

# Town of Concord

## Municipal Vulnerability Preparedness Program



## Community Resilience Building Workshop Summary of Findings

December 2018

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Prepared for the Town of Concord by Kim Lundgren Associates, Inc.  
With a grant from the Massachusetts Executive Office of Energy and  
Environmental Affairs



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## Town of Concord

### Community Resilience Building Workshop Summary of Findings



#### Section 1: Overview

The Town of Concord has been a revolutionary and leading community throughout history. In particular, Concord has set the pace in Massachusetts for what it means to be a sustainable town, and the community members have truly driven its success through active participation. The Town also incorporated climate change into their 2016 Hazard Mitigation Plan and established ambitious climate mitigation goals in 2017 through Town Meeting. Therefore, the Town of Concord viewed the Municipal Vulnerability Preparedness (MVP) process as an opportunity to expand its efforts in climate adaptation. This summary of findings report presents the results from the MVP process where the Town engaged numerous stakeholders in Community Resilience Building workshops to identify strengths, vulnerabilities, and priority actions.

The Town of Concord is well known for its historic character and valuable natural assets. Concord is home to sites marking the start of our nation's independence, to natural wonders written about by the likes of Thoreau and Ralph Waldo Emerson, and to the location where Louisa May Alcott wrote and set the classic book, *Little Women*. For many,



### **Concord's Climate Mitigation and Greenhouse Gas (GHG) Reduction Goals**

1. 25% reduction in town-wide GHG emissions from 2008 baseline by 2020
2. 100% carbon-free electricity source by 2030
3. 80% reduction in town-wide GHG emissions from 2008 by 2050

climate action is a step towards protecting precious resources in addition to their livelihoods. The Town of Concord is also concerned about isolated and vulnerable populations, such as the growing senior population. Almost 20% of Concord's population is 65 years or older.<sup>i</sup> The number of residents in this age bracket is projected to increase to 34% of the population by 2030.<sup>ii</sup> This age group has grown 9% since 2010.<sup>iii</sup>

Changes in climate have been notable in Concord. The hazards of greatest concern, as determined through the MVP process, are the changing precipitation patterns leading to flooding and drought, extreme heat, and the intensity of storms. In 2018 alone, Concord experienced several extreme weather events, including four nor'easters in three weeks in the spring and long duration heat waves in the summer. Statewide, Massachusetts has seen a 21% increase in winter precipitation from 1971-2000 and an increasing amount of this precipitation is falling as rain rather than snow.<sup>iv</sup> Overall, the total average annual precipitation across the Northeastern states has increased by approximately 10% in the last fifty years, and there has been a 70% increase in the amount of precipitation falling in very heavy events. The Northeast has experienced a 1.43 degree rise in temperatures comparing the average annual temperature between 1986-2016 and 1901-1960.<sup>v</sup> These lived changes have incited an urgency to plan and implement actions to enhance Concord's resiliency.

Concord's Sustainability Division initiated the MVP process in June 2018. The Town of Concord partnered with Kim Lundgren Associates, Inc. (KLA) to design the process that would allow the Town to become an MVP Community and leader in climate resilience. To complete the required MVP work, the Town created a Core Team of key internal stakeholders to serve as advisors throughout the process. The Town and KLA then collaboratively designed and hosted two MVP workshops using the Community Resilience Building process. The Town of Concord's central objectives during the workshop 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 efforts to increase resilience.



## Section 1: Overview

Participants in the workshops worked together in four small groups and identified: a) the highest priority hazards; b) the strengths and vulnerabilities in infrastructure, socio-economic systems, and environmental assets of the Town; and c) several adaptation actions for each hazard. Every stakeholder group then put forth their highest priority actions for infrastructure, socio-economic systems, and environmental assets. Afterward, the whole group voted on their “highest priorities” using three dot stickers. Ultimately, the group collectively defined and agreed upon the final set of high priority action items and the top three are listed below. We then presented these outcomes and sought community input at two listening sessions.

### **The top three highest priority actions from the workshop were:**

- Promote and highlight low impact development and green infrastructure (14 votes)
- Develop an integrated resource management plan for the town (10 votes)
- Prioritize action plan for police/fire/DPW facilities located in the floodplain (9 votes)

There has been a growing interest among residents in climate resilience, including a citizen petition at the 2018 Town Meeting urging the Town to take action to prepare for a changing climate. Therefore, when applying to the Municipal Vulnerability Preparedness (MVP) Grant, Concord requested, and then was granted, extra funds to go above and beyond the community engagement efforts required of the MVP process. The additional community engagement activities are described in an addendum in more detail, but the activities are included in the process timeline below. The timeline records the number of events the Town of Concord completed as part of the MVP process up to mid-December 2018. More community engagement is planned for the end of December, and this report will be updated accordingly, including the addendum previously mentioned.

### **July**

- Conducted research on historic and projected changes and impacts from climate change.
- Identified and invited key internal stakeholders to be part of the Core Team.
- Convened with the Core Team to establish goals for the MVP process.
- Worked with the Core Team to determine an initial set of high-priority hazards.

### **August**

- Created a Community Engagement Strategy.
- Started social media outreach.
- Identified community stakeholders and designed the MVP workshops using the Community Resilience Building process.

## September

- Hosted two, four-hour MVP workshops with 34 participants that resulted in priority actions.
- Tabled at an extra outreach event focused on electric vehicles where we engaged community members on the linkages between greenhouse gas reduction efforts and climate resilience.
- Launched an online interactive survey to gain knowledge about resident's concerns regarding hazards and their feedback on actions the Town can take to become more resilient.

## October and November

- Filmed and produced three videos related to climate resilience and sustainability.
- Prepared for and hosted two listening sessions to discuss the results from the workshop and solicit feedback from the community.
- Presented MVP findings to the Climate Initiative Group at Newbury Court, a retirement community.
- Presented MVP findings to the Concord Business Partnership, a collective of business-owners.
- Conducted outreach to schools to gather information on how to best reach the youth audience.
- Hosted a two-hour workshop for partners in Concord to learn how to communicate about climate change to the people they serve.

## December

- Conducted a series of workshops with the high school Green Team to plan and film a Facebook Live event.
- Screened, *Before the Flood*, at a youth event and briefly discussed the climate impacts expected in Concord.

The MVP outcomes presented here have laid the groundwork for future action. The Town recently convened the first meeting of a newly formed Climate Action Advisory Board, which will be able to utilize this report for their future climate action planning efforts. The remainder of the report will focus on details of the areas of concern, strengths of the Town, and actions identified as high priorities through the MVP Process. The Town of Concord would also like to thank the Massachusetts Executive Office of Energy and Environmental Affairs for their financial and technical support.

## Section 2: Top Hazards

Before the initial kick-off meeting with the Core Team, the consultant team created a one-page summary and presentation on Concord's climate change projections using Concord's Multi-Hazard Mitigation Plan, the MAGIC (Minuteman Advisory Group on Interlocal Coordination) Climate Change Resilience Plan, the Massachusetts Climate Change Clearinghouse (Resilient MA) and other relevant regional reports. The Appendix provides this summary of the historical as well as projected changes in weather and climate experienced in Concord. This information was foundational to the MVP process as it helped to ground all stakeholders in what has historically changed in the region and what types of changes and associated impacts to expect going forward.

