 ft
- 3 - 4 ft
- 4 - 5 ft
- 5 - 6 ft
- 6 - 7 ft
- 7 - 8 ft
- 8 - 9 ft
- 9 - 10 ft
- 10 - 20 ft
- More than 20 ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N
W E
S

0 2,000 4,000
Feet

1:48,000

NOTES

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2018 Multi-Hazard Mitigation Plan

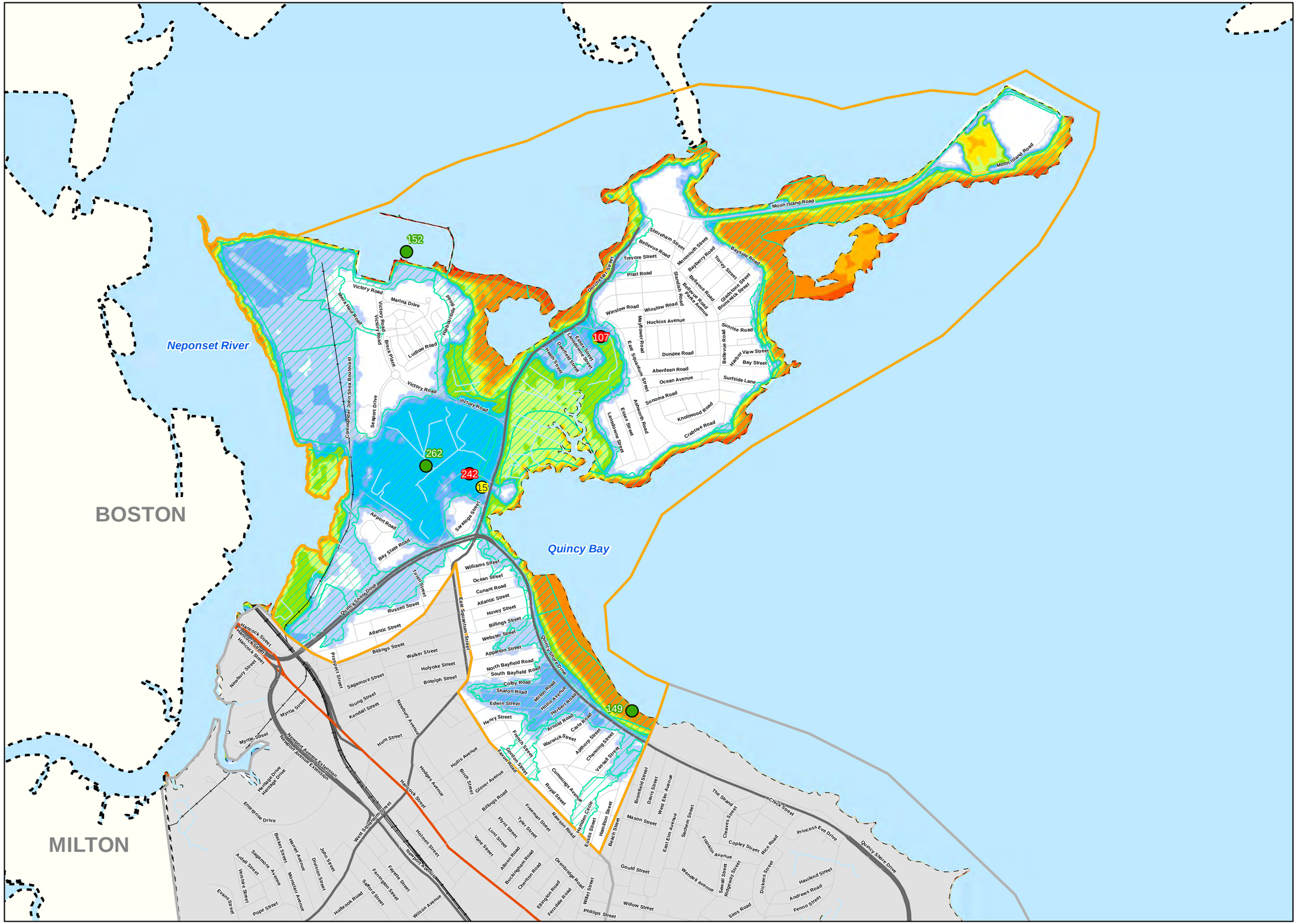
Quincy, Massachusetts

September 2018

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Map 5.2A FEMA Flood Zones and 2030 Boston Harbor Model

Squantum Point/ Marina Bay


Neponset River
Quincy Bay
BOSTON
MILTON
152
262
242
15
107
149
Victory Road
Marina Drive
Pleasure Point Road
Merrit Hall Road
Ludlow Road
Birch Place
Commander John Shea Boulevard
Seaport Drive
Airport Road
Bay State Road
Seabaga Street
Quincy Shore Drive
Moon Island Road
Bayside Road
Shoreham Street
Bellevue Road
Monmouth Street
Bayberry Road
Torrey Street
Trevore Street
Pratt Road
Dorchester Street
Standish Road
Bellevue Road Extension
Glastonbury Street
Bunnstick Street
Winslow Road
Huckins Avenue
Mayflower Road
Sunrise Road
Dundee Road
Aberdeen Road
Ocean Avenue
Sonoma Road
Surfside Lane
Harbor View Street
Bay Street
Bellevue Road
East Squantum Street
Ashworth Road
Knollwood Road
Crabtree Road
Edge Street
Lansdowne Street
Essex Street
Lawrence Street
Dorchester Street
Hallett Street
Williams Street
Ocean Street
Conant Road
Atlantic Street
Hovey Street
Billings Street
Webster Street
Appleton Street
North Bayfield Road
South Bayfield Road
Colby Road
Sharon Road
Edwin Street
Henry Street
Milton Road
Hollis Avenue
Herbert Road
Arnold Road
Carle Road
Warwick Street
Apthorp Street
Channing Street
Vassall Street
French Street
Carlton Street
Saxon Road
Cummings Avenue
Royal Street
Billings Road
Glover Avenue
Birch Street
Hollis Avenue
Hancock Street
Holmes Street
Newport Avenue
West Squantum Street
Hodges Avenue
Heritage Drive
Enterprise Drive
Newport Avenue Extension
Myrtle Street
Newbury Street
Hancock Street
Prospect Street
Sagamore Street
Young Street
Kendall Street
Hunt Street
Neponset Avenue
Walker Street
Holyoke Street
Botolph Street
Billings Street
Atlantic Street
Russell Street
Tirrell Street
Quincy Shore Drive

Map 5.2B FEMA Flood Zones and 2030 Boston Harbor Model

Neponset River

BOSTON

MILTON

Quincy Bay

Blacks Creek

Furnace Brook

LEGEND

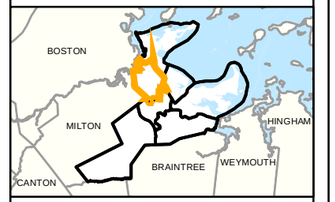
Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas

2030_BH-FRM Flood Depth 1%

- 1ft or Less
- 1 - 2 ft
- 2 - 3 ft
- 3 - 4 ft
- 4 - 5 ft
- 5 - 6 ft
- 6 - 7 ft
- 7 - 8 ft
- 8 - 9 ft
- 9 - 10 ft
- 10 - 20 ft
- More than 20 ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



0 625 1,250

Feet

1:15,000

NOTES

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2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

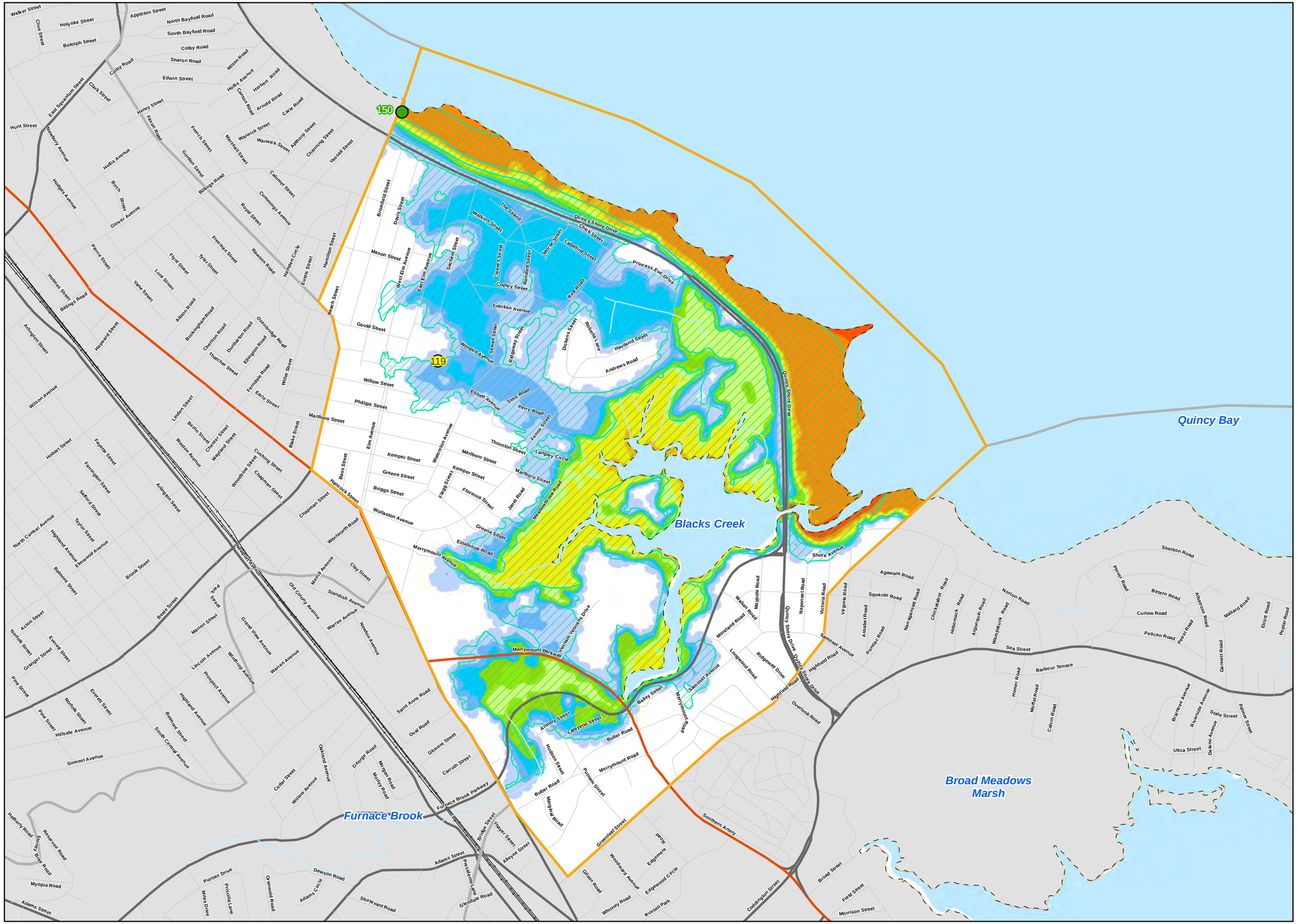
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Map 5.2C FEMA Flood Zones and 2030 Boston Harbor Model

Merrymount/ Blacks Creek



LEGEND

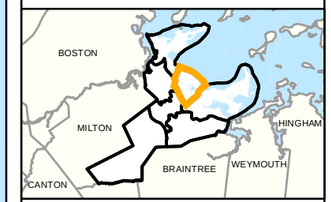
Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas

2030_BH-FRM Flood Depth 1%

- 1ft or Less
- 1 - 2 ft
- 2 - 3 ft
- 3 - 4 ft
- 4 - 5 ft
- 5 - 6 ft
- 6 - 7 ft
- 7 - 8 ft
- 8 - 9 ft
- 9 - 10 ft
- 10 - 20 ft
- More than 20 ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N W E S

