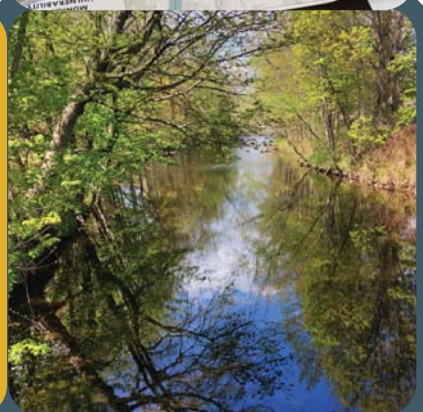
Northampton **Climate Resilience & Regeneration Plan**

An element of the Sustainable Northampton Plan

Addressing the climate emergency by
Regenerating a healthy community,
ADAPTING to and MITIGATING climate change

Northampton Climate Action Plan (CAP)

Adopted 2021



Sustainable Northampton Comprehensive Plan (Jan. 2008 amended through Jan. 2021)

Sustainable Northampton Plan adopted (MGL C.41, s.81D) January 2008
Amended under MGL Section 81D to add
Pedestrian & Bicycle Compehensive Plan January 2017
Open Space, Recreation, and Multiuse Plan June 2018
Climate Resilience and Regeneration Plan, January 2021

Climate Resilience and Regeneration Plan history:
Northampton Planning Board adopted January 28, 2021
Energy & Sustainability Commission endorsed December 22, 2020
City Council endorsed _____, 2021

Acknowledgments

We acknowledge the Northampton is build upon and benefited from the traditional land stewardship and contributions of Indigenous and First Peoples, inlcuding the Nipmuc and Pocumtuc Nations.

We also want to acknowledge and thank you to all who contributed to this plan:

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Community Partners (Partner Training, interviews, and conversations Forbes Library, Northampton Neighbors, Way Finders, ServiceNet, Edgardo Cancel (community leader), Lilly Library, Northampton Senior Center, Northampton Survival Center, Highland Valley Elder Services, Community Legal Aid, Community Development Corporation, The Literacy Project, Pioneer Valley Habitat for Humanity, Marianne LaBarge, Alisa Klein, Northampton Housing Authority, Mass Fair Housing, Northampton Community Arts Trust, Center for Human Development, Northampton Youth Commission, Northampton High School Environmental Club, Greater Northampton Chamber of Commerce.

Additionally, thank you to the hundreds of community members who also provided input at public workshops and through on-line platforms, contributing to the vision, framework, and strategies capture in this plan.

Project Funding

Massachusetts Municipal Vulnerability Program (Planning Grant)
Massachusetts Planning Assistance Grant
City of Northampton

Consultant Team

Linnean Solutions, Kim Lundgren Associates, and Fuss & O'Neill.

Project Management and Coordination

Northampton Office of Planning & Sustainability

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5-STAR community and National Leader in Sustainability

USGBC LEED for Cities Certified 9 (final rating is pending)

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Bikers on the MassCentral Rail Trail. Alternative modes of transportation, like biking, serve both resilience and regeneration.

Image credit: John Phelan

SECTION ONE

Executive Summary & Introduction

The Plan: A Commitment

In 2018, Mayor Narkewicz committed the City of Northampton to becoming a net carbon neutral city by 2050. City Council endorsed this goal in 2018.

We commit to a City that will thrive, even with climate change. We will:

- Be a net carbon neutral City by 2050.
- Ensure that City government building and operations are net carbon neutral by 2030.
- Ensure that community carbon emissions, building on Smith College's commitment to be net carbon neutral by 2030, will be 50% lower by 2030 and 75% lower by 2040.
- Incorporate climate resilience and regeneration into all future city plans and capital improvement planning.
- Incorporate equity, is a cross cutting need, into every climate action.
- Address energy sources, building energy, transportation, land use, food systems, waste systems, trees and forests, carbon sequestration, and waste; recognizing that the first step in carbon neutralization is conservation and reducing demands (e.g., energy, transport, materials).
- Commit that our top priority needs to be the high impact practices that are most effective at achieving these commitments.
- Become a more resilient city to address the climate change that is coming. This will range from physical features (e.g., stormwater and storms), to social investments to support our communities on the frontline of climate change.
- Develop a biennial resilience & regeneration action plan that includes an annual and long term carbon budget.
- Ensure coordinated response across all of city government.

What do we mean by resilience and regeneration?

Resilience: Increasing the capacity of our city to better anticipate, adapt, and thrive in a changing climate no matter what kinds of acute shocks and chronic stresses we experience. *Climate adaptation* is part of the city's resilience efforts.

Regeneration: Reducing our city's contribution to climate change, while renewing the health of natural and human systems damaged by climate change, and growing the vitality of people, the economy, and ecosystems for the future. *Climate mitigation* is part of the city's regeneration efforts.

The City's commitment to reduce its carbon footprint will come from changes in city operations inside the City and outside the City (e.g., its purchasing power and management of city watershed lands), our community's energy footprint, and community-wide direct carbon emissions (scopes 1 and 2). In addition, we will reduce community consumption that results in carbon emissions elsewhere in the world (scope 3).

In 2018, Mayor Narkewicz committed the City of Northampton to being carbon neutral by 2050. This plan is the next step.

The Plan: A Road-map

This plan is both a commitment and a road-map. It signifies our dedication to mitigating climate change and the actions we need to build an increasingly **resilient** and **regenerative** future. It is a plan for simultaneously reducing our greenhouse gas emissions, building our capacity to adapt to stresses, and improving our healthy ecosystems, inclusive communities, and ensuring all Northampton residents can thrive.

Our goals and actions are ambitious, necessary, and achievable. This plan outlines the path to that goal—transitioning from fossil fuels to renewable energy sources, increasing energy efficiency, and creating systems for consuming fewer resources while enhancing our quality of life.

We as a city commit to:

- Creating and updating specific action plans needed to move this plan forward.
- Bringing climate resilience and regeneration into the conversation on every significant city action (regulatory, investment, legislative, budgetary).

We are already feeling the effects of climate change, globally and locally. More frequent higher temperatures, storm intensity, drought risk, and flooding, will increasingly take a toll on our infrastructure, ecosystems, agriculture, and health.

Those impacts are not equally felt. The greatest effects are on communities at the frontline of climate change (e.g., the homeless, populations of color, low income residents, farmers, those in low lying areas). All of the systems we rely on—whether those are wastewater systems, food systems, or social service systems—must effectively adapt to these new stresses.

How does this fit into other plans?

The *Resilience and Regeneration Plan* builds on a legacy of City sustainability and resilience planning and will contribute to future planning. The next Sustainable Northampton Comprehensive Plan update will incorporate this Climate Resilience and Regeneration Plan and its framework.

All city plans must advance resilience and regeneration around a wide variety of stresses and shocks (e.g., economic and housing), not only the climate change, which is the focus of this plan.

The plan defines a recommended approach. Except for its role as one of the Zoning Special Permit criteria, the plan has no legal teeth. Its power comes from building a consensus vision.

Our vision is to reduce our impact of climate change on the environment and on our communities. We need to *renew* the health of ecosystems and communities that have been and will be compromised by climate change. In all our work, we must create stronger, healthier, and more equitable systems.

Every action we take has the capacity to achieve multiple community benefits. Consequently, we've worked to identify research- and experience-based strategies, and ways to expand the impact of strategies, that will not only help meet Northampton's resilience and regeneration goals, but also encourage regional collaboration, greater economic and cultural vitality, and greater equity through opportunities and resources here in Northampton.

We acknowledge our limits as a small city and that our regeneration and mitigation efforts amount to nothing absent concerted and stepped up state, federal, and international actions. Northampton needs to move forward as aggressively as we can, as we collectively work towards limiting global climate warming to 1.5 degrees Celcius above pre-industrial levels (the accepted target used by the Intergovernmental Panel on Climate Change, 2018, and others). If the state and federal government provide more tools, we should be working towards 2030 climate neutrality.

With our limited tools and financial resources, we must:

- Focus on high impact practices, the most impactful resilience and regeneration actions.
- Focus on the practices that provide us with the highest resilience and regneration Return on Investment (ROI).

Northampton Resilience and Regeneration Framework

Figure 1. Northampton Climate Resilience and Regeneration Framework In developing strategies that will help us reach our regeneration and resilience goals, we also look for opportunities to increase economic and cultural vitality, equity, and regional collaboration.

Building on Past Success

Northampton is committed to being one of the most sustainable communities in the nation. We are proud to have been the first city to receive a 5-STAR rating under the former STAR Communities Rating System for sustainable communities and the highest Commonwealth Capital score under the former Massachusetts Smart Growth scoring. We are now a LEED for Cities and Communities certified community and use that system to track and improve upon our progress.

We created a vision for a sustainable community in our 2008 Sustainable Northampton Comprehensive Plan. Since then we have up-zoned our core commercial, residential, and industrial/office districts to encourage walkable and bikable development patterns; adopted the energy stretch code; invested in solar PV capacity; hired an energy coordinator; ramped up energy efficiency in municipal buildings; doubled the amount of our protected conservation land; restored natural systems and revitalized new open spaces; designed resilient stormwater systems with natural systems; invested in public art; implemented the ValleyBike regional bike share program; improved bicycle and pedestrian accommodations and complete streets; planted over 1,000 shade trees; and invested millions in social equity, to name but a few of the many efforts.

Our dedication to track and reduce city-wide greenhouse gas emissions supports our commitment to the Global Covenant of Mayors for Climate and Energy—and now our pledge to be carbon neutral by 2050. This commitment can be seen throughout Northampton's governing bodies including the City Council and Planning Department (see Appendix for a list of City Council resolutions on environmental issues). These investments in the past, present, and earmarked for the future demonstrate how we've been both forward-looking and *forward-moving* in reaching those goals. Nevertheless, there is much more to do. The Northampton Climate Resilience and Regeneration Plan intends to build on that momentum, integrating actions already underway, and laying out next steps for legislation, decision-making, implementation, and tracking progress over both the short- and long-term.

Summary of Resilience and Regeneration Strategies

Reaching carbon neutrality by 2050 is a challenge and an opportunity for Northampton that will require action at individual, city, and regional scales. We have identified a set of strategies, ranging from policies, regulatory changes, and capital improvement projects, to new programs and advocacy that will move us towards a more resilient and regenerative Northampton.

Reaching carbon neutrality by 2050 is a challenge and an opportunity for Northampton that will require action at individual, city, and regional scales.

Northampton Resilience and Regeneration Strategies

Figure 3. Strategy organization in Action Plan section of this plan

How are the strategies organized?

Northampton is tracking its progress using the new US Green Building Council (USGBC) rating system LEED for Cities and Communities. This replaced the former STAR Communities program. The Resilience and Regeneration strategies are broken down by the categories defined in the rating system to help us track how our actions help us make progress.

Time-frame Notations

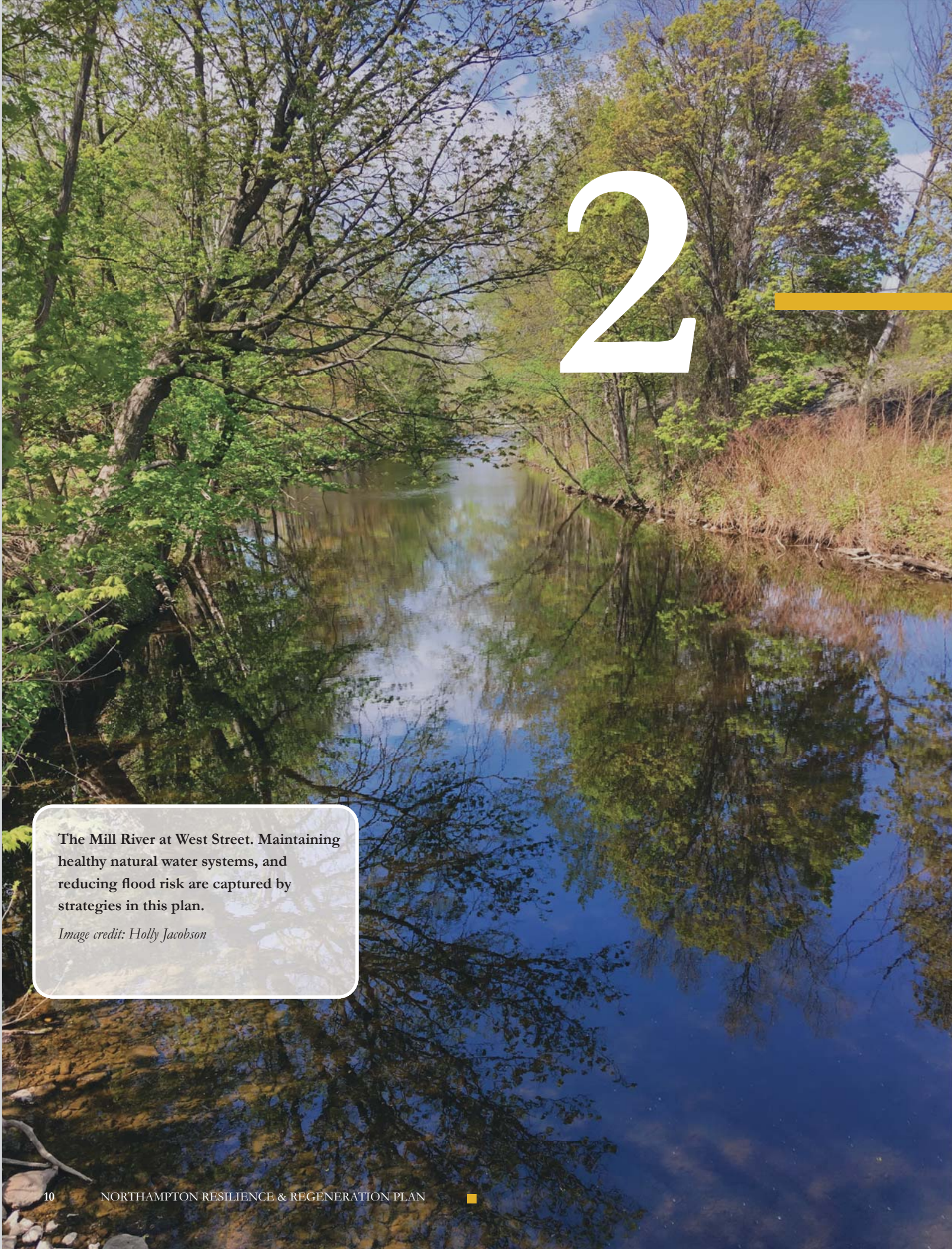
Short-term = less than one year
Mid-term = one to three years
Long-term = over three years

Cost Notations

Cost ranges include costs for the implementer and roughly represent:

$	= Capital cost (<$1M) = Planning/policy/program implementation (<$25k)
$$	= Capital cost ($1-5M) = Planning/policy/program implementation ($25-250k)
$$$	= Capital cost (>$5M) = Planning/policy/program implementation (>$250k)

2



The Mill River at West Street. Maintaining healthy natural water systems, and reducing flood risk are captured by strategies in this plan.

Image credit: Holly Jacobson

SECTION TWO

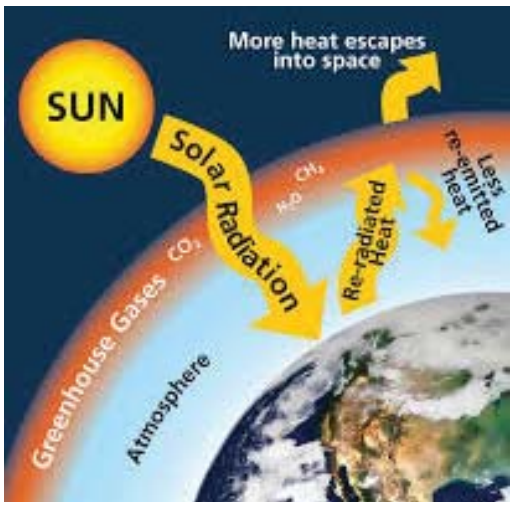
Climate Change in Northampton

Why is the Climate Changing?

The fossil fuels we use for generating electricity, heating our homes and workplaces, growing the food we eat, and fueling our cars, as well as trash breaking down in landfills release greenhouse gases (GHGs) into the atmosphere. Naturally occurring greenhouse gases are important for regulating the Earth's temperature and keeping it warm enough for life on this planet.

Since the industrial revolution, however, human activity such as burning fossil fuels, converting our forests to farms and human development, and producing waste has caused much larger quantities of greenhouse gases (particularly carbon dioxide and methane) to be released into the atmosphere than is sustainable. The amount of carbon dioxide has increased 100 times faster in the last 60 years than previous natural increases! This large increase in greenhouse gases is causing global temperatures to rise and is disrupting our climate patterns, causing more extreme weather events.