During the kick-off meeting, the consultant team presented the findings of that initial research and then engaged the Core Team in a discussion about what hazards concerned them the most, what vulnerabilities were their top priorities, and what climate-related impacts they have already experienced. From this discussion, the group narrowed in on four top hazards, which were then confirmed as the top hazards of concern at the stakeholder meeting.

The top concerns were:

- Flooding
- Drought
- Extreme Heat
- Intense Storms

### Flooding

Concord is experiencing more precipitation now than it did a century ago and it's falling in higher concentrations. This increase in intense rainfall events can overwhelm our riverbanks and stormwater drainage systems causing flash flooding and damage to our property and infrastructure. The expectations are that we will see more days with precipitation over one inch in the winter. If the ground is frozen and the water cannot infiltrate the soil, then this will cause widespread flooding conditions.

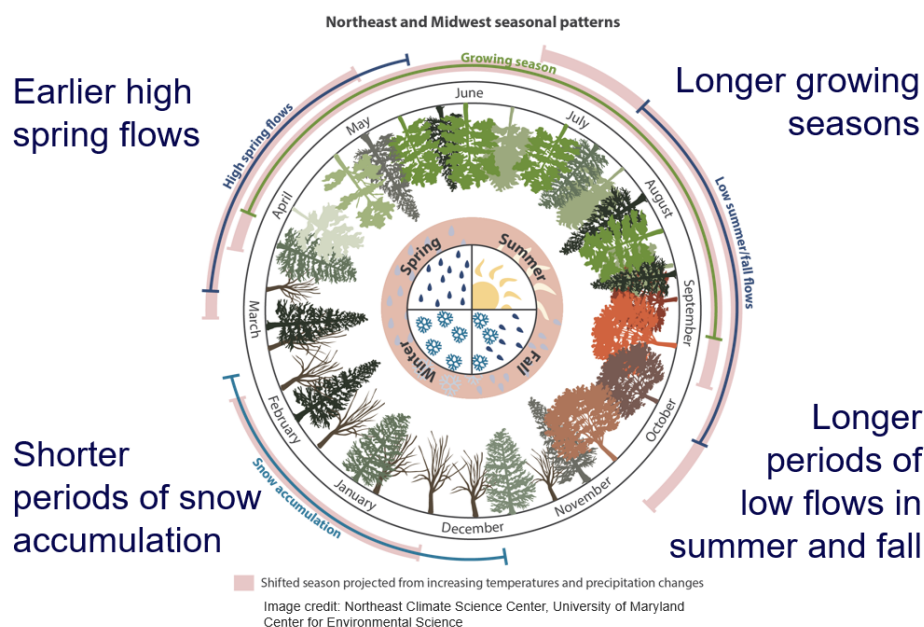
Flooding of property, key facilities, and bridges were major concerns noted in the workshop. Flooding of major arteries, emergency routes, and residential basements have been experienced in Concord. The most recent severe flooding happened in March 2010 with a total of 14.83 inches of rain.

More intense rainfall also impacts Concord in other ways. For example, more powerful precipitation runoff can result in greater nutrient loading in our rivers and ponds. This combined with warmer waterbody temperatures can cause algal blooms and fish kills. White Pond has experienced regular algae blooms. On September 4th, 2018, a water use advisory was issued for White Pond because of the algae blooms.



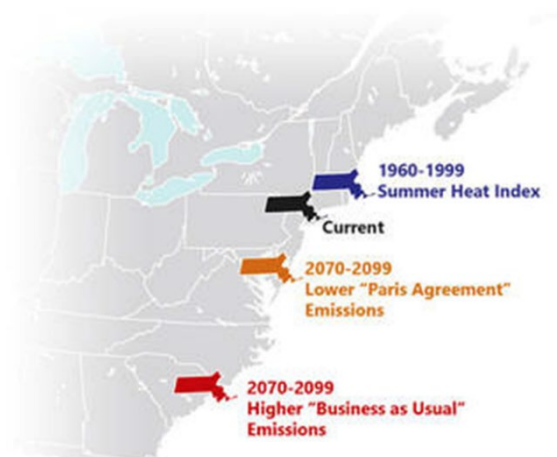
### Drought

Even though more annual precipitation is projected overall, it is anticipated to fall in extreme events in the winter and spring rather than in smaller more sporadic events throughout the year. Thus, there will be longer periods of time that experience no rainfall, especially in the summer and fall, increasing the potential for drought. In addition, rising temperatures will melt snow earlier in spring and increase evaporation leading to drier soil conditions going into summer. Drought can stress our water supply, while demand for outdoor watering may increase. Droughts also impact ecosystems and crop production by altering the soil moisture and water depth (and temperatures) that plants and animals rely on to flourish. Concord has enacted water use restrictions every summer in recent years. The figure below displays how growing seasons, stream flows, and snow accumulation will change overtime.



### Extreme Heat

Annual temperatures are rising, which changes how we will experience every season here in Concord. We will see greater days above 90°F in the summer and fewer days falling below 32°F in winter (see Table 1). One of the largest concerns related to extreme heat includes heat-related deaths and illnesses. In the summer of 2018, Concord experienced an extensive heat wave and encouraged seniors and people who are medically vulnerable to keep hydrated and stay inside. Additionally, new temperature



## Section 2: Top Hazards

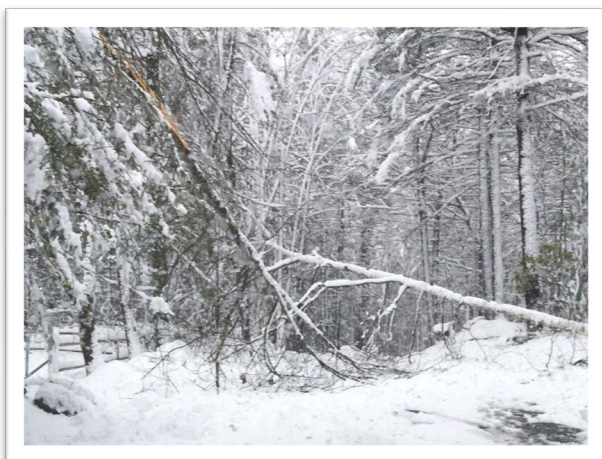
patterns have the potential to impact our ecosystems, biodiversity, and crop production. We may also see changes in our energy demand required to maintain livable and comfortable temperatures in our homes. This can increase energy costs for residents.