0 500 1,000

Feet

1:12,000

NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

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Q-0019

Map 5.2D FEMA Flood Zones and 2030 Boston Harbor Model

Furnace Brook North

MILTON

Furnace Brook

Furnace Brook

LEGEND

Community Assets

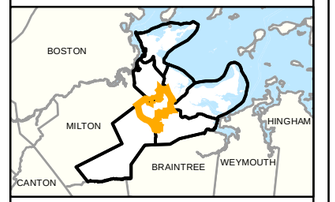
- Built Environment
- Economy
- People

- 100 Year Flood Zone
- Planning Areas

2030_BH-FRM Flood Depth 1%

- 1ft or Less
- 1 - 2 ft
- 2 - 3 ft
- 3 - 4 ft
- 4 - 5 ft
- 5 - 6 ft
- 6 - 7 ft
- 7 - 8 ft
- 8 - 9 ft
- 9 - 10 ft
- 10 - 20 ft
- More than 20 ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N W E S

0 500 1,000

Feet

1:12,000

NOTES

Map Created for City of Quincy. Resource data provided by: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, City of Quincy, Metropolitan Area Planning Council, and MassDOT

2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

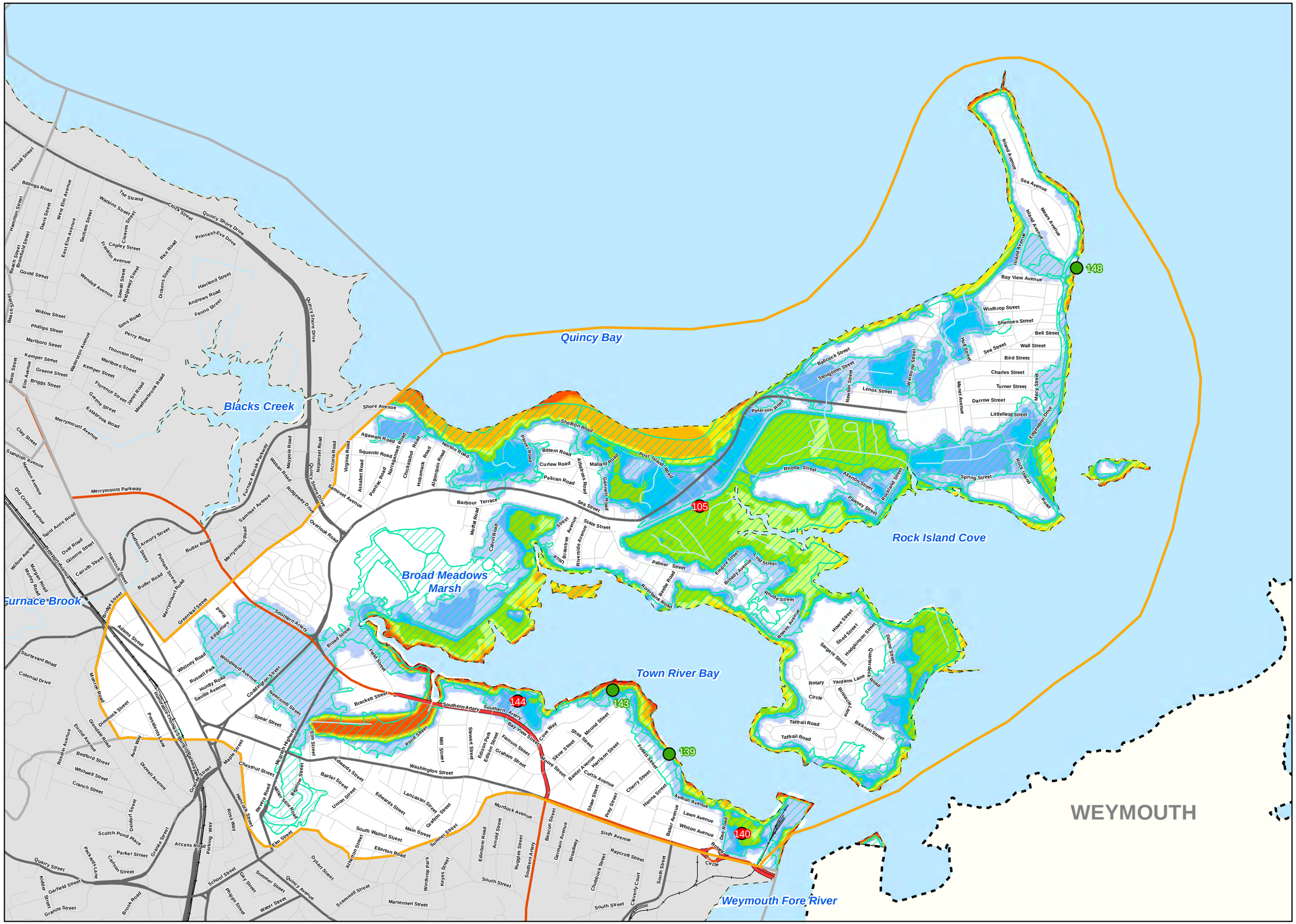
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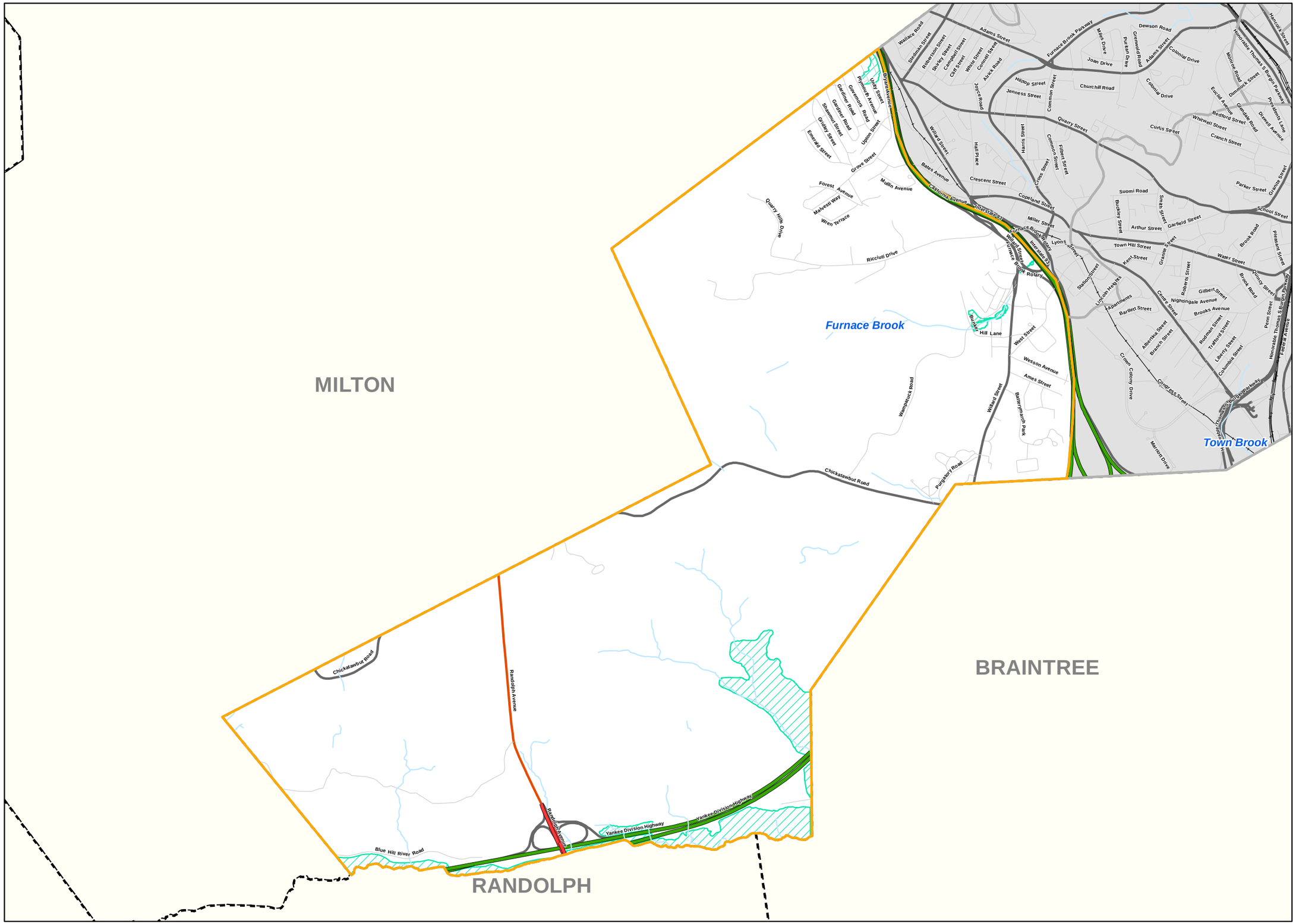
Map 5.2E FEMA Flood Zones and 2030 Boston Harbor Model

Houghs Neck/ Germantown


Quincy Bay
Blacks Creek
Broad Meadows Marsh
Furnace Brook
Rock Island Cove
Town River Bay
Weymouth Fore River
WEYMOUTH
148
105
144
143
139
140
Island Avenue
Sea Avenue
Means Avenue
Bay View Avenue
Winthrop Street
Shennen Street
Bell Street
Wall Street
Bird Street
Charles Street
Turner Street
Darrow Street
Littlefield Street
Sea Street
Babcock Street
Stoughton Street
Newton Street
Lenox Street
Peterson Road
Shelton Road
Agawam Road
Squanto Road
Norton Road
Bittern Road
Curlew Road
Pelican Road
Mallard Road
Gannett Road
Post Island Road
Rhoda Street
Asterton Street
Rockledge Street
Spring Street
Rock Island Road
Pawsey Street
Barbour Terrace
Sea Street
Palmer Street
Empire Street
Bowdoin Avenue
Long Street
Rhode Street
Howe Street
Shed Street
Hodgkinson Street
Sargent Street
Bowes Avenue
Quincy Point Road
Dewar Street
Rotary
Yardarm Lane
Binnacle Lane
Taffrail Road
Bicknell Street
Circle
Bracket Street
Southern Artery
Bay View Street
Cove Way
Shea Street
Mound Street
Farnum Street
Graham Street
Edison Park
Ellison Street
Stewart Street
Mill Street
Pond Street
Elm Street
Washington Street
Edwards Street
Barter Street
Union Street
Lancaster Street
Grafton Street
Summer Street
Main Street
South Walnut Street
Ellerton Road
Moore Street
Baxter Avenue
Curtis Avenue
Harrison Street
Cherry Street
Harris Street
Avalon Avenue
Lawn Avenue
Whiton Avenue
Roney Cycle
Dee Road
Baker Avenue
Pray Street
Shaw Street
Foster Street
Hull Street
Market Avenue
Macy Street
Edgewater Drive
Rock Island Road
Shore Avenue
Sixth Avenue
Raycroft Street
Chubbuck Street
Chickering Court
South Street
Germain Avenue
Broadway
Arnold Street
Edmboro Road
Ruggles Street
Southern Artery
Winthrop Park
Keyes Street
Martensen Street
Scammell Street
Quincy Avenue
Water Street
Gay Street
Summer Street
Phipps Street
School Street
Dwight Street
Allerton Street
Access Road
Parking
Granite Street
Hancock Street
Ross Way
Revere Road
Miller Stile Road
Maple Street
Chestnut Street
Edwards Street
Lancaster Street
Murdock Avenue
Main Street
Summer Street
Elm Street
Whitwell Street
Cranch Street
Bedford Street
Euclid Avenue
Glendale Road
Rosalen Avenue
Avon Way
Diswell Avenue
Granite Street
Deldorf Street
Scotch Pond Place
Parker Street
Carlson Street
Packards Lane
Quarry Street
Kidder Street
Garfield Street
Granite Street
Brook Road
Merrymount Parkway
Furnace Brook Parkway
Wollaston Boulevard
Quincy Shore Drive
Victoria Road
Virginia Road
Assabet Road
Pontiac Road
Narragansett Road
Chickatabot Road
Hobomack Road
Algonquin Road
Neponset Road
Maypole Road
Wollaston Road
Ridgeway Drive
Overlook Road
Samoset Avenue
Merrymount Road
Butler Road
Hutchinson Street
Harmony Street
Putnam Street
Hancock Street
Carruth Street
Gilmore Street
Ovid Road
Saint Anns Road
Old Colonial Avenue
Newton Avenue
Standish Avenue
Clay Street
Willow Avenue
Morton Road
Norton Road
Bridge Street
Adams Street
Sturtevant Road
Colonial Drive
Morse Road
Shimmock Street
Presidents Lane
Whitney Road
Russell Park
Hunley Road
Saville Avenue
Woodward Avenue
Crowlington Street
Newcomb Street
Spear Street
Edgemere Road
Greenleaf Street
Whitney Road
Broad Street
Field Street
Southern Artery
Turnpike
Furnace Brook Parkway
Quincy Shore Drive
Princess Eve Drive
Chiltern Street
The Strand
Watkins Street
Cleaves Street
Copley Street
Franklin Avenue
Rice Road
Dickens Street
Havilend Street
Andrews Road
Fenno Street
Sims Road
Perry Road
Thornton Street
Marlboro Street
Kemper Street
Greene Street
Briggs Street
Florence Street
Jamel Road
Greene Street
Meadowbrook Road
Merrymount Avenue
Watertown Avenue
Phillips Street
Willow Street
Gould Street
Wendell Avenue
Sewall Street
Ridgeway Street
Beach Street
Bloomfield Street
Hamilton Street
Davis Street
West Elm Avenue
East Elm Avenue
Seaholm Street
Billings Road
Vassall Street
Elass Street
Elm Avenue
Beach Street
Clay Street
Standish Avenue
Newton Avenue
Old Colonial Avenue
Saint Anns Road
Ovid Road
Gilmore Street
Carruth Street
Willow Avenue
Morton Road
Norton Road
Hancock Street
Bridge Street
Adams Street
Sturtevant Road
Colonial Drive
Morse Road
Shimmock Street
Presidents Lane
Whitney Road
Russell Park
Hunley Road
Saville Avenue
Woodward Avenue
Crowlington Street
Newcomb Street
Spear Street
Edgemere Road
Greenleaf Street

