City of Woburn

Community Resilience Building Workshop

Summary of Findings

April 2019

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Source: Patch, 2017

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Photo Source: Patch, 2017

1.0 INTRODUCTION

Source: Boston University

In 2017, the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) initiated the Commonwealth's Municipal Vulnerability Preparedness (MVP) grant program to help communities plan for and take action toward becoming more resilient to the impacts of climate change. The program provides Planning Grants to assist municipalities in preparing for the impacts of climate change through participation in a community climate vulnerability workshop and development of a climate change action plan. Communities that complete the planning grant program receive "a Certified MVP Community" designation, are then eligible for MVP Action Grants, and achieve increased standing in other state grant programs (Figure 1). MVP Action Grants fund the implementation of priority climate change adaptation actions that have been described in the municipality's MVP plan. In 2018, the City of Woburn received an MVP Planning Grant to follow the Community Resilience Building (CRB) Workshop Guidance, developed by The Nature Conservancy. This grant has enabled Woburn to consider the impacts of climate change and plan for resilience.

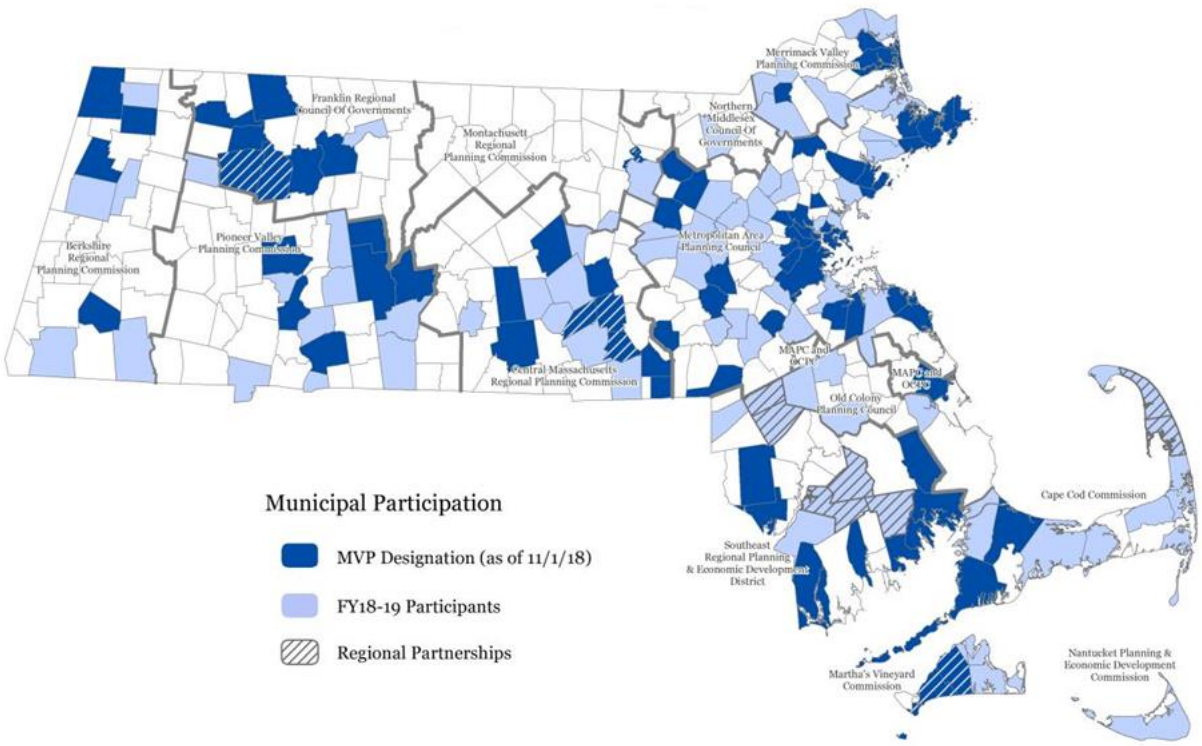


Figure 1. Massachusetts Communities Participating in the MVP Program

1.1 Environmental Risk in Woburn

Figure 2. Flooding at Four Corners
Source: CBS Boston, 2017

The City of Woburn is already experiencing the effects of climate change, including increases in precipitation intensity and frequency, storms and temperatures. More extreme precipitation events are causing severe local riverine and stormwater flooding in Woburn. In the aftermath of past storms, main roads have been inundated causing hardships to businesses and residents. Four Corners is regularly flooded during heavy precipitation, oftentimes making the intersection impassable. Areas of significant standing water also occur on Olympia Avenue, New Boston Street, Washington Street, Salem Street, and School Street. Extreme precipitation regularly caused flooding damage to residences and businesses, and cut off the main access point to the west side of Woburn, restricting emergency vehicle access. In addition to flooding, Woburn also experienced a microburst on July 8, 2018, which ran along Bedford Road, taking down dozens of trees along its path and making the road impassable.

Woburn, along with the entire northeastern United States has also been experiencing the effects of temperature increases. Since 1970, annual average temperatures in this region have increased by 2° F. Globally, the five warmest years on record occurred in the past five years (2014-2018) and 18 of the 19 hottest years have occurred since 2001 (https://climate.nasa.gov/news/2841/2018-fourth-warmest-year-in-continued-warming-trend-according-to-nasa-noaa/). This poses significant health risks to vulnerable populations who are susceptible to, or are not able to find relief from, heat.

Sections 7.5 and 7.6 of this report, Works Cited and Additional Resources, respectively, present more information on climate change projections and adaptation plans in Massachusetts and Woburn.

1.2 Land Use in Woburn

Located in eastern Middlesex County, 10 miles northwest of Boston, the City of Woburn is bordered by Winchester to the south, Stoneham and Reading to the east, Wilmington to the northeast, and Burlington to the northwest. The City has a total area of 12.9 square miles, of which 12.7 square miles is land and 0.2 square miles is water. The City is in the Mystic River watershed. Located within the upper reaches of the watershed, the 102-acre Horn Pond is fed my several brooks and discharges via Horn Pond Brook to the Aberjona River and the Mystic Lakes, eventually reaching the Mystic River.

As Woburn faces a range of environmental risks, the adaptation strategies it implements will need to consider the City's varying landscape conditions. The City's commercial, forest, and residential developments will be impacted differently by riverine and stormwater flooding, extreme temperatures and wind, and will require localized solutions. Considering the full scope of Woburn's environmental risks can lead to a comprehensive set of strategies to prepare for extreme events and mitigate their impacts.

1.3 Demographics in Woburn

The needs of vulnerable populations should be carefully considered when planning for environmental risk. Vulnerable populations can include the elderly, children, the infirmed, residents with language barriers, residents with special needs, the homeless, undocumented residents, and residents with low or moderate income. 2010 census data for the City of Woburn shows that of the 38,120 residents of Woburn, approximately 7,578 are children (under 18) and 7.8% of these children live in poverty. Of the 6,066 residents who are age 65 or older, 7.8% live in poverty (American Community Survey (ACS), 2017).

The City of Woburn's land use is primarily made up of residential development, forest, and commercial/ industrial development (Figure 3). The residential area comprises over one-third of the City's area

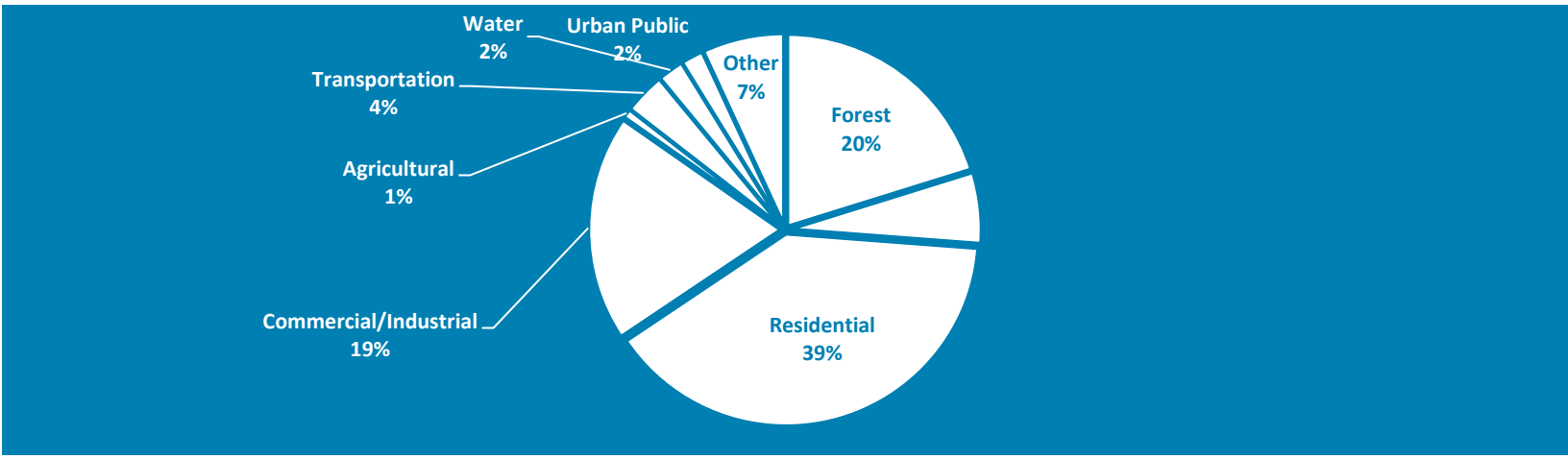


Figure 3. Land Use in Woburn (Source: MassGIS)

Other demographic information for the City of Woburn is summarized below:

Population

- 38,120 residents were recorded by the 2010 Census (U.S. Census Bureau, 2010)
- 39,701 residents were estimated in 2017 (ACS, 2017)
- 46,635 residents are projected by 2035 (Metropolitan Area Planning Council [MAPC], 2016)

Age

- 19.2% of residents are under age 18 (ACS, 2017)
- 15.9% of residents are 65 or older (ACS, 2017)

Education

- 94.3% of residents have a high school diploma (U.S. Census, 2013-2017)
- 39.9% of residents have a bachelor's degree (U.S. Census, 2013-2017)

Income

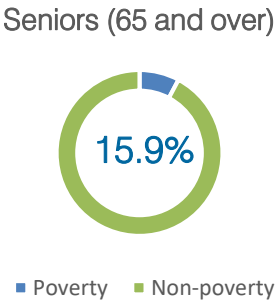
- Median household income is $83,872 (ACS, 2017)
- 7.2% of residents are below the poverty level (ACS, 2017)
- 30.69% of population is low to moderate income (ACS, 2006)

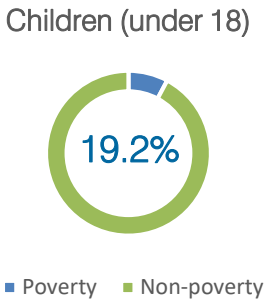
Employment

- 34,323 jobs were recorded by the 2010 Census (2012 Economic Census of the U.S., https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF)
- 34,601 jobs are projected by 2035 (MAPC, 2016)

Residential Property Values

- There are 16,277 housing units (U.S. Census 2013-2017)
- The median property value is $394,900 (U.S. Census 2013-2017)





2.0 COMMUNITY RESILIENCE BUILDING WORKSHOP: SUMMARY OF FINDINGS

The timeline of climate adaptation and mitigation efforts in Woburn extend for several years. Woburn first introduced a Hazard Mitigation Plan in 2007, which was later updated in 2015 (MAPC, 2015). The Federal Emergency Management Agency (FEMA) updated the area's Flood Insurance Rate Maps (FIRM) in 2010, including Horn Pond as well as the brooks feeding the pond, and the Aberjona River and floodplain, which covers a large portion of Woburn's commercial district. The Mystic River Watershed Association's Resilient Mystic Collaborative has re-run the floodplain model using increased precipitation to simulate conditions under climate change.

Woburn's application to the Municipal Vulnerability Preparedness (MVP) Planning Grant advances the City's history of climate change planning. The MVP program helps support Massachusetts communities prepare for extreme weather and implement priority resilience projects. Communities that complete the MVP program become certified and are eligible to apply for MVP Action grant funding. As a participating community, Woburn can use this funding to improve resilience and preparedness for natural and climate-driven hazards; collaborate with stakeholders regarding climate change, natural hazards and impacts; and increase education, planning, and implementation of priority actions.

Woburn's MVP application outlined the impact of extreme weather events and pledged to incorporate findings from the MVP Project into future planning efforts. Findings of the MVP Planning Project will be incorporated into future updates of the City's Hazard Mitigation Plan as well as into other future city planning efforts, including updates of the Open Space and Recreation Plan and the Master Plan.

To plan for the Community Resilience Building Workshop, the City of Woburn followed the process described in the Community Resilience Building Workshop Guidebook (The Nature Conservancy, undated). The Guidebook presents a clear approach on how to organize the public process for mitigating the impacts of and increasing resilience against natural hazards and climate change. An important aspect of the planning process is the discussion it promotes among community members about creating a safer, more resilient community. The project used three tiers for project planning and public outreach: 1) the Core Team, with representation from municipal leadership at the City of Woburn, that planned the CRB Workshop, 2) stakeholders who represented entities that could be vulnerable to, or provide strength against, natural hazards and climate change, and 3) the general public, who live and work in the City. Developing a resilience plan that reflects the values and priorities of stakeholders and the general public of the City of Woburn is likely to produce greater community support and result in greater success in implementing mitigation strategies that reduce risk.

2.1 The Core Team

The City of Woburn, with support and leadership from Mayor Scott Galvin and City Engineer Jay Corey, P.E., convened the Core Committee to act as a steering committee for the development of the MVP Plan. The Core Committee met on January 3, 2019 to establish goals for the plan, and to provide reports, maps, and other pertinent information related to natural hazards and climate change impacts in Woburn. The Core Committee developed the invitation list for the Community Resilience Building Workshop at which key stakeholders would help the City identify hazards, vulnerabilities, strengths, and propose actions to mitigate the impacts of natural hazards and climate change. The Core Committee sought to include municipal leaders as well as politicians, representatives from local nonprofit organizations, other local jurisdictions, regional organizations, and state government. The Core Committee met again on April 9, 2019 to review the list of priority actions developed in the CRB Workshop and comments received

during the public comment period. Agendas and notes from the Core Team meetings are presented in Appendix E. Members of the Core Committee are listed in Section 7-3.

2.2 Community Resilience Building Workshop

Stakeholders with subject matter expertise and local knowledge and experience, including public officials, regional organizations, environmental organizations, and state and federal government, were invited to engage in an all-day Community Resilience Building Workshop, held on March 26, 2019. The workshop's central objectives were to:

- Define top local, natural, and climate-related hazards of concern
- Identify existing and future strengths and vulnerabilities
- Develop prioritized actions for the Community
- Identify immediate opportunities to collaboratively advance actions to increase resilience

During the first part of the Workshop, Weston & Sampson provided information about natural hazards and climate change, and participants identified top hazards. The participants then identified infrastructural, societal and environmental features in the City that are vulnerable to or provide strength against the identified hazards. During the second part of the Workshop, participants identified and prioritized key actions that would improve the City's resilience to the natural and climate-related hazards (Figure 4). A list of all invitees and attendees is included in Section 7.1 of this Plan.

Twenty-four stakeholders participated in the event, working alternatively in large and small groups to identify hazards, at-risk areas, and recommendations related to environmental risk and climate adaptation.

Figure 4. Discussions During the Community Workshop

3.0 TOP HAZARDS AND VULNERABLE AREAS

Natural hazards in Woburn include heavy precipitation, riverine and stormwater flooding, heat, wind, drought, erosion, and winter storms. The 2015 Hazard Mitigation Plan summarized the following natural hazards:

Table 1. Woburn Risks Summary		
Hazard	Frequency	Severity
Flooding	High	Serious
Dam Failures	Medium	Serious
Winter Storms	High	Minor
Ice Storms	Medium	Minor
Hurricanes	Medium	Serious
Nor'easters	High	Serious
Thunderstorms	High	Minor
Tornadoes	Very Low	Serious
Brush Fires	Medium	Minor
Earthquakes	Very Low	Serious
Landslides	Very Low	Minor
Extreme Temperatures	Medium	Minor
Drought	Low	Minor

(Source: City of Woburn Hazard Mitigation Plan, 2015)

3.1 Top Hazards

Workshop participants reviewed all the climate risks during the CRB workshop. The top four hazards identified by participants during the workshop are:

3.1.1 Flooding

Between 1961 and 2015, the 24-hour, 100-year rain event increased from 6.5 inches to 8.4 inches (NOAA, 2015; U.S. Department of Commerce, 1961). This increased precipitation causes both rivers and storm drain systems to exceed their capacities, resulting in flooding.

3.1.2 High Winds

High winds will impact infrastructure, trees, and properties.

3.1.3 Snow and Ice

Winter storms, and associated snow and ice, can damage infrastructure and properties and result in power outages. In the past few decades, more rain has been observed during the winter months. Winters

are projected to become rainier and icier, which can increase the chances of damages like those caused by the December 2008 ice storm that struck central Massachusetts.