[A]



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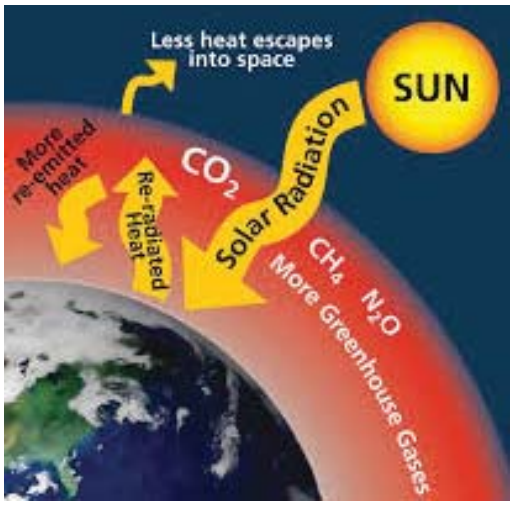

Figure 3. This image depicts the greenhouse gas effect that is at the root of climate change. While greenhouse gases in the atmosphere are important for trapping heat from the sun (image **[A]**), too many greenhouse gases in the atmosphere is changing the climate on Earth (image **[B]**).

Image credit: Will Elder, National Park Service.

Changes in Global Surface Temperatures and CO_2 in the Atmosphere

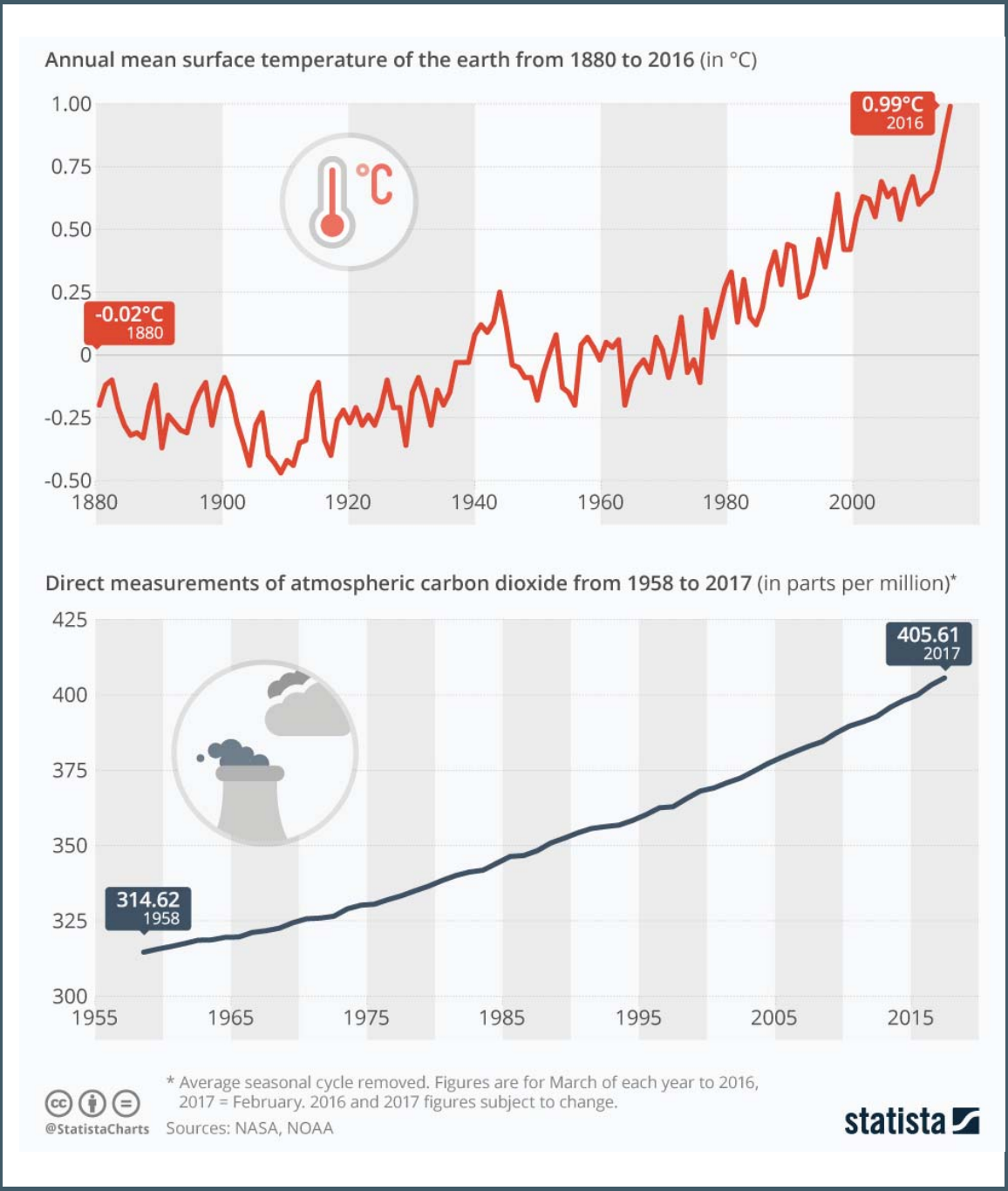

Figure 4. Change in the annual mean surface temperature of the earth from 1880 to 2016 (top) and change in the carbon dioxide concentrations in the atmosphere from 1958 to 2017 (bottom).

Image credit: Martin Armstrong, Statista.
See: www.statista.com/chart/8471/co2-levels-and-global-warming

Signs of a Changing Climate and Future Projections

Climate Change in Northampton

As a result of climate change, Northampton is experiencing increasing mean temperatures and more intense storms. These changes are taking a toll on our infrastructure, ecosystems, and health, including more frequent flood events, wear and tear on our roads, spread of new invasive species, disruptions to farming, and increasing vector-borne disease. Even if we can achieve significant reductions in greenhouse gas emissions globally, even if we can become net carbon neutral, feedback loops will continue and we will see and experience the intensifying impact of these changes within the next thirty years and even more so by the end of the century.

Changes in Temperature

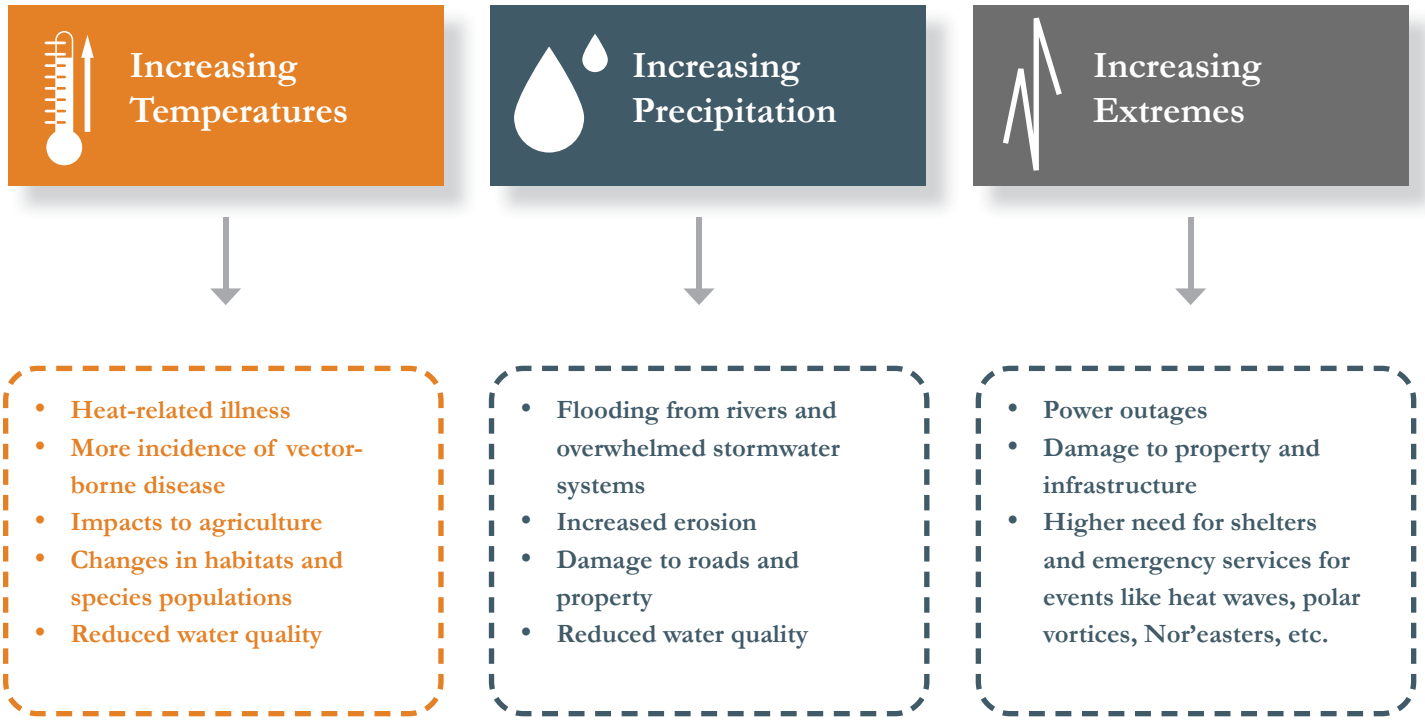

Figure 5. Key indicators of climate change in Northampton (solid boxes) and some of the potential impacts we are likely to see from those changes (dashed boxes). *Icon credit: André Luiz and Baboon designs from the Noun Project.*

Maximum Summer Temperatures for Northampton, MA

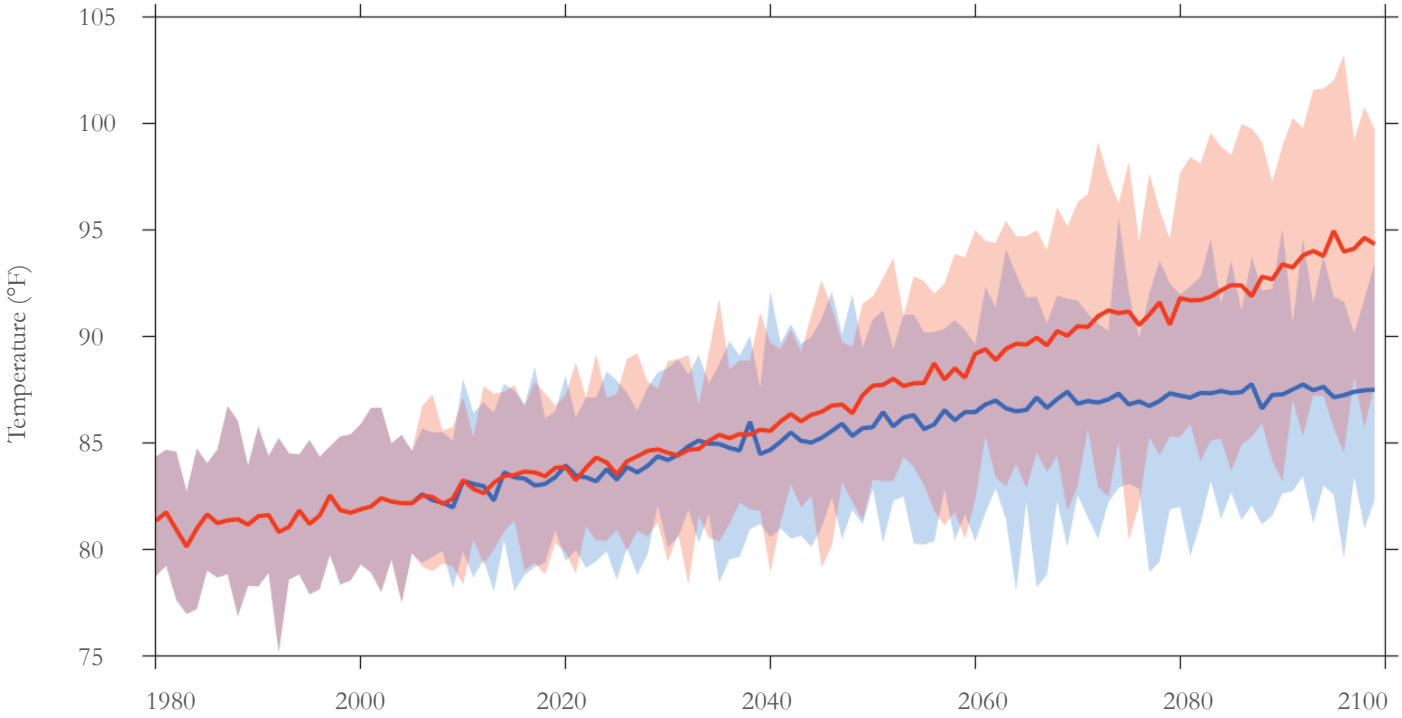

Figure 6. Summer temperatures (average maximum daily temperatures for June – August) have been increasing over the past several decades, and are expected to continue to increase through the end of the century. Whereas the average maximum temperature in the summer is currently around 83°F, it may increase to nearly 95°F by 2100. The red line shows a "business-as-usual" case if we continue to emit greenhouse gases globally at the same rate. The blue line shows temperature change projections with significant greenhouse gas emissions reductions.
Historical simulations (1980-2005) and projections (2006-2099) in seasonal averages of maximum daily temperature from a 29-member, high resolution (4 km) statistically downscaled Coupled Model Intercomparison Project (CMIP5) ensemble mean lower (RCP 4.5 W - thick blue line) and higher (RCP 8.5 - thick red line) representative concentration pathway (RCP) emission scenarios. Red and blue lines for the period 1980-2005 are identical. The light blue (light red) shading represent the highest and lowest values from the 29 different model RCP 4.5 (RCP 8.5) simulations for each year. Graph from Elizabeth Burakowski and Cameron Wake, Earth System Research Center/EOS, U. of New Hampshire.

Annual temperatures in the Northeast have been warming 0.5°F per decade on average since 1970, with winter temperatures increasing even faster at 1.3°F per decade (Massachusetts EOEEA/Department of Energy Resources (EEA). (2017). *Resilient MA: Climate Change Clearinghouse for the Commonwealth.* Retrieved from http://resilientma.org/.) In Western Massachusetts, specifically, average annual temperatures have increased 1.9°F since 1970 (Climate Central. (2019). "US Warming by State." Retrieved from www.climatecentral.org/gallery/maps/us-warming-by-state, using Springfield, MA data).

Based on downscaled climate projections, average temperatures for the Connecticut River Basin are expected to increase 3–6°F by 2050 and 4–11°F by the end of the century (Downscaled climate projections by the Northeast Climate Science Center at UMass-Amherst. Accessed from Massachusetts Climate Change Projections, Massachusetts EOEEA/Department of Energy Resources, 2017.

With these changes in temperature we will see more days with extreme heat and fewer days below freezing. From 1970–2000, the Connecticut River Basin had an average of roughly 6 days with maximum temperatures of 90°F each year, a number which is expected to increase to 16–42 days by 2050. Likewise, by 2050 the Connecticut River Basin is likely to have 19–37 fewer days where temperatures dip below 32°F each year.

Along with potential impacts to the city's agriculture, air quality, and the health of our water supplies, these temperature increases are already showing effects on our ecosystems by degrading the health and longevity of tree species that are accustomed to colder climates, contributing to pest outbreaks, and facilitating the spread of invasive species. Insects,

Minimum Winter Temperatures for Northampton, MA

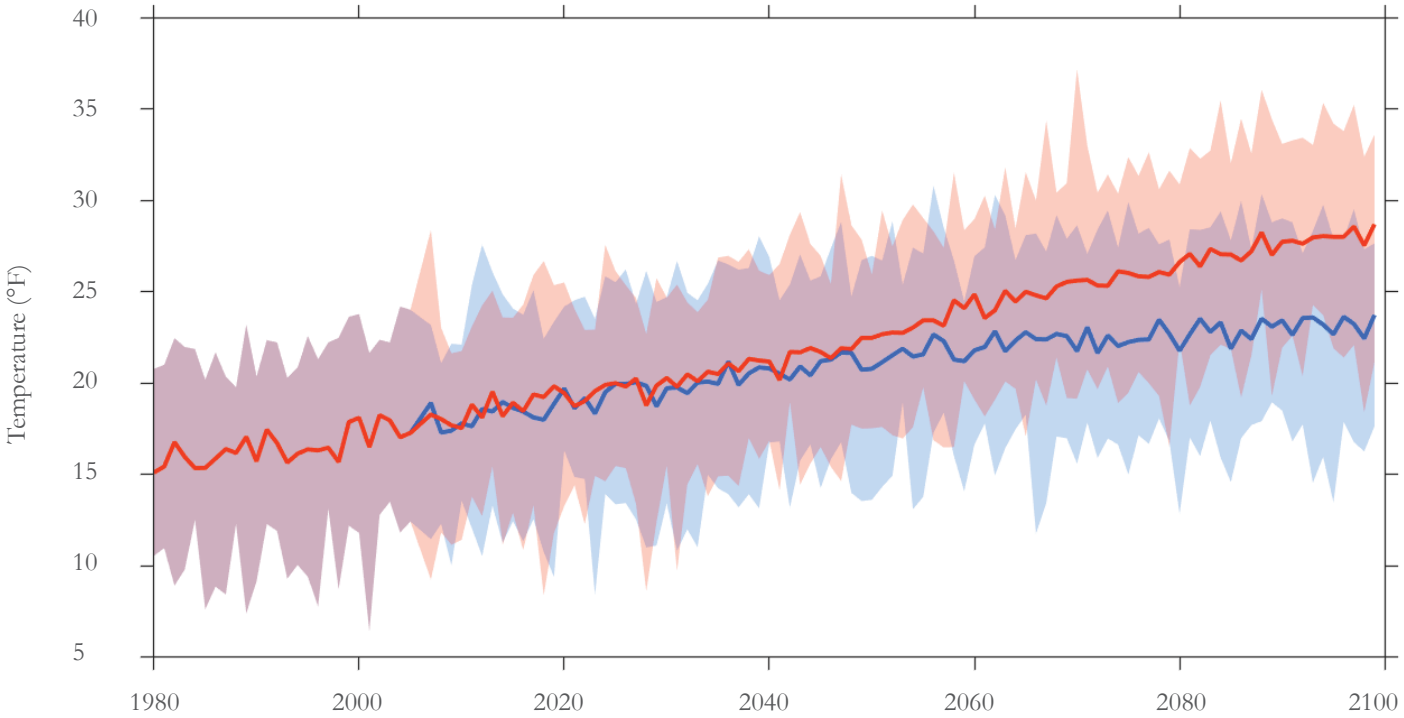

Figure 7. Winter temperatures (average minimum daily temperatures for December - February) have been increasing over the past several decades, and are expected to continue to increase through the end of the century. The average winter minimum temperature (approximately 18°F) may increase to nearly 28°F by 2100. The red line shows a "business-as-usual" case if we continue to emit greenhouse gases globally at the same rate. The blue line shows temperature change projections with significant greenhouse gas emissions reductions.
Historical simulations (1980-2005) and future projections (2006-2099) in seasonal averages of minimum daily temperature from a 29-member, high resolution (4 km) statistically downscaled Coupled Model Intercomparison Project (CMIP5) ensemble mean lower (RCP 4.5 W - thick blue line) and higher (RCP 8.5 - thick red line) representative concentration pathway (RCP) emission scenarios. Red and blue lines for the period 1980-2005 are identical. The light blue (light red) shading represent the highest and lowest values from the 29 different model RCP 4.5 (RCP 8.5) simulations for each year. Graph from Elizabeth Burakowski and Cameron Wake, Earth System Research Center/EOS, U. of New Hampshire.

including tick species that carry Lyme disease, are less likely to die off in the winter with higher winter temperatures, leading to higher breeding rates. Northampton has seen increasing rates of Lyme disease cases and increases in mosquito and other vector-borne disease.