Map 5.2F FEMA Flood Zones and 2030 Boston Harbor Model

Furnace Brook South



LEGEND

Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas

2030_BH-FRM Flood Depth 1%

- 1ft or Less
- 1 - 2 ft
- 2 - 3 ft
- 3 - 4 ft
- 4 - 5 ft
- 5 - 6 ft
- 6 - 7 ft
- 7 - 8 ft
- 8 - 9 ft
- 9 - 10 ft
- 10 - 20 ft
- More than 20 ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N
W E
S

0 1,000 2,000
Feet

1:24,000

NOTES

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2018 Multi-Hazard Mitigation Plan

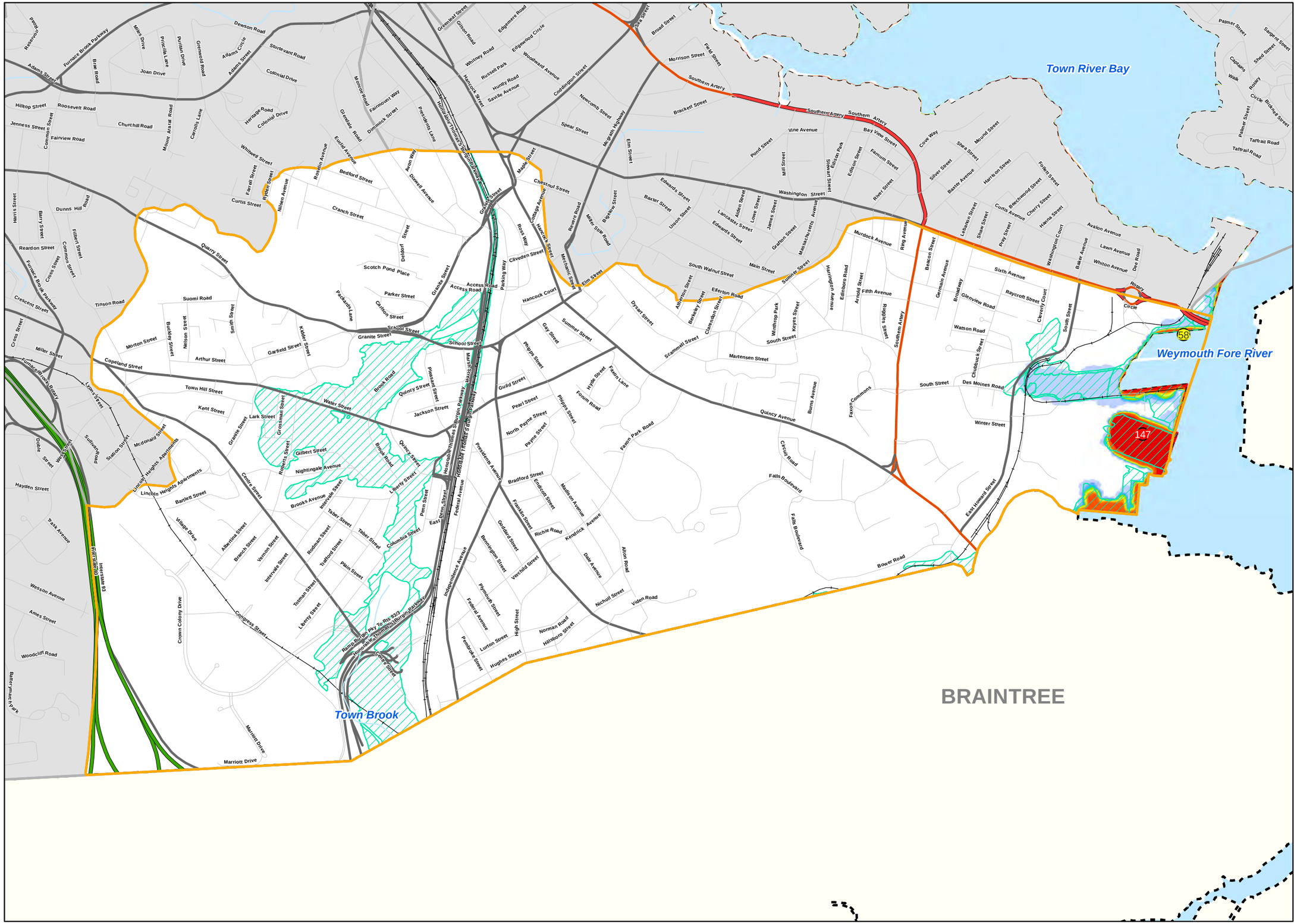
Quincy, Massachusetts

September 2018

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Map 5.2G FEMA Flood Zones and 2030 Boston Harbor Model

South Quincy/ Fore River



LEGEND

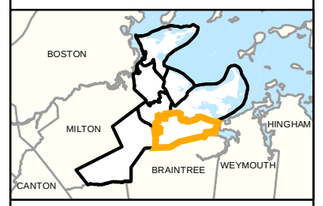
Community Assets

- Built Environment
- Economy
- People
- 100 Year Flood Zone
- Planning Areas

2030_BH-FRM Flood Depth 1%

- 1ft or Less
- 1 - 2 ft
- 2 - 3 ft
- 3 - 4 ft
- 4 - 5 ft
- 5 - 6 ft
- 6 - 7 ft
- 7 - 8 ft
- 8 - 9 ft
- 9 - 10 ft
- 10 - 20 ft
- More than 20 ft
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road

LOCUS MAP



N W E S

0 600 1,200

Feet

1:14,400

NOTES

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2018 Multi-Hazard Mitigation Plan

Quincy, Massachusetts

September 2018

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SECTION 6

CAPABILITY ASSESSMENT

Quincy has a unique set of capabilities including authority to enact regulations and policies, develop programs, hire staff, appropriate funding and other resources to accomplish mitigation and reduce long term vulnerability. By reviewing the existing capabilities in a community, the planning team can identify resources that currently reduce disaster losses or could be used to reduce disaster losses in the future. Section 6 includes a review of Quincy's existing planning mechanisms, administrative capacity, funding mechanisms, education and outreach and existing mitigation measures specifically addressing natural hazards.

Section 6 Capability Assessment

6.1 EXISTING PLANNING MECHANISM

C6 b.

The Planning Team updated information regarding existing planning mechanisms to mitigate natural hazards in the City of Quincy**. Table 6.1** summarized the local plans that include hazard mitigation elements.

C1 a

Table 6.1
Summary of Current Planning Efforts related to Hazard Mitigation

C6 d

Date of Plan	Status	Plan Name	Department Responsible for Update
2014	To be updated in 2019	Open Space and Recreation Plan	Planning and Community Department, Parks and Recreation Departments
N/A	Ongoing	Comprehensive Emergency Management Plan (CEMP)	Emergency Management Department
2016	Draft Completed	Quincy Resilient Draft Plan	Planning and Community Development
2007	Completed	Quincy Center Revitalization and Development Plan	Planning and Community Department
2015	Completed	Consolidated Action Plan	Planning and Community Department
2010	In Progress	Stormwater Management Plan	Department of Public Works
2016	In Progress	Capital Improvement Plan	Mayor's Office

City of Quincy Open Space and Recreation Plan- The 2011-2018 Quincy Open Space & Recreation Plan and its 7-year updates are approved by the Commonwealth Executive Office of Energy & Environmental Affairs (EOEEA). The purpose of the plan is to guide future management and development of the City's Recreation and Open Space assets. Guided by the plan, the City has identified and supported the acquisition of parcels protected by the Wetlands Protections Act and Rivers Act and advanced other water quality improvement measures. The plan will be reviewed and updated in 2018-2019. The next Open Space & Recreation Plan update will occur immediately after the adoption of this HMP update. The City will make efforts to align related goals and objectives of the two plans.

City of Quincy Comprehensive Emergency Management Plan – The CEMP addresses mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. The plans contain important information regarding flooding, hurricanes, tornadoes, dam failures, earthquakes, and winter storms. Therefore, the CEMP is a mitigation measure that is relevant to all of the hazards discussed in this plan. Quincy's Emergency Management Department maintains the plan on an ongoing basis.

Resilient Quincy Plan was drafted in 2016. The aim of the effort was to focus on identifying unique zones throughout Quincy that share common characteristics and assess the systems of society and how they are currently performing and whether they a prepared to meet future environmental change. Public outreach and new partnerships were developed as a result of the vulnerability assessment project. Public outreach

consisted of two public workshops, a community survey, and educational materials made available at several community events. The working group then appeared before the Planning Board, the Zoning Board of Appeals, and the Conservation Commission to provide information on the project and to garner feedback.

City of Quincy Center District Urban Revitalization and Development Plan – The Quincy Center District Urban Revitalization and Development Plan was adopted in 2007 with the goal of revitalizing the City's historic downtown. The plan focuses on public investments towards modernizing aged infrastructure including an overhaul of the stormwater drain system that will support new private investment. In addition, any new development that comes forward must follow the City's Downtown Design Guidelines for sustainability (i.e., Site, Water Management, Energy, Materials).

City of Quincy Consolidated Action Plan – The 2015– 2020 Consolidated Action Plan was adopted in 2015. While it primarily focuses on housing and economic development work to be performed using federal Housing and Urban Development (HUD) funds, issues that touch on flooding and hazard mitigation can be found throughout the plan. The plan focuses more on policies than on detailed recommendations.

Quincy Stormwater Management Plan- This plan is a requirement of the new 2016 EPA small MS4 General Permit and must be finalized by July 1, 2019. The plan addresses areas of flooding due to stormwater issues and best management practices to minimize flooding and protect water quality. The Quincy Stormwater Action Committee was convened to oversee the plan.

Capital Improvement Plan sets the community's investment goals for major public infrastructure projects and other improvements for a five-year period. The last Plan was issued in 2016 and is provided in Appendix C. Stormwater and flood control projects on the 2016 CIP include Black's Creek tide gate and marsh restoration and projects in West Quincy. Stormwater improvement projects are also funded through the Water and Sewer Enterprise Fund.

6.2 EXISTING ADMINISTRATIVE CAPACITY

The City has multiple staff members that assist with planning, development, and implementation of hazard mitigation. **Table 6.2** provides a summary of the positions and the roles are further described below.

The Planning and Community Development Department and Planning Board participate in site plan review to make sure buildings are constructed to meet all applicable codes, regulations and City ordinances to minimize the risk of natural hazards from development. The Planning Department is leading the HMP update and resiliency planning.