*Table 1. Projected changes in temperature<sup>vi</sup>*

| <b>Middlesex County</b>            | <b>Observed<br/>Baseline<br/>1971-2000</b> | <b>Mid-Century<br/>Projected</b> | <b>End of Century<br/>Projected</b> |
|------------------------------------|--|----------------------------------|-------------------------------------|
| Average Number of Days Below 32° F | 147  | 113                              | 102                                 |
| Average Number Days Above 90° F    | 7  | 32                               | 46                                  |

### Intense Storms

Storms expected to increase in intensity and duration. We are likely to see more Nor'easters, stronger winds, persistent winter cold spells, and heavier, moisture-filled snow. Downed trees and snow-packed or icy roads disrupt emergency management systems, delay commutes, and disrupt the movement of goods, which hinders our local economy. In addition, these hazards damage infrastructure like roads, bridges, and private property. In 2016, there was a tornado that caused power outages and took weeks to totally recover. In addition, in 2018, Concord experienced four nor'easters in three weeks. Losing power was a widespread concern for stakeholders. They were cognizant of the dependence on energy to power life-sustaining machines, access critical information databases (prescription), keep the heat on during winter, communicate with emergency management and family (losing cell phone charge).



## Section 3: Concerns and Challenges

Once hazards were agreed upon at the stakeholder workshop, participants worked in small groups to articulate what they saw as the community's strengths and vulnerabilities in three core areas: environmental features, socio-economic features, and infrastructural features. In total, there were four breakout groups individually identifying what they saw as the important features in all three core areas. The following bolded features were identified by at least three out of the four groups during the workshop as primary features of concern. Nearly all features were identified as both strengths and vulnerabilities regarding the impacts of climate change. Below we have described how each feature was considered a vulnerability.

### Infrastructure

- Utilities
  - Aging **conduits for service** (pipes or powerlines) and no redundancy
  - The **Wastewater Treatment Plant and the associated system's** ability to cope with intense rainfall that could overwhelm their system
  - The uncertainty of the **drinking water supply** security in times of drought
  - **Concord Municipal Light Plant and their system's** vulnerability to intense storms (downed trees) and need to diversify energy sources
- **Roads and bridges** prone to flooding, especially the South Bridge
- **Communications system** after an event and improving cell phone service
- **Police and Fire Departments** are in the floodplain

### Social and Economic

- **Confined populations (schools and hospitals), seniors, medically vulnerable, lower-income households** were consistently identified as populations in the community who are the most vulnerable to heat and isolation
- **Historic districts** are at risk of being damaged by potential high winds and flooding
- **Farmers** will need to adapt to new temperatures and precipitation patterns
- There is a need for **more information** about where vulnerable populations are living and ensuring there is a plan for their safety upon power outages

### Environmental

- **Water resource** protection to drought
- **Open space and wetlands** protection from development
- **Biodiversity security** and mitigating invasive species
- **Environmental quality** and ensuring the soil, air, and water quality are maintained under stress caused by climate change

The Appendix includes photos of all the completed matrices.



### Section 3: Concerns and Challenges

Many of the stakeholders expressed the need for education and outreach to the community. Concord has a very engaged public; however, many of the people contributing to civic life already understand the challenges associated with a changing climate. As a part of the extended scope of this MVP process, the Town will be better connected to new partners and subpopulations within the town.

## **Section 4: Current Strengths and Assets**

As a final wrap-up to the stakeholder workshop, we asked participants to provide their reflections. Numerous people commented on how the workshop was very enlightening to all the great work that is already being done in Concord. Concord has succeeded in conserving and preserving a plethora of open space, wetlands, and riverine buffers. As owners and operators of their own light plant, Concord has a great opportunity to lessen the community's contribution to climate change by investing in clean energy. The Town has also had a long history of protecting natural resources and open space that will be assets well into the future. The following assets were consistently identified as features that strengthened the Town's resilience.

- Water and Wastewater Treatment Plant and associated system
- Concord Municipal Light Plant and associated system
- Emergency communication system
- Historic Districts
- Open Space and Wetlands

## Section 5: Top Recommendations to Improve Resilience

Over 140 actions were identified at the stakeholder meetings. Of these possible actions, each small group was asked to submit their “highest, high priorities” to be voted on by the entire group. Then every person in the group had three votes to place on their top priorities as they saw fit.

### Infrastructural

| Votes | Actions |
|-------|---------|
|-------|---------|

- |    |   |
|----|---|
| 14 | Promote and highlight low impact development and green infrastructure.  |
| 9  | Prioritize action plan for police/fire/CPW facilities located in the floodplain.  |
| 7  | Find ways to improve cell service throughout the town to ensure ongoing communication.  |
| 5  | Rehabilitate or build new bridges and dams to account for climate projections and the 100-year flood, starting with South Bridge. |

### Societal/Economic

| Votes | Actions |
|-------|---------|
|-------|---------|

- |   |  |
|---|--|
| 6 | Expand database and educational outreach to seniors and medically vulnerable to collect information on critical needs, including prescriptions |
| 2 | Inventory and develop a needs assessment for vulnerable populations to expand plans for emergency preparedness                                 |
| 1 | Review existing communication and preparedness and response protocols and plans (from businesses, schools, town) to ensure they are aligned    |

### Environmental

| Votes | Actions |
|-------|---------|
|-------|---------|

- |    |  |
|----|--|
| 10 | Develop an integrated resource management plan for the town.   |
| 6  | Educate people and encourage ecosystem health by utilizing updated emerging threats and best practices.                    |
| 4  | Create an economic action plan/partnership between public and private agricultural sites.                                  |
| 2  | Take action through policies and programs to increase water efficiency and minimize the use of fresh water for irrigation. |



## **Section 6: Conclusions**

Concord is a leader in sustainability and strives to be a model for other municipalities. Therefore, the Town of Concord is committed to reducing their climate vulnerability by both preparing for the potential impacts and reducing its greenhouse gas contributions. The MVP process was an opportunity to acknowledge the success stories in Concord and to identify additional areas to take action. One of these areas of opportunity is to extend the Town's capacity to address climate by bringing more residents and business owners to the table. To that end, the Town of Concord will continue to engage, listen, and support residents and business owners in pursuit of our climate goals. Internally, the Town plans to seek funding opportunities to implement the actions identified in the MVP process and to continue to refine the actions into a detailed plan.

## Section 7: Acknowledgments

The Town of Concord would like to thank all the following Core Team members that made this project a success.

We would also like to express our appreciation to the Town's Police and Fire Department, Harvey Wheeler Community Center (Council on Aging), and ConcordCAN for hosting our stakeholder meetings and listening sessions.

In addition, we'd like to thank the Massachusetts Executive Office of Energy and Environmental Affairs for the financial support to execute this project.

### CRB Workshop Participants

The following people, in addition to the Core Team, attended the CRB Workshop.

- Alison Field-Juma, OARS
- BJ Dunn, Minuteman National Park
- Bob Andrews, ConcordCAN
- Brian Schlegel, Concord Public Schools
- Cameren Cousins, Fenn School
- Dan Gainsboro, Municipal Light Board
- Deborah Green, Board of Health
- Elizabeth Hughes, Town Planner
- Eric Boroush, MinutemanARC
- Gary Kleiman, Planning Board
- Gregory Higgins, Natural Resources Commission
- Jane Obaggy, Chamber of Commerce
- Janet Miller, Comprehensive Sustainability and Energy Committee
- Jill Block, Board of Health
- Joan Entwistle, ConcordCAN
- Karlen Reed, League of Women Voters
- Laurie Livoli, Building Commissioner
- Lindsay Kafka, Mothers Out Front
- Lori Gill-Pazaris, ConcordCAN
- Nick Pappas, Climate Action Advisory Board
- Ray Considine, Board of Health
- Susan Griffin, National Grid
- Susan Rask, Public Health
- Tom McKean, Select Board

We also reached out to representatives from the following groups and hope to work with them in the future on climate action and resilience planning efforts: Agriculture Committee, Concord Academy, Concord Housing Authority, Emerson Hospital, Energy New England, Historical Commission, MAPC, Public Works Commission, Regional School District Committee, REUSIT, and Walden Woods Project.