With increasing average temperatures, Northampton will see more extended heat waves, which produce more challenges than the occasional hotter day. Extreme heat, humidity, and sustained heat waves cause heat-related illness, particularly for people with compromised immune systems, asthma, or without access to air conditioning. We recognize and need to address how climate change disproportionately affects some community members (frontline communities) more than others (climate justice).

Changes in Precipitation

Average annual rainfall has increased by nearly ten percent in the Northeast since 1970 *(Massachusetts Climate Change Clearinghouse. (2017). "Changes in Precipitation," from http://resilientma.org/changes/changes-in-precipitation#fn_1).* The intensity of downpours has also increased significantly. Between 1958 and 2010, the Northeast experienced a 70% increase in the precipitation that fell in "very heavy events," the heaviest 1% of all daily events *(Horton, R., Yohe, G., Easterling, W., Kates, R., Ruth, M., Sussman, E., Whelchel, A., Wolfe, D., & Lipschultz, F. (2014) Ch. 16: Northeast. "Climate Change Impacts in the United States." The Third National Climate Assessment. J. M. Melillo, Terese Richmond, and G. W. Yohe, Eds. U.S. Global Change Research Program, 16-1-nn).*

Mill River stream flow data (US Geological Survey) show annual mean flow and annual peak flow have trended upward over the past 80 years, showing the impact of these precipitation changes (**Figures 8** and **9**).

Total Western Massachusetts annual precipitation is expected to increase over the course of the century. Currently the Connecticut River Basin sees an average of roughly 46 inches of annual precipitation. This is projected to increase to 48–53 inches by 2050 and to 55 inches by the end of the century. The majority of that increase is projected to occur in the winter months; the summer and fall may in fact see a decrease in precipitation.

Likewise, the intensity of storms is projected to increase, which is measured by more precipitation over a shorter period of time. The Connecticut River Basin currently sees roughly 6.5 days in a year on average where precipitation exceeds one inch. The number of days is expected to increase to between 7 and 10 days by 2050 and up to 11 days by 2100. *(Climate projections in this section are all downscaled climate projections by the Northeast Climate Science Center at UMass-Amherst, from Massachusetts Climate Change Projections by Massachusetts EOEEA/Department of Energy Resources, 2017).*

Annual Mean Flow for the Mill River (USGS Site 1171500)

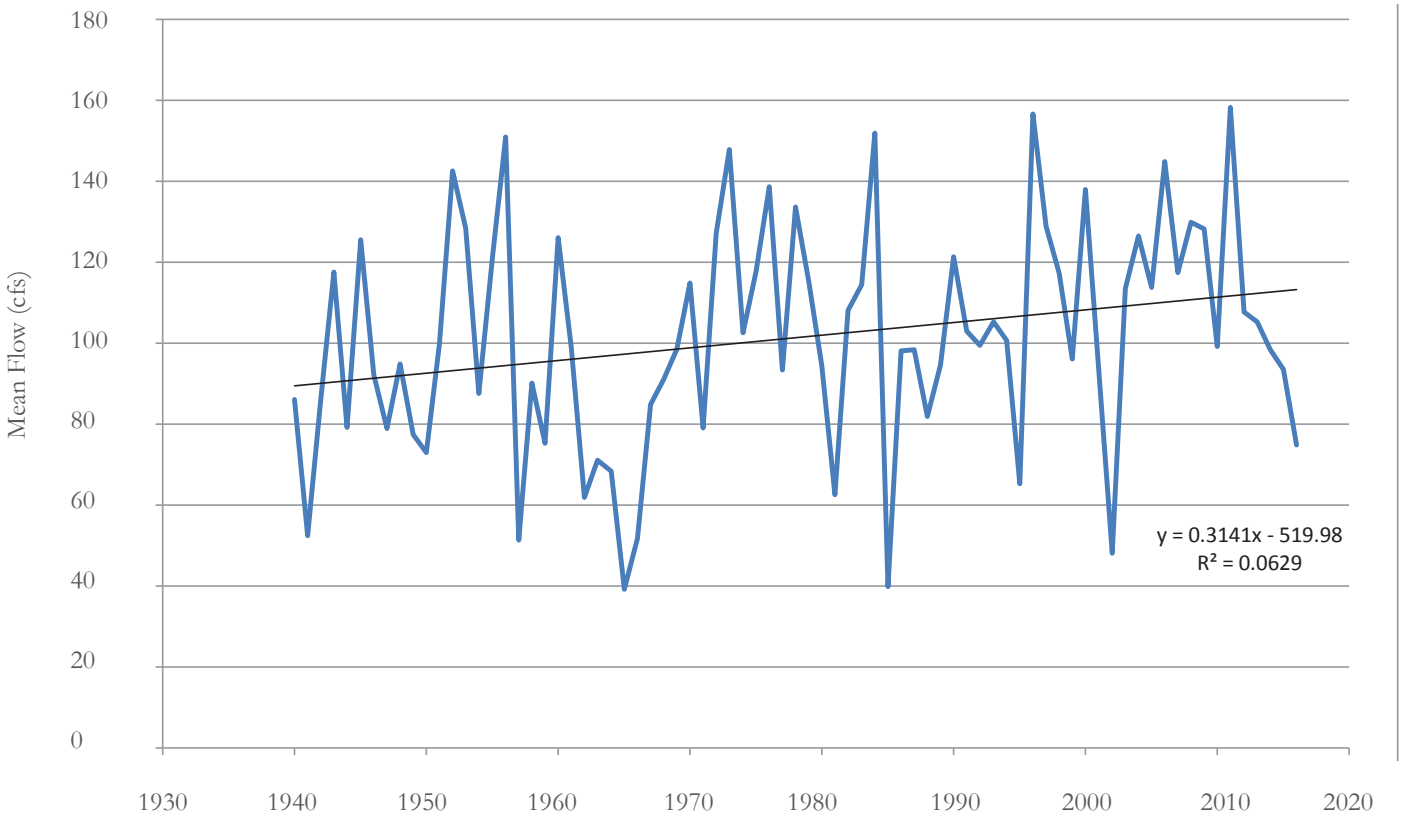

Figure 8. Historic annual mean flow for the Mill River (USGS Site 1171500)

With these major storms, Northampton faces three types of flood risk: 1) Riverine flooding from the Connecticut River, Mill River, Manhan River, Parsons Brook, and unnamed streams; 2) Localized flooding when infiltration and the stormwater system reaches maximum capacity; and 3) Downtown flooding if floodwaters over-top the levee or if the levee or Hockanum Road pump station fail. Much easterly portion of the city sits within the floodplain of the Connecticut River. The flood control system, which was built in the 1940s after two major floods in the 1930s damaged much of the city, affords the downtown protection from major floods. The system was designed, however, to protect against a maximum predicted flood level in the 1940s, with additional freeboard of two to five feet along the earthen levees and concrete walls. Although this is a conservative design, it may not be sufficient for the higher intensity storms expected with climate change.

More frequent high-intensity rain events will surpass the capacity of the city's aging culvert and stormwater systems, causing more localized flooding. Without updated infrastructure design standards and new strategies for infiltrating and storing water, flooding is likely to increasingly impact roads, buildings, and communities.

The flood control systems for the Connecticut and Mill Rivers were designed and constructed by the US Army Corps of Engineers to protect the city from flooding. Areas within the City that would flood without the levee structures are considered to be a levee-protected zone according to FEMA. FEMA is currently updating their floodplain mapping, a process that currently includes the City's obtaining engineering certification of the levee system. This FEMA map modernization and City certification is anticipated to be complete in 2025.

Annual Peak Flows for the Mill River (USGS Site 1171500)

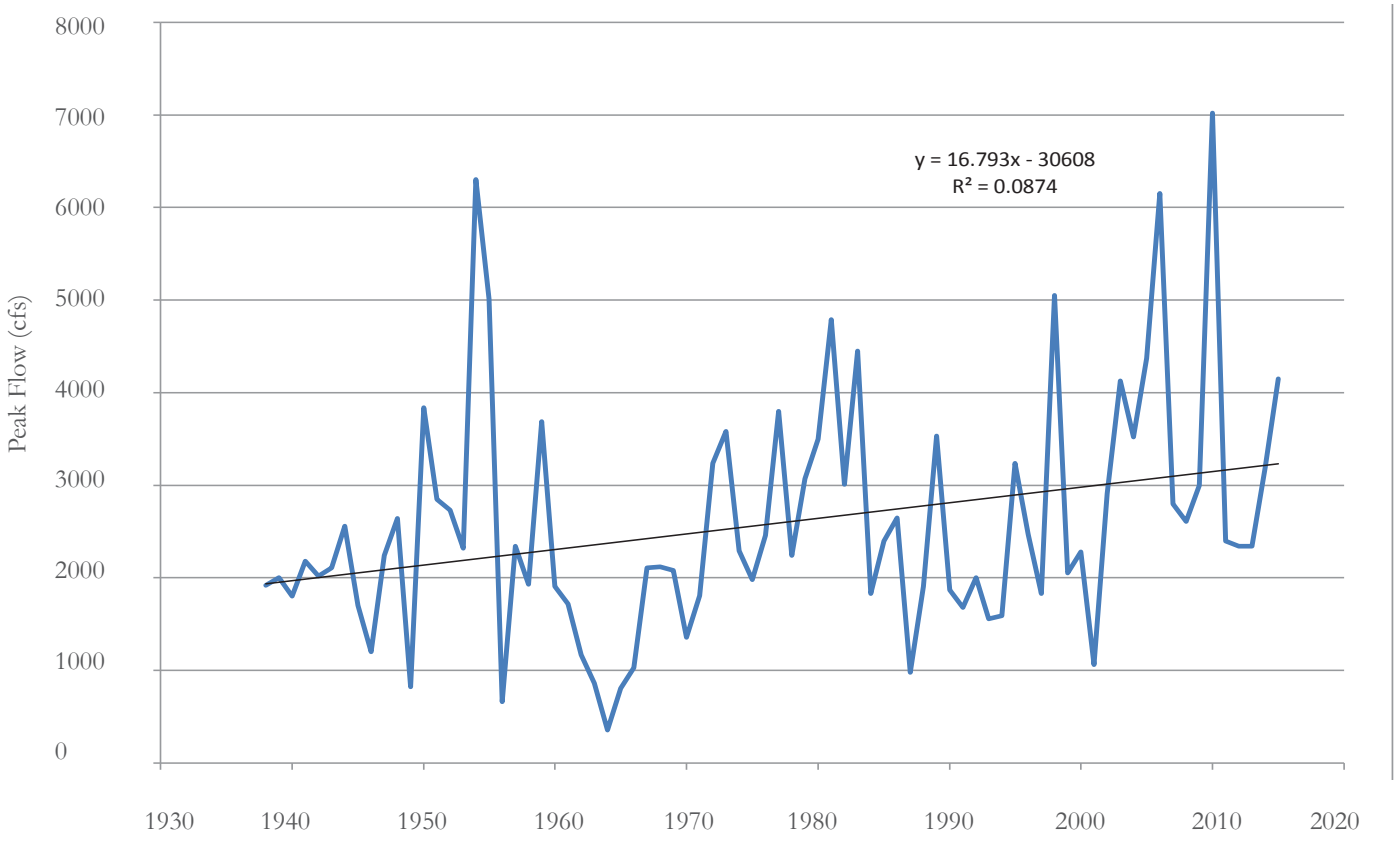

Figure 9. Historic annual peak flow for the Mill River (USGS Site 1171500)

Variability and Extremes

Climate change will bring average higher temperatures and more precipitation. That shift, however, will not result in steady weather patterns. In the Northeast we expect greater variability and more extreme weather. This may include longer periods of drought, more severe hurricanes, heavier snowstorms, or polar vortices.

Despite our city's robust water supply, longer periods of dry weather may impact the quantity and quality of that supply. In 2016, Massachusetts issued a drought declaration in which the Connecticut River Region reached "warning" status. Although Northampton had implemented water restrictions in years past, this level of drought demonstrated the need for further water use conservations as we continue to see the effects of climate change.

In particular, the vast majority of Northampton's farmland is not irrigated, making the city's agriculture especially vulnerable to drought.

The City must increase the resiliency of the city's systems to address extreme storm events that can bring power outages, interruptions in transportation, heavier reliance on homeless and emergency shelters, and business and service closures.

Community members and staff discussed the potential impacts from climate hazards (e.g., rising temperatures, increased precipitation, floods, droughts, and more intense storms) at several workshops. See the Community Resilience Building Workshop Summary of Findings (2018, amended 2020)

Annual Average Precipitation for Northampton, MA

Figure 10. Average annual precipitation has been increasing over the past several decades, and is expected to continue to increase through the end of the century. The red line shows a "business-as-usual" case if we continue to emit greenhouse gases globally at the same rate. The blue line shows projections for the change in annual precipitation with significant greenhouse gas emissions reductions.

Historical simulations (1980-2005) and future projections (2006-2099) in annual averages of total precipitation from a 29-member, high resolution (4 km) statistically downscaled Coupled Model Intercomparison Project (CMIP5) ensemble mean lower (RCP 4.5 W - thick blue line) and higher (RCP 8.5 - thick red line) representative concentration pathway (RCP) emission scenarios. Red and blue lines for the period 1980-2005 are identical. The light blue (light red) shading represent the highest and lowest values from the 29 different model RCP 4.5 (RCP 8.5) simulations for each year. Graph from Elizabeth Burakowski and Cameron Wake, Earth System Research Center/EOS, University of New Hampshire.

Equity Disparities and Frontline Communities

Some of our residents, generally those with the least resources, will be disproportionately hit be climate change (frontline communities).

Some individuals can drive away and stay in a hotel when a major storm is threatened. Some can afford to purchase air conditioning or swim in a pool when it is hot. Some can afford higher water rates. Some can purchase more robust housing.

Some cannot. The frontline communities for climate change tend to be the communities who are already facing chronic stress, low income, populations of color, homeless, under employed, those with disabilities, and many other existing situations that add to the day to day challenge.

These frontline communities include those who are under chronic stress. For example:

- The 1% of the population that is experiencing homelessness and others under the most severe chronic stress
- The 15% of the population below the poverty line
- The 40% of the population that is housing-burdened and under chronic stress
- Populations of color who may be suffering from structural racism
- Elderly and health compromised residents
- Persons with disabilities.

During periods of acute stress (extreme storm events, natural and human-made disasters, and pandemics) 100% of the population is at much greater risk from climate change.

3

Northampton coordinates ValleyBike share for the Pioneer Valley, part of its strategy for low carbon transportation.

Image credit: Planning & Sustainability

SECTION THREE

Pathways for Action

Northampton's Carbon Neutrality Goals

The City of Northampton is committed to net carbon neutrality by 2050, City buildings and operations to net carbon neutrality by 2030, and community carbon emissions to a 50% reduction by 2030 and a 75% reduction by 2040. This commitment is aided by Smith College's commitment to be net carbon neutral by 2030.

The city and its commercial, industrial, institutional, and residential partners need to ensure greenhouse gas emissions are reduced to as close to zero as possible and any remaining emissions are covered by offsets or sequestration, while incorporating climate resilience and regeneration into all future city plans and capital improvement planning. Addressing energy sources, building energy, transportation, land use, food systems, waste systems, trees and forests, carbon sequestration, and waste, while acknowledging that the most effective carbon neutralization strategy is always conservation and reducing demands (e.g., energy, transport, materials).