3.1.4 Extreme Heat and Drought

This hazard includes very high temperatures. Average temperatures in the area could increase by 2.8°F to 6.2°F by mid-century, and by 3.8°F to 10.8°F by the end of the century (NECASC 2018). There could also be an increase in days with temperatures above 100°F. The number of these extremely hot days could increase between 1 and 3 days by 2050, and between 1 and 13 days by 2100 (NECASC 2018). This hazard also includes drought or extended periods with lower than normal precipitation. There is a higher risk of drought in the summer and fall which will worsen as temperatures increase under climate change. This could potentially affect water supply, river, streams and wetlands, as well as vegetation and crops.

3.2 Vulnerable Areas

Participants discussed vulnerable areas during the CRB Workshop. The areas that flood most frequently were cited as a concern. Four Corners (at the intersection of Russell Street and Cambridge Road) is often flooded during rain events. Flooding at Four Corners effects the road, parking lots, as well as adjacent businesses, cutting off direct access between the police and fire departments, and the west edge of the City. Areas of concern identified in the CRB workshop are summarized in the table below:

Table 2: Vulnerable Areas in Woburn	
Category	Name
Streets	Four Corners, Olympia Ave., Nashua/Draper St., Hart/Wyman St., Washington St., Salem St., School St.
Drainage	Citywide, Four Corners
Horn Pond	Horn Pond, Horn Pond Brook

Figure 5. Streets flooded after a storm. Source: Patch, 2017

Figure 6. Woburn exit off Route 128 closed. Source: Patch, 2016

Figure 7. Woburn street after a storm. Source: Patch, 2017

4.0 CURRENT CONCERNS AND CHALLENGES PRESENTED BY HAZARDS AND CLIMATE CHANGE

The main areas of concern were grouped within the following three categories or "features": infrastructural, societal, and environmental.

4.1 Infrastructural

Workshop participants identified those key infrastructural features in Woburn that are most vulnerable to natural hazards and climate change impacts or may be so in the future. They are:

- Streets that are susceptible to flooding, including: Four Corners, Olympia Avenue, Nashua/Draper Street, New Boston Street, Washington Street, Salem Street, and School Street (the most commonly cited infrastructural area of concern was Four Corners).
- Culverts, including Shaker Glen Brook culvert
- The approach road to the new Boston Street bridge, which begins construction in 2021.
- Water treatment plant
- Radio tower
- Police station
- Public Roadways and traffic volume
- Emergency Services

4.2 Societal

Workshop participants discussed the impact of climate change on vulnerable populations. These vulnerable communities will need support and access to shelters, information, cooling centers, and evacuation plans in the event of an emergency. Concerns related to the societal category include:

- Individuals living in poverty
- Public shelters
- Social media/education/public outreach
- Energy dependent population (oxygen/dialysis dependent)
- Elderly populations
- Population with addiction/living in halfway houses or in adult day care
- Children
- Low- to moderate-income population
- Immigrants and people with language barriers
- Commuting population
- Outpatient care
- Medical reserve corps
- First responders/medical staff
- Courthouses
- Commerce centers

Figure 8. Areas of Concern Include Four Corners, the Police Station, the Aberjona River and Traffic Volume. Transportation, Assisted Living Facilities, and Horn Pond Dam

4.3 Environmental

Workshop participants identified those key environmental features in Woburn that are most vulnerable to natural hazards and climate change impacts. They are:

- Horn Pond
- Horn Pond Brook
- Forest
- Wetlands
- River herring
- Aberjona River/superfund site (operable units 1 and 2)
- Floodplains
- Sweetwater Brook (stormwater management)
- Open space (Clapp Park)
- Watersheds (Aberjona)
- Invasive species
- Air quality
- Pests
- New development
- Surface/stormwater quality
- Cranberry bog
- Aquifers/groundwater protection
- Conservation areas
- Community gardens
- Middlesex canal
- Solar energy

5.0 CURRENT STRENGTHS AND ASSETS

Despite the range of risks that Woburn faces, participants in the workshop were able to identify several existing strengths and assets within the city.

5.1 Infrastructural

Workshop participants identified those key infrastructural features in Woburn that provide strength against natural hazards and climate change impacts. They are:

- Emergency shelter at high school
- New schools
- Upgrades to Horn Pond Dam
- Pumping station
- Police/fire department
- Emergency Response
- Radio Tower
- Public shelter options
- Commercial buildings
- Drinking water system
- Transportation center

5.2 Societal

Workshop participants identified those key societal aspects of Woburn that provide strength against natural hazards and climate change impacts. They are:

- Public buildings/churches
- Multi-lingual residents
- First responders/med staff
- Commuter population
- Medical reserve corps
- Council of social concern/council on aging
- Elderly housing
- Assisted care/rehab centers
- Halfway houses
- Daycare centers
- Outpatient care
- Schools
- Courthouses

5.3 Environmental

Workshop participants identified those key environmental features in Woburn that provide strength against natural hazards and climate change impacts. They are:

- Horn Pond
- Forest
- Wetlands
- River herring
- Floodplains
- Sweetwater Brook
- Clapp Park
- Aberjona watershed
- New developments
- Community gardens
- Middlesex canal
- Greenspaces/canopy
- Groundwater protection (zoning)
- Solar energy

Figure 9. The Horn Pond Dam, which was repaired and improved in 2017. Source: mapio.net

6.0 TOP RECOMMENDATIONS TO IMPROVE RESILIENCE

After listing vulnerabilities, hazards, and possible actions, participants ranked their recommendations from high to low priority. A summary of findings from the groups matrices is included below.

Figure 10. Participants Created Matrices of Risks and Vulnerabilities at Each Table, Before Consolidating Findings into One Matrix and Ranking Priority Actions

6.1 Highest Priorities

- Horn Pond Brook hydraulic and vegetation improvements for flood control and fish migration.
- Address flooding at Four Corners at the intersection of Cambridge and Russell Streets.
  - Reduce flooding by adding flood storage and wetland creation/restoration in adjacent empty lot along Russell Street that the City is in the process of acquiring.
  - Repair culvert along Shaker Glen Brook
  - Floodproof businesses
  - Work with business to add green infrastructure as well as permeable surfaces
  - Repair drainage to allow emergency access to west side of the City during high intensity rain events
- Increase storage, drainage upgrades, drainage improvements, raise roads and add green infrastructure in areas that flood regularly, including but not limited to Four Corners, Olympia Ave, Nashua/Draper St, New Boston St, Washington Street, Salem St, and School St.
- Improve stream crossings/culverts – increase capacity and clean regularly.
- Additional funding to DPW for road/drainage maintenance and upgrades. DPW preventative maintenance plan and stormwater management plan.
- Add an additional emergency shelter in the City.
- Coordinate and improve communications systems with EMS. Work with doctors, senior center, housing authority, grocery stores and shelters to pass along information on the RAVE system (state and local emergency notification system) to seniors, low income, commuting, non-English speaking residents. Create list of at-risk residents in case of power failure. Provide incentives to look in on fragile residents more systematically. Consider more extensive training (less than EMS).
- Upgrade and increase drinking water management for increased population and drought. This could include redundant pumps, capital improvement plan, investment, and execution.
- Add additional requirements for new developments. These areas can contribute to stormwater retention and green infrastructure to reduce flooding. Avoid losing open space. Floodplain zoning should be for a 500-year storm.
- Develop a stormwater task force. Review and update stormwater ordinance as necessary to address stormwater quality and quantity and to promote stormwater management onsite.
- Maximize site-specific stormwater retention. Identify opportunities for enhanced stormwater retention.

6.2 Moderate Priorities

- Add backup generators to critical infrastructure, such as pump stations and the radio tower which services five communities. Add redundancies on water towers. Add generators and cooling centers for elderly housing.
- Protect police station from flooding. Options include relocation of facility, dry floodproofing the lower level, moving generator to a higher elevation, and adding pumps to the basement to prevent flooding.
- Create stormwater storage areas in the Horn Pond forest.
- Widen and clear trails in the forest around Horn Pond as a buffer to isolate brush fires, as well as access for emergency vehicles.
- Evaluate opportunities for stormwater management on Sweetwater Brook.
- Upgrade fire department station 3 equipment building and apparatus
- Add curbside composting to decrease rats
- Manage open water to reduce insects
- Test, monitor, create plan to prevent toxic site erosion and discharge.
- Design parks to increase shade, and to reduce heat and stormwater.
- Create urban forest plan for public and private land. Replace trees damaged in storms. Assess condition of public trees, trimming branches and removing dead trees. Replant with new trees and inventory their condition.
- Upgrade drainage and building elevations on older schools.

6.3 Additional Priorities

- Regular inspections and proper maintenance on the Horn Pond Dam, as well as outreach to neighboring communities
- Implement billing/incentives for water conservation.
- Vulnerability assessment on Horn Pond
- Study floodplain performance.
- Provide transportation for public housing and low-income residents to emergency shelters.
- Subsidize cooling and heating strategies with Eversource.
- Consider zero net energy, shelter-in-place housing standards for new developments. Consider emergency services in multi-family houses.
- Sand bagging and vegetated berms at the wastewater pump station.
- Keep up with wastewater transport system improvements and monitor for wastewater overflows at Horn Pond.
- Work with the regional transportation center to establish an evacuation route and alternative route plan.
- Come up with reasonable alternatives to reduce salt for deicing.
- Monitor sites for invasive species.

6.4 Preliminary Schedule

The City has developed a preliminary schedule for priority projects:

2019: Horn Pond Brook improvements, shade trees at the Senior Center, stormwater best management practices (BMPs)/green infrastructure at Four Corners, and rain garden at Horn Pond.

2020: Washington Street business area flood improvements

2021: Four Corners culvert improvements, wetlands improvement, and stormwater BMPs

2022: New Boston Street Bridge culvert improvements

7.0 REFERENCES

7.1 CRB Workshop Participants:

Table 3: List of Workshop Invitees and Attendees	
Name	Affiliation
Mayor Scott Galvin*	Mayor, City of Woburn
Jay Corey, Jr.*	Woburn City Engineer
Beth Rudolph	Winchester Town Engineer
Max Grundy*	Edens
Chad Reynolds*	Leggett McCall Properties
Cindy Friedman	Commonwealth of Massachusetts
Darlene Mercer-Bruen	City Council
Dan Orr*	Woburn Planning Board
David Dunkley*	Woburn Public Schools
Dr. Matthew Crowley	Superintendent of Schools
Duane Cleak*	Conservation Commission
Edward Tedesco	Ward Six Alderman
Fran Coulter	Woburn Housing Authority
Gerry Kehoe	Woburn Residents Environmental Network
Heather Maguire	Woburn Business Association
James Delong	Recreation Department
James M. Gill	Winchester Department of Public Works
Jay Duran	Department of Public Works
Jeffrey Zukowski*	Massachusetts Emergency Management Agency
Joanne E. Campbell	Ward One Alderman
Joseph R. Tarby III	Murtha Cullina Attorneys at Law
Julie Wormser*	Mystic River Watershed Association
Kathleen Theoharides	Assistant Secretary of Climate Change
Matt Barrett*	Engineering Department
Meghan Doherty*	Health Department
Michelle Ciccola	Commonwealth of Massachusetts, House of Representatives
Joanne Collins*	Council on Aging
Len Burnham*	Department of Public Works
Lindsay Higgins	City Council – Ward 7 Alderman
Mark E. Gaffney	City Council – Ward 4 Alderman
Martin Pillsbury	Metropolitan Area Planning Council
Michael D. Anderson*	City Council President

Table 3: List of Workshop Invitees and Attendees	
Name	Affiliation
Michael P. Concannon	City Council Alderman at Large
Mike Aveni*	Cummings Properties
Richard F. Gately	City Council Ward 2 Alderman
Robert F. Rufo Jr.*	Police Department
Robert J Ferullo Jr.	City Council Alderman at Large
Rory Lindstrom	Woburn Recreation Director
Ross Morrow*	Lexington Engineering Department
Sarah White	Massachusetts Emergency Management Agency
Stephen Adgate*	Fire Chief
Orazio Deluca*	Purchasing Agent
Patrick Herron*	Executive Director, Mystic River Watershed Association
Richard Haggerty	Commonwealth of Massachusetts
Thomas C. Quinn*	Inspectional Services Building Commissioner
Thomas F. Hayes	Burlington Town Engineer
Thomas Maher*	Woburn Housing Director
Tina Cassidy	Woburn Planning Director
Tony Blazejowski*	Woburn Water Department Manager
William Campbell	Woburn City Clerk
Keith Peary*	Woburn Fire Department

Weston & Sampson / Kathleen Baskin
Weston & Sampson / Steven Roy
Weston & Sampson / Lindsey Adams / Table 1
Weston & Sampson / Adria Boynton / Table 2
Weston & Sampson / Dana Martin / Table 3
Weston & Sampson / Jill Getchell / Table 4
Weston & Sampson / Alex Gaspar / Table 5

Notes:
Asterisks (*) are placed next to attendees

7.2 Citation

City of Woburn. 2019. *Community Resilience Building Workshop Summary of Findings*. Prepared by Weston & Sampson. Woburn, Massachusetts.

7.3 Project Core Committee

City of Woburn, Municipal Leadership:
Scott Galvin, Mayor

City of Woburn, Core Team Members:

Table 4: Members of the Core Team	
Name	Affiliation
Jay Corey	City Engineer
Matt Barrett	Engineering Department
Len Burnham	Department of Public Works
Meghan Doherty	Board of Health
Robert F. Rufo	Police Department
Stephen Adgate	Fire Department
Tina Cassidy	Planning Office

Note: for contact information for the Core Team Members, please refer to the meeting minutes included in Appendix E.

Weston & Sampson, Team Assisting with the Workshop:
Kathleen Baskin, Project Manager/Facilitator
Lindsey Adams, Table Facilitator
Adria Boynton, Table Facilitator
Dana Martin, Table Facilitator
Alex Gaspar, Table Facilitator
Jill Getchell, Table Facilitator
Steve Roy, Table Facilitator

7.4 Acknowledgements

A special thanks to the Massachusetts Executive Office of Energy and Environmental Affairs for providing the grant that funded the Community Resilience Building Workshop. Additional thanks to all the participants and to the Workshop Project Team for a successful event.

7.5 Works Cited

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7.6 Additional Resources

Massachusetts Climate Change Adaptation Report (Massachusetts Executive Office of Energy and Environmental Affairs, Adaptation Advisory Committee, 2011)

APPENDIX A

Workshop Materials

Agenda
Attendance
Base Map used for participatory mapping exercises

City of Woburn
Municipal Vulnerability Preparedness Project
Community Resilience Building Workshop
Program Room, Woburn Public Library
45 Pleasant Street, Woburn, MA 01801
Tuesday, March 26, 2019
8:45 am – 4:30 pm

8:45 am – 9:00 am	Registration and Refreshments
9:00 am – 9:20 am	Welcome and Introductions • Mayor Scott Galvin • Jay Corey, City Engineer • MVP Committee Members • Weston & Sampson Team • Participant Introductions
9:20 am – 9:30 am	MVP Workshop Purpose and Overview • MVP Program Background • Purpose, Desired Outcomes, Objectives, Expectations • Review Agenda • Logistics
9:30 am – 10:10 am	Data Resources and Overview of Science • Hazards • Existing Climate Change • Projected Climate Change • Recent Planning Efforts • Overview of Data and Maps Being Used During Workshop
10:10 am – 10:35 am	Large Group Exercise #1 • Identify Major Hazards in Community • Prioritize Top Four Hazards
10:35 am – 10:50 am	BREAK

10:50 am – 11:05 am	Risk Matrix
	• Hazards
	• Features
	  • Infrastructure, Societal, Environmental
	  • Vulnerability or Strength
	  • Location
	  • Ownership
	• Actions

11:05 am – 11:25 am	Small Group Exercise #1 • Infrastructure and Buildings Features • Vulnerability or Strength, Location, Ownership
11:25 am – 11:45 pm	Small Group Exercise #2 • Societal Features • Vulnerability or Strength, Location, Ownership
11:45 pm – 12:05 pm	Small Group Exercise #3 • Environmental Features • Vulnerability or Strength, Location, Ownership

City of Woburn
Municipal Vulnerability Preparedness Project
Community Resilience Building Workshop
Program Room, Woburn Public Library
45 Pleasant Street, Woburn, MA 01801
Tuesday, March 26, 2019
8:45 am – 4:30 pm

12:05 pm – 1:05 pm	LUNCH
1:05 pm – 1:35 pm	MVP Community Actions • Infrastructure • Nature-Based Solutions
1:35 pm – 2:35 pm	Small Group Exercise #4 • Define MVP Community Actions
2:35 pm – 2:50 pm	BREAK
2:50 pm – 3:50 pm	Large Group Exercise #2 • Identify MVP Priority Actions
3:50 pm – 4:30 pm	Wrap-up and Closing Remarks