## Section 7: Acknowledgments

### **CRB Workshop Project Team**

#### *Town of Concord, MVP Core Team*

- Alan Cathcart, Water/Sewer Superintendent
- David Wood, CMLP Director
- Delia Kaye, Natural Resources Director
- Elizabeth Hughes, Town Planner
- Erin Stevens, Public Information Officer
- Ginger Quarles, Senior Services Director
- Jared Stanton, Director of Finance and Operations, Concord Public Schools
- Joseph O'Connor, Police Chief
- Kate Hanley, Sustainability Director, Project Sponsor
- Kate Hodges, Assistant Town Manager
- Marcia Rasmussen, Director of Planning and Land Management
- Mark Howell, Chief Information Officer
- Rich Reine, Public Works Director
- Ryan Orr, Facilities Director
- Tom Judge, Fire Chief

#### *Consulting Team, Kim Lundgren Associates, Inc.*

- Kim Lundgren, Lead Facilitator
- Amanda Kohn, Facilitator
- Kara Runsten, Facilitator
- Jennifer Dudgeon, Facilitator
- Julia Masters, Facilitator

### **Citation**

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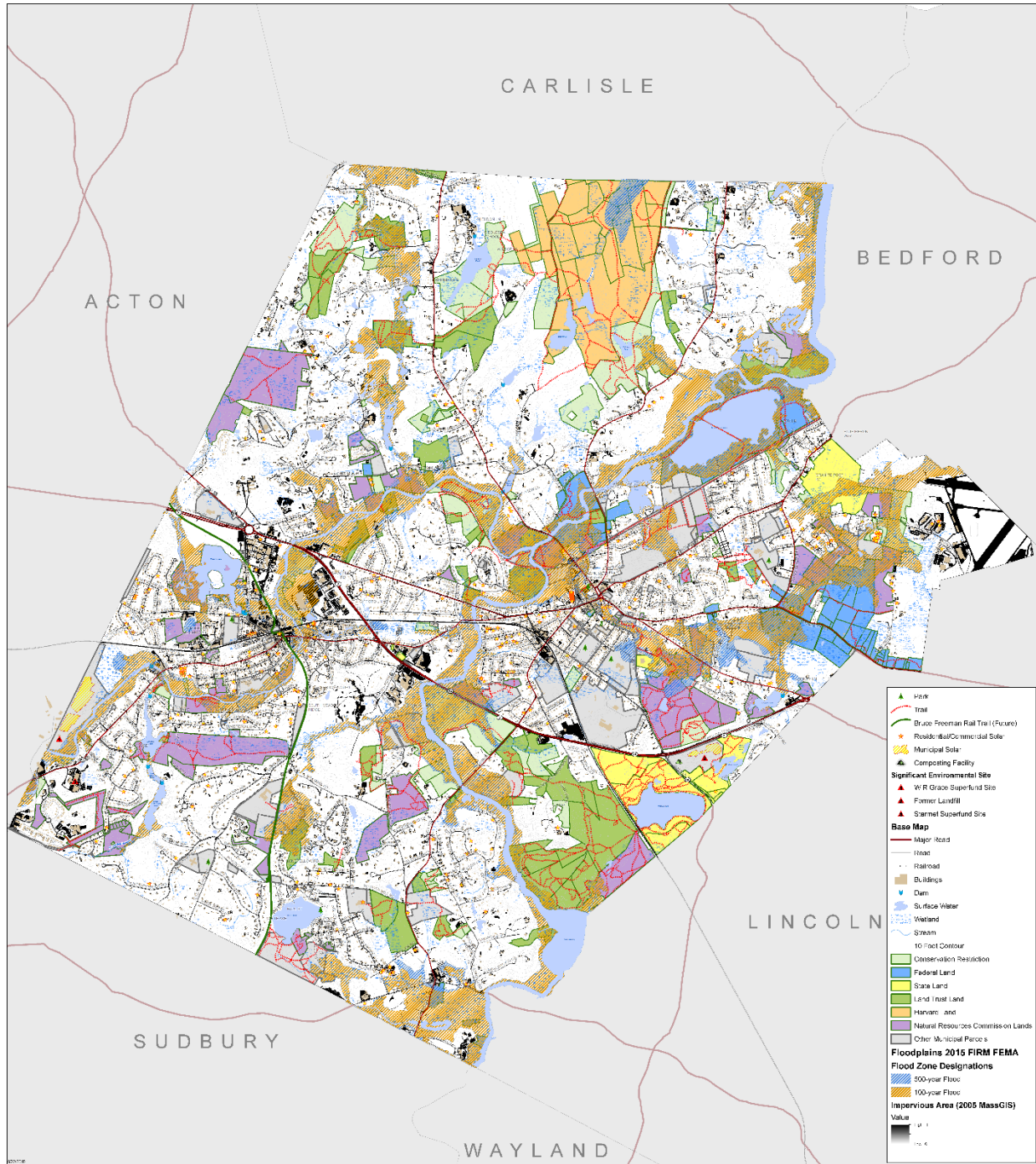


## **Appendix**

The Appendix contains the following materials:

- Base Maps used during stakeholder meeting
- Stakeholder Matrices
- Climate Summary One-pager
- Sources