Northampton's Greenhouse Gas Emissions Inventory

To understand Northampton's contribution to global greenhouse gas (GHG) emissions, we conducted an inventory of the GHG emissions produced within the city. This Community Greenhouse Gas Emissions Inventory identifies the major sources of emissions and the quantity emitted from those sources. To allow for comparison with our peer cities, the GHG inventory followed the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC), which is an international accounting protocol. The inventory is based on 2016 data, the most recent set of data in hand.

Figure 11. shows the results of the inventory, broken down by sector.

Greenhouse Gas Emissions- Scopes

We focus on Scope 1 and 2 emissions, but work on some actions to address Scope 3.

Scope 1 – Direct Emissions (e.g., fuel combustion on-site, vehicle emissions, gas line leaks, within the city), with related offsets.

Scope 2 – Indirect Emissions from off-site production of city electricity use.

Scope 3 – Other Indirect Emissions beyond control, such as the global footprint of products consumed in the city.

Northampton 2016 Community Greenhouse Gas Emissions by Sector

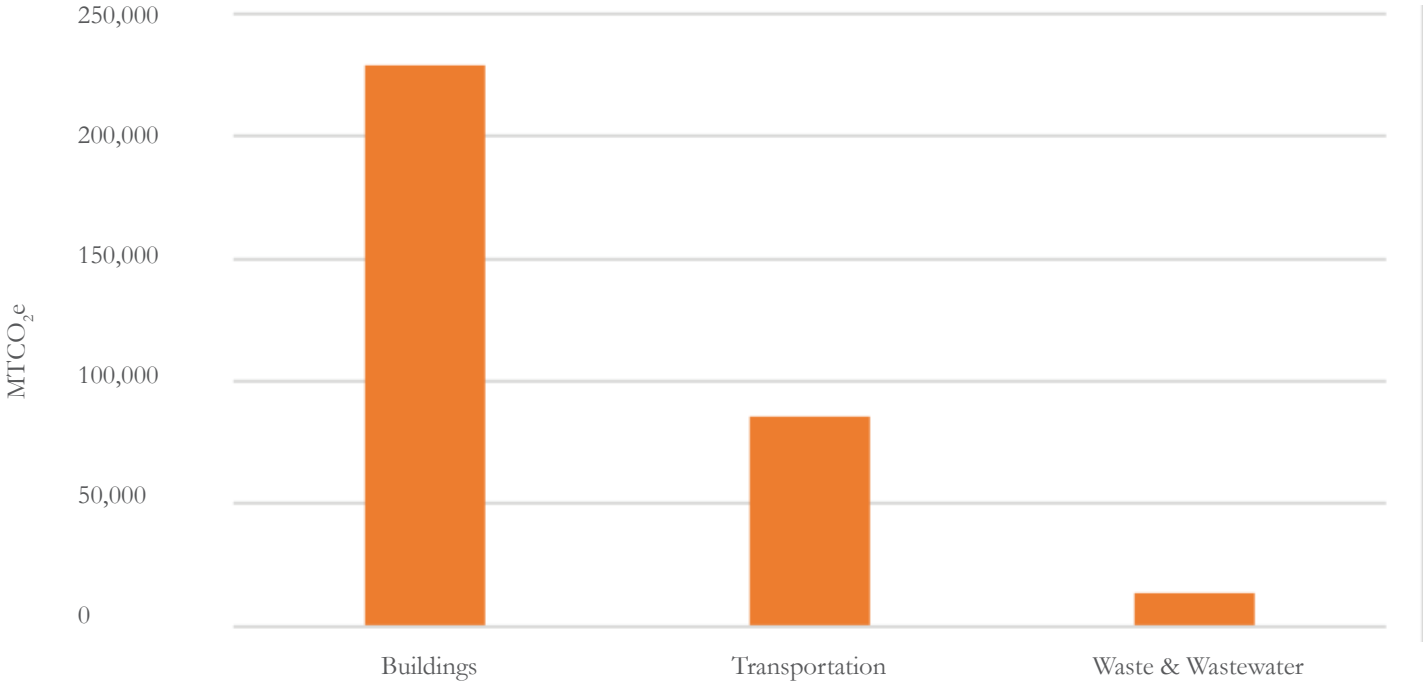

Figure 11. Northampton's 2016 community GHG emissions by sector. Commercial and residential buildings account for 70% of the GHG emissions in Northampton.

Emissions totaled approximately 329,140 $MTCO_2e$ in 2016. That is the same amount of emissions that roughly 70,000 gasoline-powered cars release in one year. Commercial and residential buildings together account for 70% of community GHG emissions. Transportation accounts for 26%, while waste and wastewater treatment account for 4%.

Figure 12. Shows more detailed information about where our community greenhouse gas emissions are coming from. The 52% of emissions labeled "commercial and multi-family buildings" includes emissions from all commercial and institutional properties in Northampton, including municipal facilities, multi-family housing and Smith College and Cooley Dickinson Hospital. The energy we use in private homes makes up 18% of our community emissions. Data related to energy use and emissions from industrial buildings and processes and from agriculture, specifically, was unavailable and therefore is not included in this analysis. The assessment indicates, however, that building energy use presents a significant opportunity for targeting emissions reductions.

Another area of opportunity for targeting emissions reductions is in "on-road transport," which makes up 26% of our community's emissions. These emissions include both gas- and diesel-powered vehicles used for commercial and personal use. Meanwhile, "water and wastewater treatment and discharge" accounts for 3% of our total emissions, and includes emissions from electricity use and other emissions at the water and wastewater treatment plants and throughout the entire system. While "solid waste disposal" emissions are low at 1% this is an important and common area to address as the actions we take to reduce the amount of material sent to the a sanitary landfill or incinerator can have other benefits, e.g., reducing our material consumption and the energy use associated with the production, packaging, and transportation of products.

Burning fossil fuels is the main source of greenhouse gas emissions globally. In Northampton, emissions from fossil fuels account for 87% of Northampton's total inventory. **Figure 17**. Provides total emissions by fuel source and use. Natural gas used in building heating and hot water is the primary source of emissions from stationary sources, and emissions from gasoline are nearly double that of diesel fuel as it relates to mobile sources.

Though it is often reported to have a lower carbon footprint than oil and coal, when gas leakage is included natural gas is an extremely high emitter of GHG emissions relative to renewable energy sources. Investments in natural gas supplies and distribution are not compatible with the City's net zero carbon goal. New investments in natural gas create additional stranded assets in the long-term. Northampton will continue to use existing natural gas pipelines within a larger transition away from a dependency on oil and coal while transitioning to renewable energy sources.

What is $MTCO_2e$?

$MTCO_2e$ is an abbreviation for "metric tons of carbon dioxide equivalent." GHG inventories look at several types of greenhouse gases, which each have a different capacity for trapping heat. Because humans produce more carbon dioxide (CO_2) than any other GHG, emissions of GHGs are counted based on how each GHGs heat trapping capacity compares to that of CO_2. This is called the CO_2 equivalent (CO_2e). At a community scale, GHGs are measured in metric tons of CO_2e ($MTCO_2e$).

Northampton 2016 Community Greenhouse Gas Emissions by Sub-Sector

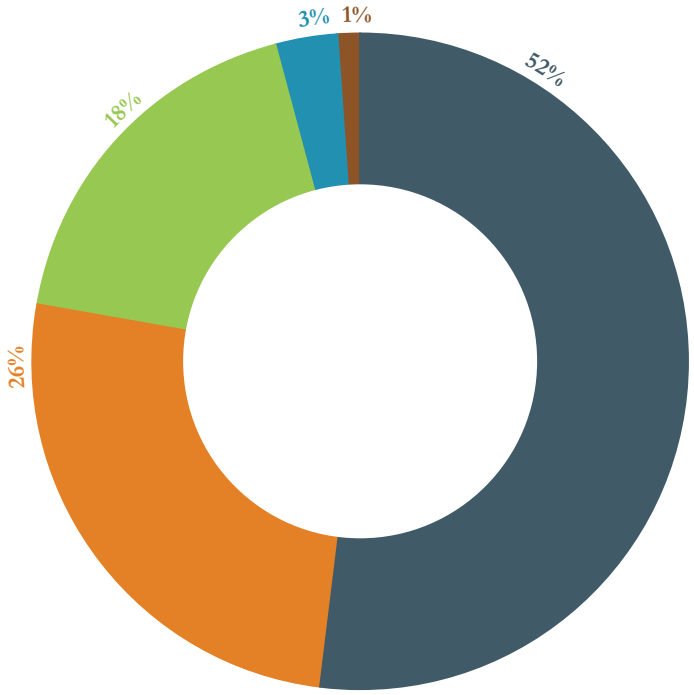

Figure 12. Northampton's community greenhouse gas emissions by sub-sector. Commercial buildings, which include all commercial and institutional facilities, account for 52% of the community's emissions.

Northampton 2016 Community Greenhouse Gas Emissions by Fuel Type

Sector	Greenhouse Gases Emissions ($MTCO_2e$)					*Total*
	Stationary Energy			Mobile Energy		
	#2 Fuel Oil	Natural Gas	Electricity	Gasoline	Diesel	
Buildings	13,620	128,770	58,070	-	-	*200,460*
On-road transportation	-	-	-	56,740	29,060	*85,800*
Water	-	-	500	-	-	*500*
Wastewater	-	-	680	-	-	*680*
Total	*13,620*	*128,770*	*59,250*	*56,740*	*29,060*	*287,440*

Figure 13. Northampton's greenhouse gas emissions ($MTCO_2e$) by fuel source and sector.

Though solid waste appears to only account for 1% of all GHG emissions in these figures, in reality, the carbon footprint from this sector is much larger. This disparity is due to the GHG emissions produced through the production, packaging, and shipping of products that eventually become solid waste within the Northampton community. Though Northampton does not include these emissions within its inventory as they are accounted for by the communities generating and transporting these products, it is important to understand how our communities' consumption and waste practices ultimately contribute to a global network of large-scale emitters.

Moving Forward

Greenhouse gas emissions are a primary indicator for a more sustainable and resilient future. To ensure we are constantly moving toward our goal of carbon neutrality, it will be essential for the city to develop a streamlined process to collect energy use and emissions data for ongoing tracking and reporting purposes. There is also a strong need to improve the quality and availability of the data based on shifts in priorities and market transformations. For example, through Community Choice Aggregation, Northampton will gain access to some electric utility data that previously was challenging to come by. It will be critical to have a system in place for identifying what our current and future data needs might be and ensuring that we are equipped to store, manage, and utilize that data to tell the story of our path to carbon neutrality.

What is mobile versus stationary energy?

Mobile energy refers to the energy used for transport activities like driving a car.

Stationary energy refers to the electricity and natural gas used in our buildings, including homes, schools, and offices.

Our Path to a Carbon-Neutral and Regenerative City

Pathways

The Carbon Neutral Pathway Analysis quantifies the impact of a the pathways that have the potential to yield the greatest reductions and for which data was readily available. The city needs a comprehensive approach to reducing emissions that prioritizes conservation and efficiency, as well as includes as additional pathways with impacts that have yet to be quantified, including targeting mode shift and changes in land use. We recognize that many of the strategies within these pathways may result in higher short-term costs and that many members of our community would be disproportionately burdened by these cost increases. Equity is a primary lens for this plan and needs to be part of all relevant implementation efforts.

The Carbon Neutral Pathway Analysis assessed the reduction potential of the first six of the following pathways, although the vehicle emissions standards pathways is totally at the federal and state levels. These pathways, and the others not analyzed, should be pursued simultaneously and presented in no particular order. They tackle the sectors that make up the majority of Northampton's GHG emissions- buildings, transportation, and electricity generation.

All of the pathways are reflected in the strategies in Section Four.

PATHWAY 1

Reduce Energy Demand- Efficiency and Conservation

Reducing energy use, from buildings, from transportation, from consumption, and all other energy users is always the most effective way to reduce greenhouse gas emissions.

Within the City's footprint, increasing building energy efficiency is the most cost-effective way to reduce greenhouse gas emissions and, at the same time, retain more money within the city. This requires a wide variety of actions, including a much stronger energy stretch code, zoning incentives, public investment in city buildings, energy benchmarking and disclosure, planting of street trees to reduce heat island effects, and right-sizing new construction to avoid over-building.

Regulations can range from incentives, technical assistance, energy performance standards (for new buildings) to a benchmarking and disclosure requirements (for existing buildings meeting certain thresholds) to assess and disclose their energy use and other performance indicators against some benchmark. The latter action creates market incentives to improve building performance (typically achieving between 2-11% energy reductions annually). *(US Environmental Protection Agency (2012) "Benchmarking and Energy Savings."*

The City is leading by example, with the Mayor issuing an executive order (2020) to examine HVAC systems in city buildings with a plan towards the City being able to achieve its city operations carbon neutral target by 2030.

Reducing consumption and moving to a zero waste framework, where waste generation is dramatically reduced and what is generated becomes a resource instead of a waste (e.g., composting of materials) has a relatively small effect on local greenhouse gas emissions (scope 1 and 2 emissions). Those steps, however, have a dramatic effect on the long footprint that Northampton has on the entire world (scope 3 emissions) because GHG emissions to make and ship products to Northampton can be reduced. These actions will take place both within the City and, through its management of public land and purchasing power, outside of the City.

PATHWAY 2

Electricity from Renewable / Low-Carbon Sources

This pathway calls for transforming Northampton's electricity supply as a climate change mitigation mechanism. To achieve zero carbon electricity, all fossil fuel generation sources must be replaced by renewables, with any remaining generation "neutralized" with carbon offsets or carbon credits. Northampton has advanced this pathway by encouraging private and municipal solar (including relevant zoning, three commercial scale and many smaller scale solar PV installations, and past participation in MassCEC's Solarize Mass Program). Per capita solar

capacity through this program grew eight times faster in Northampton than the statewide average. Because conservation and energy demand reduction are usually more cost-effective than switching to renewables, Northampton is actively pursued both strategies. Efficient distributed energy and distributed energy storage (batteries or other storage mechanisms), on both City and private facilities and land, are critical to this effort.

PATHWAY 3

Electric Vehicle Deployment

Encouraging the shift toward electric vehicles (EVs) can significantly reduce GHG emissions and improve air quality in Northampton, even with today's electricity mix. Increasing the adoption of electric vehicles requires:

- Converting more of the city fleet to electric vehicles.
- Continuously expanding EV charging infrastructure.
- Informing the public on state and federal EV incentives.

Northampton is already making progress in this area with 60 EV charging station ports within 9 miles of the city, with many more private ones installed by local businesses and residents.

PATHWAY 4

Net Zero Energy Buildings

A Net Zero Energy (NZE) building produces enough renewable energy to meet its own annual energy consumption requirements. Typically, they are highly energy efficient and leverage passive solar to minimize the renewable energy requirements. This requires a combination of state building code reforms, local zoning and other incentives, and the City leading by example by ensuring that all new and existing municipal and school buildings are built and rehabilitated to Net Zero Energy. Requiring all new and major redevelopment to meet these aggressive requirements can go a long way toward reducing greenhouse gas emissions in our new and existing buildings sector.

PATHWAY 5

Electrification of Thermal Loads

Switching from traditional heating systems to newer air source and ground-source heat pumps can reduce energy demand and eliminate or dramatically reduce on-site fossil fuel consumption, and switch the energy source to electricity, which will eventually be served by 100% renewable sources. The increased performance and energy efficiency of air-source heat pumps (ASHPs) and ground-source heat pumps manufactured for cold weather climates today is a result of technical, manufacturing, and installation advances. The first run of the HeatSmart Northampton ASHP program helped 54 homeowners around Northampton make the switch to ASHPs. The city has already joined others in the community in using more efficient, but capital-intensive, ground-source heat pumps at its Senior Center. Smith College is exploring switching its entire thermal load to ground-source heat pumps as part of its own efforts to be carbon neutral by 2030. The city is beginning the necessary energy studies to ensure that it electrifies its thermal (heating and cooling) systems in its public buildings as boilers and heating systems fail and/or require major upgrades.

PATHWAY 6

CAFE and Other Vehicle Standards

The federal Corporate Average Fuel Economy (CAFE) standards, first enacted in 1975, set the minimum average fuel performance of the cars and light trucks sold in the United States. CAFE standards have resulted in more efficient (higher miles per gallon) passenger vehicles on the road. Separately, the US Environmental Protection Agency (EPA) greenhouse gas tailpipe emissions regulations also apply to all vehicles, working in coordination with CAFE and truck standards toward more efficient, less polluting vehicles. Even with the 2020 federal attempts to rollback some of these standards, fuel efficiency and per vehicle emissions will continue to improve, especially with the increase in electric vehicles.

PATHWAY 7

Transportation Mode Shift

Mode shift is moving trips from single occupancy motor vehicles (SOV) to alternative transportation options. The most cost effective ways are to provide more sustainable options, walking, bicycling, and public transit, and providing land use options to reduce the number and length of necessary trips. These sustainable forms of transportation reduce greenhouse gas emissions, and bring social equity, community cohesion, and health benefits by providing more affordable transportation methods, better access to goods and services for residents without cars or who cannot drive, and avenues for healthy outdoor activity.