Community Resilience Building Workshop
City of Woburn
Woburn Public Library, 45 Pleasant Street, Woburnn, MA
Municipal Vulnerability Preparedness Planning
March 26, 2019 - 8:45 am to 4:30 pm

Invitee	Organization	Signature
Max Grunder ~~Brad Dumont~~	Edens	
Chad Reynolds	Leggett McCall Properties	
Dan Orr	Planning Board	
David Dunkley	Pubic Schools	
Duane Cleak	Conservation Commission	
Edward Tedesco	City Council	
Gerry Kehoe	Woburn Residents Environmental Network, Inc. (WREN)	
Heather Maguire	Woburn Business Association	
James Delong	Recreation Department	
Jay Corey Jr.	Engineering	
Jay Duran	Department of Public Works	
Jeffrey Zukowski	MEMA	

Community Resilience Building Workshop
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Invitee	Organization	Signature
Joanne Collins	Council on Aging	
Joanne E. Campbell	City Council	
Joseph R. Tarby III	Murtha Cullina Attorneys at Law/ Winchester Winchester Hospital Board of Directors	
Julie Wormser	MyRWA	
Kathleen Theoharides	Massachusetts Executive Office of Energy and Environmental Affairs	
Len Burnham	Department of Public Works	
Lindsay Higgins	City Council	
Mark E. Gaffney	City Council	
Matt Barrett	Engineering	
Meghan Doherty	Health Department	
Michael D. Anderson	City Council	
Michael P Concannon	City Council	

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Invitee	Organization	Signature
Michelle Ciccola	Commonwealth of Massachusetts	
Mike Aveni	Cummings Properties	
Orazio Deluca	Purchasing Department	
Patrick Herron	MyRWA	
Robert F. Rufo Jr.	Police Department	
Robert J. Ferullo Jr.	City Council	
Rory Lindstrom	Recreation Department	
Ross Morrow	Lexington Engineering Department	
Sarah White	Massachusetts Emergency Management Agency	
Mayor Scott Galvin	Mayor's Office	
Stephen Adgate	Fire Department	
Thomas C. Quinn Jr.	Inspectional Services	

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Invitee	Organization	Signature
Thomas F. Hayes	Burlington Engineering Department	
Thomas Maher	Woburn Housing Authority	
Tony Blazejowski	Woburn Water Department	
Jill Getchell	weston & sampson	
ADRIA BOUNTON	W & S	
Alex Gaspar	WTS	
Keith Peary	Woburn Fire Dept.	
Steven Roy	Weston + Sampson	
Kathleen Baskin	Weston + Sampson	
Dana Martin	Weston + Sampson	
Lindsey Adams	Weston + Sampson	

FIGURE 1

CITY OF WOBURN

HAZARDS AND RESOURCES

MARCH 2019 SCALE: NOTED

Weston & Sampson

APPENDIX B

Workshop Presentation

welcome

Weston & Sampson 1

1

Community Resilience Building Workshop

Woburn, Massachusetts
March 26, 2019

Weston & Sampson 2

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Welcome & Introductions

Weston & Sampson 3

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Woburn Introductions

Municipal Leadership

- Mayor Scott Galvin
- Jay Corey, City Engineer
- Core Team Members
  - Matt Barrett, Engineering
  - Len Burnham, DPW
  - Meghan Doherty, Board of Health
  - Robert F. Rufo, Police Department
  - Stephen Adgate, Fire Department
  - Tina Cassidy, Planning Office

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Weston & Sampson Introductions

Assisting with the Workshop

- Kathy Baskin, Project Manager/Facilitator
- Table Facilitators
  - Lindsey Adams
  - Adria Boynton
  - Alex Gaspar
  - Dana Martin
  - Jill Getchell
  - Steve Roy

5

Participant Introductions

- Your name
- Relationship to Woburn
- Why you are here today

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Workshop Outline

Workshop-Wide
- Overview of Science & Data Resources
- Characterize Hazards

BREAK

Individual Tables
- Identify Community Features
  - Infrastructure
  - Societal
  - Environmental

Post-Workshop
- Combine Ideas
- Prepare Report

LUNCH

Individual Tables
- Identify and Prioritize Actions

BREAK

Workshop-Wide
- Determine Overall Priority Actions

7

What is the Municipal Vulnerability Preparedness (MVP) Program?

Massachusetts program:
- Assist municipalities plan for climate change resiliency and implement priority projects

Helps communities:
- Define extreme weather hazards and climate change impacts
- Identify key features
- Determine vulnerabilities and strengths
- Develop and prioritize actions
- Complete vulnerability assessments
- Implement key actions

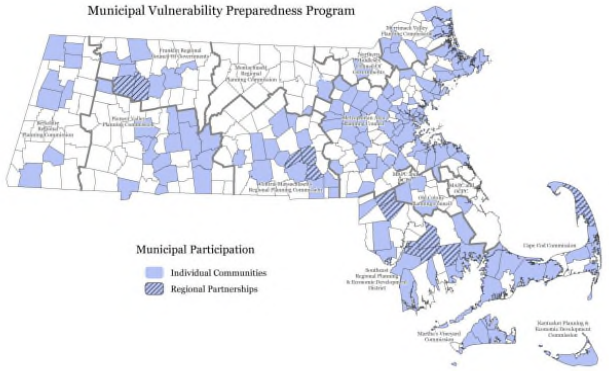
Exit 36 Route 128

(Source: https://patch.com/img/cdn/users/12838/2015/09/T800x600/20150956

8

Eligible Communities

Complete MVP program; become certified; apply for MVP Action grant funding



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What the MVP Program offers Woburn

- Improved **resilience and preparedness** of natural and climate-driven hazards
- **Collaboration with stakeholders** about climate change, natural hazards and impact
- **Increased education, planning, and implementation** of priority actions
- Access to **grants**

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Data Resources & Overview of Science

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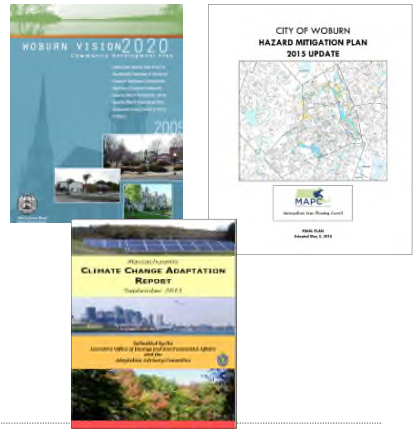
Data Resources

Lots of great work has already taken place recently!

- Massachusetts Climate Change Projections (NECSC, 2018)
- Massachusetts Climate Change Adaptation Report (MA EEA, 2011)
- Woburn Vision Community Development Plan (WPB, 2020)
- City of Woburn Hazard Mitigation Plan (MAPC, 2016)



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Woburn's Land Use

- Large commercial city surrounded by suburban residential development

- Forest (20.2%)
- Salt marsh/wetlands (6.0%)
- Residential (39.4%)
- Commercial & Industrial (19.1%)
- Agricultural (0.8%)
- Transportation (3.5%)
- Water (2.2%)
- Urban Public (1.9%)
- Other (6.9%)

(Source: https://www.passporthealthusa.com/locations/ma/woburn/274/

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Natural Hazards in Woburn

Current and future under climate change

Extreme Heat

Heavy Precipitation

Wind

Drought

Snow/Ice

Erosion

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Hazards in Woburn

Hazard	Frequency	Severity
	Woburn	Woburn
Flooding	High	Serious
Dam failures	Medium	Serious
Winter storms	High	Minor
Ice Storms	Medium	Minor
Hurricanes	Medium	Serious
Nor'easters	High	Serious
Thunder Storms	High	Minor
Tornadoes	Very Low	Serious
Brush Fires	Medium	Minor
Earthquakes	Very Low	Serious
Landslides	Very Low	Minor
Extreme Temperatures	Medium	Minor
Drought	Low	Minor

(Source: City of Woburn Hazard Mitigation Plan, 2015)

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Repetitive Loss Structures

Table 8. Repetitive Loss Properties Summary

Property Type	# of Properties	Number of Claims	Building Losses	Contents Losses	Total Losses Paid
Single family	4	8	$55,997.90	$13,474	$69,471.19
2-4 family	1	3	$8,667.30	$3,081.00	$11,748.30
Non-residential	2	4	$505,415.52	$0.00	$505,415.52
TOTAL	7	15	$570,080.32	$16.555	$586,635.01

Source: Federal Emergency Management Agency, National Flood Insurance Program

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Existing Climate Change

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Increased Temperatures in Northeast

- Warmer annual temperatures - up 2°F since 1970
- Warmer winters - up 1.3°F per decade since 1970
- Decreasing winter snowpack
- Earlier flowering plants
- More frequent extreme summer heat

Horn Pond

Source: https://www.woburnbusiness.org/events/#!event/2018/8/3/11am-story-stroll-at-horn-pond

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Heavy Precipitation

Riverine and Stormwater Flooding

- Woburn's most frequent and serious natural disaster
- Affects infrastructure, property damage, natural resources

Russell Street and Cambridge Road in Woburn, MA

(Source: CBS Boston, 2017)

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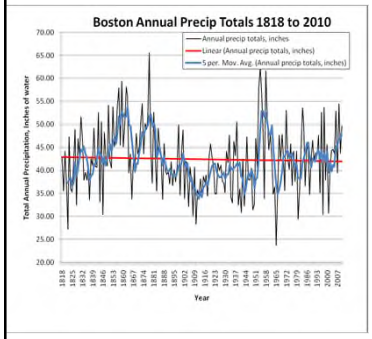
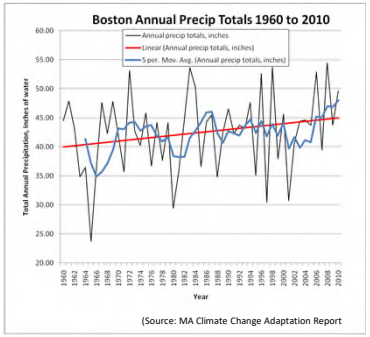
Annual Precipitation in Boston

January 1818 to December 2010





(Source: MA Climate Change Adaptation Report

The blue line represents a five-year moving average and the red line a least squares regression.

20

Change in Precipitation

6-hour, 10-year event
- 1961 = 3.2 inches
- 2015 = 3.35 inches

24-hour, 100-year event
- 1961 = 6.5 inches
- 2015 = 8.40 inches

(Sources: NOAA TP-40, 1961 and NOAA Atlas Volume 10, 2015)

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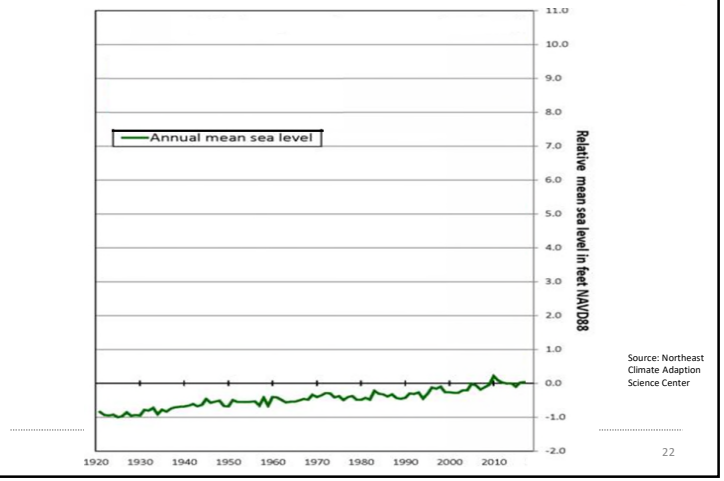
FYI only: Sea Level Rise



Source: Northeast Climate Adaption Science Center

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Predicted Climate Change

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Increased Temperatures/Extreme Heat

	Observed Baseline	Projected Change 2050's	Projected Change End of Century
MA Average Temp (°F)	47.6	+2.8 to +6.2	+3.8 to +10.8
Woburn Average Temp (°F)	50.1	+2.7 to +6.1	+3.5 to +10.8
Days with Temperatures Above 90°F	8	+8 to +29	+12 to +67
Days with Temperatures Above 100°F	<1	<1 to 4	1 to 16
Days with Temperatures Below 32°F	119	-17 to -42	-23 to -66

(Source: NECSC, 2018)

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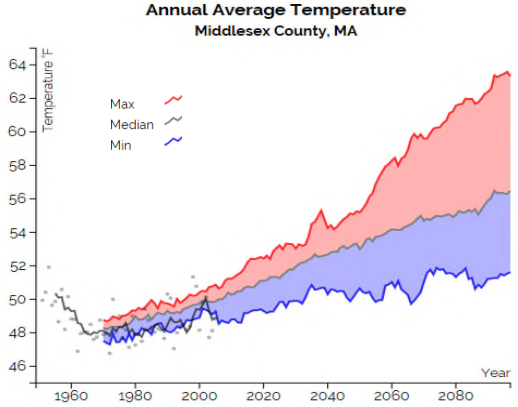
Projected: Annual Average Temperature in Middlesex County



(Source: Northeast Climate Adaption Science Center)

25

25

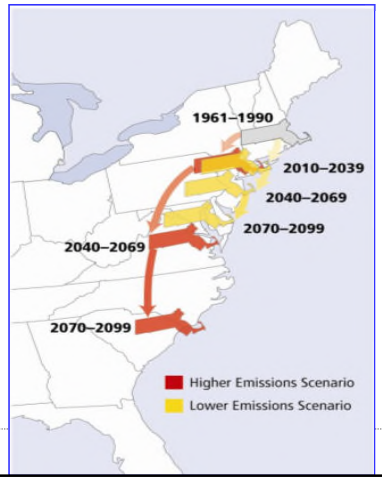
Extreme Heat

Temperatures Predicted to Increase

Winter: 15 to 40%

Summer: 6 to 18%

(Source: NECIA/UCS, 2007)



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Heavy Precipitation

Predicted

- Higher winter flows and flooding
- Earlier peak flows in spring
- Extended summer low flows

(https://patch.com/massachusetts/woburn/power-almost-fully-restored-woburn-other-area-towns)

Increased flooding, polluted stormwater and wastewater discharges

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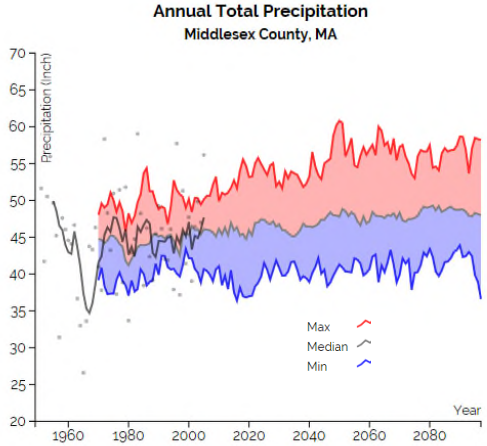
Heavy Precipitation

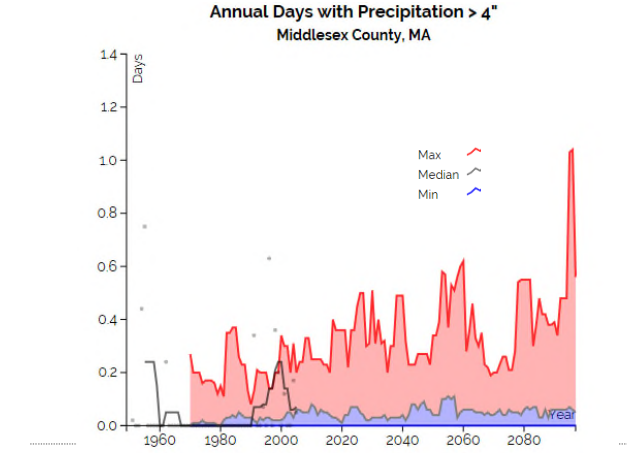


(Source: Northeast Climate Adaption Science Center)

28

28

Heavy Precipitation



(Source: Northeast Climate Adaption Science Center)

29

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Drought

- Higher risk of drought in summer and fall
- Projected impacts to:
  - Water supply
  - Rivers, streams, wetlands
  - Vegetation and crops

Old Pumping Station at Horn Pond

(Source: serc.carleton.edu/woburn/issues/woburn_water_supply.html)

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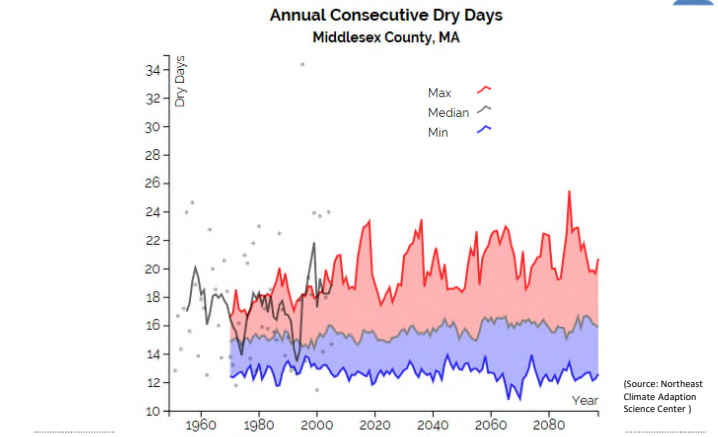
30