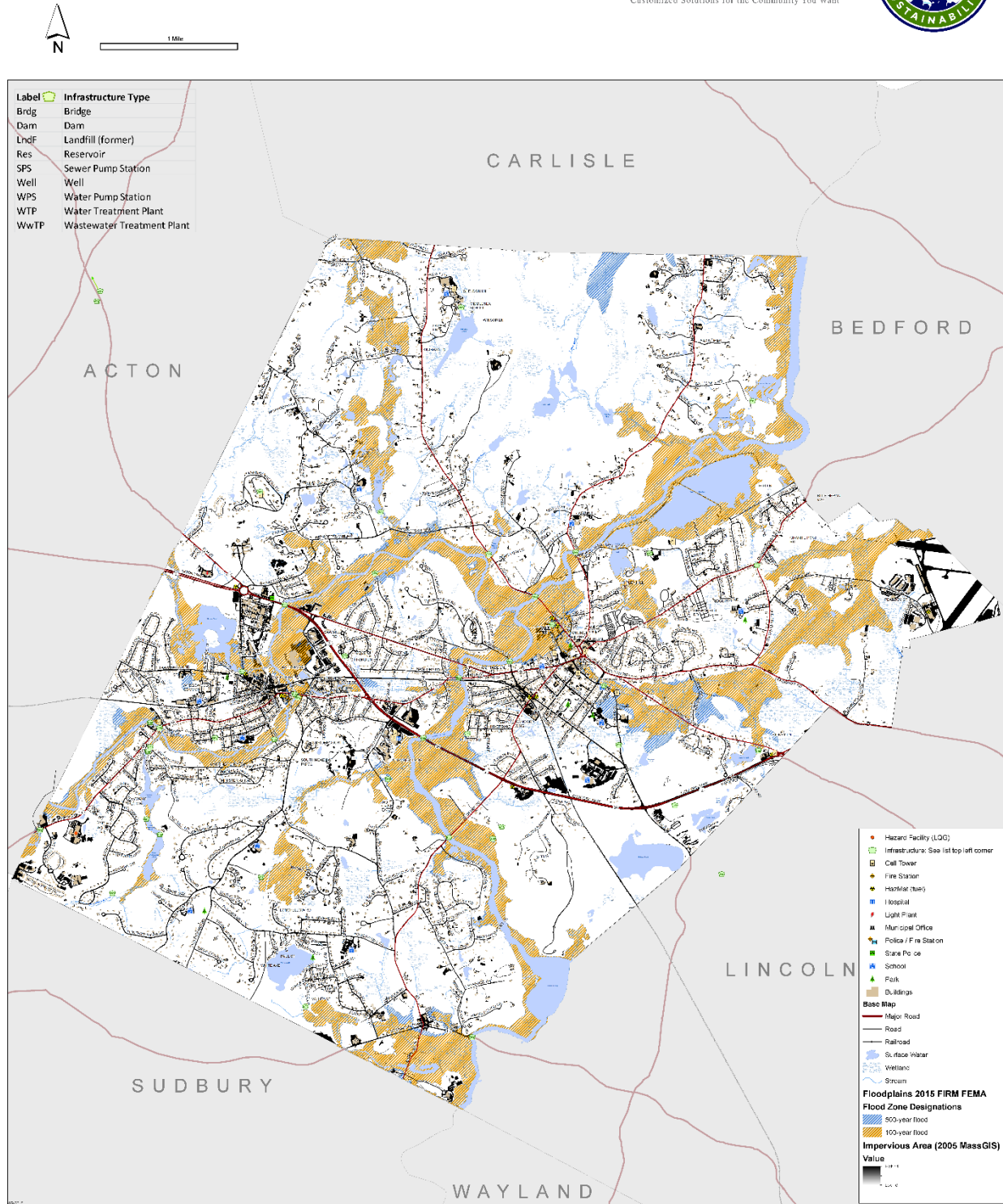
# Municipal Vulnerability Preparedness Program Town of Concord, MA Environmental Factors