Northampton has made the use of sustainable transportation modes increasingly feasible for residents by investing in shared use paths; complete streets with shade trees that are welcoming to walkers, cyclists, and transit users; and launching ValleyBike, the regional electric-assist bike share program. Northampton must further expand walking, bicycling, bike share, car share, and public transportation improvements to reduce GHG emissions and increase equitable access. Because a trip avoided is even better than a mode shift, the Land Use Patterns pathway below is critical.

PATHWAY 8

Land Use Patterns

Northampton's land use patterns play a key role in our pathway towards a carbon neutral and regenerative city. Compact development connected to multi-modal transit (e.g., bus routes and ValleyBike), trail networks, and in close proximity to amenities, encourages walking, biking, and bus use; reduces vehicle miles traveled; and encourages more efficient land and resource use through green infrastructure. Development review, zoning, planning, and infrastructure investments can all encourage an increase in the percentage of residents living within walking distance of downtown and commercial and village centers. Along with focusing on people over vehicles, encouraging a diversity of housing types; and installing community amenities (e.g., bike lanes, sidewalks, and parks), siting solar power systems, often with battery storage, on City and private land to offset energy needs, this pathway reduces GHG emission reductions.

PATHWAY 9

Carbon Sequestration and Offsets

Planting and retaining trees, especially street trees, and maximizing carbon storage in trees and soils is critical to reducing atmospheric carbon. Soils represent the Earth's largest reservoir of terrestrial carbon, storing more carbon than vegetation and the atmosphere combined. Rural and urban forests provide carbon sequestration and offset benefits through forest management activities including the re-establishment of forests, retaining existing forests, increased street trees, and sustainable forest management practices. While enhancing carbon sequestration has a relatively minimal impact on offsetting the city's current level of greenhouse gas emissions, these practices become critical as the city's emissions approach zero. Furthermore, understanding that the current healthy soils and forests in the city store an immense amount of carbon further justifies land preservation efforts. Offsets are a critical part of the City being able to offset its own operations by 2030.

PATHWAY 10

Carbon Budgeting and City Operations

The City's effort to achieve carbon neutrality for City buildings and operations cuts across all of the above pathways. In addition, because City department heads and operation managers have more intimate knowledge of possibilities, highlighting the carbon footprint and offsets of all city operations and creating capital and operating budgets of allowable carbon emissions may be the most effective way to incentivize future reductions.

Cost of Carbon-budgets and offsets

Carbon offsets and mitigation need to be valued for aligning carbon budgets with fiscal budgets. For planning purposes, some literature assumes that carbon pricing at around $100/ton, reflecting the value of efficiency measures in New England. See, for example: www.synapse-energy.com/sites/default/files/AESC-2018-17-080.pdf.

Pathways Greenhouse Gas Reduction

Northampton's goal of carbon neutrality means that our emissions in 2050 will equal zero metric tons of carbon dioxide equivalent ($MTCO_2e$). Our consultants analyzed Pathways 1 through 6, above, for their GHG emissions reduction potential in low-case, mid-case, and high-case scenarios.

The low-case emissions reduction scenario is the status quo scenario. The mid-case scenario is more aggressive actions, achievable with continued effort, support, and focus on reducing emissions. Neither scenario is sufficient to achieve the City's goals.

The high-case scenario is market transformation, exemplary achievement, and remarkable progress by the year 2030 in each pathway area. The model, while only an estimate, provide guidance as we move towards carbon neutrality.

Northampton's committed goals are more aggressive than even the high case scenario. This requires:

1. Additional pathways to be modeled as more information and resources becomes available.
2. Significant financial and political investments.
3. Acceptance of the trade-offs with other public policy goals

Emissions Reduction Potential of Analyzed Pathways (#1 - 6)

Pathway	Low	%	Mid	%	High	%
1. Renewable / Low-Carbon Electricity	13,564	4.1%	19,086	5.8%	24,609	7.5%
2. Electric Vehicle Deployment	5,927	1.8%	12,281	3.7%	25,418	7.7%
3. Energy Benchmarking and Disclosure	9,061	2.8%	13,710	4.2%	18,861	5.7%
4. Net Zero Energy New Buildings	5,656	1.7%	11,313	3.4%	22,625	6.9%
5. Electrification of Thermal Loads	3,831	1.2%	7,931	2.4%	12,301	3.7%
6. CAFE & Other Vehicle Standards	12,320	3.7%	19,069	5.8%	28,455	8.6%
Total	50,359	15.3%	83,390	25.3%	132,269	40.1%

Figure 14. Reduction potential in $MTCO_2e$ of each analyzed pathway under three scenarios (low-case, mid-case, and high-case scenarios) in 2030. Percentages indicate the percent reduction in emissions by 2030, aiming for 100% reduction by 2050.

Northampton High-Case Greenhouse Gas Emissions Projection

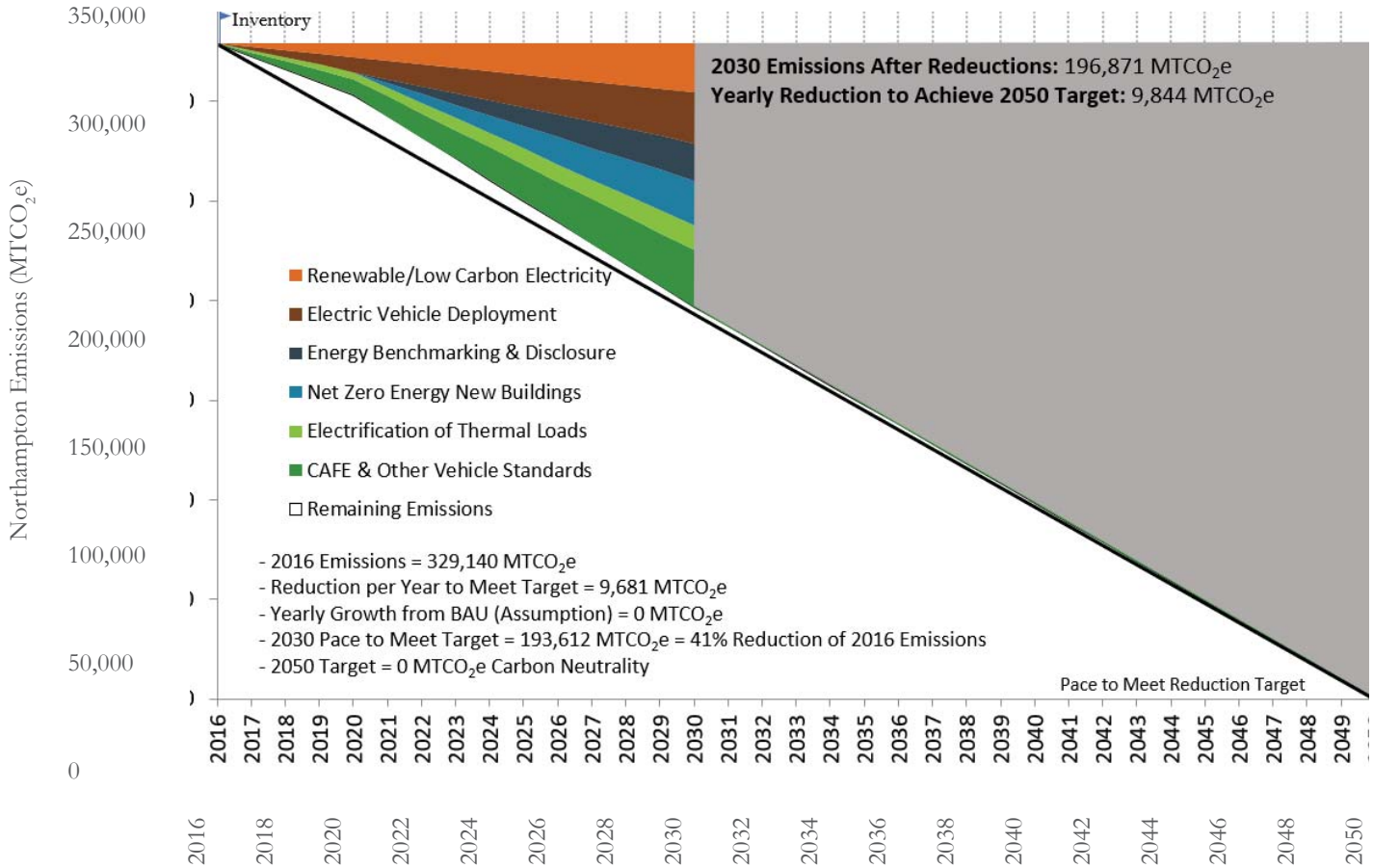

Figure 15. Greenhouse gas reduction potential of SIX selected pathways under a high-case scenario. The thick black represents a straight line to the 2050 carbon neutrality. Each wedge represents a reduction pathways emission reduction potential. The other three pathways and other actions are needed to achieve the City's more aggressive carbon neutrality commitments.

Our Path to Climate Adaptation and a Resilient City

Pathways

In addition to our pathways for reducing greenhouse gas emissions, Northampton is pursuing pathways to adapt to climate change and increase our resilience. These strategies cross our built, natural, and social systems, and overlap with our efforts to create a carbon neutral and regenerative city.

PATHWAY 1

Northampton Designs with Nature for Stormwater

With climate change increasing annual precipitation and the frequency of intense storms, Northampton needs to improve how we direct, infiltrate, and store stormwater. This includes updating design standards for stormwater infrastructure and stormwater management—particularly ones that use natural systems (e.g., existing mature trees, new plantings, healthy soil systems, water storage, wetlands preservation and enhancement, collectively part of green infrastructure) to absorb and store water. In 2018 the city launched *Northampton Designs with Nature*, to assess ten potential sites for green infrastructure projects to improve stormwater infiltration and to reduce the risk of localized flooding in the city, and advance this approach more broadly. The green infrastructure site projects bring co-benefits, such as reduced heat island effect, healthier wildlife habitat, enhanced carbon sequestration, and new recreational opportunities. Northampton will using the design principles developed in the *Northampton Designs with Nature* project to implement blue-green infrastructure (natural systems with rivers, streams, ponds, wetlands, and vegetation) to infiltrate stormwater, reduce runoff volumes and peak flows, and provide additional storage capacity within public rights-of-way and open space. Specific projects include, for example, the Rocky Hill Greenway- Pine Grove Golf Course restoration, the Route 66 Ice Pond restoration, and the Elm Street Brook watershed Low Impact Development Best Management Practices.

PATHWAY 2

Resilient Building and Energy Systems

This pathway calls for retrofits, upgrades, and new construction of buildings and energy systems that can better withstand floods, heat waves, or extreme storms. The development of micro-grids and distributed energy systems with battery storage, particularly to power emergency services, will provide backup power alternatives if the grid fails. In the case that portions of the city do lose power, buildings with greater "passive survivability" will help keep occupants safe. "Passive survivability" refers to the ability of a building to maintain critical conditions—such as staying warm enough in the winter to keep occupants well—even during extended loss of power, heating fuel, or water. Encouraging resilient building retrofits and design standards, ranging from increased freeboard heights, continuous insulation, renewable and redundant energy sources and battery storage, and minimum R-values or air-tightness levels, can all contribute to the resilience of buildings and their occupants, and in many cases, increase energy efficiency as well.

PATHWAY 3

Healthy and Resilient Natural Ecosystems

Healthy natural ecosystems play a significant role in infiltrating stormwater, improving air quality, keeping temperatures cooler on hot days, sustaining healthy food systems, and contributing to the overall resilience of Northampton. Consequently, this pathway calls for preserving and planting street shade trees, restoring natural ecosystems whenever feasible, monitoring ecosystems to ensure their health, as well as developing adaptive management methods to support ecosystems in adapting to changing climate conditions. This scope includes monitoring natural water systems to address changes in water quality due to climate change as well as implementing new park, forestland, and farmland soil management practices to enhance soil health. It will also include developing city strategies for expanding an urban tree canopy

and ensuring resilient tree and forest populations, such as ongoing monitoring protocols, selective harvesting, adaptive species planting, and invasive species removal in tandem with a public campaign to help raise awareness around addressing vulnerabilities in tree stocks and ecosystems to invasive species, pests, and local climate changes.

PATHWAY 4

Resilient and Connected Landscapes

This pathway calls for the continuation of open space preservation efforts, acquisition of land that will experience more frequent flooding with climate change, and the prioritization of protecting land for the long-term migration of wildlife and plants that is critical for healthy ecosystems to thrive with climate change. Priorities for land protection include areas denoted in the Nature Conservancy's map of Resilient and Connected Landscapes that are in the "Resilient with Confirmed Diversity, Climate Flow Zones, or Climate Corridor mapped areas." The City should discourage development (e.g., residential and solar PV) in this relatively narrow band along the western edge of the City, except in existing developed areas. Open space preservation efforts should also prioritize these areas, as the city has done for a number of years. Future development should not occur within any mapped areas that are defined by the city, state, or federal government as areas of resilient and connected landscapes with confirmed diversity or determined to be important climate corridors for climate resiliency.

PATHWAY 4

Healthy and Equitable Communities

This pathway calls for both strengthening resources and services that support health and wellbeing, as well as creating spaces and processes for building stronger relationships between neighbors, organizations, businesses, and the city. Resilience research shows that stronger social bonds with one's community and neighbors leads to a more resilient community. Likewise, inequity—whether seen through income, education, access to resources, access to decision-making, among other avenues—continues to prohibit collective community resilience. This pathway includes safeguarding and improving the health of food systems and food security for all residents; creating accessible recreational areas with an expanded urban canopy where all residents can cool off in high heat; encouraging community conversations and neighborhood-driven initiatives around climate adaptation; and ensuring that diverse voices play a role in shaping Northampton's future.

PATHWAY 5

Knowledge and Skills for Addressing Climate Change

This pathway focuses on enhancing education, skills development, and job training in areas that will build awareness and knowledge around climate change and support climate mitigation and adaptation action. One avenue includes developing a climate curriculum, co-produced with youth and students, in Northampton public schools that address resilience and regeneration. Smith Vocational and Agricultural School is both suited to hands-on education in this area and to development of demonstration installations. The curriculum would systematically build on new topics over the course of a K-12 education, preparing youth for understanding the impacts of climate change as well as equipping them to be leaders in climate action. This pathway also includes supporting job training or career development programs in fields that will support the local economy and simultaneously support Northampton in reaching its resilience and regeneration goals.

In partnership with new and existing community partners the city would expand resilience and regeneration skills development programs in tandem with demonstration projects or other municipal efforts. These could include job training or career development (e.g., as green infrastructure installation and maintenance; permaculture, regenerative, and resilient agricultural practices; urban forestry; clean energy and energy efficiency technologies).

PATHWAY 6

Hazard Mitigation and Emergency Preparedness

A number of strategies can support Northampton in preparedness, response, and recovery from a climate shock, particularly over the time-frame immediately preceding, during, and after a hazard. For flood events, these strategies include ongoing evaluations and upgrades to the city's flood control infrastructure; encouraging residents to invest in flood insurance; as well as delineating floodplain boundaries, evacuation routes, and/or flood-safe buildings with signs or other markers. For floods as well as other types of emergencies including severe storms, power outages, and periods of high heat, Northampton can add to its

already robust multi-pronged strategy for various levels of resilience-based communication, including emergency alerts, regular notifications (e.g., parking bans), and ongoing public education and outreach on a variety of climate change topics.

NORTHAMPTON'S

Framework for Resilience & Regeneration

RESILIENCE

Adaptive Capacity

Increasing the capacity of systems to better withstand climate hazards, systematically learning and adapting standards and practices to better respond.

Strong & Healthy Communities

Building a sense of community through social networks or social cohesion, reducing the vulnerability of Frontline Communities (e.g., homeless, low income, populations of color, new Americans), and increasing community health and safety in culturally sensitive ways.

Climate-Smart Action

Developing the city's and community's ability to make decisions that better prepare us for climate change through education, use of climate projections, and collaboration across city departments.

REGENERATION

Nature as Model

Employing natural systems to use water wisely, enhance soil health, draw carbon out of the atmosphere, maintain comfortable air temperatures, and improve air quality.

Respect Resource Limits

Using resources responsibly by reducing our consumption, mitigating greenhouse gas emissions, and material reuse, re-purposing, and up-cycling.

Stewardship

Taking care of our planet through preserving healthy habitats, managing non-native species and disease vectors, and improving environmental education.

ECONOMIC & CULTURAL VITALITY

Conscious Economic Exchange

Creating stronger local economies by increasing the number of jobs that pay a living wage, sourcing materials and labor locally, and supporting an inclusive economy.

Forward-Looking Economy

Preparing our economy for the future by strengthening job-related skills training, diversifying the economy and supporting entrepreneurial activity, and encouraging diverse workforces.

Creative and Cultural Value

Supporting the creative economy, local agriculture, and other industries with local cultural significance in Northampton.

EQUITY

Distributional Equity

Reducing disparities in access to resources as well as educational and economic opportunity, and mitigating exposure to hazards for those who face disproportionate harm.

Procedural Equity

Including diverse and non-traditional stakeholders in decision-making and in the measurement of project success, and ensuring transparency in the development of programs or projects.

Structural Equity

Actively recognizing and working to change structural forces of inequity, including developing pathways for more diverse and representative leadership and addressing institutional racism.

Inter-generational Equity

Addressing the needs of those not yet involved in or empowered to participate in the decision making process, or even alive today.