Drought



(Source: Northeast Climate Adaption Science Center)

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Ice/Snow Storms

- Past few decades, more rain in winter
- Projected, more rainy and icy winters

(Example: serious damage caused by Dec 2008 ice storm)

(Source: Woburn Patch)

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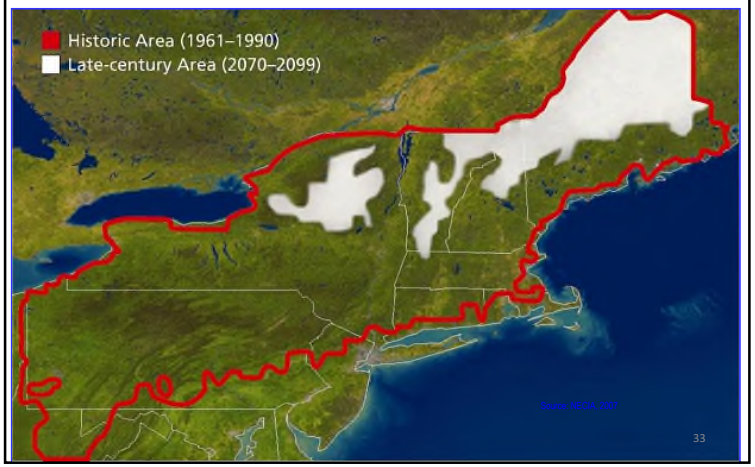
Predicted Snow Cover

(Source: UCSUSA "Confronting Climate Change in the U.S. Northeast")



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Wind

(Source: WGNS Radio)

- NWS Wind Advisory:
  - 31 to 39 mph for at least one hour
  - Any wind speed between 46 to 57 mph
- NWS High Wind Warning:
  - 58 mph or higher

Impacts: town resources, infrastructure, trees, private and public property

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Wind

(Source: WGNS Radio)

Scale No. (Category)	Winds(mph) Storm	Surge (ft)	Potential Damage
1	7 — 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

(Source: National Oceanic and Atmospheric Administration)

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FYI only: Boston Sea Level Rise Projections

Threatens barrier buildings, infrastructure, beach and dune systems, and people

Emission Scenario	2030 (ft)	2050 (ft)	2070 (ft)	2100 (ft)
Intermediate	0.7	1.4	2.3	4.0
Intermediate-High	0.8	1.7	2.9	5.0
High	1.2	2.4	4.2	7.6
Extreme	1.4	3.1	5.4	10.2

- Increased coastal flooding
- Permanently inundated low-lying coastal areas
- Increased shoreline erosion

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(Source: Northeast Climate Adaption Science Center)

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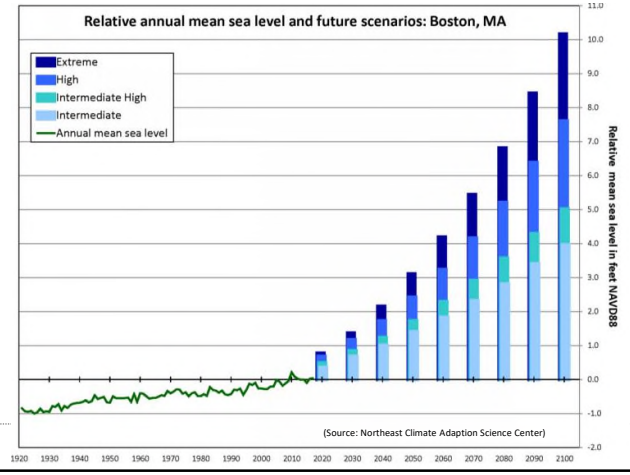
FYI only: Sea Level Rise and Storm Surge



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Choose Four Hazards

Extreme Heat

Heavy Precipitation

Drought

Snow/Ice

Wind

Erosion

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15-Minute Break!

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Risk Matrix

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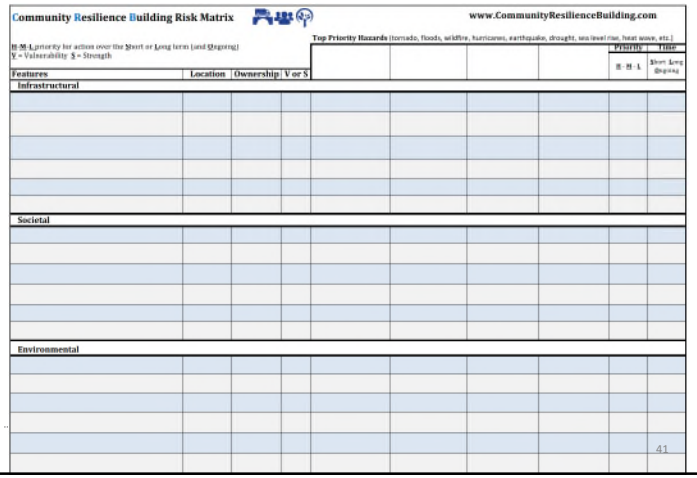
Risk Matrix


Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S					Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

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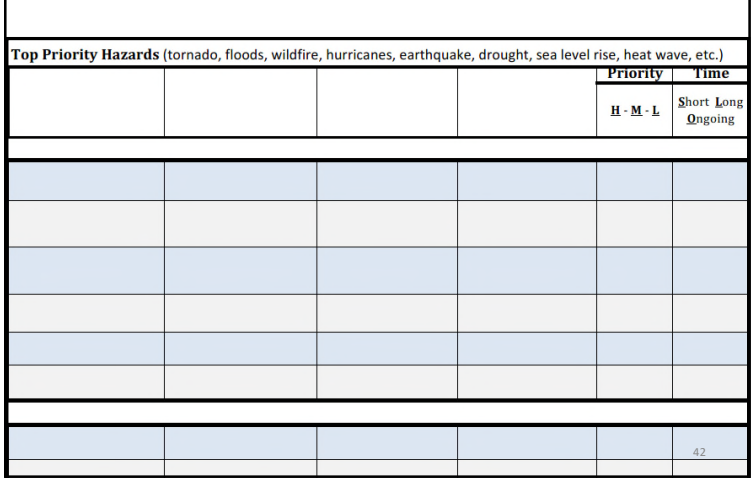
Risk Matrix - Hazards


Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

				Priority H - M - L	Time Short Long Ongoing

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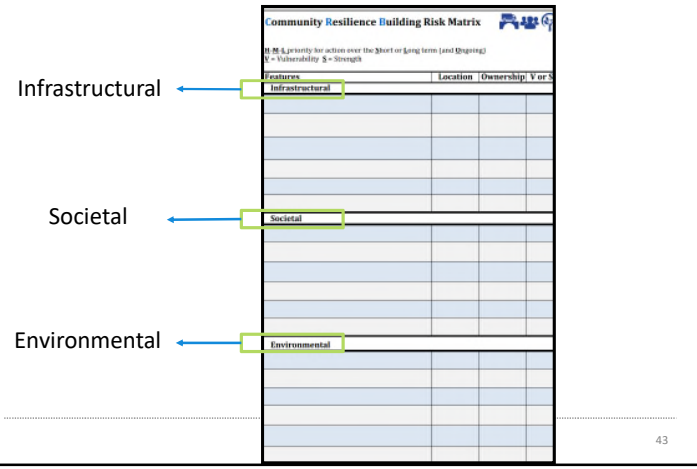
42

Risk Matrix- Features



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Features in Woburn

Infrastructural, societal, and environmental features

Features — **Location** — **Ownership** — **Vulnerability or Strength**

Infrastructural
Societal
Environmental

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Features in Woburn
Location

Infrastructural, societal, and environmental features

Features — Infrastructural, Societal, Environmental

Location — Town-wide, Multi-Neighborhood, Single-Neighborhood, Specific Location

Ownership

Vulnerability or Strength

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Features in Woburn
Ownership

Infrastructural, societal, and environmental features

Features — Infrastructural, Societal, Environmental

Location — Town-wide, Multi-Neighborhood, Single-Neighborhood, Specific Location

Ownership — State, Town, Private, Shared

Vulnerability or Strength

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Features in Woburn
Vulnerability or Strength

Infrastructural, societal, and environmental features

Features — Infrastructural, Societal, Environmental

Location — Town-wide, Multi-Neighborhood, Single-Neighborhood, Specific Location

Ownership — State, Town, Private, Shared

Vulnerability or Strength — Vulnerability, Strength, Both

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Infrastructure Features

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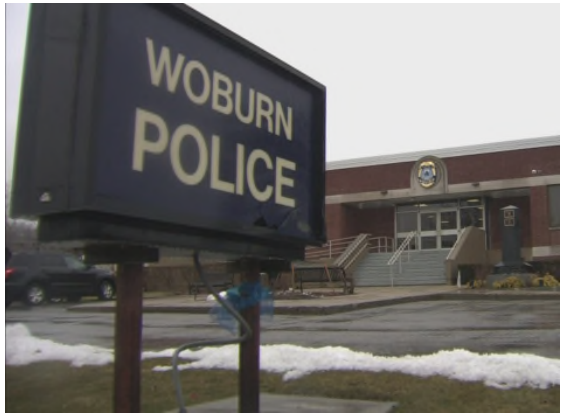
Infrastructure

- Utilities such as electric power, gas, water, hydraulics, compressed air, municipal
- Water supply and treatment plants
- Wastewater treatment plants, sanitary & stormwater sewer systems
- Energy
- Manufacturing equipment and pollution control equipment
- Communication, data and voice computer networks
- Transportation

(Source: Boston Herald, 2018)

Infrastructure: Police



(Source: boston.cbslocal.com)

Infrastructure: Fire Department

(Source: www.woburnma.gov/government/woburn-fire-department/)

Infrastructure: Wastewater Treatment and Collection

Infrastructure: Roadways

(https://www.baysideengineering.com/civil-engineering-design-services/)

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Infrastructure: Water Supply

(Source: https://serc.carleton.edu/woburn/issues/woburn_water_supply.html)

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Infrastructure: Dams

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Critical Facilities and Infrastructure in Woburn, MA

Critical Area and Infrastructure
Lake Terrace and Lake Circle
Arlington Road
Dragon Court
Washington Street near Cedar Court
Barlett Drive and Pearl Street Rear
Washington Street near Wendy's/ Montvale Avenue
Word Street at Traverse Street
Lillian Street near Kennedy School
Cambridge Road
Winn Street to Hart Street
Salem Street at Aberjona Drive
Bedford Road: Marlboro Road to Cambridge Street
Horn Pond Dam

(Source: City of Woburn Hazard Mitigation Plan, 2015)

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High Priority Flood Hazard Mitigation

Mitigation Action	Geographic Area	Benefit	Estimated Cost
Drainage improvements at Arlington Road/Lake Avenue	Arlington Road	High	$255,000
Drainage improvements Cambridge Road	Cambridge Road near Russell Street	High	$470,000
Drainage improvements at Hart Street- 24" relief line	Hart Street	Medium	$1,045,000
Hart St/Winn St stream and culvert cleaning	Hart Street and Winn Street	High	TBD
Drainage improvements Salem Street at Aberiona Dr	Salem Street and Aberjona Drive	High	TBD
Bedford Road: Marlboro to Cambridge	Bedford/Marlboro /Cambridge	High	TBD

(Source: City of Woburn Hazard Mitigation Plan, 2015)

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Societal Features

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Societal: Woburn's People

- Population
  - 2010 Census: 38,120
  - 2035 Projection: 46,634
- Age
  - Under age 20 = 21.6%
  - Age 65 or older = 15.9%
- Education
  - 94.3% high school
  - 39.9% Bachelors degree
- Income
  - Median household = $83,872
  - 30.69% low to moderate income
  - 7.2% below poverty level

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Societal: Woburn's Jobs

- Number of Jobs
  - 2010 Census: 34,323
  - 2035 Projection: 34,601
- 2,438 Businesses
  - Professional & Technical Services
  - Construction
  - Health Care and Social Assistance
  - Wholesale Trade

(Source: Executive Office of Labor and Workforce Development; MAPC)

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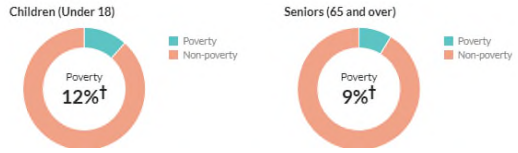
Societal: Vulnerable Populations

Elderly, low/moderate income, special income, language barriers, infirmed



31.56% of Woburn's population is low to moderate income

(Source: Censusreporter.com)

Census data: ACS 2016 5-year

61

Societal: Assisted Living and Senior Centers

https://www.seniorliving.com/featured-community/monarch-homes-woburn

62

Environmental Features

63

Environmental: Natural Resources

- Horn Pond
- Coldwater Streams
- Forests
- Marshes & Wetlands
- Aquifers

(https://www.massmoments.org/moment-details/complaint-filed-on-toxic-pollution-in-woburn.html)

64

Environmental: Natural Resources

(http://hornpondwoburn.com/winitihooloo.html)

(https://www.passporthealthusa.com/locations/ma/woburn/274/)

(https://www.woburnma.gov/news/2018/07/kayak-rentals-at-horn-pond/)

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Environmental: Climate Stressors

- Flooding
- Erosion
- Water quality/quantity impacts
- Invasive fauna/flora
- Wetlands impacts
- Increased stormwater runoff
- Less groundwater recharge
- Vector-borne diseases

(Source: Natural Hazard Mitigation Plan)

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66

Environmental: Horn Pond

- Primary water body in Woburn
- Watershed of 10 square miles
- When pond volume is exceeded, flooding occurs on nearby roadway and residences
- Defense against severe weather events and rainfall

(https://www.tripadvisor.com/Attraction_Review-g41948-d7142157-Reviews-Horn_Pond-Woburn_Massachusetts.html)

(Source: Natural Hazard Mitigation Plan)

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Environmental: Forest

- Woburn = 20% forest
- Reduce subsurface and overland flow
- Sequester carbon
- Ice storms and wind events can damage
- Change in species composition from increasing temperatures

(http://freedomsway.org/about-fwnha/our-communities/woburn-ma/)

(Source: MA Climate Change Adaptation Report, 2011)

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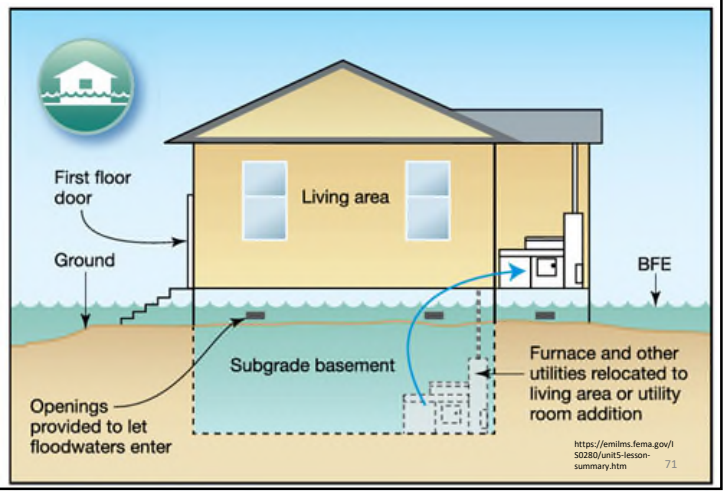
1-Hour Lunch