# Municipal Vulnerability Preparedness Program

## Town of Concord, MA

### Infrastructure Factors

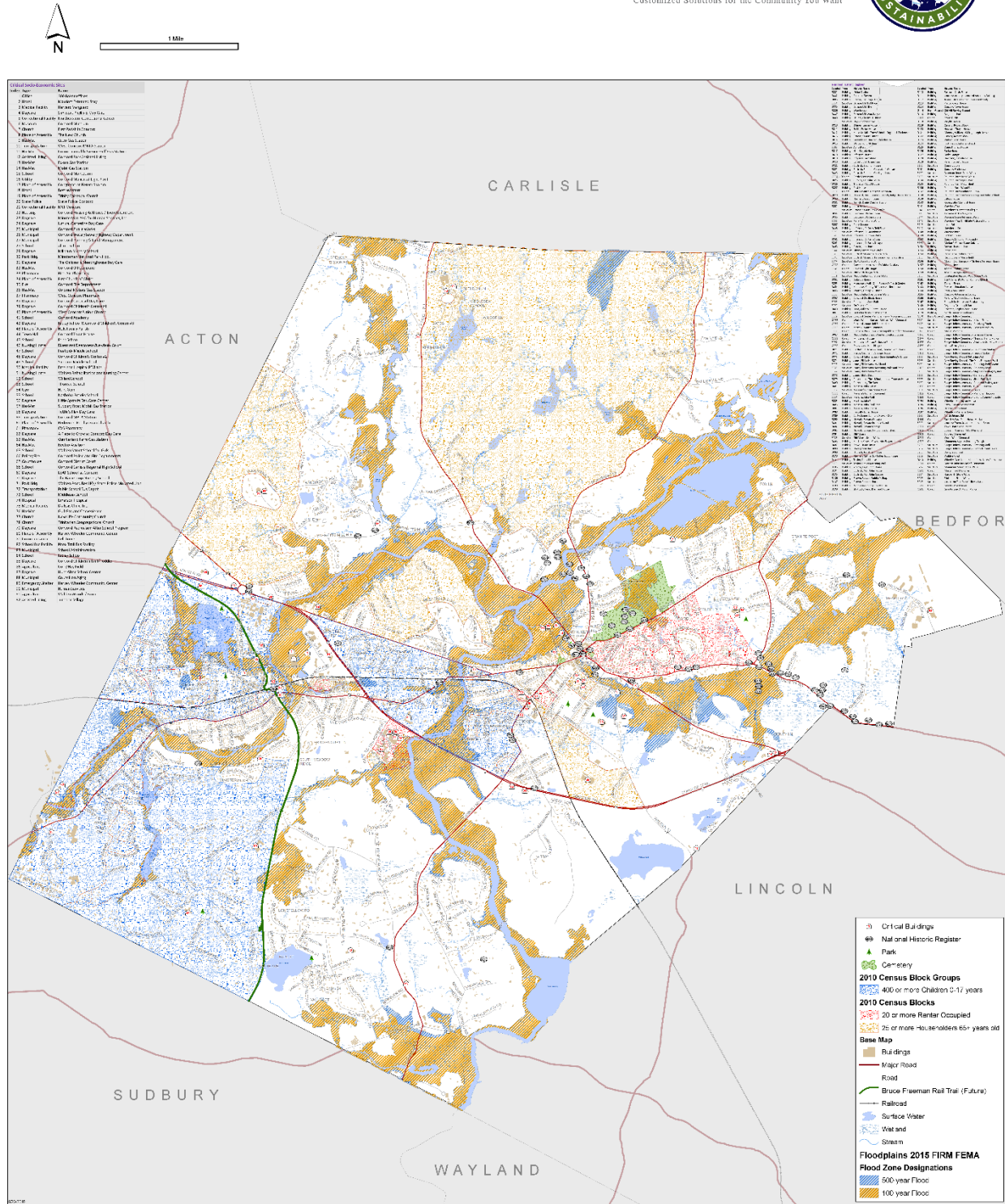




**Municipal Vulnerability Preparedness Program  
Town of Concord, MA  
Infrastructure Factors**



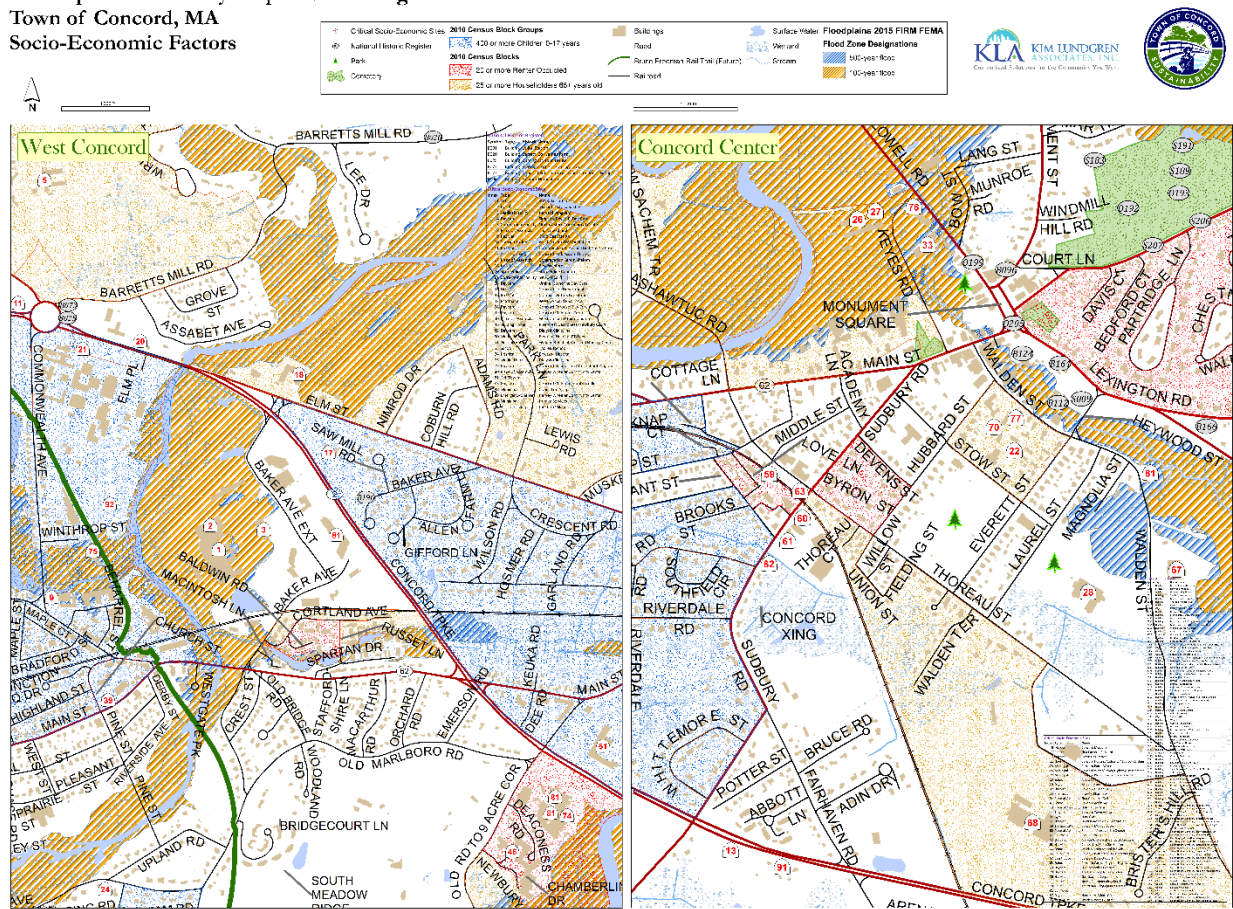
# Municipal Vulnerability Preparedness Program Town of Concord, MA Socio-Economic Factors





# Appendix

## Municipal Vulnerability Preparedness Program Town of Concord, MA Socio-Economic Factors





www.CommunityResilienceBuilding.org

**Community Resilience Building Risk Matrix**

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

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

| Features  | Location                    | Ownership                | V or S | Flooding   | Heat | Intense Storms | Drought                                   | Priority                              | Time               |
|---|-----------------------------|--------------------------|--------|--|------|----------------|---|---------------------------------------|--------------------|
|   |                             |                          |        |  |      |                |   | H - M - L                             | Short Long Ongoing |
| <b>Infrastructure</b>   |                             |                          |        |  |      |                |   |                                       |                    |
| <b>Utilities</b><br>Natural Gas<br>Water/Sewer<br>Communications<br>Electricity<br>Emergency Response<br>- Hospitals<br>- Pharmacies<br>- Nursing Homes     | Armed<br>Specific Locations | Public + Govt<br>Private | V/S    | 1. Prioritize sewer lines (and then gas) for replacement w/ plastic lines (Flood)<br>2. Build stronger network of utilities for repair + response (Flood + IS)<br>3. Diversify fuel sources - renewable w/ vulnerable (F + IS) |      |                | 4. Tree Maintenance Plan (Intense Storms) | 1. H 4. H 1.0 4.5<br>2. H 2.0 3.5 3.5 |                    |
| <b>Medical</b>  | Around Town                 | Public + Govt<br>Private | V/S    | 1. Locate service, flood (H)<br>2. Add shelter/backup (H)<br>3. Communication w/ flood (H)<br>4. Sign Bridges w/ 100-year flood, start @ S. Bridge<br>5. Permanent Placement Buffer near floodplain                            |      |                |   | 1. H 4. M 1.5 4.5<br>2. H 2.5 3.0 3.0 |                    |
| <b>Roads + Bridges + Dams</b>   | Specific                    | Public                   | V/S    | 1. Locate service, flood (H)<br>2. Add shelter/backup (H)<br>3. Communication w/ flood (H)<br>4. Sign Bridges w/ 100-year flood, start @ S. Bridge<br>5. Permanent Placement Buffer near floodplain                            |      |                |   | 1. H 4. M 1.5 4.5<br>2. H 2.5 3.0 3.0 |                    |
| <b>Public Works + Public Safety</b><br>Fire Dept Station<br>- Police<br>- Shelters (Emergency)<br>- Fire Dept Station<br>- Police<br>- Shelters (Emergency) | Specific                    | Public                   | V/S    | 1. Locate service, flood (H)<br>2. Add shelter/backup (H)<br>3. Communication w/ flood (H)<br>4. Sign Bridges w/ 100-year flood, start @ S. Bridge<br>5. Permanent Placement Buffer near floodplain                            |      |                |   | 1. H 4. M 1.5 4.5<br>2. H 2.5 3.0 3.0 |                    |
| <b>Flood Hubs</b><br>- Grocery<br>- Personal Supplies   | Specific                    | Private                  | V      | 1. Locate service, flood (H)<br>2. Add shelter/backup (H)<br>3. Communication w/ flood (H)<br>4. Sign Bridges w/ 100-year flood, start @ S. Bridge<br>5. Permanent Placement Buffer near floodplain                            |      |                |   | 1. H 4. M 1.5 4.5<br>2. H 2.5 3.0 3.0 |                    |
| <b>Communications</b>   |                             |                          |        | 1. Locate service, flood (H)<br>2. Add shelter/backup (H)<br>3. Communication w/ flood (H)<br>4. Sign Bridges w/ 100-year flood, start @ S. Bridge<br>5. Permanent Placement Buffer near floodplain                            |      |                |   | 1. H 4. M 1.5 4.5<br>2. H 2.5 3.0 3.0 |                    |
| <b>Societal / Economic</b>  |                             |                          |        |  |      |                |   |                                       |                    |
| <b>Seniors</b><br>- Homeless<br>- Facilities  | Homeless + Facilities       | Private (local)          | V      |  |      |                |   |                                       |                    |
| <b>Medically Vulnerable</b>   |                             |                          | V      |  |      |                |   |                                       |                    |
| <b>Historical Character</b>   |                             |                          | V/S    |  |      |                |   |                                       |                    |
| <b>Farming Community</b>  |                             |                          | V/S    |  |      |                |   |                                       |                    |
| <b>Economic Assets</b>  |                             |                          | V/S    |  |      |                |   |                                       |                    |
| <b>Lower income households</b>  |                             |                          | V      |  |      |                |   |                                       |                    |
| <b>Environmental</b>  |                             |                          |        |  |      |                |   |                                       |                    |
| <b>Vector/Vector borne diseases</b>   | Everywhere                  | N/A                      | V      |  |      |                |   | H                                     | 5.0                |
| <b>Invasive Species</b>   | Everywhere                  | N/A                      | V      |  |      |                |   | H                                     | 1.0                |
| <b>Tree Canopy + Long forested ecosystems</b>   | L                           |                          | V/S    |  |      |                |   | H                                     | 2.0                |
| <b>Wetland / Floodplains</b>  | Many Bays                   |                          | S      |  |      |                |   | H                                     | 2.0                |
| <b>Network of long forested ecosystems protected lands</b>  | Various                     |                          | S      |  |      |                |   | H                                     | 2.0                |
| <b>Soil Health</b><br>- Tiers   | Anywhere                    |                          | V/S    |  |      |                |   | H                                     | 1.5                |