Cultural Equity

Our decision making values all cultures equally.

REGIONAL COLLABORATION

Collaborative Learning

Creating platforms for sharing insight or information between communities, and developing tools, processes, or frameworks that allow communities to replicate success.

Interdependence

Working with neighboring communities to share resources and take advantage of economies of scale, or creating complimentary or aligned approaches.

Nested Systems

Considering the way local systems affect regional systems and vice versa by working at a watershed or ecosystem scale and by making local changes that impact regional systems.

Evaluating the Actions, Achieving Co-Benefits

This **p**lan provides guiding principles that shape all of our planning. A resilient and regenerative community requires investments in projects and programs and adjusting the way we plan, develop policies, and implement those policies. We must consider the potential for achieving resilience and regeneration outcomes in every investment we make.

We cannot be a resilient and regenerative city without being an equitable city. **Equity, along with resilience and regeneration, is** our third guiding principle for planning and implementation. We must recognize and reconcile injustice, create more equitable access to resources and opportunities, and have an inclusive processes for planning and decision-making.

Likewise, fostering **Economic and Cultural Vitality** is integral to making Northampton strong, healthy, and vibrant. We must support local businesses and job and skill-training opportunities, and nurture a creative economy.

Northampton is one city nested within our region and state. We must grasp the opportunities to share learning and accelerate adoption of practices by working collectively across the Pioneer Valley, Massachusetts, and even broader scales. Thus, we look for opportunities for **Regional Collaboration** as a guiding principle to exchange insight and plan collectively with other communities, particularly in addressing global climate change.

These guiding principles guide the Resilience and Regeneration Plan.

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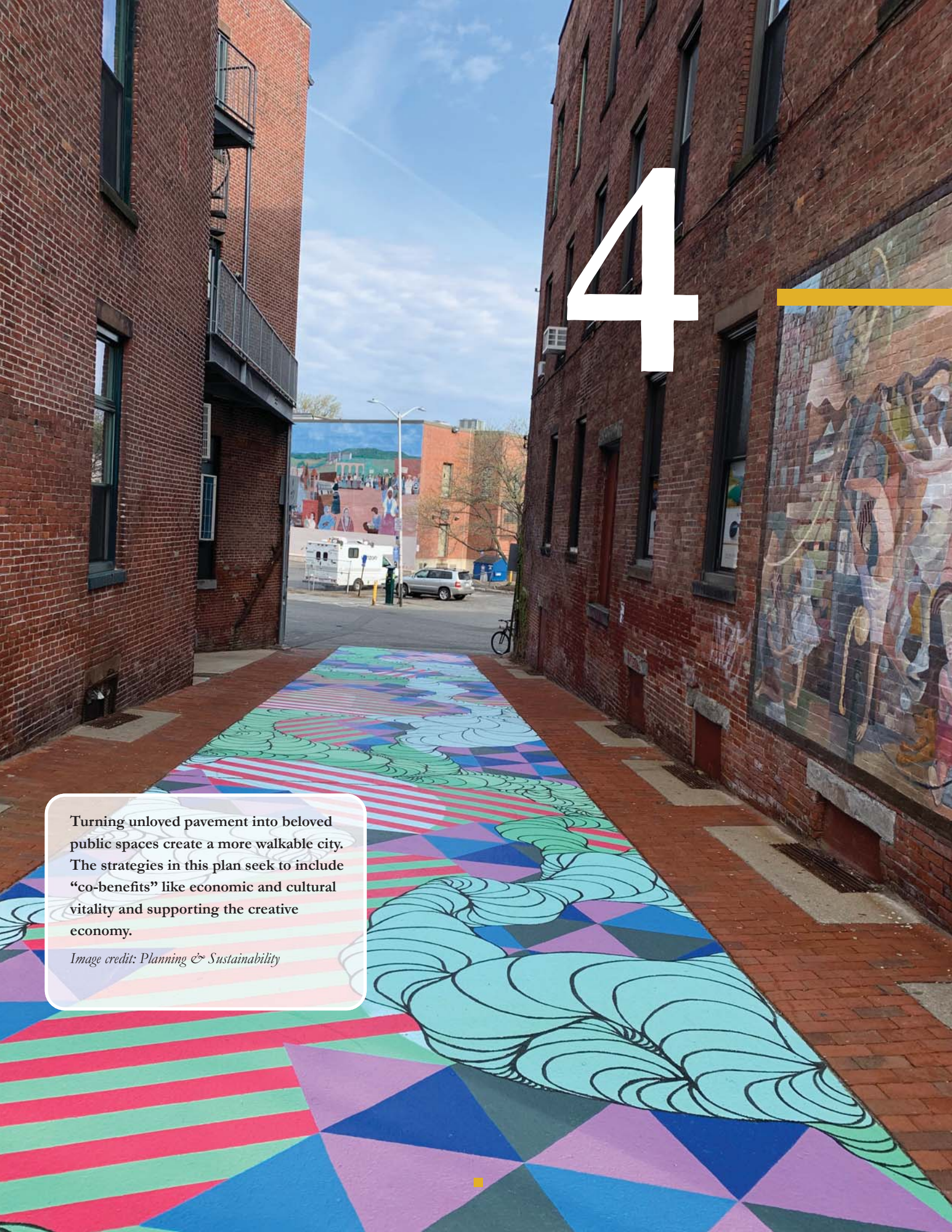


Turning unloved pavement into beloved public spaces create a more walkable city. The strategies in this plan seek to include "co-benefits" like economic and cultural vitality and supporting the creative economy.

Image credit: Planning & Sustainability

SECTION FOUR

Action Plan: Resilience & Regeneration Strategies

Northampton started to track its progress using the US Green Building Council (USGBC) rating system LEED for Cities and Communities, which replaced the former STAR Communities program. LEED for Cities is a third party rating system designed to help communities compare themselves to a norm and to peer communities and promote honest reporting and minimize green-washing. The Resilience and Regeneration strategies are broken down by the categories defined in the rating system to help us track how our actions help us make progress towards the LEED for Cities and Communities goals.

ALL CATEGORIES 1

ALL CATEGORIES 1

Integrate resilience and regeneration principles into the development of all city and public school outreach, projects, plans, budgets, and processes

Systematically apply the Resilience and Regeneration Framework to the development of city projects, programs, and plans. The framework helps to integrate resilience and regeneration thinking into work across departments, ensures investments and planning supports Northampton's resilience and regeneration goals, and amplifies the potential of the city's work in creating co-benefits. Most specifically, develop specific internal policies to:

- Set a long term and annual City of Northampton carbon budget. Such a budget would establish allowed carbon emissions allocated to each city department to integrate carbon reduction as part of each city department's core mission.
- Evaluate the impact of all proposed city capital improvement projects on greenhouse gas emissions to understand how projects may hinder or advance progress towards the city's goal of being net-zero by 2050 and city operations being net-zero by 2030.
- Integrate climate change projections into all future capital projects, ensuring new infrastructure can withstand current and projected impacts.
- Using socio-economic data, integrate an equity-based prioritization factor in the process for capital improvements project selection that adds priority to projects that will benefit neighborhoods with higher proportions of people with low incomes, people of color, or people living with physical or mental disabilities.
- Ensure that the next revision to the Sustainable Northampton Comprehensive Plan incorporates the Resilience and Regeneration Plan as a key unifying theme.
- Include resilience and regeneration principles as a cross cutting strategy (in addition to specific strategies that follow) in all city education and outreach efforts.
- Provide adequate City staff, resources, and commitment to achieve these targets.
- Creating a biennial action plan with specific actions, metrics, and political consensus to move forward.
- Integrate education and curriculum on climate resilience and regeneration in public schools, with students co-producing such curriculum. Foster a culture of ecological stewardship, resource conservation, and climate preparedness.
- Focus on high impact practices that provide the greatest resilience and regneration Return on Investment (ROI), that is the least cost (financial and other burdens) to achieve success.

Type: Policy
Lead: Mayor's Office; Planning & Sustainability, Central Services, Public Works; School Department; Smith Voc; Youth Commission
Time-frame: Short-term launch- Ongoing process
Cost: $$$

ENERGY 1. RENEWABLE & RESILIENT ENERGY SUPPLY

Electricity is 20% of our energy load. It will grow as we electrify our energy souces.

ENERGY 1A

Launch a regional entity to coordinate regional strategies, including a Community Choice Aggregation 3.0 (CCA 3.0) Program for electricity aggregation

Northampton, with Mayoral and City Council (2020) approval, is working with Amherst and Pelham (with the hope that more communities will join in the future) to create a regional Joint Powers Entity for regional renewable and resilient energy supplies.

A key first step is forming a Community Choice Aggregation program to become the default electricity provider and aggregate demand with GHG reducing electricity supply systems.

Northampton received a $75,000 grant from the Urban Sustainability Directors Network (USDN) in 2019 to explore a new model for Community Choice Aggregation, CCA 3.0 optimized around greenhouse gas reductions. The resulting bulk purchasing power can allow a contract with an electricity supplier with the goal of greening the energy supply and, eventually, providing the energy storage needed for load shifting to reduce peak energy periods. This program would automatically enroll residents, unless they opt out, and would include a commitment to purchasing power from locally-produced distributed energy sources and gaining access to affordable renewable energy sources for low-income residents. This work would also have a strong focus on reducing GHG emissions.

Program goals also include incorporating energy storage and other tactics to reshape the load profile to reduce peak energy periods. Implementing CCA 3.0 as a region will reduce our collective reliance on fossil fuels, encourage the expansion of local renewable energy sources, and amplify our ability to transition to a cleaner, more efficient energy supply.

- Formalize a Joint Powers Entity dedicated to GHG reductions.
- Apply for state approval of its CCA.
- Arrange for a broker (in the near term) and potentially a staff or consultant model in the long term for its CCA.
- Develop an aggregation business plan optimizing GHG reductions.
- Secure a competitive supplier.
- Engage and educate community members.
- Partner with community groups (e.g., Community Action and their home weatherization program).

Type: Program
Lead: Central Services - Energy; Planning & Sustainability
Time-frame: Mid-term
Research and planning underway
Cost: $$

ENERGY 1B

Procure more renewable energy projects on city property and through city partnerships

The City's goal is to enable an annual electricity output from renewable electricity projects that matches or exceeds municipal and public-school electric usage and to maximize use of renewable-thermal technologies in municipal and school buildings.

Northampton has a regulatory structure and open space and pilot agreements to encourage in renewable energy systems on both public and private land (e.g., 3.3 MW solar array atop the closed Glendale Road landfill and a total of 10 MW of private sector solar arrays at Ryan Road and Park Hill Road). The City has installed smaller solar-electric, solar hot water, solar air pre-heat, geothermal and air-source heat pump systems on city and school properties. Two municipal buildings, the James House and the Senior Center, are completely heated and cooled by renewable-thermal systems: air-source heat pumps and a geothermal system respectively.

- Continue to install renewable energy projects and lead by example on city and school properties (e.g., photovoltaic canopies over parking lots, energy storage to shave peak demand). Ground-mounted installations are most cost effective, but building and parking lot canopies installations are an important part of the mix.
- Establish capital improvement plans to reduce the thermal load and replace fossil fuel heating with renewable thermal systems in public buildings.
- Expand public-private partnerships for renewables on private property.
- When feasible, use local contractors to install these projects and create educational opportunities (e.g, the 106 kW city-owned solar-electric array on Smith Vocational and Agricultural High School is used for their renewable energy coursework.
- Maintain the current zoning prohibition on commercial photovoltaic where intact forests are most critical for climate resilience and addresses the trade-off between the installation of PV systems and the ecological and carbon impacts.

Type: Capital Improvement
Lead: Central Services - Energy; Planning for regulatory
Time-frame: Mid-term
(Typical implementation takes 1-3 years)
Cost: $$

ENERGY 1C

Continue building out distributed energy resources for critical services

Northampton received two grants through the MA Department of Energy Resources, Community Clean Energy Resiliency Initiative, for critical services distributed: 1) Installation of a 20-kilowatt, canopy-style array with battery storage on the Fire Department parking lot on Carlon Drive, and 2) A micro-grid to service Cooley Dickinson Hospital, the Department of Public Works headquarters, and the Hampshire County emergency shelter at Smith Vocational and Agricultural High School to improve their ability to maintain operations during power failures. These investments follow an internal study begun in 2012 that assessed the resilience of the city's electrical grid.

Continue to identify opportunities and move forward with the development of distributed energy resources in Northampton, focusing on redundant systems and hybrid energy storage systems, to ensure that critical services (and potentially business centers) can continue to operate during a climate hazard and serve vulnerable populations. Perform public outreach and awareness of such distributed energy services to build support.

Type: Capital Improvement
Lead: Central Services - Energy; New CCA 3.0
Time-frame: Mid-term for the development of the current micro-grid project; Ongoing for continued opportunities
Cost: $$$

ENERGY 2. ENERGY EFFICIENCY & HIGH PERFORMANCE BUILDINGS

Buildings generater 70% of our GHG emissions

ENERGY 2A

Enourage the real estate market to place greater value on building energy features, inlcuding deep energy retrofits and zero energy new buildings.

Require, by ordinance, that building owners of large buildings report energy use through utility bill disclosure. For smaller buildings, establish an incentive program for voluntary utility cost disclosure targeted to home owners and tenants. Phase in mandatory disclosure for all building types.

Work with local lenders, appraisers, realtors, and the Multiple Listing Service (MLS) to encourage greater valuation and transparency of building energy features by mandating listing of attained energy performance credentials including verified Home Energy Rating System (HERS rating). Tools and initiatives to further promote energy performance consideration in building valuation:

- Mandate building energy assessments at time of sale
- Popularize Property Assessed Clean Energy (PACE) financing for existing buildings
- Develop local Green Financing and streamline EEM/EIMs (FHA's Energy Efficiency/Improvement Mortgages) to enable and encourage home buyers to invest in energy upgrades at time of purchase or major renovation.
- Lead by example by disclosing municipal school building energy consumption and targets for reduction

Type: Policy & Program
Lead: Central Services - Energy
Time-frame: Mid-term (1-3 years)
Cost: $$

ENERGY 2B

Expand program for building electrification to convert from oil and natural gas heat to heat pumps or other electric sources

Expand efforts to encourage building energy retrofits and building electrification, including replacing on-site fossil-fuel powered heat with far more efficient electrically powered heat pumps (mini-splits and centralized heat pumps) for residential, commercial, and institutional buildings

- Establish strong partnerships with rate-payer supported programs (Mass Clean Energy Center and MassSave) and financing programs (PACE, future CCA 3.0, potentially CDBG Housing Rehab).
- Focus on ease of participation and incentives.
- Subsidize the cost of heat pumps in affordable housing and low-income households.
- Consider ground source heat pumps for large commercial and institutional installations' thermal loads, although they are generally not cost-effective for small scale installations. The city uses ground source heat pumps for Senior Center and Smith College is assessing ground source heat pumps.
- Prepare to end fossil fuel combustion in all City buildings. The first step, currently underway, is to examine every building and create capital improvement plans to improve building envelopes and ventilation systems and decarbonize all thermal loads (heating, cooling, and hot water)

Type: Program
Lead: Central Services - Energy
Time-frame: Short-term
Cost: $ without financial incentives;
$$-$$$ With financial incentives

ENERGY 2C

Apply Resilience and Regeneration point system in site plan review process

Apply a Resilience and Regeneration point system in site plan approvals to encourage lower transportation needs, higher passive survivability, no on-site fossil-fuel combustion, net-zero energy buildings, and walkable zoning densities in urban core areas.

Developers earn points for adopting specific resilience and regeneration measures, with a minimum point requirement. Points can be awarded for prescriptive (a list of approaches) and performance-based approaches to reduce carbon emissions and/or improve site and building resilience. For example, minimum HER ratings, net-energy zero, passive house, passive survivability, increased free-board heights, continuous insulation, renewable and redundant energy sources and battery storage, minimum R-values or air-tightness levels, among other measures. Certification systems such as PHIUS's Passive House Standard and USGBC's Resilience Pilot Credits and/or Reli Rating System could be drawn from in the development of the point system. All included measures should enhance the resilience of the city's building stock and/or contribute to lowering the city's GHG emissions.

Type: Policy
Lead: Planning & Sustainability
Time-frame: Mid-term to develop and implement the policy
Cost: $

ENERGY 2D

Require that all new buildings be built to Net Zero Energy standards and advocate for higher Building Code standards

Work with other Massachusetts communities to advocate for higher resilience and regeneration standards in the Massachusetts Building Code and in the International Building Code (IBC) on which the Massachusetts Building Code is based. To the extent allowed under the state building code and local zoning authority, require all new buildings to meet high performance standards and be verified as Zero Energy ready. Consider DOE Zero Energy Ready Home (ZERH), Passive House Institute United States (PHIUS+) standards. A Zero Energy building has comparatively very low energy loads and is highly energy efficient. With a robust building enclosure and right sized mechanical systems prioritized, renewable energy is produced or procured to offset what the building uses on an annual basis. Zero Energy building standards should be required and market transformation incentivized through:

- Advocate for an updated Massachusetts Builidng Code Stretch Energy Code, if not a base building code, that requires Zero Energy performance.
- Ensure the city leads by example by ensuring all new municipal buildings and feasible major renovations meet Zero Energy building standards.
- Consider retrofit and renovation regulation and incentives to achieve high performance building certifications for existing buildings.
- Advocate for expansion of zero energy and passive house utility incentives through the Massachusetts Energy Efficiency Advisory Council.
- Advocate for legislative updates to revise utility cost-effectiveness metrics to value carbon reductions with expanded Mass Save programs.
- Plant shade trees to reduce heat gains in buildings.