69

Community Actions

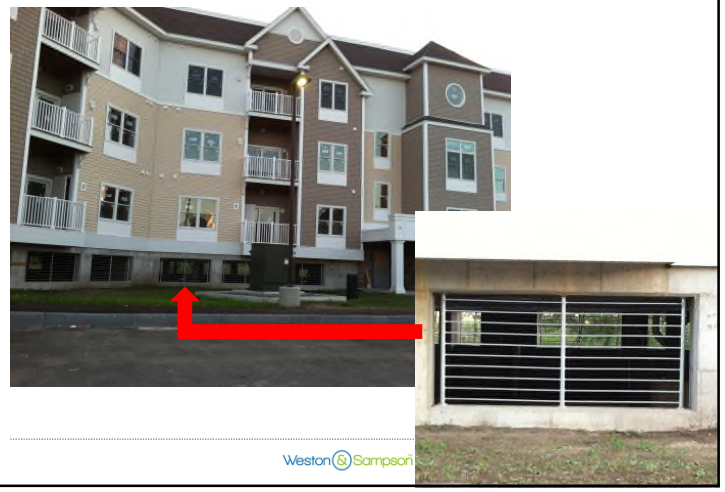
70

Wet Floodproofing



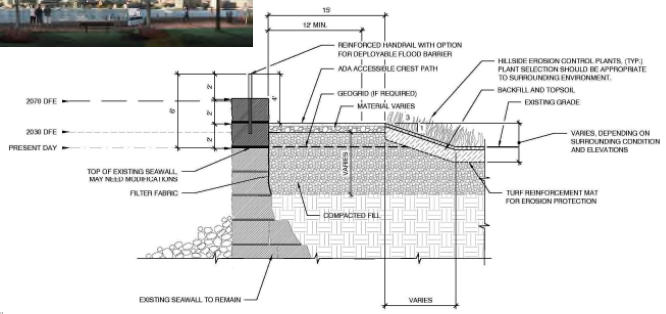
71

Raised Buildings



72

Flood Walls

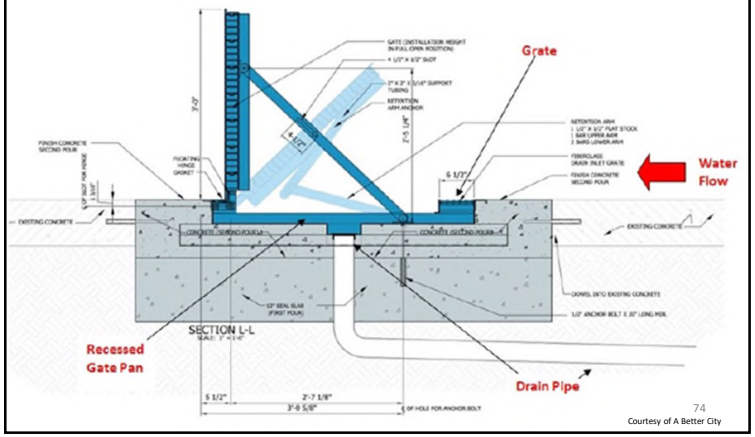


HARBORWALK BARRIER SEAWALL SAMPLE SECTION

73

73

Deployable Flood Barriers



Courtesy of A Better City

74

74

Preventing Sewer Backflow

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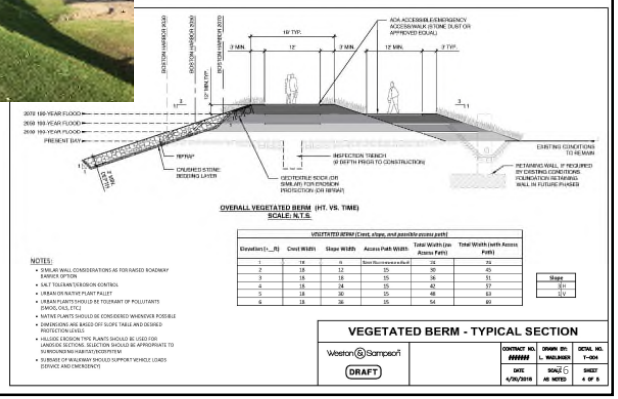
Vegetated Berms



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Multi-Purpose Flood Storage

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Low Impact Development (LID)

An innovative, ecosystem-based approach to land development and stormwater management

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Porous Asphalt and Permeable Pavers

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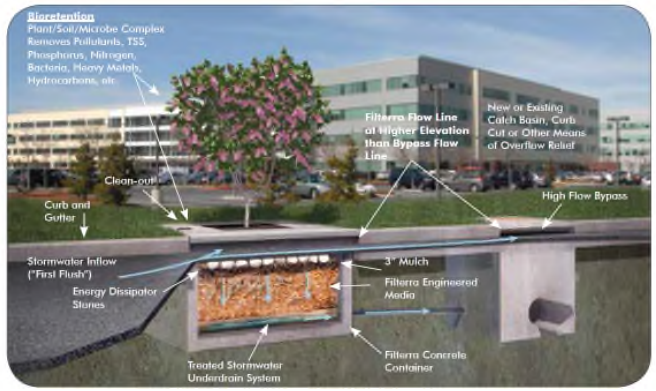
Street Trees & Tree Box Filters



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Rain Garden in a median strip of a townhouse project. Please note the depressed curb and grate inlet structure

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Stormwater Detention & Retention

82

82

Culvert Widening to Improve Habitat and Flow

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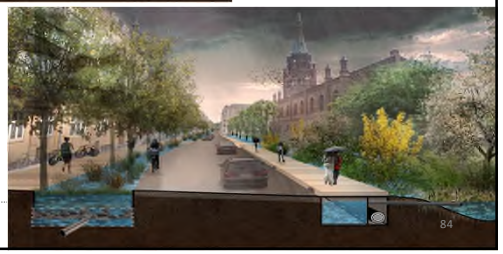
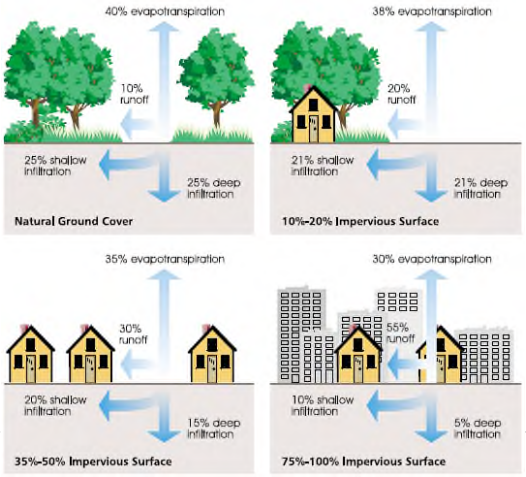
Cloudburst Streets



MATTHÆUSGADE - CLOUDBURST STREET 84

84

Reduce Impervious Areas



Source: Federal Stream Corridor Restoration Handbook (1998)

85

Green Roofs

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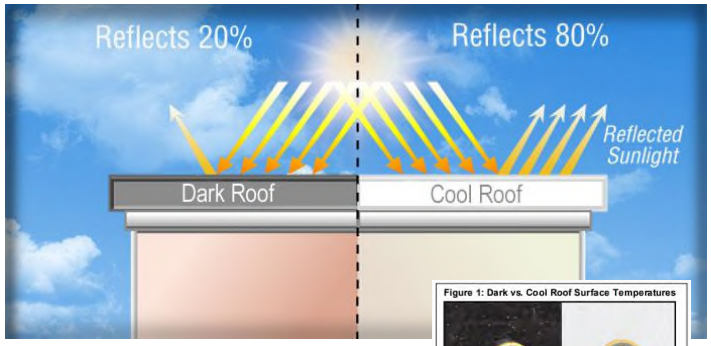
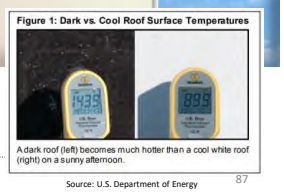
Cool Roofs



Source: Heat Island Group at Lawrence Berkeley National Laboratory



Source: U.S. Department of Energy Guidelines for Selecting Cool Roofs

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Cooling Centers

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Source: The Mercury News

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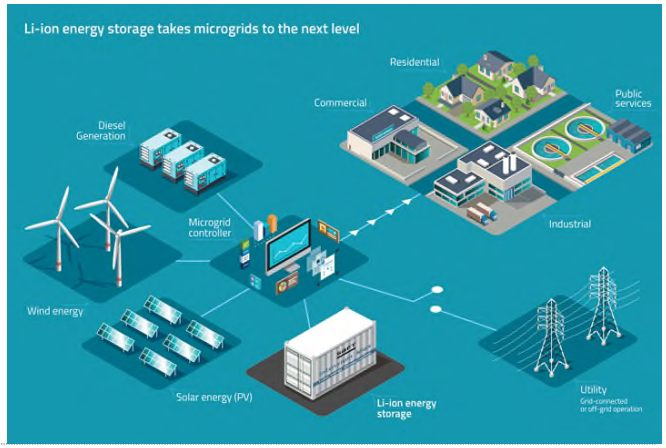
Renewable Micro-Grids



Source: altenergymag.com

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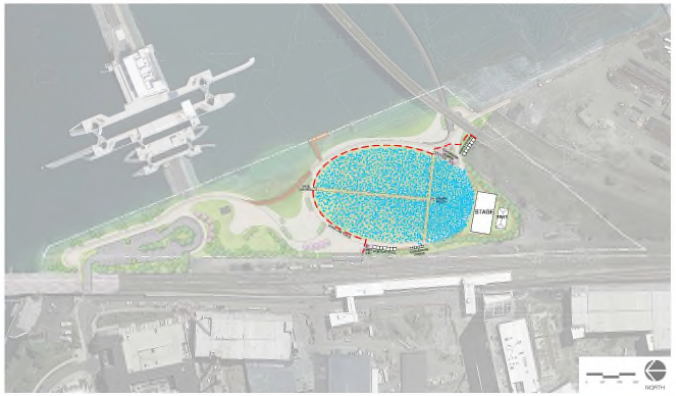
Landscape Design to Accommodate Water

Draw Seven Park, Somerville – Existing Conditions



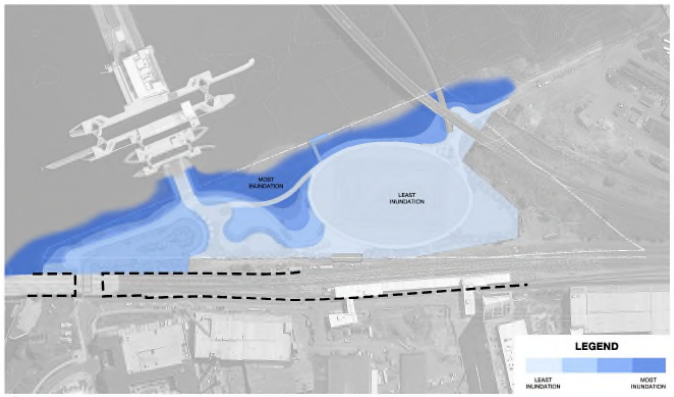
CONCEPT #1 - CROWD DIAGRAM

DRAW SEVEN PARK

90

Landscape Design to Accommodate Water

Draw Seven Park, Somerville – Flooded Conditions

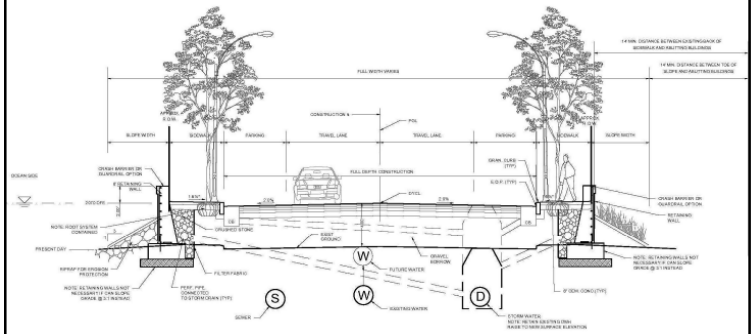


CONCEPT #1 - INUNDATION DIAGRAM

DRAW SEVEN PARK

91

Raised Roadways



SAMPLE SECTION

92

Retrofitted Floodproof Doorways

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Re-evaluate Local Regulations & Policies

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94

15-Minute Break!

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Define Community Actions

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Identify Priority Actions

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H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S					Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

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Wrap-up & Closing Remarks

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thank you

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100


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transform your environment
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APPENDIX C

Participant Risk Matrices

Table 1
Table 2
Table 3
Table 4
Table 5
Master Risk Matrix

Community Resilience Building Risk Matrix

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H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
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Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Drought/Heat	Snow/Ice	Wind		Priority H - M - L	Time S Long O ngoing
Infrastructural										
Horn Pond Dam	Horn Pond	City	V	Inspect regularly					L	O
Roads: Four Corners, Olympia Ave., Nashua/Draper, Hart St & Wyman, Washington St., School St.	Citywide	State/Private/City	V	Increased Storage, ainage upgrades/new drainage, green infrastructure		more staff to clear roads with down trees			H	O/L
Drainage	Citywide	City/ Private/ Shared	V						H	O/L
Pump Stations		City	V/S	Repair drainage. Add backup generators					L	S
Police & Fire Department		City	V/S	move location of fire station when new one is constructed. Update police department/move generator higher.		backup generator			M	S
Emergency Response	Four Corners	City	V/S	repair drainage. Ad ional shelter	additional shelter				H	O/L
Radio Tower	Zion Hill	Regional	V/S				backup generator		M	S
High School		City	S	emergency shelter, the school is equipt with cots and generator					H	O
Societal										
Seniors	Citywide	Housing Authority, Senior Center	V	RAVE Communication: work with doctors, senior center, housing authority, and grocery stores to pass along information on RAVE					H	O
Low Income	Citywide		V	RAVE Communication: work with housing authority and grocery stores to pass along information on RAVE					H	O
Public Building/Churches		Public, Private	S	Can be used as shelter.Put in backup generator.					L	S
Non-English	Citywide		V/S	RAVE & Police are both multi-language					H	O
Patch	Citywide		S	Reach out to Patch to norify residents during/before a hazard/emergency.					M	S
Youth	Citywide		V	work with schools - reverse 911					H	O
Environmental										
Horn Pond		City	V/S	dam inspection					L	O
Forest		City	V/S	stormwater storage	widening trails. Clearing/trimming				L	S
Wetlands		City	V/S	wetland creation					M	S
Herring		City/State	S	fish ladder					M	S
Aberjona River/Superfund Site		City/Federal/State	V	chemicals washing downstream during high intensity storm?						

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Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Wind	Extreme Heat + Drought	Snow and Ice		Priority H - M - L	Time Short Long Ongoing
Infrastructural										
Private Property		Private	V/S	rain gardens/ permeability/ green space			inspections/oversight		H	O
Public Roadways (Traffic)		Public	V/S	elevate roads/pervious pavement/green medians/ water collection			more DPW support/funding		H	O
Water Treatment	Horn Pond	Public	V/S	backstops		billing/incentives for water cons				
Dams	Citywide	Public	V/S	proper maintenance/inspection	Regional collaboration				M	O
Emergency Services	Citywide	Public	S	Resiliance planning					H	O
Public Shelter Options	Citywide	Public	S	Backup Generators. Confirm shelter locations.						
Commercial Buildings (Main St. - Small Business Owners)	Citywide	Public	S							
Societal										
Elderly			V/S	Affordable housing. Transportation					H	O
First Responders/Med. Staff			S	Safe Facilities, well located, low response times.					H	O
Individuals in Poverty			V	Identify Shelters, point of contact					M	O
Children			V	Programming/IDing local groups					M	O
Immigrant/ESL			V	Translation services, IDing community centers					M	L
Commuter Population			V/S	Digital PSAs, Create TDMs					M	O/L
Environmental										
Trees	Citywide	Public/Private	V/S	Identifying trees in ROWs. Tree setbacks (Outside ROW). Identify an arborist. Inventory new trees.						
Horn Pond		Public	V/S	Vulnerability Assessment						
Flood Plains	Citywide		V/S	Study performance						
Stormwater Management (Sweetwater Brook)	Citywide/local		V/S	Evaluate opps.						
Open Space (Clapp Park)			V/S							
Watersheds (Aberjona)			V/S							
Invasive Species	Citywide		V							
Air Quality	Citywide		V							

Community Resilience Building Risk Matrix

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Features	Location	Ownership	V or S	Flooding	Heat/Drought	Wind	Snow/Ice		Priority H - M - L	Time S Long O ngoing
Infrastructural										
Police Station		muni	S/V	fix, move flood-prone garage	coordinate + improve communications/systems. With other EMSs, need backup generator				L	O
High School		muni	S/V	optimize use as emergency shelter					L	ongoing
Fire Dept Station 3		city, state, private	V	upgrade comm. Equipment building, apparatus					M	M
4 Corners Intersection (Rt 3)		city, state, private, businesses & roadways	V	site-specific flood mgt, private improvements to parking, businesses			need exter attn to manage winter flooding		H	S/O
Horn Pond Dam		muni	S/V	maintain to keep up with increased rainfall					M	L
Drinking Water System	City-wide	multiple	S/V	upgrade/increased mgt for increased population, drought. Redundant pumps, capital improvement plan, investment, execution					H	O
Societal										
People on Oxygen/dialysis	Citywide	public & private	V	need list of at-risk residents, if power fails. Eversource has database and action plan for checking in on fragile residents.					H	S/O
Medical reserve corps	citywide	volunteers	S/V	Consider providing incentives to look in on fragile residents more systematically. Consider more extensive training (less than EMS)					L	O
Public Housing/Low-income residents	citywide	private + muni	V	Transportation to emergency shelter. Tree planting, insulating, other cooling investments					H	S
Council of Social Concern/Council on Aging	north woburn	NGO + muni	S/V	develop natural disaster plan specific to senior citizens					L	O
Low-mod $ residents	dispersed	private	V		subsidize cooling strategies (Eversource)		Subsize heating strategies (Eversource)		M	O
senior citizens (today's middle age)	dispersed	private	V	consider zero net energy, shelter-in-place housing standards for new developments. Consider emergency services in multi-family houses					M	O
Environmental										
Horn Pond Brook	south woburn	muni	V	Needs stream restoration post dam improvements and stream side flood management, erosion control					M	S
Increased pests (rats, mice, ticks)	Citywide		V	manage water re: insescts near people	curbside composting to decrease rats				M	O
Toxic sites	next to horn pond, various		V	test, monitor, create plan to prevent toxic site erosion and discharge					L	O
New developments (esp 40b)	Citywide	mostly private	S/V	can contribute to stormwater and GI upgrades when permit new developemtn (like Lexington). Avoid losing open space. Flood plain zoning to 500-yr storm					H	S/O
surface/stormwater quality (hotter, lower oxygen, contaminated)			V	develop stormwater department. Stormwater quality and quantity ordinances to manage on site					M/H	O
Open space/urban forest	largerr areas esp, but also street trees	multiple	S/V	max site-specific retention. ID opportunities for enhanced stormwater retention	design parks to increase shade, urban forest plan for public/private land	replace trees damaged in storms			H	S/O