**Lower income households**

1. Grant program or low-interest micro-loans for reducing vulnerability: air conditioning, sump pumps, generators

2. Evaluate programs for lower cost utilities. H-S

**Historic Character**

1. Encourage + guide beyond minimum building codes, for example fire code structural M+L

**Farming Community**

1. Build economic resilience with investment in agriculture infrastructure: like cold storage, housing, equipment + H<sub>2</sub>O H-S

**Economic Assets**

1. Educate people on how to minimize damage (like sump pumps) H-S

2. Determine value of structures w/ 500-year flood plain M-S

3.

1. Establish transportation from private homes to shelters (F+IS) + H+S

2. Educate + guide to shelter in private homes (F+IS+H) H+S

3. Encourage + guide to shelter in private homes (F+IS+H) H+S

4. Encourage + guide to shelter in private homes (F+IS+H) H+S

5. Encourage + guide to shelter in private homes (F+IS+H) H+S

6. Encourage + guide to shelter in private homes (F+IS+H) H+S

7. Encourage + guide to shelter in private homes (F+IS+H) H+S

8. Encourage + guide to shelter in private homes (F+IS+H) H+S

9. Encourage + guide to shelter in private homes (F+IS+H) H+S

10. Encourage + guide to shelter in private homes (F+IS+H) H+S

# Appendix

| Community Resilience Building Risk Matrix  |                    |                |        | www.CommunityResilienceBuilding.org  |      |        |        |
|--|--------------------|----------------|--------|--|------|--------|--------|
| Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) |                    |                |        |  |      |        |        |
| Priority   |                    |                |        | Time   |      |        |        |
| H-M-L  |                    |                |        | Short Long Ongoing   |      |        |        |
| Features   | Location           | Ownership      | V or S | FLOODING   | HEAT | STORMS | DRUGHT |
| <b>Infrastructure</b>  |                    |                |        |  |      |        |        |
| Emergency Hospital   | One Spot           | Private        | S/V    | Medication Dispensing - Supply of meds beyond hospital needs to provide as community |      |        |        |
| Fire/Police  | Multiple Locations | Public         | V      | Fire/Police Stations   |      |        |        |
| Water/Wastewater Systems   | Multiple           | Public         | V/S    | Water/Wastewater Treatment Plants  |      |        |        |
| Electric Power Lines   | Across Town        | Public/Private | S/V    | Electric Power Lines   |      |        |        |
| Communication (Cell Tower + Fiber Optic)   | Across Town        | Both           | S/V    | Communication (Cell Tower + Fiber Optic)   |      |        |        |
| Bridges  | Across Town        | Both           | V      | Bridges  |      |        |        |
| <b>Societal/Economic</b>   |                    |                |        |  |      |        |        |
| Seniors  | Across Town        | Private        | V/S    | Seniors  |      |        |        |
| Disabled   | Across Town        | Private        | V      | Disabled   |      |        |        |
| Confined (Prison/Hospital)   | Multiple           | Public/Private | V      | Confined (Prison/Hospital)   |      |        |        |
| Children   | Across Town        | Public         | V      | Children   |      |        |        |
| Emergency Responders   | Across Town        | Public/Private | V      | Emergency Responders   |      |        |        |
| Low Income   | Across Town        | Public/Private | V      | Low Income   |      |        |        |
| <b>Environmental</b>   |                    |                |        |  |      |        |        |
| Open Spaces (Protected)  | Multiple           | Public/Private | V/S    | Open Spaces (Protected)  |      |        |        |
| Waterways/Water Bodies   | Multiple           | Public/Private | V/S    | Waterways/Water Bodies   |      |        |        |
| Biodiversity   | Multiple           | Public/Private | V      | Biodiversity   |      |        |        |
| Enviro Quality   | Multiple           | Public/Private | V/S    | Enviro Quality   |      |        |        |
| Agriculture  | Multiple           | Public/Private | V/S    | Agriculture  |      |        |        |
| Private Open Space   | Multiple           | Private        | V      | Private Open Space   |      |        |        |