Type: Policy and Advocacy
Lead: Central Services - Energy; Planning & Sustainability
Time-frame: Medium-term
Cost: $

ENERGY 2E

Encourage resilience and regeneration building and site improvements

Promote resilient and regenerative building and site improvements that property owners can make to protect properties and people against flooding, extreme weather, and heat wave. Work with existing federal, state, and local programs to expand access to and encourage use of educational and financial tools and resources, including working with utilities and existing community organizations to make these tools and resources financially and culturally accessible to all residents:

- Promote clean technology education and adoption programs that increase buildings' ability to support occupants during times of stress such as long-term power outages or heat waves, including energy efficient and high-performance building improvements.
- Promote on-site battery power backup systems, as the technology becomes cost-effective, ideally coupled with on-site renewable electricity.
- Advocate to the Massachusetts Energy Efficiency Advisory Council that the Mass Save utility incentive programs expand current Passive House incentive programs to include all residential building types, new and existing.
- Plant shade trees to reduce energy demand and heat islands.
- Implement a "One Cool Room" program to support residents whose health is vulnerable to heat waves to establish access to at least one room at their residence that is cooled by a high efficiency cooling technology such as an air-source heat pump.
- Encourage lighting plans so, to the extent reasonably achievable, all lights have a clear purpose, are directed only to where needed, are no brighter than necessary, are used only when it is useful, and use warmer color lights available.

Type: Program
Lead: Planning & Sustainability; Central Services -Energy

Time-frame: Short-term for campaign development; Ongoing for continued promotion
Cost: $

ENERGY 2F

Accelerate community adoption of energy efficient & high-performance building improvements with a focus on more equitable access.

Advance increased energy efficiency and installation of solar-electric (PV), solar-hot water, heat pumps, energy recovery ventilation and other high-performance building technologies. Because the city has no direct control over building improvements in the private sector, partnering with organizations that offer assistance such as free building assessments, weatherizations of 1-4 unit homes, guidance for small businesses, and bulk purchasing of renewable energy and high performance building technologies. Support residents of all income-levels and backgrounds and businesses of all sizes.

Build on the success of past City outreach programs (e.g., Solarize Northampton led to installation of 0.5+ megawatt of solar electric, HeatSmart Northampton raised awareness of minisplit air source heat pumps for high-performance heating and cooling, and the City's utility-funded partnership with the Center for EcoTechnology helps small businesses access utility energy efficiency assistance programs). Future efforts could include:

- Establish staff within the planned regional Joint Powers Entity (JPE) to run marketing campaigns and collaborate with a JPE-run intermunicipal CCA 3.0 program.
- Coordinate and partner for energy investments through Property Assessed Clean Energy (PACE), CDBG Housing Rehabilitation, a CCA 3.0 program, rate-payer supported programs (e.g., Massachusetts Clean Energy Center and the MassSave program), and other partners (e.g., Community Action Pioneer Valley and the Center for EcoTechnology.
- Identify barriers to entry for energy efficiency efforts and identify gaps in who participates; Create programs that will create more equitable access to renewable energy and high-performance building technologies for low-income residents, communities of color, and historically underserved and underrepresented populations. Co-develop program with uderserved stakeholders that are culturally competent, effective, and address structural barriers. Develop more effective ways to provide resources to low and moderate income residents, businesses, and nonprofits, preferably in partnership with existing local programs (e.g., partner with Community Action Pioneer Valley home weatherization program and the City's housing rehabilitation program could bundle new renewable energy systems.

Carbon offsets are critical to our carbon neutrality goals

ENERGY 3. CARBON SEQUESTRATION OFFSETS

- Focus on ease of participation (reduce time and effort) and bundling of incentives.
- Identify subsidies for the cost of high-performance technologies in affordable housing and low-income households.
- Promote potential use of ground source heat pumps for large commercial and institutional installations, which are generally only cost-effective for large scale installations (e.g., the City uses ground source heat pumps for Senior Center heating and cooling, and Smith College is assessing ground source heat pumps for the campus's thermal load).
- Develop municipal programs to encourage landlords to improve energy efficiency and incorporate clean energy technologies into their housing units.
- Encourage rental listing agencies to highlight sustainable and resilient features of housing units in advertisements.
- Explore introducing a building energy assessment and/or supplying educational materials to building owners and developers at key decision points such as at the home point-of-sale or during building permitting.

  Identify potential residential technologies or measures that can enable renters to participate in energy efficiency, such as Wi-Fi-enabled "smart" thermostats.
- Survey local landlords to identify unanticipated barriers to landlord investments in high performance building improvements, such as a lack of access to long-term tenant's apartments, and pilot new outreach and assistance programs aimed at overcoming identified barriers.

Type: Program and Policy
Lead: Central Services-Energy
Time-frame: Long Term
Cost: $$$

ENERGY 3A

Adopt city open space management practices for soil carbon storage

Adjust or adopt new municipal landscaping, and parkland management practices to enhance the city's soil carbon storage. (The City has already eliminated its use of synthetic nitrogen fertilizers on city recreation areas.) Organic amendments, in particular, can amplify the carbon storage capacity of soils. Best Management Practices for post-development soil amendments recommend the application of 7.5cm of compost for landscape beds, and 4.5cm for turf grass, with compost containing 22% carbon and 2% nitrogen. One-time applications of such amendments have shown to increase average carbon sequestration by 0.22 metric tons per hectare per year.

Additional landscaping and parkland management strategies to enhance soil carbon storage could include: emphasizing native perennials in plantings and using annuals to fill gaps; minimizing the use of pavement and unproductive mulch; eliminating synthetic nitrogen fertilizers on public and private school athletic fields; incorporating nitrogen-fixing trees and perennials into the landscape; mowing, cutting back, and/or heavily mulching over weeds instead of pulling; and using biological and mechanical controls when possible, while limiting herbicides to areas where so far there are not effective alternatives for curbing the growth of invasive plants (e.g., Japanese Knotweed). These strategies for enhancing soil health also support stormwater infiltration.

Type: Program
Lead: School Dept, Central Services, city land managers.
Time-frame: Short-term for new management practices
Cost: $$

ENERGY 3B

Protect, grow, and enhance the city's forestland and public lands and their capacity to store carbon

Continue the City's efforts to conserve forestland in the City and in the City's drinking watersheds and aquifers outside the City, particularly large blocks of mature and contiguous forestland and urban tree cover. Continue open space acquisition, per the city's Open Space, Recreation, and Multi-Use Trail Plan and drinking watershed management strategies. Identify opportunities to replant cleared areas with diverse native species in the city's conservation and watershed areas. Add public and equitably distributed urban tree canopy to serve historically underrepresented populations and those more at risk to heat waves.

Tree cover, from shade trees and larger tracts:

- Adds shade, cooler summers, and reduced heat island effect, alleviating air conditioning loads
- Increases stormwater infiltration, conserves water supplies, and reduces erosion
- Sequesters carbon
- Improves air quality, reduces noise pollution, decreases wind speed, and reduces glare
- Makes Northampton more walkable, a more sustainable and resilient transportation practice
- Enhancees ecosystem and habitat creation

This work is needed in tandem with the City's existing anti-gentrification measures to ensure that, as green spaces are built up in low income communities, the City continue its emphasis on creating entry level lots and expanding affordable housing.

Consider adopting practices of public land management that prioritize carbon sequestration and storage such as long-term carbon sequestration and storage planning in forest stewardship plans, and education programs for the adoption of similar practices on private land. Further protecting and enhancing the diversity of tree species within the city's forests, will also increase forest stability, resilience, and long-term benefits for carbon storage.

Identify sites that should be kept out of permanently protected open space to reserve the ability to install solar photo-voltaic (as the City did at the two newest solar PV installation at the Ryan Road former Bill Willard, Inc and the Park Hill Road extension).

Explore recommendations of the Massachusetts Healthy Soils Action Plan (Massachusetts Energy and Environmental Affairs), including improving farming, forestry and lawn care practices to reduce erosion, improve production, increase carbon sequestration and storage, and better withstand intensive weather events and droughts. Strategies include the application of organic matter or bio-solids (e.g., sludge, compost, wood chip mulches, or biochar) on the forest floor and strategic organic matter to build soil organic matter, maximize forest biomass, prevent erosion, and increase carbon sequestration and storage capacity.

Calculate carbon credits, using accepted guidelines, for carbon sequestration, but retire the credits so they can be used to count for the City's carbon offsets.

Type: Program
Lead: Planning & Sustainability; Public Works
Time-frame: Ongoing
Cost: $

ENERGY 3C

Support education and training in regenerative agriculture, agroforestry, silvopasture, and urban forestry.

Identify opportunities to support education and training in regenerative agriculture, agroforestry (the integration of trees in agricultural), silvopasture (the integration of trees and livestock grazing), urban forestry, and biochar application for interested farmers. These approaches aim to minimize soil disturbance, enhance site biodiversity, maintain microbial communities to support soil health, and add to crop diversification. Trees planted along riverbanks (riparian buffers) and as windbreaks stabilize soils, prevent erosion, improve water quality, and retain carbon in the ground. Benefits can include increased landscape drought resilience.

All three practices—regenerative agriculture, agroforestry, and silvopasture— increase carbon sequestration potential of agricultural lands by 0.6 $MTCO_2e$, 1.3 $MTCO_2e$, and 4.8 $MTCO_2e$ per hectare per year, respectively. Likewise, biochar application to agricultural lands has shown to amplify crop productivity while simultaneously amplifying the long-term storage of carbon. Consider peer-to-peer learning models through collaboration with local and regional farming initiatives with the explicit goal of developing contextually-specific practices for enhancing carbon sequestration and storage. Use such collaborations as a platform for identifying adjustments to municipal policies or systems, such as aligning lease lengths with harvest rotations for longer-term perennial plantings, which can further facilitate adoption of regenerative agriculture practices.

Type: Program
Lead: Planning & Sustainability
Time-frame: Mid-term
Cost: $$ - $$$

ENERGY 3D

Establish Greenhouse Gas Emissions Offset Community Fund

Establish a voluntary local fund for those who want to offset their greenhouse gas emissions. Residents and businesses could track their emissions through a community-endorsed tool and pay into the fund depending on their footprint. This fund would build on the city's pilot gasoline carbon offset receipts, which currently add support to ValleyBike. It would provide funding for community mitigation/ sequestration projects.

Equity can be enhanced by working with and prioritizing investments to neighborhoods historically under-served and underrepresented populations.

Type: Program
Lead: Planning & Sustainability
Time-frame: Mid-term
Cost: $

WATER 1. STORMWATER MANAGEMENT

Stormwater and heat are our biggest climate adaption needs

WATER 1A

Establish new design storm intensities and rainfall distributions

Examine the new design storm intensities and rainfall distributions when the Massachusetts Stormwater Handbook is updated (circa 2021-2022) to address climate change. The new standards will likely be based on the upper confidence interval of the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 to represent current precipitation conditions, plus or minus some factor to address climate change. This approach will produce higher design storms than the current standard (SCS- Technical Paper-40 with RCS Type III regional rainfall distribution).

- The City may want to go beyond the state standards.
- For example a 20% increase in design rainfall intensity is consistent with climate change projections for extreme precipitation in a 50- to 100-year planning horizon, based on a 50-year design life for storm drainage infrastructure, and the 50-100 year useful life.
- Alternatively, rainfall distributions can based upon updated, site-specific rainfall data.

Figure 16. 24-hour duration design storm (at City Hall)

Return Period	NOAA Atlas 141	IF increased by 20%
1 year	2.46" (2.53" NRCC value)	3.04" (NRCC)
2 years	3.08"	3.70"
10 years	4.93"	5.92"
25 years	6.09"	7.31"
50 years	6.99"	8.39"
100 years	7.88"	9.46"
500 years	11.3"	13.56"

Type: Policy
Lead: Public Works, Planning for zoning and subdivision regs.
Time-frame: Short-term
Cost: $

WATER 1B

Raise requirements for closed drainage systems

Consider requiring new and replacement closed drainage systems (city and private) to be designed for 10-year storm events, 25-year storm events at critical facilities. DPW could waive the requirement in specific situations (e.g., when localized pipe upgrades may affect downstream undersized pipes). In addition, the impacts of overland flow during flood conditions should be studied in the design of closed drainage systems, as surface flow is a significant component of overall flow during flood events within the city.

Update the city's stormwater management standards for new development and redevelopment sites consistent with the Massachusetts Stormwater Handbook when it is revised (circa 2021-2022).

Consider implementing changes to the city's Stormwater Ordinances (Chapter 281) proposed by the Pioneer Valley Planning Commission (PVPC), including to strengthen stormwater regulations and meet the post-construction stormwater management provisions of the MS4 General Permit.

Type: Policy
Lead: Public Works for stormwater; Planning & Sustainability for zoning and subdivision regulations
Time-frame: Mid-term
Cost: $

WATER 1C

Produce green infrastructure plans and implementation projects

Build on the Northampton Designs with Nature concept of nature based solutions to identify a range of nature based green infrastructure solutions to improve stormwater retention, detention, and infiltration, expand urban shade tree canopies, and a wide range of co-benefits (e.g., reduced heat island effect, healthier wildlife habitat, enhanced carbon sequestration, and new recreational opportunities).

The kind of projects that are relevant include:

- The restoration of the Pine Grove Golf Course, now part of the Rocky Hill Greenway, to restore its natural hydrology (Phase I completed in 2020).
- Green infrastructure in the Elm Street Brook watershed (building on the work of a Smith College Picker Engineering evaluation)
- Flood control improvements at the Route 66 Ice Pond (currently under consideration by FEMA for funding)
- Various urban tree and other shade tree canopy planting plans.

Type: Capital Planning
Lead: Planning & Sustainability and Public Works
Time-frame: Short-term
Cost: $$$

WATER 1D

Increase stormwater system conveyance capacity and storage through blue-green-gray infrastructure

Upgrade aging storm drainage infrastructure with larger-capacity pipes as pipes are replaced to provide additional in-line conveyance capacity and storage. Simultaneously look for complementary opportunities to implement blue-green infrastructure to infiltrate stormwater, reduce runoff volumes and peak flows, and provide additional storage capacity within public rights-of-way and open space. Support the development of green infrastructure systems by defining appropriate native plant species to be used in all projects.

Apply *Northampton Designs with Nature* design principles to the design and implementation of green infrastructure projects, including identifying and prioritizing projects that can have the greatest impact on reducing stress on the stormwater infrastructure system, mitigating flood risk and damage, improving healthy ecosystems and water quality, reducing the heat island effect, and enhancing the community's accessibility to green space. Integrate environmental justice in identifying locations for green infrastructure installation or resilient infrastructure upgrades that will benefit neighborhoods with higher proportions of people with low incomes, people of color, or people living with disabilities. Include those communities in the design and evaluation.

Expand planned projects to have a larger focus on blue-green infrastructure, including an education component on the importance of these design features. If the city continues to consider daylighting portions of the downtown Historic Mill River, consider the potential to provide additional flood storage within the daylighted area to better protect other areas behind the levee from flooding. Given the significant capital cost of these upgrades, the city should take a system-wide approach to planning and implementation, including comprehensive storm drainage system modeling.

Type: Capital Improvement
Lead: Public Works and Planning & Sustainability
Time-frame: Ongoing
Cost: $$$

WATER 2. WATER SUPPLY

Water supply is a long term risk, but one that requires a very long planning period

WATER 2A

Research long term water supply needs in light of climate change

Establish a framework for researching and long term planning of city's public potable water systems, including water quality and quantity monitoring and modeling. Proactive City and regional long term planning may identify whether new or alternative water supplies are required beyond the city's existing three active reservoirs and two wells. DPW's Drought Management Plan (2021) will help advance this planning and mitigation.

Continue Public Works existing water supply watershed land preservation and management efforts for source protection. Continue to ensure that the amount of water withdrawn equals, on a medium term average, the amount of water entering the system through precipitation and water flow (i.e., no "mining" of groundwater).

Work with the Pioneer Valley Planning Commission to advance data collection, and strategy development related to the impacts of climate change on water quality to a regional scale.

Type: Program
Lead: Public Works
Time-frame: Mid-term to long-term
Cost: $$$

WASTE 1. WASTE REDUCTION

Solid waste is 1% of our GHG emissions. Our supply chain (scope 3) dwarfs our scope 1 and 2 GHG emissions.