Community Resilience Building Risk Matrix

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Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Wind	Extreme Heat/Drought	Snow/Ice		Priority H - M - L	Time S Long O ngoing
Infrastructural										
Horn Pond Dam	Citywide	City	V/S	stream channel improvements, instrumentation improvements, fish passageway					H	S/L/O
Four Corners (Bus. Area)	Citywide	City, Private	V	improved culverts (cleaning + inc size), new piping					H	S/L/O
Washington St. (Bus. Area)	Citywide	City, State, Private	V						H	O
New Boston St. (Bus. Area)	Citywide	City &Private	V						H	O
Olympia + Wildwood (Bus. Area)	Citywide	City &Private	V						H	O
Sewage Pump Station	Draper Street	City	V	sand bagging, vegetated berms					M	S
Culverts (-)	Dix Rd, Citywide	City, state, private	V						M	L
Water Supply Wells	Horn Pond Wellfield	city	V						M	O
Sewage Transport System	Horn Pond interceptor	city & Burlington	V	sewer overflow decreased WQ. Keep ip with improvements. Monitoring, replace liner					L	O
Police Department (minor flooding)	Harrison Ave.	City	V/S	Pumps to prevent flooding.					M	L
Transportation Center	Citywide	State & Private	V/S	Evacuation Route					M	O
Historic Building at Horn Pond				Continuous maintenance					M	O
Societal										
Elderly Housing	Citywide	Municipal/Private	V/S	Generators. Cooling Centers					M	O
Assisted Care/Rehab Centers	Citywide	Municipal/Private	V/S	Text/social media/email notification					M	O
Halfway Houses	Citywide	State & private	V/S	Education/ contingency planning					M	O
Daycare Centers	Citywide	private	V/S	Education/ contingency planning					M	O
Transient Workers/Commuters	Citywide	public & Private	V/S	Temporary shelters like school and senior center			Continued operation to keep roads open		M	O
Outpatient Care	Citywide	Private	V/S	Emergency evacuation plan, alternative route plan					M	O
Schools	Citywide	public & Private	V/S	Engage social service agencies for outreach					M	O
Courthouses	Citywide	state	S							
Commerce centers (malls)										
Environmental										

Horn Pond area	SE Woburn	Municipal & Private	V/S	stream channel improvements. Plant management				H	S/L/O
Aquifers (Contamination of water supply)	Horn Pond	Municipal & Private	V	manage QW elevation			alternatives to salt for deicing	H	S/L/O
Industraplex sites (OU1 +OU2)	NE Woburn	Municipal & Private	V	Continued monitoring for sewage overflow		water conservation (social media connection)			
Invasive Plants	Citywide		V	monitoring sites					
Aberjona Rover (WQ Issues + Flooding)	East Woburn		V					L	O
Cranberry Bog			V	stream & vegetation maintenance				L	O
Conservation Areas			V				social media notification when paths open	M/L	O
Bike Paths/Walking Trails									
Comm. Gardens	Citywide	DCR (State)	V/S						
Middlesex Canal	Citywide	City	V/S						

Community Resilience Building Risk Matrix

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Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Extreme Heat/Drought	Wind	Snow/Ice		Priority H - M - L	Time Short Long Ongoing
Infrastructural										
New Boston Bridge		S/L	V	Drainage/proper elevation			DPW prev. main plan. Storm management		H	L
MWRA (Draper to Brook)		S/L	V						M	SL
Four Corners		L	V	Maint on culvert					H	O
Pumping Station		L	V/S	pre maintenance					H	L
School Buildings (older)		L	V	upgrading drainage, building elevation					M	L
Societal										
Elderly/Seniors			V		back-up generator, cooling center		maintenance snow removal		M	O
Low Income			V	comm. Outreach, reverse 911					M	O
Healthcare			V	city website, social media					M	O
Adult Day Care			S/V	public relations, shelter in place					M	O
Commuting population (93 accident)			V	communication(billboard, solar signs)					H	O
Diverse population/shelters			V	multi-lingual comm./ notices					M	O
Environmental										
Horn Pond/Water Infrastructure			S/V	inter. Community outreach above/below stream					H	O
Aberjona River			S/V	adjoining abutters					H	O
Open space/city operated			V	pre-maint/resources					L	O
green spaces/canopy			S	using existing space to store H2O					L	O
ground water protection - zoning			S	Building codes, DEP, zoning laws					H	O/L
Solar Energy			S		upkeep, maintenance				M	O

Community Resilience Building Risk Matrix

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Features	Location	Ownership	V or S	Flooding	Wind	Extreme Heat/Drought	Snow/Ice		Priority H - M - L	Time Short Long Ongoing
Infrastructural										
Horn Pond Dam			V	inter-community outreach					H	
Horn Pond Brook				remove hydraulic limitations					H	
Four Corners		private, state, city		flood storage, wetland creation, repair culvert, floodproofing businesses, parking improvements (private)			manage winter flooding		H	
New Boston St. Bridge			V	proper elevations to alleviate flooding. Stormwater Management Plan + Preventative maintenance plan						
Police Station				fix or move garage. EMS backup generator	EMS backup generator				L	O
Aberjona River				inter-community outreach						
Radio Tower (serves 5 communities) police, emergency, fire communications.					backup generator/repeators on water storage tanks (redundancies)					
Washingotn St. Business Area				impervious surfaces create flooding of roads and building (infiltration system). Culvert and piping improvements.						
Draper St. to Hollis Brook (MWRA injector low elevations and protecting local waste water system from surcharging and flooding)				(low lying areas) wastewater injector station suceptable to flooding (sweetwater brook). Implement P.S. with backup generator and preventative maintenance plan						
Public Roadways/Traffic Volume				elevate roadway, pervious pavement, drain infrastructure. Increase storage, green infrastructure	More staff for downed trees					
Water Treatment Plant										
Fire + Police (Emergency Services)				Resilience planning. Repair drainage to alleviate flooding that impacts emergency response vehicles						
Societal										
Public Shelters				Housing vulnerable populations/temporary shelters						
Social Media/Education				Leverage S.M. for environmental notification and conservation education. Community outreach including upstream./downstream communities						
Energy Dependent Population (oxyden/dialysis dependent)				city-wide database of population at high risk and action plan (energy compant, city, health departtment)						
Low/Moderate Income + addiction/adult day care				Transportation to shelters in case of emergency, community outreach program/reverse 911, leverage P.R. and social media.						
Elderly population				housing and transportation programs						
Environmental										
Pests/rats						curbside composting (not in yard)				
New Development				stormwater mitigation plan						
Stormwater Management				opportunities to improve sweetwater brook						

Watersheds				evaluate locations of development/implement storwater permit						
Horn Pond Brook				Remove hydraulic impediments for fish, vegetation improvements (affecting fish and recreational uses)						
Stream Maintenance										
Open Space/Urban Forest				increased stormwater retention in existing open spaces	Tree replacement	increased shade trees	tree replacement			

APPENDIX D

Annotated Maps and Matrices from Participants

Legend

- DPW
- Daycares
- Food/Grocery/Supply Stores
- Gas Stations
- Hotels/Motels
- Town Hall
- Fire Stations
- Local Police
- Underground Storage Tanks
- Pipeline
- Powerline
- Substation
- Railroad
- Sewer Pump Station
- Drinking Water Booster Station
- Water Tank

Hospitals
- Hospital with ER

Schools (Pre-K Through HS)
- Public
- Private

Colleges and Universities
- Private

Libraries
- Public
- Academic
- School

Long Term Care Residences
- Assisted Living Facility
- Nursing Home
- Rest Home

Dams
- High Hazard
- Significant Hazard

DEP Wetlands
- Marsh/Bog
- Wooded marsh
- Open Water

FEMA National Flood Hazard Layer
- 1% Annual Chance of Flooding (Zones A, AE, AH, AO)
- AE: Regulatory Floodway
- D: Possible But Undetermined Hazard
- X: 0.2% Annual Chance of Flooding

BURLINGTON FIRE DEPARTMENT Headquarters

BURLINGTON POLICE DEPARTMENT

BURLINGTON

LAHEY CLINIC

Vine Brook

Butterfield Pond Dam

Butterfield Pond

WILMINGTON

Mill Pond Reservoir North Dike

Mill Pond Dam

Mill Pond

Mill Pond South Dike

Maple Meadow Brook

Upper Woburn Street Pond

Lower Woburn Street Pond

Aberjona River

Mary D Altavesta School

Linscott-Rumford School

WOBURN FIRE DEPARTMENT Station 2

Halls Brook

Middlesex Canal

READING FIRE DEPARTMENT West Side Station

READING

Mishawum Lakes

WOBURN

WOBURN FIRE DEPARTMENT Dispatch Station 3

John F Kennedy Middle School

Daniel P Hurld School

Daniel L Joyce Middle School

WOBURN POLICE DEPARTMENT

Malcolm White School

Woburn Memorial High School

WOBURN FIRE DEPARTMENT West Side Station 5

St. Charles Elementary School

Shamrock School

WOBURN FIRE DEPARTMENT East Woburn Station 4

Goodyear Elementary School

Burbank Pond

Whittemore Pond

Cummings Brook

Little Brook

Fowle Brook

Shaker Glen Brook

Sucker Brook

Horn Pond Brook

Horn Pond Dam

WOBURN FIRE DEPARTMENT Headquarters

Clyde Reeves School

LEXINGTON

WINCHESTER

WAKEFIELD

STONEHAM

Sweetwater Brook

N

1,100 0 1,100

Scale In Feet

FIGURE 1

CITY OF WOBURN

HAZARDS AND RESOURCES

MARCH 2019 SCALE: NOTED

Weston & Sampson

Legend

- DPW
- Daycares
- Food/Grocery/Supply Stores
- Gas Stations
- Hotels/Motels
- Town Hall
- Fire Stations
- Local Police
- Underground Storage Tanks
- Pipeline
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Hospitals
- Hospital with ER

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- AE: Regulatory Floodway
- D: Possible But Undetermined Hazard
- X: 0.2% Annual Chance of Flooding

All new housing development basements flooded.

7-eleven KFC repetitive loss

BURLINGTON FIRE DEPARTMENT Headquarters

BURLINGTON POLICE DEPARTMENT

BURLINGTON

WILMINGTON

READING

WAKEFIELD

STONEHAM

WOBURN

LEXINGTON

WINCHESTER

LAHEY CLINIC

Mill Pond Reservoir North Dike

Mill Pond Dam

Mill Pond

Mill Pond South Dike

Maple Meadow Brook

Upper Woburn Street Pond

Lower Woburn Street Pond

Aberjona River

Mary D Altavesta School

Linscott-Rumford School

WOBURN FIRE DEPARTMENT Station 2

Halls Brook

Middlesex Canal

Mishawum Lake

Halls Brook Flats

READING FIRE DEPARTMENT West Side Station

WOBURN FIRE DEPARTMENT Dispatch Station 3

John F Kennedy Middle School

Daniel P Hurld School

Daniel L Joyce Middle School

WOBURN POLICE DEPARTMENT

Malcolm White School

Woburn Memorial High School

WOBURN FIRE DEPARTMENT West Side Station 5

St. Charles Elementary School

Shamrock School

WOBURN FIRE DEPARTMENT East Woburn Station 4

Goodyear Elementary School

Whitemore Pond

Burbank Pond

Sweetwater Brook

Clyde Reeves School

WOBURN FIRE DEPARTMENT Headquarters

Horn Pond

Horn Pond Dam

Horn Pond Brook

Butterfield Pond Dam

Butterfield Pond

Vine Brook

Shaker Glen Brook

Sucker Brook

Fowle Brook

Little Brook

Cummings Brook

Scale In Feet: 1,100 0 1,100

FIGURE 1

CITY OF WOBURN

HAZARDS AND RESOURCES

MARCH 2019 SCALE: NOTED

Weston & Sampson

Legend

- DPW
- Daycares
- Food/Grocery/Supply Stores
- Gas Stations
- Hotels/Motels
- Town Hall
- Fire Stations
- Local Police
- Underground Storage Tanks
- Pipeline
- Powerline
- Substation
- Railroad
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- Drinking Water Booster Station
- Water Tank

Hospitals
- Hospital with ER

Schools (Pre-K Through HS)
- Public
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Colleges and Universities
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Libraries
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Long Term Care Residences
- Assisted Living Facility
- Nursing Home
- Rest Home

Dams
- High Hazard
- Significant Hazard

DEP Wetlands
- Marsh/Bog
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FEMA National Flood Hazard Layer
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BURLINGTON FIRE DEPARTMENT Headquarters

BURLINGTON POLICE DEPARTMENT

BURLINGTON

LAHEY CLINIC

Vine Brook

Butterfield Pond Dam

Butterfield Pond

LEXINGTON

WILMINGTON

Mill Pond Reservoir North Dike

Mill Pond Dam

Mill Pond

Mill Pond South Dike

Maple Meadow Brook

Upper Woburn Street Pond

Lower Woburn Street Pond

Aberjona River

Mary D Altavesta School

Linscott-Rumford School

WOBURN FIRE DEPARTMENT Station 2

Halls Brook

Middlesex Canal

Sylvan Road

WOBURN

Boyd Road

Rumford Park Avenue

Highet Avenue

Brentwood Road

Mishawum Road

Eaton Avenue

Dewey Avenue

READING FIRE DEPARTMENT West Side Station

READING

WOBURN FIRE DEPARTMENT Dispatch Station 3

Daniel P Hurld School

John F Kennedy Middle School

Daniel L Joyce Middle School

WOBURN POLICE DEPARTMENT

Malcolm White School

Woburn Memorial High School

WOBURN FIRE DEPARTMENT West Side Station 5

St. Charles Elementary School

Shamrock School

WOBURN FIRE DEPARTMENT East Woburn Station 4

Goodyear Elementary School

Burbank Pond

Sweetwater Brook

WAKEFIELD

STONEHAM

4 Corners

Clyde Reeves School

WOBURN FIRE DEPARTMENT Headquarters

Horn Pond Dam

Horn Pond Brook

Little Brook

Cummings Brook

Shaker Glen Brook

Fowle Brook

Sucker Brook

WINCHESTER

MWRA

N

1,100 0 1,100
Scale In Feet

FIGURE 1

CITY OF WOBURN

HAZARDS AND RESOURCES

MARCH 2019 SCALE: NOTED

Weston & Sampson

#1

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Heavy Precipitation	Drought/ Heat	Snow/ Ice	Wind	Priority H - M - L	Time Short Long Ongoing
Infrastructural	Dam/Horn Pond - inspect dam		Private						
Roads		Woburn State	V	increased storage, drainage upgrades/new drainage Four corners, Olympia Ave, Nashua/Draper, Hart St., Washington St., Salem St., School St, Dam, Wyman + (Flooding)	green infrastructure		more staff to clear roads w/ down trees	H	O/L
Drainage			V					H	O/L
PUmp Stations			V/S	repair drainage backup generator				L	S
Police Dept / Fire Dept	RAVE		V/S	move Fire Station updates to Police department move generator higher			back up generator	M	S
Emergency Response	Avalon Development Flooding 4 corners		V	repair drainage	Additional Shelter			H	L/O
Radio Tower	regional		V/S				✓ back up generator	M	S
Societal	Woburn Winchester Lexington Arlington								
Seniors	throughout		✓	RAVE communication work with doctors		& senior center & housing authority to pass along info on RAVE		H	O
Low income	"		V	↳ work w/ housing authority				H	O
Public Buildings / Churches			S	can be used as a shelter put in backup generator				L	S
Non - English			V/S	RAVE & police multi language				H	O
Patch				Notify resident during/before a hazard / emergency reach out to patch to Grocery stores				M	S
Youth				work with schools - reverse 911				H	O
Environmental									
Horn Pond			V/S	dam inspection				L	O
Forest			V/S	stormwater storage	cooling widening trails clearing/trimming			L	S
Wet lands			V/S	wetland creation				M	S
Herring			S	fish ladder				M	S
Aberjona River / Industry				chemicals washing downstream during high intensity storm?					