The City Department of Public Works (DPW) is responsible for cleaning catch basins, maintaining tide gates, developing new flood control infrastructure and responding to all flood related emergencies. The DPW also is tasked with maintaining hydrants and pressure testing to ensure that hydrants have enough water for fires. The DPW has separately addressed specific hazard mitigation initiatives including the Water Systems Vulnerability Assessment, Emergency Response Plan, Storm Sewer Overflow policy and Disaster Debris Management Plan. The DPW Engineering Division also reviews development proposals under the site plan review process focusing on stormwater management, roadway adequacy, and sewer and water service.

CAPABILITY ASSESSMENT

The Department of Traffic, Parking, Alarm and Lighting (TPAL) is responsible for providing efficient operation of traffic signals and streetlights during hazard events and providing support to the Quincy Police Department (QPD) to implement road closures during multiple emergency types. TPAL is tasked with maintaining pedestal, pole and overhead mounted traffic signal and street lighting equipment, while the Fire Alarm division maintains a citywide network of fire alarm boxes and the city-owned fiber optic network, which functions as a backbone for emergency communications.

The City's Public Buildings Department is responsible for the maintenance of all public buildings including 20 school buildings (some used as emergency shelters), 8 fire stations, police headquarters, City Hall, DPW buildings, Parks Department building (which houses the City's Emergency Management Office) and others. Public Buildings is responsible for maintaining all City buildings to ensure a healthy and comfortable work environment, be emergency ready (with generators and HVAC systems functional) and operating as efficiently as possible.

The Department of Parks and Forestry maintains all City trees and implements an inventory and maintenance program to target tree work. The Department has an active tree planting program to help alleviate urban heat islands from impervious surfaces. The City is considering creating a new Natural Resources Department, that would include Parks, Forestry, Conservation and Cemeteries to better address Quincy's natural resources.

The Mayor is proposing to create a new Department of Natural Resources that would include the following divisions: Park, Forestry, Recreation, Cemetery and a new division, Conservation. The Conservation Division will be headed by an Earth Scientist whose duties include the stewardship, maintenance and improvement of the City's ecological resources. The proposal is currently before the City Council for action as of October 23, 2018.

The Quincy Health Department addresses public health issues related to water quality, vector borne diseases and extreme temperatures impacts on vulnerable populations.

Quincy Department of Inspectional Services includes the Zoning Board of Appeals, Conservation Commission and building inspectional services. The Department provides a public safety function by enforcing the appropriate codes and regulations to ensure that buildings are safe for people to inhabit.

Quincy Department of Emergency Management, Police Department and Fire Department support all aspects of the Hazard Mitigation Plan, with an emphasis on community preparedness and emergency response.

Local Emergency Management Planning Committee (LEPC) – Quincy's LEPC meets as needed but at least three times a year. The Quincy Fire Chief attends Norfolk County Fire Chiefs meetings as well as Metro Chiefs and the Mass Urban Chiefs. The Quincy public safety agencies (QFD, QPD, etc.) participate in relevant areas of the Boston Urban Area Security Initiative (UASI). Quincy Emergency Management also participates and maintains an active presence in MEMA Region 2.

Table 6.2
Hazard Mitigation Staffing

Staff	Hazard Mitigation Role
Inspectional Services and Public Buildings Departments	Enforces Mass Building Code, Quincy Municipal Code and maintains all critical building facilities
City Engineer	Maintains the infrastructure to protect the City from flooding, implements mitigation projects, maintains and updates the HMP plan with the City Planner
Floodplain Administrator	Reviews projects for NIFP compliance and manages the Community Rating System Program
Emergency Management Director	Implements the Comprehensive Emergency Management Plan, leads the LEPC and provides education on community preparedness. The Emergency Management Director coordinates with both the Quincy Fire and Police Departments to align Hazard Mitigation strategies with the Departments ongoing programs and policies.
City Planner	Maintains and updates HMP plan with the City Engineer, incorporates HMP goals into other City plans, lead on resiliency planning efforts
Director, Public Buildings	Ensures that public buildings including Police Headquarters, fire stations, City Hall, and public buildings used as emergency shelters are prepared for emergency events.
TPAL Director	Coordinates with QPD in implementing road closures during emergency events; maintains traffic signals, alarm system and city-fiber optic network.
Parks and Forestry Director	Maintains and improves tree canopy, implements invasive species removal

6.3 EXISTING FUNDING MECHANISMS

The City has multiple funding mechanisms in place or planned to help fund mitigation projects.

- Capital Improvement Funding has been used for flood control projects, City equipment and facility improvements.
- The City charges user fees for water and sewer, including new hookups to maintain these utilities. New developments pay additional fee to augment the Department of Public Works sewer and drainage rehabilitation programs.
- The City has utilized funding from a variety of State and Federal sources to fund hazard mitigation projects including FEMA Pre-Disaster Mitigation, Flood Mitigation Assistance, Hazard Mitigation Assistance, US Dept of Housing and Urban Development, State Revolving Funds for Clean Water and Drinking Water, Community Development Block Grants. Grants were used to improve the resiliency of the community including public works (improve drainage, flood proofing pump stations), seawalls repairs and housing improvements projects (elevating utilities and residence) above the flood plain elevation. The City recently received state funding to participate in the Municipal Vulnerability Project to provide additional opportunities for public involvement with the 2019 Quincy Multi-Hazard Mitigation Plan.
- Community Preservation Act - Quincy first adopted the Community Preservation Act in 2006 with a local surcharge of less than 1 percent. CPA funds are used to finance investments in open space.
- The City augments funding sources to finance investments in open space with the Hotel/Motel Tax.
- Coastal Zone Management grants.

6.4 EDUCATION AND OUTREACH METHODS

Quincy provides information about flood warning, flood hazards, risks, methods and techniques for flood proofing, names and addresses of specialty (design/construction) contractors for retrofitting, precautions during storms, availability of emergency services, and flood insurance. The City's Emergency Management Department distributes multiple publications published by the UASI, including "Prepared not Scared", "Family Disaster Plan", and "Disaster Supply Kit", to interested homeowners. The Emergency Management Department plans to take advantage of MEMA-led workshops to train neighborhood volunteers to assist first responders during emergencies such as providing support for shelter operations.

The City developed and published the "Citizens Input Application for Quincy Flood Mitigation Planning" interactive map-based webpage to solicit information about recent flood damage to City infrastructure: http://tighebond.maps.arcgis.com/apps/webappviewer/

The Public is informed about publicly funded mitigation projects/programs by the following methods:

- Individual letters to property owners in the target areas,
- Community meetings and group presentations including lectures and brochures to various civic groups and high school/college students

Outreach to minority communities using translated materials, partnering with community organizations, such as, Quincy Asian Resources (QARI), Boston Chinatown Neighborhood Center (BCNC) and churches, and outreach efforts at community events, such as the August Moon Festival.

- News items and feature stories in newspapers, mailing information fliers and brochures to insurance, real estate agents, bank and title company offices, and local engineers, architects and surveyors
- Placement of the required information in schools, public libraries and community centers, especially in flood prone areas, and
- Public information/coordination meetings sponsored by the Mayor and Ward Councilors.

Quincy has a number of watershed and neighborhood groups that publish newsletters and meet regularly to share important information including the Adams Shore Community Association, Friends of Butlers Pond, Friends of Wollaston Beach., Hospital Hill Neighborhood Association, Houghs Neck Community Council, Merrymount Association, Montclair-Wollaston Neighborhood Association, Penn's Hill Neighborhood Association, Post Island Beach Association, Quincy Parks Conservancy, and the Squantum Community Association

Quincy City Staff are provided with opportunities to learn about regional climate change initiatives, through workshops, webinars, and other events offered by state agencies, MAPC, local universities and other organizations. The Department of Planning and Community Development and Emergency Management Director plan to take a more active role in sharing upcoming events with City Departments.

6.5 EXISTING MITIGATION MEASURES

6.5.1 FLOOD HAZARD MITIGATION MEASURES

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Participation in the National Flood Insurance Program (NFIP)

The City of Quincy complies with the NFIP by enforcing floodplain regulations, maintaining up-to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements. FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at https://www.fema.gov/policy-claim-statistics-flood-insurance. Data for Quincy is presented in **Table 6.3** including data through July 31, 2018. Since the 2013 plan, the policies in force have increased by 695 and the total losses have increased by359.

Table 6.3
Flood Insurance Categories

Flood Insurance Categories	Values
Flood insurance policies in force (as of 7/31/2018)	3,824
Coverage amount of flood insurance policies	$937,953,708
Premiums paid	$3,983,425
Total losses (all losses submitted regardless of the status)	1769
Closed losses (Losses that have been paid)	1,401

Flood Insurance Categories	Values
Open losses (Losses that have not been paid in full)	6
CWOP losses (Losses that have been closed without payment)	362
Total payments (Total amount paid on losses)	$13,307,863

Identification of Repetitive Loss Areas – The City's Engineering Office, with support from the Planning Department, actively tracks impacts and changes to repetitive loss properties in the city. Flood prone areas of Quincy that suffer repetitive losses are listed in **Section 3**.

CRS Program Participation – The City of Quincy participates in the Community Rating System (CRS) program, gaining a reduction in flood insurance rates for property owners in the City in exchange for mitigation actions taken to reduce the City's potential vulnerability to flooding. The program functions on a rating system ranging from Class 9 to Class 1, with 1 being the highest Class. An individual community's rating is based on the number of points they receive, with points allocated for each flood mitigation measure enacted. Quincy currently has a rating of Class 8, resulting in a 10% reduction in flood insurance rates in the City.

Elevating Repetitive Loss Properties - The City continues to pursue grants in order to provide support for residents to elevate homes or utilities in locations with repetitive losses. The City pursues resources from FEMA, including the Flood Mitigation Assistance, Hazard Mitigation, and Severe Repetitive Loss grant programs.

Land Acquisition for Open Space- The City, as a matter of previously established policy, thoroughly evaluates all properties that come under its ownership as to whether there is a need to convert said property to "Open Space". As a matter of policy all parcels located in the Special Flood Hazard Area (SFHA), in a tidal zone, and/or in areas subject to storm water flowage are designated as "Open Spaces". The City utilizes two distinct funding sources to finance investments in open space; Community Preservation Act, and Hotel/Motel Tax.

Public Works Operations/Maintenance Activities – The Public Works Department actively maintains the City's storm drain system. The following specific activities serve to maintain the capability of the drainage system through the reduction of sediment and litter build up and proper maintenance and repair.

Drainage System Mapping- The City's drainage system mapping has been updated, additional outfalls have been located and future maintenance will comply with the new NPDES MS4 Phase II General Permit.

Street sweeping –Street sweepings are conducted twice a year. In some commercial districts like the North Quincy Business Area, the Wollaston Business Area, and the Quincy Center Business Area, street sweepings occur daily.

Catch basin cleaning – Catch basin cleaning is performed continuously during the year.

Roadway treatments – Sand and salt were used historically in Quincy to treat roadways, but starting in 2018 the city will periodically use liquid brine to reduce sand and salt use.

Outfall Pipes and Tide Gate Maintenance – Outfall pipes and tide gates are critical to controlling the surface water levels in the coastal areas prone to flooding. The maintenance of outfall pipes and tide gates is performed continuously year-round.

Snow disposal –The City conducts snow removal operations with its own equipment in some areas. However, most of the operations are conducted by snow-removal contractors. The City annually negotiates for snow disposal sites and at present, there are two locations for snow disposal, one north of downtown and one south of downtown.

Geographic Information System- The City's GIS system is a critical tool that is being used to identify the areas that are prone to flooding and the public/private assets that are at risk.

Parks and Forestry/Maintenance Activities – The Parks and Forestry Department conducts its own tree maintenance and uses its own equipment to trim and remove trees as needed.

Communications Equipment –The City utilizes multiple methods to broadcast information about emergency conditions including state emergency broadcasting methods, social media, regional network television, radio, local cable channel (QATV), Quincy Police Department (QPD) patrol cars with (public address [PA] systems) and transportable message boards.