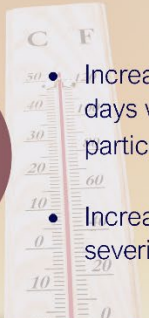

| Community Resilience Building Risk Matrix  |           |                |        | www.CommunityResilienceBuilding.org   |  |                                    |                                  |
|--|-----------|----------------|--------|---|--|------------------------------------|----------------------------------|
| Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) |           |                |        | Priority  |  | Time                               |                                  |
| H-M-L priority for action over the Short or Long term (and Ongoing)  |           |                |        | H-M-L   |  | Short Long Ongoing                 |                                  |
| V = Vulnerability S = Strength   |           |                |        | H-M-L   |  | Short Long Ongoing                 |                                  |
| Features   | Location  | Ownership      | V or S | FLOODING  | EXTREME HEAT   | INTENSE STORMS                     | DRAUGHT                          |
| <b>Infrastructural</b>   |           |                |        |   |  |                                    |                                  |
| BUILDINGS + schools  | Town-wide | Public/Private | S/v    | 1. Inspect existing buildings   | 2. Make sure all town buildings are prepared - ensure of needed fire hazard system - fire protection | 3. SOLID POWER BACKUPS + BATTERIES | 4. INVESTIGATE INTERMITTING PACE |
| WWTTP  |           | Public         | S/v    | 5. Continue to pursue a smart grid network  |  |                                    |                                  |
| Utility - Light Plant  |           | Public/Private | V/S    | 6. Implement First Net System   | 7. CERTIFY BOUNDARY  |                                    |                                  |
| COMMUNICATION SYSTEM   |           | Public         | S/v    | 8. FIND WAYS TO IMPROVE CELL SERVICE  |  |                                    |                                  |
| Roads + Bridges  |           | Public         | S/v    | 9. Ensure shoulders + edges -> trees, utility lines, etc. are appropriately maintained                      |  |                                    |                                  |
| Transit  |           |                | S      | 10. Coordinate with state + ensure options are available in case of emergency                               |  |                                    |                                  |
| Conduits - pipes for water, gas, etc.  |           |                | S/v    | 11. Continue to maintain connections + support  |  |                                    |                                  |
| BOATS  | specific  | Public/State   | S      | 12. Create a volunteer program  | 13. Upgrade + replace pipelines  |                                    |                                  |
| <b>Societal/Economic</b>   |           |                |        |   |  |                                    |                                  |
| MUTUAL ASSISTANCE PROGRAM  | Town-wide | Public/State   | S/v    | 1. Multitasked/Multiuse Preparedness activities programs  |  |                                    |                                  |
| HOSPITALS + HEALTH OFFICES   |           |                |        | 2. Work shop/Training on Preparedness + Building an emergency kit   |  |                                    |                                  |
| Affordable Housing/Low-income families   |           |                |        | 3. Review existing resources + protocols + align - RE: Preparedness + Response + Recovery                   |  |                                    |                                  |
| Disability/Medically Vulnerable  |           |                |        | 4. Provide CERT Training to Residents + Businesses  |  |                                    |                                  |
| Youth/Schools  |           |                |        |   |  |                                    |                                  |
| Pets   |           |                |        |   |  |                                    |                                  |
|  |           |                |        | 4. Town prepared for HAZARD + OTHER DISASTERS TO SECURE PEOPLE  |  |                                    |                                  |
|  |           |                |        | 5. Other library/archive are protected -> Create a collection of history, library, maps, records, documents |  |                                    |                                  |
| <b>Environmental</b>   |           |                |        |   |  |                                    |                                  |
| TREE CANOPY  | Town-wide | Public/Private | V/S    | 1. Implement tree care study + ensure CE action in the future   |  |                                    |                                  |
| RIVERS + WATERWAYS (drinking water too)  | Town-wide | Public/Private | S/v    | 2. Ensure water quality + quantity + ensure CE action in the future   |  |                                    |                                  |
| WHITE'S POND   | Specific  | State          | S/v    | 3. Investigate tree canopy + ensure CE action in the future   |  |                                    |                                  |
| WALDEN POND  | Specific  | Public/Private | S/v    | 4. Investigate tree canopy + ensure CE action in the future   |  |                                    |                                  |
| VERNAL Ponds   | Town-wide | Public/Private | S/v    | 5. Investigate tree canopy + ensure CE action in the future   |  |                                    |                                  |
| MOSQUITOES   | Town-wide | Public/Private | S/v    | 6. Investigate tree canopy + ensure CE action in the future   |  |                                    |                                  |
| TICKS  | Town-wide | Public/Private | S/v    | 7. Investigate tree canopy + ensure CE action in the future   |  |                                    |                                  |
| OPEN SPACE   | Town-wide | Public/Private | S/v    | 8. Investigate tree canopy + ensure CE action in the future   |  |                                    |                                  |
| WETLANDS   | Town-wide | Public/Private | S/v    | 9. Investigate tree canopy + ensure CE action in the future   |  |                                    |                                  |
| WILDLIFE   | Town-wide | Public/Private | S/v    | 10. Investigate tree canopy + ensure CE action in the future  |  |                                    |                                  |

# SNAPSHOT OF CONCORD'S CLIMATE HISTORY AND FUTURE SHIFTS



Climate change has already brought more extreme weather events to our area and throughout Massachusetts - all of which, are expected to worsen over time. Concord must respond to reduce the potential impacts of a shifting climate. We have an opportunity to act now, to prepare for the future, and to be a more resilient community. Join us.

## WHAT CLIMATE CHANGE LOOKS LIKE IN CONCORD

| NEW RAINFALL PATTERNS   | DROUGHTS & FLOODS   |
|---|---|
|  <ul style="list-style-type: none"> <li>• Increase in the frequency and severity of extreme rain events</li> <li>• Fewer small, periodic rain events</li> <li>• Increase in annual rainfall amounts, especially in winter</li> </ul>   |  <ul style="list-style-type: none"> <li>• Flash and prolonged flooding</li> <li>• Short- and long-term droughts, low stream flows</li> </ul>                                  |
| EXTREME HEAT  | HIGH WINDS  |
|   <ul style="list-style-type: none"> <li>• Increase in the number of days with elevated temps, particularly days over 90° F</li> <li>• Increase in the length and severity of heat waves</li> </ul> |  <ul style="list-style-type: none"> <li>• Likely to see more hurricanes, tropical storms, tornadoes</li> <li>• Stronger winds during Nor'easters and thunderstorms</li> </ul> |

[www.concordma.gov/sustainability](http://www.concordma.gov/sustainability)



## NEW RAINFALL PATTERNS

*New rainfall patterns can make it difficult for rain dependent sectors, like agriculture, that plan for a historic rain cycle. The new patterns will cause more flooding & short-term droughts.*

↑ 21 %

increase in winter precipitation in MA in the 2050s compared to 1971-2000.

↑ 10 %

increase in precipitation during the largest storms compared to 60 years ago in New England.

## DROUGHTS & FLOODS



**Concord has enacted water use restrictions every summer in recent years.**

*Droughts reduce water availability and can cause harm to wildlife and water ecosystems.*



**The most recent severe flooding happened in March 2010 with a total of 14.83 inches.**

*Floods can lead to road closures and block emergency routes. Floods can also damage critical infrastructure, private property, and irreplaceable historic structures.*

## EXTREME HEAT

48° F

Average annual temp 1971-2000



+4° F

Change in average annual temp for 2020-2049

*The impacts of extreme heat include increased heat-related deaths and illness and drier soil conditions.*

Middlesex County

Average Days per Year with Maximum Temps above

2001-2005

12

2020-2024

17

2040-2044

27

90° F

## HIGH WINDS

*The town's iconic tree-lined streets can be damaged by winds. Downed trees can result in downed power lines, power outages, and blocked traffic and emergency routes.*

\$1.6 million

Worth of severe storm damage in Middlesex County between 2006-2016.



*In March 2018, winds resulted in a number of downed trees and 2,700 electricity customers without power.*

Northeast Climate Adaptation Science Center. Resilient MA Datagrapher. MA Climate Clearinghouse.; City of Boston. 2016. Climate Ready Boston.; Massachusetts Department of Public Health-Bureau of Environmental Health. Climate and Health Profiles.; Town of Concord. 2017. Hazard Mitigation Plan Update.



### Sources

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- <sup>iv</sup> Massachusetts Executive Office of Energy and Environmental Affairs and the Department of Energy Resources. (2017). Massachusetts Climate Change Clearinghouse. <http://www.resilientma.org/>
- <sup>v</sup> Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45.
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