High School - emergency shelter equipt w/ cots & generator
Strength

#4

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Wind	Extreme Heat/ Drought	Snow/ Ice	Priority H-M-L	Time S-L-O
Infrastructural									
1. Horn Pond Brook/Dam	City	City	V|S	-Stream Channel Improvements -Instrumentation Improvements				H	S-L-O
2. Four Corners (Bus. area)	City	City + Private	V	-Fish Passage way					
3. Washington St. (Bus area)	City	City, State + Priv.	V	-Improved Culverts (cleaning + Inc. Size) New Piping				H	O
4. New Boston St. (Bus. area)	"	City + Priv.	V						
5. Olympia + Wildwood (Bus. area)	City	City + Priv	V						
6. Sewage Pump Station	Draper St.	City	V	- Sand Bagging				M	S
7. Culverts (—)	Dix Rd	"	"	- Veg. Berms					L
	City Wide	City + State	V						
8. Water Supply Wells	Horn Pond wellfield	Private	V	- Sewer overflow & WQ keep up w/ improv.				M	O
9. Sewage Transport System	Horn Pond Interceptor	City + Burlington	V	- Monitoring / replace liner				L	O
10. Police Dept. (minor flooding)	Harrison Ave.	City	V|S	- Pumps to prevent flooding				M	L
11. Transportation Center	City wide	State + Priv.	V|S	- Evacuation Route				M	O
12. Historic Building at Horn Pond				- Continuous Maintenance				M	O
Societal									
1. Elderly Housing	City wide	Municipal + Private	V|S	- Generators		Cooling Centers		M	O
2. Assisted care / Rehab Centers	City wide	"	V|S	- Text / social media / email Notification					
3. Halfway Houses	"	State + Priv.	V|S					M	O
4. Daycare Centers	City wide	Private	V|S						
5. Transient workers / commuters	"	Public + Priv	V|S	Temporary shelters like school + Senior Center			- Continued operation to keep roads open	M	O
6. Out Patient Care	City wide	Private	V|S						
7. Schools	City wide	Public + Private	V|S						
8. Court houses	City wide	State	S						
~~9. Transportation Center~~									
9. Commerce Centers (malls)									
Environmental									
1. Horn Pond area	SE Woburn	Municipal + Private	V|S	- Stream Channel Improvements - Plant management - Manage GW elevation			- alternatives to salt for deicing	H	S-L-O
2. Aquifers (contamination of water supply)	Horn pond	"	V					H	SL-O
3. Industraplex Sites (OU1 + OU2)	NE Woburn	Private + municipal	V	- continued monitoring for sewage overflow		- water conservation (social media connection)			
4. Invasive Plants	City wide		V	- monitoring sites					
5. Aberjona River (WQ issues + flooding)	East Woburn		V					L	O
6. Cranberry Bog			V	- Stream + vegetation maintenance			- social media notifications when paths open	L	O
7. Conservation Areas			V					M/L	O
. Bike Paths / walking trails			V						
. Comm. Gardens									
. Middlesex ~~Canal~~ Canal									

#5

mmunity Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

priority for action over the **S**hort or **L**ong term (and **O**ngoing)
lnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

res	Location	Ownership	V or S	Flooding	Extreme Heat/Drought	Wind	Snow/Ice	Priority H - M - L	Time Short Long Ongoing
astructural									
w Boston BRIDGE		S/L	V	Drainage/ proper elevation			DPW prev. main plan Storm MGT	H	O
WRA Draper to Brook		S	V	Generators: Pump Station DPW: pre. maint plan	→	→	→	M	O
OUR CORNERS		L	V	Maint. on Culvert				H	O
UMPING STATION		L	V/S	pre. maintenance				H	O
chool Building (older)		L	V	upgrading drainage Bldg. elevation				M	L
etal									
lderly / Seniors			V		Back-up generator cooling center		Maintenance Snow Removal	M	O
ow Income			V	-Comm. outreach -Reverse 911	→	→	→	M	O
ealthcare Drugs/Alcohol			V	-City Website -Social Media	→	→	→	M	O
ult Daycare			S/V	-Public Relations -Shelter in Place	→	→	→	M	O
mmuting Population (93 Accident)			V	-communication (Billboard, Solar Signs	→	→	→	H	O
erse Population / Shelters			V	Multi-Lingual Comm./ notices	→	→	→	M	O
onmental									
rn Pond / Water Infrastructure			S/V	inter-community outreach about/below stream	→	→	→	H	O
ujon a River			S/V	-Adjoining Abutters	→	→	→	H	O
n Space / City Operated			V	-pre. maint / resources	→	→	→	L	O
n Space / Canopy			S	using existing space to store H_2O				L	O
s Water Protection - Zoning -			S	-Building Codes, DEP, Zoning Laws				H	O/L
r Energy (Landfill Area)			S	N/A	Upkeep/ maintenance →			M	O

FINAL 1 of 2

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Wind	Extreme Heat/Drought	Snow/Ice	Priority H-M-L	Time S Long O ngoing
Infrastructural									
Horn Pond Dam ●●●			V	inter community outreach remove				H	
Horn Pond Brook ●				hydraulic limitations				H	
4corners ●●●●●		private, state, City		flood storage wetland creation, repair culvert floodproofing business, building improvements (private)			manage winter flooding	H	
New Boston St Bridge ●●●			S V	proper elevations to alleviate flooding SMP & prev. maint. plan					
Police Station ●				fix or move garage	EMS Backup generator			L	O
Aboajora River				inter-community outreach					
Societal									
Public Shelters				housing vulnerable populations/temp shelter					
Radio Tower [serves five communities] Police, Emerg, Fire Communication				0	backup generator repeaters on water storage tanks	(redundant repeaters)			
Environmental									
pests/rats				curbside composting (not in yard)					
New Development ●●●●				stormwater mit. plan					
Stormwater Management ●				opportunities to improve sweetwater brook					
WATERSHEDS ●●				EVALUATE LOCATIONS OF DEVELOPMENT/IMPLEMENT	STORMWATER PERMIT				

FINAL 2 of 2

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-M-L priority for action over the Short or Long term (and Ongoing)
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Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Wind	Extreme Heat/Drought	Snow/Ice	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Washington St Business Area	● ●			impervious surfaces create flooding of roads + buildings (infiltration systems) culvert + piping improvements					
MWRA injection to Draper St to Hills brook	● ● ●			(low lying area) wastewater injection elevation + protecting local ww system from surcharging + flooding		Implement P.S. w/ backup generator + station susceptible to flooding (sweetwater brook) preventative maintenance plans			
Public Roadways/Traffic Volume	●			elevate roadway pervious pavement drain infrastructure	(increase storage, green infrastructure) mac staffo for snow		* more staffo…		
Water Treatment Plant						[illegible]			
Fire + Police (Emergency services)	● ● ● ●			Resilience Planning repair drainage flooding that impacts emergency response vehicles					
Societal									
Social Media/Education				leverage s.m. for environmental notification + conservation Community outreach mail includes upstream/downstream communities			education		
Energy Dependent Pop (oxygen/dialysis dependent)				city-wise database of population @ high risk + action plan			(energy company, city, health dept.)		
Low/Moderate Income (addiction/adult day care) ●				Transportation to shelters in case of emergency Community outreach program / Reverse 911, leverage PSR. + social media					
Elderly Population ●				Housing + Transportation programs					
Environmental									
Horn Pond Brook ● ● ● ● ● ●				Remove hydraulic impediments for fish, vegetation improvements (attracting fish + recreational uses)					
Stream Maintenance									
Open Space/Urban Forest ● ●				Increased stormwater retention in ex. open spaces	Tree Replacement	Increased Shade Trees	Tree Replacement		
Ground Water Supply ● ●				Zoning laws + storm water management plan to protect supply		Water conservation methods + incentives			

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	FLOODING	WIND	EXTREME HEAT + DROUGHT	SNOW + ICE	Priority H - M - L	Time S Short L Long O Ongoing
Infrastructural									
COMMERCIAL BUILDINGS (MAIN ST - SMALL BUSINESS OWNERS)	CITY-WIDE	PRIVATE	V/S						
Societal									
Environmental									
INVASIVE SPECIES	CITY WIDE	-	V						
AIR QUALITY	CITY WIDE	-	V						

#2

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

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Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	FLOODING	WIND	EXTREME HEAT + DROUGHT	SNOW AND ICE	Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Private Property		Private	V/S	Rain gardens / permeability / green space			Inspections / oversight	M	O
Public Roadways (Traffic)	HORN POND	PUBLIC	V/S	Elevate roads / water collection	Pervious pavement / green medians		More DPW support / funding	H	O
Water Treatment	↓		V/S	Backstops		Billing / Incentives for water cons.			
Dams	Citywide		V/S	Proper maintenance / inspections	Regional Collaboration →			M	O
Emergency Services	" "	Public	S	Resilience Planning →				H	O
Public Shelter Options	" "	Public	S	Back up Generator confirm locations →					
Societal									
Elderly			V/S	APP. HOUSING → TRANSPORTATION →				H	O
First Responders / Med. staff			S	SAFE FACILITIES → WELL LOCATED → LOW RESPONSE TIMES →				H	O
Individuals in Poverty			V	IDENTIFY SHELTERS → POINT OF CONTACT →				M	O
Children			V	PROGRAMMING / ID'ING LOCAL GROUPS →				M	O
Immigrant / ESL			V	TRANSLATION SERVICES → ID'ING COMMUNITY CENTERS →				M	~~O~~ L
Commuter Pop.			V/S	DIGITAL PSAs → CREATE TDMs →				M	O/L
Environmental									
Trees	Citywide	Pub/Private	V/S	Identifying trees in ROWS Identify an arborist		Tree Setbacks (OUTSIDE ROW) Inventory new trees			
Horn Pond	—	Public	V/S	Vulnerability Assessment →					
Flood Plains	Citywide		V/S	Study performance →					
Stormwater Mgmt. (Sweetwater Brook)	Citywide / local		V/S	Evaluate Opps. →					
Open Space (Clapp Park)			V/S						
Watersheds (Aberjona)			V/S						

#4 3

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Heat/drought	Wind	Snow/Ice	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Police Station		muni	S/V	fix, move flood-prone garage	coordinate + improve communications/systems w other EMSs, need backup generator →	→	→	L	O
High School		"	S	Optimize use as emergency shelter →	→	→	→	L	ongoing
Fire Dept Station 3		"	V	upgrade comm. equipment bldg, apparatus →	→	→	→	M	M
4 Corners intersection (Rt 3)		city, state private private businesses + roadway	V	site-specific flood mgt, private improvements to parking, businesses			need extra attn to manage winter flooding	H	S/O
Horn Pond Dam		muni	S/V	maintain to keep up w increased rainfall				M	L
Drinking water system	city wide	multiple	S/V	upgrade/increased mgt for increased population, drought → redundant pumps, capital improvement plan, investment, execution				H	O
Societal									
People on Oxygen / dialysis	citywide	public + private	V	need list of at-risk residents if power fails - Eversource has database + action plan for checking in on fragile residents				H	S/O
Medical reserve corps	"	volunteers	S	consider providing incentives to look in on fragile residents more systematically consider more extensive training (less than EMS)				L	O
Housing / low-income residents	"	private + muni	V	transportation to emergency shelter - tree planting, insulating, other cooling investments				H	S
Council of Social Concern / Council on Aging	North Woburn	NGO + muni	S	- develop natural disaster plan specific to senior citizens				L	O
low-mod $ residents	dispersed	private	V		Subsidize cooling strategies (Eversource?)		subsidize heating strategies (Eversource)	M	O
Senior citizens (today's middle age)	"	"	V	consider zero net energy, shelter-in-place housing standards for new developments consider emergency services in multi-family houses				M	O
Environmental									
Horn Pond Brook	south Woburn	muni	V	needs stream restoration, post-dam improvements ← stream side flood mgt, erosion control				M	S
Increased pests (rats, mice, ticks)	city wide		V	manage water re: insects near people	curbside composting to decrease rats			M	O
Toxic sites	next to Horn Pond various		V	test, monitor, create plan to prevent toxic site erosion + discharge → deployable flood barriers				L	O
New developments (esp 40b)	city wide	mostly private	S/V	- can contribute to stormwater + G	upgrades when permit new development (like Lexington)			H	S/O
surface/stormwater quality (hotter, lower oxygen, contaminated)			V	- avoid losing open space - flood plain zoning to 500-yr storms - develop stormwater department - stormwater quality + quantity ordinances to manage on site				M/H	O
Open space / urban forest	larger areas esp, but also street trees	multiple	S/V	- max site-specific retention - ID opportunities for enhanced stormwater retention	design parks to increase shade, urban forest plan for public/private land		← replace trees damaged in storms	H	S/O

APPENDIX E

Core Team Meetings

January 3, 2019
April 9, 2019

City of Woburn
Municipal Vulnerability Preparedness Planning Grant Project
Core Team Meeting
Woburn City Hall, Engineering Conference Room, 10 Common St, Woburn, MA 01801
Thursday, January 3, 2019
2:00 pm – 3:30 pm

Agenda

1. Introductions — 10 minutes

2. Project Overview — 15 minutes
   a. MVP Planning Grant
      i. Municipal and stakeholder driven process
      ii. Workshop(s) to identify strengths and vulnerabilities
      iii. Matrix and report identifying MVP Key Actions
   b. MVP Action Grants

3. Core Team Role — 10 minutes
   a. Develop schedule
   b. Organize implementation of the Community Resilience Building Workshop
   c. Inform community priorities/Determine how decisions from Workshop will be used

4. Community Resilience Building Workshop(s) — 20 minutes
   a. Overview of climate projections
   b. Map of key resources/assets
   c. Discuss hazards and key features (infrastructure, society, environment)
   d. Prioritize MVP Key Actions
   e. MVP Risk Matrix

5. Data Needs and Sources — 20 minutes
   a. Interviews with municipal officials
   b. Applicable reports and materials
      i. City of Woburn Hazard Mitigation Plan 2015 Update (MAPC, 2016)
      ii. Woburn Vision 2020 Community Development Plan (2005)
      iii. Emergency operation plans
      iv. Other ongoing planning efforts
   c. Critical assets and infrastructure

W&S Action Item: Review materials and incorporate into Workshop and Report(s)
Woburn Action Item: Identify and provide any additional resources

Weston & Sampson

6. Workshop Participants
    a. Prepare list of workshop invitees, for example: 20 minutes
        i. Woburn City Government (Mayor, Mayor's Office, City Council, Planning, Public Works, Conservation, Health, Inspection Services, Fire, Police, Emergency Management Agency, and more)
        ii. State Government (Agencies, State Representatives, State Senators, MAPC)
        iii. Federal Government (US Environmental Protection Agency, Army Corps of Engineers)
        iv. Institutions (hospitals, schools, other)
        v. Businesses (Chamber of Commerce, realtors, and more)
        vi. Neighborhood/Community/Environmental Groups (Mystic River Watershed Association)
        vii. Neighboring Communities
    b. Invitations and RSVPs
    c. Table Assignments

    W&S Action Item: Draft invitation to stakeholders
    Woburn Action Item: Finalize list of invitees; send invitation and track RSVPs, assign participants to tables

7. Workshop Schedule 10 minutes
    a. One 8-hour or two 4-hour meetings
    b. Weekday or weekend
    c. Day or evening

    Woburn Action Item: Determine format and schedule of Workshop

8. Workshop Materials 45 minutes
    a. Draft Powerpoint
    b. Draft map for discussion at tables
    c. Other

    W&S Action Item: Finalize Workshop materials based on Core Team input
    Woburn Action Item: Help to fill mapping and Powerpoint gaps

9. Workshop Staffing 15 minutes
    a. Facilitators – Weston & Sampson
    b. Note-Takers – City of Woburn (Core Team)

    W&S Action Item: Identify six table facilitators
    Woburn Action Item: Identify six table note-takers

10. Wrap Up and Next Steps 15 minutes

Town of Woburn
Municipal Vulnerability Preparedness (MVP) Grant Project
Core Team Meeting Notes
Thursday, January 3, 2019
2:00 pm – 3:30 pm

Attendance

Woburn
Jay Corey, Engineering
Matt Barrett, Engineering
Len Burnham, DPW
Meghan Doherty, Board of Health
Robert F. Rufo, Police Department
Stephen Adgate, Fire Department
Tina Cassidy, Planning Office

Weston & Sampson
Kathy Baskin, Project Manager
Jill Getchell

Discussion

MVP Program Overview (Kathy)

- Year 1: MVP Planning and Hazard Mitigation Planning
  - 70+ municipalities in 2017-2018
  - 80+ municipalities in 2018-2019
  - Municipal and stakeholder driven process
  - 8-hour Community Resiliency Building Workshop to identify strengths, vulnerabilities and strategies and relationship to HMP process
  - Development of Risk Matrix to identify MVP Key Actions
- Year 2 and beyond: MVP Action Grant
  - Funding is available for implementation of Key Actions
  - MVP program ties into other funding programs; MVP certified communities receive extra points awarded on other EEA grant/loan applications

Core Team Role (Kathy)

- Core Team defines goals and develops schedule
- Organizes implementation of the Community Resilience Building Workshop and Listening Session
- Determines how information and decisions from Workshop will be used
- Reviews recommendations and prioritizes Action Items

MVP Community Resilience Building Workshop/

Components of the Workshop are:

- Provide an overview of climate projections
- Use of large map depicting key resources, assets and infrastructure
- Discussion of strengths and vulnerabilities

- Prioritize MVP Key Actions
- Use of the Risk Matrix to organize ideas

Data Needs and Sources

- Reports and materials previously identified by Weston & Sampson:
  - Massachusetts Climate Change Projections (NECSC, 2018)
  - Massachusetts Climate Change Adaptation Report (MA EEA, 2011)
  - City of Woburn Hazard Mitigation Plan 2015 Update (MAPC, 2016)
  - Woburn Vision 2020 Community Development Plan (2005)
  - Emergency Preparedness Plan (Meghan knows location)
  - After Action Plan (2006) (Jay knows location)
  - Woburn Master Plan (2015) (Tina knows location)
  - Open Space and Recreation Plan (Tina knows location)
- Hold possible side meetings with staff that we need more input from

List of Workshop Attendees

- Preliminary list of invitees developed during meeting
- List will be screened and narrowed; need to follow up as to who will finalize list and assign contact information
- Suggestions to invite:
  - Schools - Superintendent
  - Cumming Property (largest property owner)
  - Woburn Business Association – Heather Maguire
  - MAPC North Suburban Planning Council – Sarah Philbrick
  - Woburn Residents' Environmental Network (WREN) - Gerry Kehoe (listed as Chairman)
  - Mystic River Watershed Association – Patrick Herron or Julie Wormser
  - Mayor Delegates
  - Eden Group – developer of Woburn Mall
  - Leggitt Meyer
  - State Representative Richard Haggerty
  - State Representative Michelle Ciccola
  - State Senator Cindy Friedman
  - City Aldermen
  - Joe Tardy (Hospital in Winchester)
  - Woburn's Building Inspector - Tom Quinn
  - Woburn Boys and Girls Club (Chief of Police Robert Rufo is on board of directors)
  - Key residents

Schedule

- An 8-hour one-day Workshop on a weekday from 9:00 am to 5:00 pm is preferable
- Tentatively set for the week of February 21st, with a back-up snow date within the same week.
- The meeting will be at the Senior Center.