Emergency Power Generators – Quincy Fire Department (QFD) fire stations, QPD headquarters, Department of Public Works, Parks Department, City Hall, School Administration (Coddington) Building, Senior Center, Veterans Memorial Stadium, public high schools and seven public elementary/middle schools and the preschool have emergency power generators. The high schools would be the primary shelters for a mass sheltering. The senior center has also been used a shelter in the past, but its capacity is limited to approximately 50. Quincy Emergency Management also has 6 portable generators that can be used to run pumps, lighting and supply limited emergency power for small scale activities. TPAL is responsible for assisting in wiring emergency generators in response to power outage situations. TPAL has a generator that is used to power key intersections during hazard events. The Fire Department, Public Works and the Emergency Management Department share maintenance responsibilities of generators.

Emergency Pumps- The Department of Public Works has an inventory of three 6-8-inch mobile pumps, and 40 2-inch pumps to respond to flood and sewer overflow situations.

6.5.1 QUINCY REGULATIONS AND ORDINANCES

A summary of the City ordinances and bylaws that provide flood mitigation benefits is provided in **Table 6.4**.

Table 6.4
Regulations, Bylaws and Policies That Provide Flood Mitigation

Regulatory Category	Applicable Section	Flood Mitigation Benefit
Zoning Ordinance Special Districts	Flood Plain District-Chapter 17.40	Overlay district for most vulnerable sections of City, includes FEMA flood zones. Development must meet State Building Codes, Title V, Wetlands Protection Regulations, Inland and Coastal Wetlands Restrictions.. The ordinance defines its Flood Plain District as special flood hazard areas as identified on the FIRMS for Quincy. Within the District, residential structures lawfully existing prior to adoption of the district may only be

Regulatory Category	Applicable Section	Flood Mitigation Benefit
		enlarged in area up to twenty-five percent of ground coverage. New construction in coastal high hazard areas must be landward of mean high tide. Encroachment in floodway must demonstrate there will not be any increase in 100-year flood.
Zoning Ordinance Special Districts	Open Space District	Preserves open space, no buildings or structures allowed unless specific open space purpose
	Planned Residential Development	Special permit sets aside 10% open space and allows higher density on remaining parcels.
Zoning Ordinance Procedures	Site Plan Review	Quincy, through its zoning control procedures, requires site plan review for all multi-family development greater than 3-units in all zoning districts and all development where the area of any new structure is ten thousand square feet or more. The City utilizes independent engineering peer review of all projects that includes review of the proposed development relative to wetlands, floodplains, drainage and other site issues.
	Special Permit Approval	Ensures developments will not cause flooding and meets all applicable regulations.
Quincy Municipal Code	Street and Sidewalk	Prohibits discharge of water into streets, requires owner to remove snow from sidewalks and roofs
	Earth Removal Permit	An earth removal permit is required to make sure that drainage will not be impacted
	Wetlands Protection Ordinance (Chapter 18.08)	Provides protection for jurisdictional areas under the Massachusetts Wetland Protection Act. FIRMS are used to determine the extent of resource areas which are regulated by the state Wetlands Protection Act and local wetlands bylaw. Unless permitted by the Conservation Commission, the ordinance prohibits removal, dredging, building, excavation, or fill activities within 100 feet of any wetland, shoreline, coastal feature, etc., and any land subject to tidal action, coastal storm flowage, or flooding. The Conservation Commission enforces these regulations through its permitting.
	Stormwater Management Permit	Regulates discharges to City's stormwater infrastructure for projects disturbing more than one acre of land. Regulation applies to development and redevelopment. A drain permit is required for connections to City storm drains. Illegal dumping or illegal connections to stormwater drainage system is prohibited.
State Regulations	DCR Dam Safety Regulations	The state has enacted dam safety regulations mandating inspections and emergency action plans. All new dams are subject to state permitting.

Regulatory Category	Applicable Section	Flood Mitigation Benefit
Subdivision Rules and Regulations	Subdivision in Flood Plain District	Subdivision Rules and Regulations contain provisions that serve to reduce the impacts of floods and erosion, with enhanced review in Flood Plain District. Through its design and layout standards, the regulations contribute to the City's overall efforts to mitigate the risks damage to property or natural resources through flooding.

6.5.2 WIND HAZARD MITIGATION MEASURES

Massachusetts State Building Code – The City enforces the Massachusetts State Building Code whose provisions are generally adequate to protect against most wind damage. The code's provisions are the most cost-effective mitigation measure against high wind given the extremely low probability of occurrence. If a tornado were to occur, the potential for severe damages would be extremely high. The Quincy Building Code-Effectiveness Grading Schedule (BCEGS) score dated March 13, 2013 was Class 8 for residential and commercial buildings.

Tree-trimming program – The City conducts its own tree maintenance and uses its own equipment to trim and remove trees. Outside contractors are utilized as needed.

Traffic Signal, Street Lighting, and Alarm/Communications Systems - TPAL conducts regular maintenance on traffic signals and street lighting infrastructure equipment to ensure safety and functionality at all times. TPAL also maintains the City's overhead fiber optic connections.

6.5.3 EXTREME HEAT

Urban Tree Planting- Quincy Parks and Forestry participates in multiple local and state initiatives to plant street trees in Quincy to reduce urban heat impacts. Quincy participates in the Greening of the Gateways Program through the Massachusetts Division of Conservation and Recreation. Funding is provided based on need, correlating areas with fewest trees and most impervious areas. Quincy planted over 600 trees in 2017-2018 with funding from the state. The City also annually funds street tree planning.

6.5.4 URBAN AND WILDFIRE HAZARD MITIGATION MEASURES

Permits Required for Outdoor Burning – The Quincy Fire Department prohibits outside burning, including the use of chimeneas. The Quincy Fire Department does not allow the use of natural gas, propane gas, charcoal, electric or other fuel source, hibachis, grills, etc. on porches, balconies, or roofs. The use of grills, hibachis, etc. is allowed if used only for cooking purposes and must be kept outdoors at ground level away from any combustibles.

Site Plan Review/ Subdivision Control – The Fire Department is involved in reviewing all subdivision and development plans and advises the Planning Board regarding access to new developments for fire trucks and ambulances, location of fire hydrants, and identification of properties that may lie outside the fire hydrant zone.

Members of the Fire Department meet yearly for a state Wildland-Urban Interface workshop. The Fire Chief plans to implement Standard Operating Procedures (SOP) for all hazards including brush fires.

Fire Alarm System – The TPAL Fire Alarm Division actively maintains the citywide Fire Alarm network and emergency communications system.

6.5.5 GEOLOGIC HAZARD MITIGATION MEASURES

Massachusetts State Building Code – The State Building Code contains a section on designing for earthquake loads (780 CMR 1613.0). Section 1613 states that the purpose of these provisions is "to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake." This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be "prudent and economically justified" for the protection of life safety.

The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings.

Section 1604.5 sets up seismic hazard exposure groups and assigns all buildings to one of these groups. Group III includes buildings that have a substantial public hazard due to occupancy or use and Group IV are those buildings having essential facilities that are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.

6.5.6 INVASIVE SPECIES REMOVAL PROGRAM

The City Parks and Forestry Department annually removes Phragmites from Passanageset Park at the Broad Meadows Marsh.

6.5.7 MULTI-HAZARD MITIGATION MEASURES

There are several mitigation measures that impact more than one hazard. These include the Comprehensive Emergency Management Plan (CEMP), the Massachusetts State Building Code and participation in a local Emergency Planning Committee. A summary of the all hazards mitigation measures are provided in **Table 6.5**.

Comprehensive Emergency Management Plan (CEMP) – Every community in Massachusetts is required to have a CEMP. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, dam failures, and winter storms. Therefore, the CEMP is a mitigation measure that is relevant to many of the hazards discussed in this Plan. Quincy maintains the CEMP on an ongoing basis.

Massachusetts State Building Code- The Massachusetts State Building Code is enforced by the Director of Inspectional Services, including many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing, and snow loads.

CAPABILITY ASSESSMENT

Local Emergency Planning – Quincy has its own Local Emergency Planning Committee. The LEPC meets as needed but at least three times a year. The Quincy Fire Chief attends Norfolk County Fire Chiefs meetings as well as Metro Chiefs and the Mass Urban Chiefs. The Quincy public safety agencies (QFD, QPD, etc.) participate in relevant areas of the Boston Urban Area Security Initiative (UASI).

Table 6.5
All Hazard Mitigation Measures

Hazard	Area	Mitigation Measure
Flood-Related	City-Wide	1. The City participates in the National Flood Insurance Program and adopted the FIRM maps. There are 3875 policies in force. The City actively enforces floodplain regulations. 2. The City cleans catch basins annually. 3. Emergency pump deployment 4. Drainage infrastructure performed using MA Chapter 90 funds. 5. Subdivision Rules for drainage 6. Floodplain Overlay Districts 7. Site Plan Review for stormwater and erosion 8. Planned Unit Development zoning district 9. Stormwater Management regulations are included in the City Zoning Ordinance. 10. New *Open Space and Recreation Plan* adopted in 2014 11. Community Preservation Act adopted in 2006. 12. Wetlands Protection Ordinance adopted in1987
Dams	City-Wide	1. DCR Dam Safety Regulations 2. State permits required for dam construction 3. Comprehensive Emergency Management Plan addresses dam safety.
Wind-Related	City-Wide	1. City capabilities for tree trimming 2. National Grid maintains trees within its power line corridors 3. The City enforces the MA State Building Code.
Winter-Related	City-Wide	1. Pretreatment with brine and standard snow operations with 50/50 salt/sand mix.
Brush Fire-Related	City-Wide	1. No outdoor burning allowed 2. The Fire Department reviews all subdivision development plans.
Geologic-Earthquake	City-Wide	1. The City enforces the MA State Building Code. 2. Evacuation plans in CEMP 3. Shelters and backup facilities available
Geologic-Landslide	City-Wide	1. Maximum slope for subdivision roads 2. Earth Removal Ordinance
Multi-Hazard	City-Wide	1. The City enforces the MA State Building Code. 2. Comprehensive Emergency Management Plan is being updated 3. City utilizes Norfolk County Emergency Incident Command Unit. 4. Quincy is a member of the Boston Area Police Emergency Radio Network (BAPERN). 5. Quincy has its own Local Emergency Planning Committee 6. Most critical facilities in Quincy have fixed generators. 7. Multi department review of all developments and sub-division.

SECTION 7

MITIGATION STRATEGY

The Mitigation Strategy is the most important part of the Hazard Mitigation Plan. It serves as the blueprint for reducing the potential losses identified in the risk assessment. The Mitigation Strategy includes goals, mitigation actions, and an action plan for implementation. This provides a framework to identify, prioritize and implement actions to reduce risks to hazards. Section 7 reviews the mitigation strategy created in 2012 and outlines a mitigation strategy for Quincy for the next five years.

Section 7 Mitigation Strategy

7.1 MITIGATION GOALS AND OBJECTIVES

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The Planning Team reviewed and updated the 2013 Hazard Mitigation Plan Goals. The 2019 Hazard Mitigation Plan includes specific plan goals, objectives and addresses additional community assets including the environment, economy and cultural facilities.

2019 Quincy Hazard Mitigation Goals

1. **Public Health and Safety**

Recommended Goal: Protect the health and safety of the public.

Objectives:

- Promote cost-effective hazard mitigation actions that protect and promote public health and safety from all hazards with an emphasis on reducing damage to repetitive and severe repetitive loss properties.
- Encourage people to be prepared before, during and after a hazard event by providing neighborhood training events and designating neighborhood captains based on the MEMA model.
- Ensure that services related to public health (e.g., sanitation, water, debris removal, hospitals and emergency services) can function during and after a hazard.
- Ensure that evacuation can happen in an organized and efficient manner.
- Minimize secondary impacts from hazards, such as the release of pollutants. (e.g., fuel spills into waterbodies).
- Promote public communications including materials and voice communications translated into Chinese, Vietnamese, Spanish and other languages as needed.

2. **Protection of Existing Infrastructure**

Recommended Goal: Protect existing properties and structures

Objectives:

- Provide resources for residents and businesses to make their buildings and properties more disaster resistant.
- Educate the public on measures they can take to protect their property from natural hazards.
- Maintain existing drainage and seawall infrastructure to protect residential and business areas from flooding.
- Ensure that critical facilities and infrastructure are protected from hazards.
- Upgrade existing structures to mitigate repetitive or severe repetitive loss properties.

- Ensure that future development / redevelopment does not make existing properties more vulnerable to hazards.

3. **Protection of Natural Resources**

Recommended Goal: Increase resilience by protecting and enhancing natural resources.

Objectives:

- Preserve and restore marsh ecosystems along coast-line and subtidal area (including shellfish habitat).
- Protect natural areas (including open space, wetlands, green spaces) to ensure that they buffer impacts to developed areas during a natural disaster.
- Protect and increase urban tree canopy.
- Manage stormwater with Low Impact Development techniques (provide capital resources to encourage investment in LID upgrades).
- Optimize techniques to provide safe access to the waterfront to avoid erosion.

4. **Emergency Response to Hazards**

Recommended Goal: Ensure that essential services can function during and after a hazard event.

Objectives:

- Ensure that critical infrastructure is protected from natural hazards.
- Ensure that key service emergency personnel and employees can get into and around the City to provide services.
- Promote effective and consistent interdepartmental communication.
- Maintain the Comprehensive Emergency Management Plan (CEMP).

5. **Planning for Future Development**

Recommended Goal: Minimize hazard risks for future development

Objectives:

- Encourage future development in areas that are not prone to natural hazards.
- Engage developers in discussions regarding the Hazard Mitigation Plan and known hazards in Quincy.
- Enforce existing zoning and building regulations, and make updates to address known hazards and risks.

- Ensure that future development meets federal, state, and local standards for preventing and reducing the impacts of natural hazards including impacts due to climate change on natural and historic resources.

6. **Regional Cooperation**

Recommended Goal: Work regionally to mitigate impacts from natural hazards and to respond and recover from hazard events.

Objectives:

- Continue to participate in regional efforts.
- Cooperate with other agencies, communities, and private entities.
- Understand priorities and capabilities of other entities to allow for resource-sharing, mutual aid, and entering into memoranda of understanding (MOU).

7. **Hazard Awareness**

Recommended Goal: Maintain Hazard Awareness

Objectives:

- Track and compile hazard related data.
- Understand the potential implications of climate change on the frequency and extent of natural hazard events and incorporate that knowledge into hazard mitigation efforts.
- Maintain publicly available information on natural hazard risks in the City.
- Integrate hazard mitigation into other City initiatives and plans.
- Encourage the business community and local agencies representing vulnerable populations to work with the City to participate in development of the hazard mitigation plan.
- Plan outreach events educating the broader community on hazard risks and community vulnerability, and the benefits of hazard mitigation including participation at community events and festivals, such as, the Farmers Market. August Moon Festival, food truck festival, etc.

8. **Hazard Mitigation Resources**

Recommended Goal: Determine priorities for directing resources for hazard mitigation and response.

Objectives:

- Maintain adequate staff resources.
- Prioritize mitigation projects.
- Continue to include mitigation projects in the Capital Improvement Plan.

- Pursue various funding sources.
- Encourage private property owners to implement measures to protect their own properties.

7.2 MITIGATION ACTIONS

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What is Hazard Mitigation?

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries, and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, education programs, infrastructure projects, and other activities.

Hazard mitigation measures can generally be sorted into six categories, according to FEMA's Local Multi-Hazard Mitigation Planning Guidance:

1. **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built, and direct public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
2. **Property Protection:** Modification or removal of existing buildings or infrastructure to protect them from a hazard. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass.
3. **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the potential risks from hazards and ways to mitigate them. Such actions include outreach projects, real estate disclosure requirements, hazard information centers, and school-age and adult education programs.
4. **Natural Resource Protection and Green Infrastructure:** Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include low impact development, sediment and erosion control, stream corridor restoration, watershed management, urban forest and vegetation management, and wetland restoration and preservation.
5. **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.
6. **Emergency Services Protection:** Actions that will protect emergency services before, during, and immediately after an occurrence. Examples of these actions include protection of warning system capability, protection of critical facilities, and protection of emergency response infrastructure.

Funding to implement hazard mitigation projects may come from a variety of federal, state, and local sources. FEMA currently has three mitigation grant programs: the Hazards Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. The 3 links below provide additional information on these programs.

HMGP: http://www.fema.gov/government/grant/hmgp/index.shtm

PDM: http://www.fema.gov/government/grant/pdm/index.shtm

FMA: http://www.fema.gov/government/grant/fma/index.shtm

Other potential funding sources include the Massachusetts Coastal Zone Management, Massachusetts Executive Office of Energy and the Environmental Dam and Seawall Removal and Repair Fund, Massachusetts State Revolving Funds, U.S. Army Corps of Engineers, and the Small Business Administration.

7.2.1 PROGRESS ON PRIOR ACTIONS

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The Planning Team reviewed the 2013 Mitigation Actions to determine what progress had been made towards implementation. **Table 7.1** provides an update on all previous mitigation actions including the description, responsible department, implementation status, and comments to describe the status. Of the 30 mitigation actions from the 2013 Hazard Plan, eight are projects describing existing capabilities, three of these were revised and included as future actions. The remaining five existing capabilities were deleted from the mitigation strategy list and are now included in **Section 6** Capabilities Assessment. Ten projects were completed and removed from the mitigation strategy list. The remaining 12 projects are ongoing and were added to the future mitigation actions list.

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Table 7.1
Review of 2013 Mitigation Actions-

Hazard(s) to Mitigate	Action Item # and Description	Responsible Department	Status: Completed/ Existing Capability/ In Progress/ Deferred/ Deleted	Explanation of Status as of 2018
Flooding	1) Retrofit and flood proof existing buildings subject to repetitive flooding*	Planning	In progress	Funding source is limited, no progress made to date
Flooding	2) Elevate Repetitive Loss Structures*	Planning	In progress	Funding source is limited, no progress made to date
Flooding	3) Property Acquisition*	Mayor's Office	In Progress	Property Acquisition has not been utilized for flood mitigation in past 5-years, it is an option for the future
Flooding	4) Salt Marsh Restoration*	DPW /Parks and Forestry	In Progress	Broad Meadows Marsh restoration completed Willow Marsh- with ACOE for restoration plan
Flooding	5) The Sagamore Creek Tide Gate	DPW	In Progress	Waiting for final approval from FEMA
Flooding	6) Stormwater Infrastructure Inspection/Cleaning Upstream of the Sagamore Creek	DPW	Completed	Project was completed
Flooding	7) Division Street Pump Station Upgrades	DPW	Completed	Project was completed

Hazard(s) to Mitigate	Action Item # and Description	Responsible Department	Status: Completed/ Existing Capability/ In Progress/ Deferred/ Deleted	Explanation of Status as of 2018
Flooding	8) Inspection and Cleaning of the Furnace Brook Culverts	DPW	Completed	Project was completed
Flooding	9) Design and Permitting for the Inspection and Cleaning of the Furnace Brook Open Channel	DPW	Completed	Project was completed
Flooding	10) The Broad Street Tide Gate	DPW	Completed	Project was completed
Flooding	11) Stormwater Infrastructure Inspection / Cleaning Upstream of the Broad Street Tide Gate	DPW	Completed	Tide gate inspection and minor repair conducted twice yearly
Flooding	12) Drainage Improvements in the Circuit Road / Spence Ave Area	DPW	Completed	Project was completed
Flooding	13) Drainage Improvements in the Penn's Hill Area	DPW	In Progress	Project for improvements submitted to ACOE in 2011, surface portions of project are completed
Flooding	14) Drainage Improvements for Town Brook and Black's Creek *	DPW	In Progress	New tide gates on hold due to permitting issues

Hazard(s) to Mitigate	Action Item # and Description	Responsible Department	Status: Completed/ Existing Capability/ In Progress/ Deferred/ Deleted	Explanation of Status as of 2018
Flooding	15) Sea Wall Repairs*	DPW	In Progress	FY2017 and FY2018 funds from EOEEA secured for Adams Shore and Manet Avenue portions of the Hough's Neck Seawall. FEMA funding is under review for the Merrymount portions of the Hough's Neck Area Seawall
Flooding	16) CRS Participation	CRS Coordinator	Existing Capability	Described under Capabilities Analysis
Flooding	17) Floodplain Mapping	Engineering Office	Complete	FEMA Zones were updated, and areas of Map Revision approved by FEMA (more)
Flooding	18) Floodplain Management	Inspectional Services Dept	Existing Capability	Described under Capabilities Analysis
Flooding	19) Flood storage and drainage system improvements on Rockland Street*	Planning / DPW	Completed	Drainage system improvement / Outfall replacement completed in 2018 as part of the Emergency Repairs to Coastal Structures Project.
Flooding	20) Tide gate management plan*	DPW	In Progress	Edgewater Tide Gate (TG#18) replacement of Tide gate; Chickatabot Road Tide Gate (TG#15) system replacement, and Rockland St Tide Gate (TG#26) replacement of broken flapper gate with a tide flex valve completed as part of the Emergency Repair Contract in May 2018.

Hazard(s) to Mitigate	Action Item # and Description	Responsible Department	Status: Completed/ Existing Capability/ In Progress/ Deferred/ Deleted	Explanation of Status as of 2018
All Hazards	21) Public Education*	DPW/Planning/ Emergency Management	Existing Capability	Public education and assistance currently provided about flood warning, flood hazards, risks, methods and techniques for flood proofing, names and addresses of specialty (design/construction) contractors for retrofitting, precautions during storms, availability of emergency services, and flood insurance. Revised to include City staff training opportunities. Provide disaster assistance training to specified non-first responder city employees to assist with disaster events.
All Hazards	22) Consolidation of Emergency Communications System	Information Technology / Emergency Management	In Progress	Keep as project due to importance
All Hazards	23) Emergency Power Generators	DPW / Emergency Management	Existing Capability	Described under Capabilities Analysis. Revised to address adding or improving generators for remaining critical facilities
All Hazards	24) Enforcement of the Zoning Ordinance and other applicable codes*	Planning / Inspectional Services	Existing Capability	Described under Capabilities Analysis
All Hazards	25) Outreach to Historic Properties	Quincy Historical Society	Existing Capability	Described under Capabilities Analysis
Brush Fire	26) Fire response MOU with DCR*	Fire Department / Emergency Management	Existing Capability	MOU with the DCR for Blue Hills still in effect

Hazard(s) to Mitigate	Action Item # and Description	Responsible Department	Status: Completed/ Existing Capability/ In Progress/ Deferred/ Deleted	Explanation of Status as of 2018
Brush Fire	27) Installation of water pipes at Blue Hills Reservation and Faxon Park.	DPW	In Progress	Hydrant installed in the Park. Another hydrant is proposed
Brush Fire	28) Widen and maintain the fire road in Faxon Park	DPW	Completed	Fire Road has been widened. A new walking path throughout the Park has been installed.
Brush Fire	29) Conduct outreach to residents about not dumping yard waste in or against the park wall for Faxon Park	Fire/ Emergency Management	In Progress	Ongoing partnership with DCR
Earthquakes	30) Municipal Building Assessment	Public Buildings Department	In Progress, Revised	Seismic Study under consideration, revised as new project including gas utility study

* Mitigation measures carried forward from the 2005 Quincy Hazard Mitigation Plan.

Projects with **Existing Capabilities** are now included in the Capabilities Assessment in **Section 6**

Projects **In Progress** or with **Revised Existing Capabilities** have been included in Future Actions Table

Projects that have been **Completed** are removed from the Future Action Table

7.2.2 MITIGATION ACTION AND ADAPTATION STRATEGY FOR 2019

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The Planning Team developed a revised Mitigation Action Plan for the 2019 Plan. The revised plan includes 16 projects carried over from the 2013 Plan- three of which were revised, and 36 new projects identified by City department staff members. The completed list of 52 projects were reviewed and refined by members of City staff who would lead in implementing the action.

The goal of the Plan is to reduce Quincy's vulnerability to hazards, and by selecting and implementing the most costs effective mitigation actions the City will be on the road toward implementing that goal. The Planning Team completed a Risk and Benefit Assessment to prioritize the most cost-effective mitigation actions, as described in **Section 7.2.3**.