Workshop Materials

- Kathy reviewed the general schedule of the workshop describing the sequence of events.

- Draft Powerpoint: The Core Team reviewed the draft workshop presentation which includes existing hazards, existing climate change, climate change projections, features that will be vulnerable or offer strength to the community under climate change, and types of actions that can be taken to alleviate impacts.
- Draft GIS Map for Discussion: The Core Team reviewed the large GIS map of the assets and vulnerabilities.

Workshop Staffing

- Weston & Sampson will provide five table facilitators for the Workshop
- The Town of Woburn will identify five table scribes/note-takers for Workshop

Wrap Up and Next Steps

- List of invitees to be finalized and follow up as to when invitations will be sent out
- PowerPoint and Map to be reviewed after edits.
- Track everyone's hours to qualify for 120 staff hours.

City of Woburn
Municipal Vulnerability Preparedness Planning Grant Project
Thursday, January 3, 2019, 2:00 pm – 3:30 pm
Core Team Meeting Sign-In Sheet

Name	Affiliation	Email Address
Len Burnham	DPW	LBurnham@cityofwoburn.com
Matt Barrett	Engineering	mbarrett@cityofwoburn.com
Jay Corey	Engineering	jcorey@cityofwoburn.com
Jill Getchell	Weston & Sampson	getchellj@wseinc.com
Kathy Baskin	Weston + Sampson	baskink@wseinc.com
Meghan Doherty	Board of Health	mdoherty@cityofwoburn.com
Robert F. Russo	Police Dept	rrusso@woburnpd.com
Stephen Adgate	Fire Dept	sadgate@woburnfd.com
Tina Cassidy	Planning Office	tcassidy@cityofwoburn.com

City of Woburn
Municipal Vulnerability Preparedness Planning Grant Project
Core Team Meeting
Woburn City Hall, Engineering Conference Room, 10 Common St, Woburn, MA 01801
Tuesday, April 9, 2019

Agenda

1. Introductions

2. Review Draft MVP Summary of Findings Report

3. Wrap Up and Next Steps

APPENDIX F

Public Listening Session

April 8, 2019

PUBLIC MEETING NOTICE

City of Woburn Municipal Vulnerability Preparedness (MVP) Plan

Woburn's MVP Plan helps to reduce the City's vulnerability to the impacts of natural hazards such as flooding, winter storms, and extreme temperatures, which are predicted to intensify under climate change. Please join the City's Engineering Department for a presentation and discussion of the Plan's update.

Date: Monday, April 8, 2019

Time: 5:30 pm

Location:

Woburn City Hall, Program Room, 10 Common St, Woburn, MA 01801

Contact: Engineering Department at (978) 468-5520

CALENDAR LISTING / MEDIA ADVISORY

WOBURN'S DRAFT CLIMATE CHANGE RESILIENCE PLAN TO BE PRESENTED AT APRIL 8, 2019 PUBLIC MEETING

A meeting will be held to present an overview of Woburn's Municipal Vulnerability Preparedness Plan and to solicit public comments. The plan outline strategies for becoming more resilient to climate change.

Who: Woburn residents, business owners, representatives of non-profit organizations and institutions, and others who are interested in preventing and reducing damage from natural hazards and climate change.

What: Woburn's City Engineer, Jay Corey, will hold a public meeting to present an overview of Woburn's draft Municipal Vulnerability Preparedness Plan. The plan will identify natural and climate change hazards affecting Woburn, including floods, drought, winter storms, and extreme temperature. It will also present strategies that the City can take to become more resilient to these impacts of climate change.

When: April 8, 2019, 5:30 PM

Where: Woburn City Hall, Program Room, 10 Common St, Woburn, MA 01801

Contact: Woburn City Engineer's Office at (781)897-5882

City of Woburn
Municipal Vulnerability Preparedness Planning Grant Project
Public Listening Session
Woburn City Hall, Program Room, 10 Common St, Woburn, MA 01801
Monday, April 8, 2019
5:30 pm – 7:00 pm

Agenda

1. **Welcome and Introductions** — 5 minutes
   Mayor Scott Galvin
   Jay Corey, P.E., City Engineer and Project Manager

2. **Overview of Municipal Vulnerability Preparedness Program** — 10 minutes
   Kathy Baskin PE, Project Manager, Weston & Sampson

3. **Summary of Hazards, Vulnerabilities & Strengths, and Priority Actions** — 20 minutes
   Kathy Baskin PE, Project Manager, Weston & Sampson

4. **Questions and Answers** — 45 minutes
   All

5. **Public Comment Period** — 5 minutes

6. **Conclusions** — 5 minutes
   Mayor Scott Galvin
   Jay Corey, P.E., City Engineer and Project Manager

welcome

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Municipal Vulnerability Preparedness

Workshop Findings and Priority Recommendations
&
Review of Draft Municipal Vulnerability Preparedness Plan

Woburn, Massachusetts
April 8, 2019

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Woburn Project Team Leadership

<u>Municipal Leadership</u>

- Mayor Scott Galvin
- Jay Corey, City Engineer
- Core Team Members
  - Matt Barrett, Engineering
  - Len Burnham, DPW
  - Meghan Doherty, Board of Health
  - Robert F. Rufo, Police Department
  - Stephen Adgate, Fire Department
  - Tina Cassidy, Planning Office

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What MVP offers Municipalities

- Preparedness for natural & climate hazards
- Collaboration with stakeholders
- Education and planning
- Grant funding for priority actions

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MVP Workshop

- Defined natural hazards Identified key features
- Determined vulnerabilities and strengths
- Developed and prioritized actions
- Next: Implement actions

1. Engage Community → 2. Identify Hazards → 3. Assess Vulnerabilities and Strengths → 4. Develop & Prioritize Actions → 5. Take Action!

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Workshop Participants

Municipal Government
- Mayor
- City Council
- Conservation Commission
- Council on Aging
- Engineering Department
- Fire Department
- Health Department
- Housing Authority
- Inspectional Services
- Planning Board
- Police Department
- Purchasing Department
- Public Schools
- Public Works
- Water Department

Statewide
- MA Emergency Management Agency

Development/Business
- Cummings Properties
- Edens
- Leggett McCall Properties

Environmental Group
- Mystic River Watershed Association

Neighboring Towns
- Lexington Engineering Department

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Top Hazards Identified at the Workshop

Flooding

High Winds

Extreme Heat and Drought

Snow and Ice

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Climate Change Impacts

Entire State (including Woburn)		Coastal Communities only (not Woburn)
Higher Temperatures	More Extreme Precipitation (More droughts, more floods)	~~Sea Level Rise & Coastal Surge~~

Goal: to protect infrastructure, environment, public health & safety, and economy

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Predicted Climate Change

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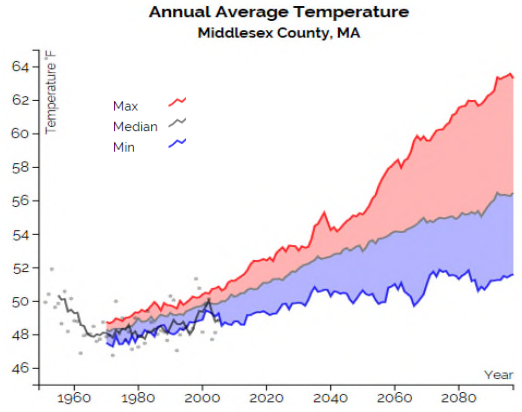
Projected: Annual Average Temperature in Middlesex County



(Source: Northeast Climate Adaption Science Center)

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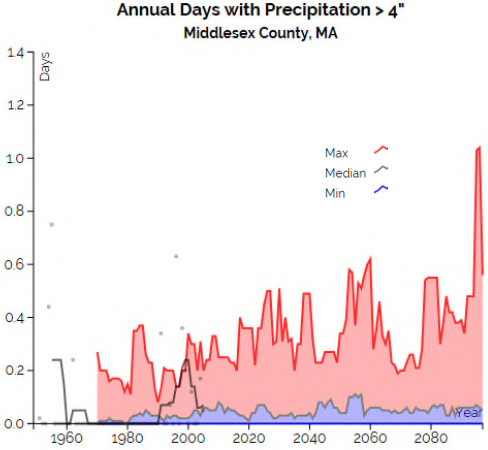
Heavy Precipitation



(Source: Northeast Climate Adaption Science Center)

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Vulnerabilities

Infrastructural

- Streets susceptible to flooding: Four Corners, Olympia Ave, Nashua/Draper St, Hart St, Washington St, Salem St, School St
- Culverts, including Shaker Glen Brook culvert
- Boston Street Bridge, to be constructed in 2020
- Water treatment plant
- Radio tower
- Police station
- Aberjona River and Superfund site
- Emergency Services

(Source: boston.cbslocal.com)

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Vulnerabilities

Societal

- Individuals living in poverty
- Public shelters
- Social media/education/public outreach
- Energy dependent population (oxygen/dialysis dependent)
- Elderly populations
- Population with addiction/living in halfway houses or in adult day care
- Children
- Low- to moderate-income population
- Immigrants and people with language barriers
- Commuting population
- Outpatient care
- Medical reserve corps
- First responders/medical staff
- Courthouses
- Commerce centers

https://www.seniorliving.com/featured-community/monarch-homes-wo

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Vulnerabilities

Environmental

- Horn Pond
- Horn Pond Brook
- Forest
- Wetlands
- River herring
- Aberjona River/superfund site
- Floodplains
- Sweetwater Brook
- Open space (Clapp Park)
- Watersheds (Mystic & Aberjona)
- Air quality
- Invasive species
- Pests
- New development
- Surface/stormwater quality
- Former cranberry bog
- Aquifers/groundwater protectio
- Conservation areas
- Community gardens
- Middlesex canal
- Solar energy

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Strengths

Infrastructural

- Emergency shelter at high school
- New schools
- Upgrades to Horn Pond Dam
- Pumping station
- Police/fire department
- Emergency Response
- Radio Tower
- Public shelter options
- Commercial buildings
- Drinking water system
- Transportation center

(Source: www.woburnma.gov/government/woburn-fire-department/)

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Strengths

Societal

- Public buildings/churches
- Multi-lingual residents
- Council of social concern/council on aging
- First responders/med staff
- Commuter population
- Medical reserve corps
- Elderly housing
- Assisted care/rehab centers
- Halfway houses
- Daycare centers
- Outpatient care
- Schools
- Patch
- Courthouses

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Strengths

Environmental

- Horn Pond
- Forest
- Wetlands
- River herring
- Floodplains
- Sweetwater Brook
- Clapp Park
- Aberjona watershed
- New developments
- Community gardens
- Middlesex canal
- Greenspaces/canopy
- Groundwater protection (zoning)
- Solar energy

(http://freedomsway.org/about-fwnha/our-communities/woburn-ma/)

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High Priority Actions

Flooding: Four Corners, Olympia Avenue, Nashua/Draper Street, Hart and Wyman Street, Washington Street, Salem Street, and School Street

- Increase flood storage
- Add green infrastructure, wetlands, rain gardens
- Repair culvert along Shaker Glen Brook
- Floodproof businesses

New Boston Street Bridge: design elevations and drainage for future conditions

Culverts: increase culvert capacities and clean regularly

Horn Pond Brook: remove hydraulic impediments along for improved habitat and flood control.

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High Priority Actions

Stormwater ordinance: addressing water quality and quantity

Open Space: maintain and protect open space

Emergency Shelter: provide more

Increase Information using RAVE System: to seniors, low income, commuting, and non-English speaking residents

Protect Water Supply and Infrastructure: including redundant pumps, capital improvement plan, investment, and execution

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Medium Priority Actions

- *System Redundancies*: backup generators to pump stations and radio tower that serves five communities, redundancies at water towers
- *Police Station*: protect from flooding (i.e. relocation, dry floodproofing, and adding pumps to the basement)
- *Stormwater*: storage in the Horn Pond forest, evaluate opportunities for SW management on Sweetwater Brook
- *Horn Pond*: widen and clear trails in forest as a buffer to isolate brush fires

(https://patch.com/massachusetts/woburn/power-almost-fully-restored-woburn-other-area-towns)

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Medium Priority Actions

- *Communications Systems*: coordinate and improve with EMS
- *At-risk Residents*: create list of in case of power failure
- *Parks*: design parks to increase shade, and to reduce heat and stormwater, create urban forest plan for public and private lands
- *Generators and Cooling*: for elderly housing

(https://www.woburnma.gov/news/2018/07/kayak-rentals-at-horn-pond/)

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Additional Priority Actions

Horn Pond Dam: inspect and maintain

Public Trees: assess, trim branches, remove dead trees, replant

Water Conservation: Implement billing and incentives

Transportation for Low Income/Residents of Public Housing: to emergency shelters

Cooling/Heating: Eversource subsidize strategies

Evacuation: establish routes

Invasive Species: monitor

Housing Improvements: consider zero net energy, shelter-in-place standards for new developments, emergency services in multi-family houses

Wastewater Pump Station: protective barrier, monitor for overflows

(Source: https://patch.com/img/cdn/users/12838/2015/09/t800x600/20150956 0be67d2a70b.jpg)

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Public Comments

- Comments accepted:
  - April 8 – April 15, 2019
- Send comments to Jay Corey
  - Email: jaycorey@cityofwoburn.com
  - Mail: John Corey, P.E.
    City Engineer
    Engineering Department
    City of Woburn
    10 Common Street
    Woburn, MA 01801
  - Phone: (781) 897-5882

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Next Steps

- Listening Session: April 8, 2019
- Comment Period: April 8 - 15, 2019
- Finalize Plan
- Send to the State for approval
- Apply for grants

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Thank You

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City of Woburn
Municipal Vulnerability Preparedness Planning Grant Project
Monday, April 8, 2019, 5:30 pm – 7:00 pm
Listening Session Sign-In Sheet

Name	Affiliation	Email Address
Gordon Vincent	City of Woburn	gvincent@cityofwoburn.com
Darlene Mercer-Bruen	Ward 5 Alderman	Bruen-n-Bruen@comcast.net
Richard Dailey	Ward 2 alderman	Richard.Dailey@yahoo.com
Lenny Bradham	DPW	LBradham@cityofwoburn.com
Joanne Campbell	Alderman Ward One	jcampbell@cityofwoburn.com
William Campbell	City Clerk	wcampbell@cityofwoburn.com
Robert Ferullo	Alderman at large	rferullo@cityofwoburn.com
MARK GRAFENBY	ALDERMAN WARD 3	grafsigns@aol.com
Thomas Quinn	City of Woburn	TQuinn@cityofwoburn.com
ED TEDESCO	ALDERMAN WARD 4	ETEDESCO@cityofwoburn.com
Scott Galvin	MAYOR	Sgalvin@cityofwoburn.com
John Carey	City Engineer	JCarey@cityofwoburn.com
Amanda Kohn	Weston + Sampson	Kohn.Amanda@wseinc.com
Kathy Baskin	Weston + Sampson	baskink@wseinc.com