7.2.3 BENEFIT COST REVIEW METHODOLOGY

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The cost benefit review is the first step in completing a prioritization of mitigation projects. FEMA does not dictate how the cost benefit review is completed, however it is a required element for the plan. For the Quincy HMP, the prioritization of projects was based on a benefit cost review using the FEMA STAPLEE method. STAPLEE is a cost/benefit analysis tool that includes considerations for **S**ocial, **T**echnical, **A**dministrative, **P**olitical, **L**egal, **E**nvironmental and **E**conomic issues.

In its simplest application, the STAPLEE method consists of a table where actions (and mitigation options) are shown along the vertical axis and the STAPLEE categories along the horizontal axis (see inset below). Each action is analyzed per the categories in STAPLEE and a mark is placed in each category that the action affects in a positive way. The action with the most marks achieves a higher priority.

STAPLEE Criteria	S (Social)		T (Technical)			A (Administrative)			P (Political)			L (Legal)			E (Economic)				E (Environmental)				
Considerations → for Alternative Actions ↓	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long-term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/ Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/ Water	Effect on Endangered Species	Effect on HAZMAT/ Waste Sites	Consistent with Community Environmental Goals	Consistent with Federal Laws

For Quincy's HMP, the basic STAPLEE basic method was modified to allow for a more detailed evaluation accounting for both **benefits** and **costs** and reflects the types of mitigation actions being considered for the City. For many of the criterion values, a range of scores were assigned. **Table 7.2**, includes the values that were considered for each STAPLEE criteria and potential scores. A final score for each mitigation action was tabulated as the sum of the cost score and the benefit score.

Table 7.2
STAPLEE Benefit Cost Review: Criteria, Considered Values and Rating Scores

	COSTS		BENEFITS	
	Cost Values	**Cost Rating Scores**	**Benefit Values**	**Benefit Rating Scores**
Social	Adversely Affects Segment of the Population or Community Values	-3=yes -2=maybe -1=no	Benefits a Large Segment of the Population	3=large 2=med 1=small
Technical	Years to Implement Project	-1=1 year -2= 2-3 years -3= 4 or more	Easy to Implement with Local Resources	3= yes
Administrative	Operations and Maintenance $$ Required	-3=high -2=med -1=low or none	Sufficient Staffing Available	3=yes 2=maybe 1=no
Political	Public Opposition	-3=high -2=med -1=low	Local Champion-Politically Acceptable	3= yes
Legal	Action Potentially Subject to Legal Challenge	-3 Subject to legal challenge	Existing Local Authority to Implement	3= state or local authority
Economic	Approximate Cost	$=$50,000-$100,000 $$= $100,001-$500,000 $$$ = $500,001-$1,000,000 $$$$= >$1,000,001	Funding Available	3= yes
Environmental	Adverse Environmental Impacts	-3=high -2=med -1=low	Other Community Goals Achieved	3=yes

Once a total cost benefit rating score was calculated for each mitigation action, all of the mitigation actions were ranked as high, medium and low priority for implementation by hazard category based on the range of scores for each hazard.

Table 7.3 includes the list of 52 future mitigation actions sorted by type of hazard including the total benefit cost rating score and final overall ranking.

Table 7.3
2019 Mitigation Action Plan

Hazard	Mitigation Action #	Lead Department	Additional Funding	Approximate Cost	Timeframe	Consistency with Mitigation Goals	Consistency with other City Plans	Benefit Cost	Priority Ranking
All Hazards	Revised Public Education-Provide additional opportunities for City Staff Departments	Mayor's Office, DPW, Planning		$	1 year	Hazard Awareness	Comprehensive Emergency Management Plan	13	High
All Hazards	Revised- Emergency Power Generators will be added or improved as needed	DPW/ Emergency Management	FEMA	$	1 year	Emergency Response to Hazards	Comprehensive Emergency Management Plan	13	High
All Hazards	Evaluation of hurricane barrier to address Sea Level Rise and increasing surge	DPW		$	1-3 years	Protect existing properties and structures	Resilient Quincy	11	High
All Hazards	Cloud Based Record Storage and Access System for Building Inspections	IT/ Inspectional Services		$$	1-2 years	Emergency Response to Hazards	Comprehensive Emergency Management Plan	11	High
All Hazards	Discuss Climate Change Adaptation Plan with Stormwater Advisory Committee annually	DPW		$	1 year	Planning for Future Development	Stormwater Management Plan	10	Medium
All Hazards	Ongoing analysis to consolidate Emergency Communications System	IT/ Emergency Management		$	1 year	Emergency Response to Hazards	Comprehensive Emergency Management Plan	10	Medium
All Hazards	Maintain Comprehensive Emergency Management Plan	Emergency Management		$	1-2 years	Emergency Response to Hazards	Comprehensive Emergency Management Plan	9	Medium
All Hazards	Incorporate coastal management staff and resources into the proposed Natural Resource Department	Parks and Forestry		$$	1-2 years	Increase resilience by protecting and enhancing natural resources	Comprehensive Emergency Management Plan /Open Space Plan	9	Medium
Coastal Erosion	Bayside Road slope protection and infrastructure hardening design, permitting & construction	DPW	EOEA/ FEMA	$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	4	High
Coastal Erosion	Houghs Neck/Manet Seawalls Construction	DPW	EOEA/ FEMA	$$$$	2-3 years	Protect existing properties and structures	Capital Improvement Plan	3	High
Coastal Erosion	Adams Shore Seawalls inclusive of Chickatabot tide gate construction	DPW	EOEA/ FEMA	$$$$	2-3 years	Protect existing properties and structures	Capital Improvement Plan	3	High
Coastal Erosion	Maintain coastal buffers to stabilize shorelines	Parks and Forestry	DCR CZM MVP	$$	1-3 years	Increase resilience by protecting and enhancing natural resources	Open Space Plan	3	High
Coastal Erosion	Germantown Seawalls Design Permitting & Construction	DPW	EOEA/ FEMA	$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	0	Medium

Hazard	Mitigation Action #	Lead Department	Additional Funding	Approximate Cost	Timeframe	Consistency with Mitigation Goals	Consistency with other City Plans	Benefit Cost	Priority Ranking
Coastal Erosion	Town River Bay Seawalls design permitting and construction	DPW	EOEA/ FEMA	$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	0	Medium
Coastal Erosion	Merrymount Seawalls Design Permitting and Construction	DPW	EOEA/ FEMA	$$$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	-1	Low
Coastal Erosion	Squantum Seawalls Design Permitting & Construction	DPW	EOEA/ FEMA	$$$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	-1	Low
Coastal Erosion	Rockland Street Private Seawalls Design Permitting & Construction	DPW	EOEA/ FEMA	$$$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	-1	Low
Brush Fire	**Ongoing** Conduct outreach to residents about not dumping yard waste in or against the park wall for Faxon Park	Fire/ Emergency Management		$	1 year	Hazard Awareness	Open Space Plan	12	High
Brush Fire	**Ongoing** Installation of water pipes at Blue Hills Reservation and Faxon Park.	DPW		$$$$	1 year	Protect the health and safety of the public	Capital Improvement Plan	11	Medium
Earthquakes	**Revised** Seismic impact evaluation and gas utility study Public Buildings has questions Regarding this study	Public Buildings Department		$	3-5 years	Protect the health and safety of the public	Comprehensive Emergency Management Plan	11	High
Flood	Sewer Interceptor Relief for Downtown- Burgin Parkway	DPW	SRF	$$$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	9	High
Flood	Ongoing Tide-gate management plan- annual cost	DPW/ Inspectional Services	EOEA/ FEMA	$	1-2 years	Protect existing properties and structures	Stormwater Management Plan	9	High
Flood	East Squantum/ Dorchester Streets Drainage Hydraulic Model	DPW	SRF	$$	1-2 years	Protect existing properties and structures	Capital Improvement Plan	9	High
Flood	Lower Town Brook Drainage Improvements- Bigelow Street	DPW	FEMA	$$$$	2-4 years	Protect existing properties and structures	Stormwater Management Plan	8	High
Flood	Incorporate Climate Change Adaptation Plan into HMP	Planning	FEMA	$	1-2 years	Protect existing properties and structures	Quincy Resilient Plan	8	High
Flood	Miller/Cross/Furnace Ave Stormwater Control Station	DPW	FEMA	$$$$	1-2 years	Protect existing properties and structures	Capital Improvement Plan	8	High
Flood	Strand Pump Station rehabilitation	DPW	MWRA	$$$$	1-2 years	Protect existing properties and structures	Capital Improvement Plan	8	High

Hazard	Mitigation Action #	Lead Department	Additional Funding	Approximate Cost	Timeframe	Consistency with Mitigation Goals	Consistency with other City Plans	Benefit Cost	Priority Ranking
Flood	Broadmeadows School Flood Protection	Public Buildings Department	FEMA	$$$	3-5 years	Protect existing properties and structures	Stormwater Management Plan	7	High
Flood	Ongoing Drainage improvements for Upper Town Brook	DPW	CZM	$$$	1-5 years	Protect existing properties and structures	Stormwater Management Plan	7	High
Flood	Convert O'Rourke Field for use as a temporary retention pond	DPW	FEMA	$$$$	5 years	Protect existing properties and structures.	Capital Improvement Plan	6	High
Flood	Blacks Creek tide gate modernization	DPW	EOEA/ FEMA	$$$$	1-5 years	Protect existing properties and structures	Capital Improvement Plan	6	High
Flood	Develop hydraulic model and update tide gates for Norton Road, Post Island Road and Bayswater Road	DPW	EOEA/ FEMA	$$$$	2-4 years	Protect existing properties and structures	Capital Improvement Plan	6	High
Flood	Adams Shore & Post Island Rd stormwater stationary pumping station	DPW	FEMA	$$$$	1-2 years	Protect existing properties and structures	Stormwater Management Plan	6	High
Flood	Purchase high capacity mobile pumps	DPW	FEMA	$$$$	1-2 years	Protect existing properties and structures	Stormwater Management Plan	6	High
Flood	Other sewer system coastal rehabilitation (Wollaston Beach, West Quincy)	DPW	MWRA	$$$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	6	High
Flood	Ongoing Salt Marsh Restoration & coordination with US Army Corps of Engineers	Parks & Forestry Dept/ DPW	CZM/ USACOE	$	1-5 years	Increase resilience by protecting and enhancing natural resources	Open Space Plan	6	High
Flood	Houghs Neck Emergency Access along MWRA sewer easement	DPW	FEMA	$$$$	3-5 years	Protect existing properties and structures	Comprehensive Emergency Management Plan	5	Medium
Flood	Small MS4 Program - Drainage System O&M Plan includes invasive species removal	DPW	MassDEP	$	2-4 years	Protect existing properties and structures	Stormwater Management Plan	5	Medium
Flood	Evaluate use of Tree Filter Boxes in flood prone areas to improve stormwater infiltration	Parks and Forestry	MassDEP	$	1-2 years	Increase resilience by protecting and enhancing natural resources	Stormwater Management Plan	5	Medium
Flood	Ongoing Division Street Pump Station upgrades	DPW	SFR	$$$$	1-5 years	Protect existing properties and structures	Capital Improvement Plan	5	Medium
Flood	Water Street Drainage Improvements - Brook Road to Brewers Corner	DPW	CITY	$$$$	5 years	Protect existing properties and structures. Protect access to SW Middle school	Capital Improvement Plan	4	Medium

Hazard	Mitigation Action #	Lead Department	Additional Funding	Approximate Cost	Timeframe	Consistency with Mitigation Goals	Consistency with other City Plans	Benefit Cost	Priority Ranking
Flood	Ballou Street bypass via Milton	DPW	SRF	$$	2-3 years	Protect existing properties and structures.	Stormwater Management Plan	4	Medium
Flood	Ongoing Sea wall repairs	DPW	EOEA/ FEMA	$$$	1-5 years	Protect existing properties and structures	Capital Improvement Plan	4	Medium
Flood	Broad Street Pumping System to protect Public Safety Complex	PDW	FEMA	$$$$	3-5 years	Protect existing properties and structures	Capital Improvement Plan	3	Medium
Flood	Small MS4 Program - water quality retrofits	DPW	MassDEP	$	3-5 years	Increase resilience by protecting and enhancing natural resources	Stormwater Management Plan	3	Medium
Flood	Ongoing -Sagamore Creek Tide Gate	DPW/ Conservation	CZM	$$$	1-5 years	Protect existing properties and structures	Stormwater Management Plan	3	Medium
Flood	Ongoing Drainage improvements in the Penn's Hill Area	DPW	FEMA	$$$$	1-5 years	Protect existing properties and structures	Capital Improvement Plan	3	Medium
Flood	Evaluate elevating critical access routes- Sea, Palmer and East Squantum Streets and Commander Shea Blvd	DPW	FEMA	$	3-5 years	Emergency Response to Hazards	Comprehensive Emergency Management Plan	0	Low
Flood	Ongoing Retrofit and flood proof existing buildings subject to repetitive flooding	Planning	U.S. HUD/FEMA	$$	1-5 years	Protect existing properties and structures	Community Rating System Plan	-1	Low
Flood	Ongoing Property Acquisition	Mayor's Office	CPA/ Hotel-Motel Tax	$	1-5 years	Protect the health and safety of the public	Open Space Plan	-1	Low
Flood	Ongoing Elevate Repetitive Loss Structures	Planning	U.S. HUD/FEMA	$$	1-5 years	Protect existing properties and structures	Community Rating System Plan	-3	Low
Invasive Species	Develop and implement invasive species removal program	Parks and Forestry, DPW	CZ/ DCR	$	1-5 years	Increase resilience by protecting and enhancing natural resources	Open Space Plan	11	High
Winter Weather and Wind	Obtain additional equipment to improve ability to respond to tree removal from natural hazard events	Parks and Forestry	FEMA	$$	1-2 years	Ensure that essential services can function during and after a hazard event	Comprehensive Emergency Management Plan	13	High

7.3 PROJECT TIMELINE FOR 2019 MITIGATION ACTIONS- EXAMPLE

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Table 7.3 includes 28 projects ranked with a high priority, 17 with a medium priority and seven with a lower priority for all hazard categories. Although all projects are important to the City, the high priority projects are summarized below relative to recommended timing of the individual mitigation actions. The City has identified its Capital Improvement Plan, Quincy Center Revitalization Plan, Stormwater Management Plan, Consolidated Action Plan, Open Space Plan and Comprehensive Emergency Management Plan as mechanisms to integrate mitigation actions over the next five years.

Three high priority mitigation actions are identified for year one:

- Provide additional opportunities to educate City staff on natural hazard risk and mitigation including climate change
- Identify needed improvements to emergency generators serving critical facilities
- Provide outreach to eliminate dumping yard waste at Faxon Park

Ten high priority projects are identified to begin in year one requiring two or more years to complete:

- Consolidate Quincy's Emergency Communication System (ranked medium, but elevated to high priority based on need)
- Purchase cloud-based record storage and access system for Building Inspectors
- Improve tide gate management plan
- East Squantum/ Dorchester Street drainage hydraulic model
- Miller/ Cross/ Furnace Ave Stormwater Control Station
- Strand Pump Station rehabilitation
- Develop Adams Shore and Post Island Road stormwater stationary pumping capacity
- Purchase high capacity mobile pumps to augment DPW ability to respond to floods
- Obtain equipment to better respond to tree removal after hazard events
- Evaluation of building a hurricane barrier to address sea level rise and increasing surge
- Maintaining coastal buffers to stabilize shorelines

Four high priority projects that are in progress but will take up to five or more years to complete, these projects include:

- Drainage improvements for Upper Town Brook
- Blacks Creek tide gate modernization
- Salt Marsh Restoration and coordination with US Army Corps of Engineers

- Invasive species removal program

Four high priority projects identified to begin in year two include:

- Houghs Neck/Manet Seawalls construction
- Adams Shore Seawalls inclusive of Chickatabot Tide gate construction
- Lower Town Brook drainage improvements
- Develop hydraulic model and update tide gates for Norton, Post Island and Bayswater Roads

Five high priority projects identified to begin in three to five years include:

- Bayside Road slope protection, infrastructure hardening- design, permitting & construction
- Seismic impact evaluation and gas utility study
- Sewer Interceptor relief for downtown- Burgin Parkway
- Broadmeadows School flood protection
- Other sewer system coastal rehabilitation (Wollaston Beach, West Quincy)
- Convert O'Rourke Field for use as a temporary retention pond

7.4 CONTINUED COMPLIANCE WITH NFIP

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The City continues to enforce required elements of the National Flood Insurance Program so that they may continue to participate in the program including:

- Issuing or denying floodplain development/ building permits
- Inspecting all development to assure compliance with the local floodplain zoning by-law
- Maintaining records of floodplain development
- Assisting in the preparation and revision of floodplain maps
- Helping residents obtain information on flood hazards, floodplain map data, flood insurance and proper construction measures.

The City periodically reviews the zoning by-law for consistency, and uses the most recent FIRM data to determine base flood elevation or the best available scientific data for determinations of base flood elevation if no FIRM data is available to achieve a reasonable measure of flood protection.

7.5 CHANGES IN PRIORITY FROM 2013 TO 2018

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While flooding continues to be the number one priority for Quincy, the 2018 risk and vulnerably analysis have shifted priorities to include addressing the full range of identified natural hazards. Climate change was considered in relation to inland and coastal flooding and projects were recommended based on potential inundation related to storm surge, sea level rise and extreme precipitation. Mitigation projects were included for the following natural hazards that were not part of the 2013 Plan:

- Coastal Erosion and Shoreline Change
- Invasive Species
- Extreme Heat

7.6 RESILIENCY VISION FOR QUINCY

Quincy is a forward-thinking community and recognizes climate change as a factor that will change weather patterns, flooding extent, habitat and species distribution, and ultimately impact its ability to recover from disaster and risk to the economic well-being of the City. The City's Open Space and Capital Improvement Plans all include specific goals and objectives recognizing the need to plan for and adapt to natural hazards affected by climate change, thus improving the resiliency of Quincy.

A resiliency vision for Quincy includes empowering the residents, business community and City Leaders to make near, mid and long-term changes that will reduce future climate change impacts, protect its vital community assets, and adapt to changes already occurring. The mitigation actions included in the 2019 Hazard Mitigation Plan complement and support this resiliency vision.

SECTION 8

PLAN EVALUATION AND MAINTENANCE

Once the 2019 Quincy Multi-Hazard Mitigation Plan is adopted by the Mayor, the plan enters a five-year “maintenance” phase. Section 8 describes how the Plan will be evaluated, updated and enhanced over the next five years.

Section 8 Plan Evaluation and Maintenance

8.1 WHO IS INVOLVED?

Each department identified in the Quincy Hazard Mitigation Plan is responsible for implementing specific mitigation actions detailed in the Mitigation Actions section of the plan (**Section 7**). Every proposed action listed in the Future Mitigation Action section is assigned to a specific "lead" department as a way to assign responsibility and accountability and increase the likelihood of subsequent implementation. Annual review will enable specific actions to be modified, if needed, rather than wait until the 5-year update, allowing mitigation projects to evolve in a more timely manner as circumstances dictate.

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Quincy Department of Engineering and Department of Planning and Community Development will jointly be responsible for ensuring that the Plan is monitored, evaluated, and updated throughout the next five years.

8.2 HOW WILL THE PLAN BE MAINTAINED?

The following activities describe how the plan will be maintained and updated over the next five years:

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Plan Monitoring

Members of the Planning Team will communicate annually to report on the implementation status of each Mitigation Action identified in **Section 7**, noting accomplishments, challenges, and recommended modifications to identified actions. The Planning Team will also describe and document any new hazard data that can be incorporated in the Hazard Profile section of the Plan, noting any new hazard location, extent, and impact.

At least once per year, the Planning Team will update the implementation status of Mitigation Actions and an evaluation of the appropriateness of the actions, noting any changes warranted.

Plan Evaluation

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The Planning Team will communicate annually to evaluate the purpose and goals of the Hazard Mitigation Plan to ensure the Plan continues to serve its purpose. The annual review will include the following activities:

- Submit survey to all members of the implementation group and other interested local stakeholders. The survey will poll the members on any changes or revisions to the plan that may be needed, progress and accomplishments for implementation, and any new hazards or problem areas that have been identified.
- Review survey results and make recommendations if any changes to the plan are needed
- Review the Mitigation Goals in the 2019 Quincy Hazard Mitigation Plan
- Discuss recent activities to reduce loss of life and property such as grants received/applied for and any completed Mitigation Actions
- Discuss ongoing or recent planning efforts that are consistent with the Mitigation Goals and Actions of the 2019 Quincy Hazard Mitigation Plan

PLAN EVALUATION AND MAINTENANCE

Plan Update

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The 2019 Quincy Hazard Mitigation Plan will be reviewed and updated every five years to ensure there is no lapse in Plan coverage. The Plan update process will be scheduled one to one and a half years before the Plan is set to expire.

8.3 WHEN WILL THE PLAN BE MAINTAINED?

A start date and time periods were assigned to each Mitigation Action in Section 7 to assess whether actions are being implemented in a timely fashion. Also, the Planning Team will communicate annually to discuss progress on Mitigation Actions.

Following a disaster declaration, the 2019 Quincy Hazard Mitigation Plan will be revised as necessary to reflect lessons learned or to address specific issues and circumstances arising from the event. It will be the responsibility of the Quincy Planning Director to coordinate with the Planning Team and ensure that appropriate stakeholders are invited to participate in the plan revision and update process following a declared disaster event.

8.4 INCORPORATION WITH OTHER PLANS

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Upon approval of the Quincy Hazard Mitigation Plan by FEMA, the Planning Team will provide all interested parties and implementing departments with access to a copy of the Plan and will initiate a discussion regarding how the Plan can be integrated into that department's ongoing work. At a minimum, the Plan will be shared with the following departments, commissions, and boards:

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- Fire Department
- Emergency Management
- Police
- Public Works
- Planning and Community Development
- Conservation Commission
- Parks, Forestry and Cemetery
- Recreation
- Health Department
- Public Buildings Department
- Building and Inspectional Services
- School
- Housing Authority
- Historical Commission
- Zoning Board of Appeals
- Planning Board
- Information Technology

The Plan will also be posted on the City's website. The posting of the Plan on the website will include a mechanism for citizen feedback such as an e-mail address to send comments. A brief Plan Summary will be developed and printed copies made available to the general public.

SECTION 9

PLAN ADOPTION

Once the draft 2019 Quincy Multi-Hazard Mitigation Plan is reviewed by the Planning Team, City officials and the public, the Plan is reviewed by the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA). If approved by MEMA and FEMA, the Mayor of Quincy can officially adopt the plan. Once the Plan is approved, in enters the five-year "maintenance" phase described in Section 8. Section 9 describes the timeline for plan adoption and includes documentation for future adoption by the Mayor of Quincy.

Section 9 Plan Adoption

Once the draft of the Quincy Hazard Plan is reviewed by the Planning Team, stakeholders, and the general public, the Plan is reviewed by MEMA and FEMA. If approved by MEMA and FEMA, the Quincy City Council can officially adopt the Plan. If and when the Plan is approved, it enters into the five year "maintenance" phase. This Section describes the timeline for plan adoption and includes documentation of the Plan adoption by the City Council.

9.1 TIMELINE FOR PLAN ADOPTION

The timeline for Plan Adoption is as follows:

December 5, 2018: After initial approval by the City Planning Board at its December 5th 2018 meeting the Planning Team submitted the Quincy Hazard Mitigation Plan to MEMA on December 14th, 2018. MEMA reviewed the Plan and returned it to the City with required edits. The Quincy Hazard Mitigation Plan was then submitted to FEMA for final review.

January 18, 2019: FEMA issued an Approved Pending Adoption status.

April 1, 2019: The Quincy City Council officially adopted the Hazard Mitigation Plan on April 1, 2019 during a regularly scheduled meeting. The order was approved by the Mayor on April 2, 2019.

9.2 PLAN ADOPTION

The Certificate of Adoptions is provided at the front of the plan.

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