WASTE 1A

Increase community waste diversion by creating and implementing a zero-waste strategy

Adopt a zero-waste framework to reduce the generation of waste and maximize material reuse. Depending on resources and consensus, actions might include, for example:

- Build on DPW's waste reduction efforts to raise awareness and foster a culture of repair and reuse by supporting community initiatives (e.g., repair cafes, the ReCenter Swap Shop, durable material exchanges, textile swap events and recycling, and other similar initiatives).
- Build on the City's existing buy recycled content to lead by example and ensure municipal entities use sustainable product purchasing practices (e.g., minimum recycled content criteria; preference for locally grown and manufactured materials, including food and compost; incentives for purchasing up-cycled and used goods and furniture).
- Educate the community and business owners about wasted food prevention strategies, encouraging food rescue, and the practice and benefits of co-composting leaf and yard waste with food scraps. Encourage all public events (e.g. fairs, festivals, concerts) to provide receptacles for source separation of trash, recyclables, and organics.
- Consider mandating commercial and residential participation in composting and require private haulers to provide organics collection and generators will have the option to utilize the curbside service or to arrange their own composting.
- Explore options for establishing a local commercial compost facility to reduce organics transportation impacts, and to keep the benefits of compost in the community.
- Eliminating petroleum-based, single-use products through phasing

out single-use plastics. The city will work toward strict use of reusable service-ware for eat-in dining, and toward requiring biodegradable, compostable or recyclable packaging and service-ware for takeout. Food service entities will be encouraged to provide accessories, such as flatware, straws, and condiments only upon request, and the city shall support third-party efforts to launch or provide a reusable takeout container service for food businesses.

- Reducing construction and demolition waste by ensuring that strong recycling and reuse requirements are met for all building-related permits. Exploring policies or incentives that would mandate or encourage property owners and contractors to choose deconstruction instead of demolition (e.g., requiring deconstruction for projects over a designated square footage, setting recycling and reuse thresholds, accelerating permitting for deconstruction projects, providing subsidies for the difference in cost between demolition and deconstruction). The city shall work

Type: Policy
Lead: DPW recycling coordinator, City Council for regulations
Time-frame: Medium term
Cost: $$

WASTE 1B

Establish comprehensive food waste prevention, donation, and composing programs in schools and large institutions

A comprehensive wasted food management program in public schools will reduce the solid waste stream, address local food insecurity, value the cafeteria as a classroom, and leverage the power of school children to serve as ambassadors of best practices. A campaign could include, for example:

- Training cafeteria staff
- Using share tables and establishing partnerships with food rescue organizations.
- Maximize use of durable trays and service-ware, basic source-separation equipment (e.g., additional receptacles), and organics hauling services.
- Encouraging on-site composting and gardening programs in schools for demonstration and educational purposes.
- Developing educational programming and signage templates.

Type: Policy
Lead: School Department with ommunity support
Time-frame: Medium term
Cost: $

TRANSPORTATION/LAND USE 1.
LOW CARBON & EQUITABLE TRANSPORTATION

Transportation is 26% of our GHG emissions. Land use is a portion of the 70% of building GHG emissions.

TRANSPORTATION/LAND USE 1A

Advance equitable transportation access

Ensure that transportation opportunities are available, safe, and desirable for all. This includes sidewalks, bike lanes, crosswalks, street trees, bike share (micro-mobility) and other investments.

- Transportation options with the lowest carbon footprint and the highest equity should have the lowest cost to end users.
- Expand equitable access transportation to address gaps for people with low incomes, communities of color, and individuals with disabilities. Access can refer to physical proximity of stations/stops/bike racks, frequency and location of network routes, level of safety, languages offered in announcements or posted information, affordability, and other barriers to use.
- Consider the balance between transit-dependent services for users who do not have other options and choice-ridership which generate the highest ridership and benefits all users. Create strategies to reduce cultural barriers to users of all income levels in public transportation.
- Promote access to short-term car rental and car sharing, especially electric vehicle fleets.
- Encourage shared parking initiatives, parking cash-outs and decoupling parking costs from the cost of housing.

Type: Policy
Lead: Planning & Sustainability and Public Works
Time-frame: Long term
Cost: $$$

TRANSPORTATION/LAND USE 1B

Expand bicycling options, including the ValleyBike share program

Promote bicycling as a safe, efficient, inexpensive low-carbon travel option. Expand our multi-use path network and its connections to the roads and sidewalks. Ensure that the trail is available for year-round use. Advance bicycle education at safety village and schools.

Celebrate our shared use path network through a marketing campaign focused on green tourism, in collaboration with local business associations.

Expand ValleyBike, the regional electric-assist bike share program in collaboration with Amherst, Chicopee, Holyoke, South Hadley, Springfield, West Springfield, UMass, and the Pioneer Valley Planning Commission. Northampton currently coordinates the program in the eight communities, but is exploring structures to move management to a regional level. Expand the winter use of the program during fair winter weather.

Continue to add new locations in urban and denser residential areas throughout the region. Continue ValleyBike outreach and the equitable access membership program.

Type: Capital Improvement & Program
Lead: Planning & Sustainability and Friends of Northampton Trails for bicycle education
Time-frame: Mid-term
Cost: $$

TRANSPORTATION/LAND USE 1C

Foster transition to electric vehicles (EV)

Encourage residents and commuters to switch from fossil fuel powered vehicles to electric vehicles (EVs). EVs are more efficient than traditional cars and will become even cleaner as Northampton's electricity is greened. Equity is a key consideration in as EVs currently require higher up-front costs for consumers. To make a city-wide transition to EVs, the city would:

- Help message efforts to increase awareness of EV, on line and at in-person events, to increase awareness of the benefits.
- Incentivize EV charging infrastructure for major new construction projects.
- Adopt an EV purchasing policy for the city fleet that requires the city to purchase or lease EVs, building on the current fuel-efficient vehicle procurement policy.
- Work to install more public charging stations in all city parking lots and encourage public or private stations in commercial areas and dense residential and mixed use neighborhoods. Charge for electricity at public charging stations to create market incentive for private charging stations.
- Explore state, federal or other subsidies to support up-front cost for shared use electric vehicles for low-income residents.
- Explore electric bus fleet to replace current public transportation buses and school buses as electric buses become affordable and/or as department's carbon budgets require offsets.
- Track the market for when the technology eventually allows heavy vehicles (DPW and fire equipment) alternatives.
- Address the equipment and training needs to maintain a City EV fleet.

Type: Policy & Program
Lead: Central Services- Energy
Time-frame: Mid-term
Cost: $$ to $$$

TRANSPORTATION/LAND USE 2. EFFICIENT LAND USE

TRANSPORTATION/LAND USE 2A

Encourage dense, mixed-use, and transit-oriented development. The lowest carbon form of transportation is to avoid trips.

Incentivize development and redevelopment that cluster multi-modal transit, mixed-use amenities, and a variety of housing types to ensure healthy, vibrant neighborhoods:

- Focus community planning and regulations on people over vehicles (e.g., allow new development to contribute to active transportation infrastructure rather than parking).
- Work with regional partners to advocate for improvements in the regional public transit system.
- Increase the percentage of the population living within walking distance of downtown, Florence Center, Bay State, Leeds, Village Hill, and King Street.
- Encourage housing diversity, smaller residential units that are efficient with resources, expanded units on developed lots, and new housing development that with affordable units.
- Install community amenities (e.g., bike lanes, sidewalks, and public space) in areas that will optimize walking.
- Consider an urban growth boundary (Farms Forests and Recreation zoning) that limits development outside of areas that are appropriate for development.
- Provide park, recreation, streetscape, and other amenities to make waking desirable.

Type: Policy
Lead: Planning & Sustainability
Time-frame: Mid-term
Cost: $$

TRANSPORTATION/LAND USE 2B

Protect land critical for the long-term migration of wildlife and plants due to climate change

These areas that are critical for healthy ecosystems to thrive even with climate change include areas denoted in the Nature Conservancy's map of Resilient and Connected Landscapes that are in the "Resilient with Confirmed Diversity, Climate Flow Zones, or Climate Corridor mapped areas."

Continue existing strategies in these sensitive areas:

- Discourage or prohibit land use development and solar photo-voltaic development in forested areas.
- Prioritize open space preservation efforts.
- Prohibit or severely limit future development within any mapped areas that are defined by the city, state or federal government as areas of resilient and connected landscapes with confirmed diversity or determined to be important climate corridors for climate resiliency.

Type: Policy
Lead: Planning & Sustainability
Time-frame: Mid-term
Cost: $$

EQUITY. INCLUSIVE, PROSPEROUS AND ENGAGED COMMUNITIES

EQUITY 1A

Support Climate Champions and Strong and Healthy Neighborhoods Programs

Support Climate Champions and strong and healthy neighborhood program to raise awareness and understanding about climate risk, adaptation, mitigation strategies, and build social resilience. Train local leaders and residents on climate change risks, adaptation and mitigation strategies, communications strategies, and identifying their own personal and professional circles to engage. Seek residents who can collectively engage a broad range of Northampton community members. Reach out to youth groups and student associations to help prepare youth for future careers in climate risk response and to empower a younger generation.

Support efforts by civic and neighborhood groups and others to connect with residents, businesses, and others to assess and strengthen social resilience and social connectivity, and to strengthen the community health and resilience (e.g., check on neighbors in climate hazards; hosting neighborhood barbecues to encourage a sense of community; holding community service events; launching a community preparedness campaign; creating an art show to highlight stories about climate change). Ensure conversations are held in culturally sensitive ways.

Type: Program
Lead: Senior Services (Aging Friendly Community); Health; Central Services-Energy; Youth Commission
Time-frame: Medium term and ongoing
Cost: $

EQUITY 1B

Partner with community organizations for inclusive planning

Equity cross cuts every recommendation in this plan. Visibility for this effort includes partnering with community partner organizations (e.g., those supporting this plan, community and resilience hub partners, and other community organizations that serve diverse communities in Northampton).

Conduct outreach sessions by attending community meetings or functions hosted by the partner organizations to reach community groups at familiar and accessible venues. Build the capacity of the partners to share information about climate risk and adaptation strategies with community members, and to relay the concerns, experiences, and insight of community members to city staff. Use this outreach process to ensure that communities that may disproportionately experience the impacts from climate change directly shape the strategies intended to enhance the city's resilience.

The Massachusetts Department of Health grant to the Collaborative for Education Services to foster inclusion and empowerment can advance this work.

Type: Program
Lead: Central Services-Energy; Planning & Sustainability
Time-frame: Ongoing
Cost: $

HEALTH & SAFETY
1. LAND USE

EQUITY 1C

Support workforce development in resilience and regeneration solutions

Support job training to support the economy and simultaneously help reach its resilience and regeneration goals. In partnership with new and existing community partners (e.g., Smith Vocational and Agricultural High School, Valley Community Development Corporation, Center for EcoTechnology) expand resilience and regeneration skills development programs in tandem with demonstration projects or other municipal efforts. This could include:

- Job training/career development in nature-based resilience and regeneration solutions (e.g., green infrastructure installation and maintenance; permaculture, regenerative, and resilient agricultural practices; and climate-resilient street tree care). Perennial plantings in the floodplain, for example, could be coordinated by the Smith Vocational and Agricultural High School horticulture program, simultaneously fostering career development, generating a new harvest crop for farmers, reducing erosion, and creating pathways to increase local food production and food security.
- Job training/career development in clean energy or energy efficiency technologies. Such a program could include, for example, training HVAC and building technicians on energy efficient building systems, distributed energy systems, and passive house standards, in conjunction with the roll out of municipal campaigns to encourage residents to pursue building retrofits.

Type: Program
Lead: Mayor's Economic Development Coordinator
Time-frame: Long-term
Cost: $$ - $$$

HEALTH & SAFETY 1A

Mitigate heat by expanding cooling opportunities at open space and streetscapes

Increase free recreation opportunities that can be used to cool off during high heat days or heat waves. This may include increasing public access to swimming areas, splash pads, or pocket parks with quality shade and vegetation. Ensure some affordable or free access to water.

Prioritize the installation of street trees, tree planting, and pocket parks in under-served neighborhoods (environmental justice areas), high traffic corridors, retail districts, parking lots, walking and biking corridors, bus stops and at community centers such as schools and health facilities.

Expanding the urban shade tree canopy reduces the heat island effect and provides shade to Northampton communities.

Type: Capital Improvement
Lead: Parks and Recreation; Public Works
Time-frame: Mid-term
Cost: $$

HEALTH & SAFETY 1B

Amend zoning and subdivision regulations for stringent flood and fluvial erosion control

Consider zoning and subdivision amendments to:

1. Amend Zoning to incorporate increase free-board requirements for new construction or substantial improvement within the flood zone, to the extent it can be done consistently with the state building code, with a minimum 1-foot free-board for residential, commercial, industrial and public buildings and a 2-foot free-board requirement is recommended for critical facilities. Continue to ban new residential housing (except replacement of existing units) in the 500-year (0.02% annual chance) flood zone.
2. Require new critical facilities be outside the 500-year floodplain with continuous non-inundated access during a 500-year flood.
3. Prohibit enlarging or extending a nonconforming use when located in a special flood hazard area and ensure property owners to redevelop and/or reconstruct nonconforming structures using more flood-resilient techniques.
4. Ensure street and parking lot design standards reduce impervious surfaces and remove barriers to the use of Low Impact Development (LID), consistent with the City's MS4 permit.
5. Update open space residential development (cluster) standards to focus on conservation development and change the review from special permit to site plan approval.
6. Adopt fluvial erosion hazard zoning along rivers and streams to limit or prohibit development in fluvial erosion hazard areas.

Type: Policy
Lead: Planning & Sustainability
Time-frame: Mid-term
Cost: $$

HEALTH & SAFETY 1C

Continue land acquisition for flood management

The city has been acquiring land in the floodplain in order to reserve land with high flood risk, as well as land near the floodplain to serve as stormwater storage before the water reaches the floodplain. Continue land acquisition for ongoing flood management in accordance with the city's open space priorities. Consider home buyouts in locations with high vulnerability to flooding.

Type: Program
Lead: Planning & Sustainability
Time-frame: Ongoing
Cost: $ - $$

HEALTH & SAFETY 1D

Assess tree, forest ecosystem, agriculture, and food systems for resilience

Seek opportunities to build on Public Works assessment of the City's water supply watershed forests and the Urban Forestry Commission/ Tree Warden street tree inventories to conduct citywide assessments of trees, forest ecosystems agriculture, and food systems resilience when remote sensing technology supports such assessment at low cost.

- Develop selective harvesting, adaptive species planting, invasive species removal, and improvements to soil health to address vulnerabilities.
- Emphasize strategies that will simultaneously support carbon accumulation in forest biomass and soils, such as organic amendments and enhancing species diversity in tree stands.
- Partner in a Northampton or regional food systems and farming resilience plan (e.g., with Communities Involved in Sustainable Agriculture, Grow Food Northampton, Pioneer Valley Food Security Plan, Healthy Hampshire, Food Security Council, Agriculture Commission, and Pioneer Valley Planning Commission).
- Identify the climate vulnerabilities that Northampton farms and forests will face from increased heat, flooding, and extreme weather.
- Identify strategies to enhance the resilience of local small-scale food production and distribution.
- Identify regional food security solutions.

Type: Assessment/Plan
Lead: Public Works (for watershed land), Planning & Sustainability (for agriculture, greenways and remote sensing), Urban Forestry Commission (for tree assessments)
Time-frame: Medium-term
Cost: $$

HEALTH & SAFETY 1E

Prepare for vector and water-borne diseases

Build on the City's health assessment of climate change (Human Impact Partners, contracted by Planning & Sustainability) and vector-borne disease monitoring led by the Northampton Health Department and Massachusetts Department of Health to identify future climate change related vector and water-borne disease risks.

Strategies might include:

- More aggressive removal of tires and other debris that hosts mosquitoes
- Mosquito larvicide treatments
- Municipal land management practices
- Hunting regulations
- Permaculture practices
- Potentially enhanced water quality monitoring, (fecal coliform and/ or benthic organisms) at Musante Beach, the Mill River, and the Connecticut River Greenway

Type: Assessment & Program
Lead: Health; Planning & Sustainability
Time-frame: Medium-term and ongoing
Cost: $$

HEALTH & SAFETY 2.
HAZARD MITIGATION

HEALTH & SAFETY 2A

Assess and upgrade the city's flood control infrastructure and earn FEMA accreditation of the flood control levees

Maintain existing inspections and oversight programs for repair, maintenance, and upgrades of flood control infrastructure, and strengthen drills and inspections as needed.

FEMA has commenced a process to modernize the Flood Insurance Rate Maps (FIRMs), which is the first update since 1978, which might potentially result in an increase in the elevation and area of the mapped floodplain. The City is assessing its flood control levees, potentially making needed improvements, to earn FEMA accreditation.

In 2019, the City completed an evaluation the flood control pump station needs and selected upgrades are underway.

Type: Capital Improvement
Lead: Public Works
Time-frame: Ongoing
Cost: $$ - $$$

HEALTH & SAFETY 2B

Enhance accessibility to hazard and climate change risk information

Implement a multi-pronged hazard and resilience-based communication

- Dispatch emergency alerts, evacuation routes, warning systems, emergency responses.
- Energy and Sustainability Commission public education and outreach on a variety of climate change topics.
- Develop a messaging strategy that uses the city's web page and social media in a more coordinated and engaging way, and that enhances accessibility for the public to climate risk
- Support communities who may not be regularly connected to city activities.
- Promote the purchase of flood insurance through the National Flood Insurance Program (NFIP), even for those located outside of the regulatory floodplain.
- Continue existing involvement in the FEMA Community Rating System (CRS) program which provides discounts for flood insurance and makes it slightly more affordable.

Type: Program
Lead: Planning & Sustainability; Dispatch; Energy and Sustainability; Central Services-Energy
Time-frame: Short-term for strategy development; Ongoing for its implementation
Cost: $

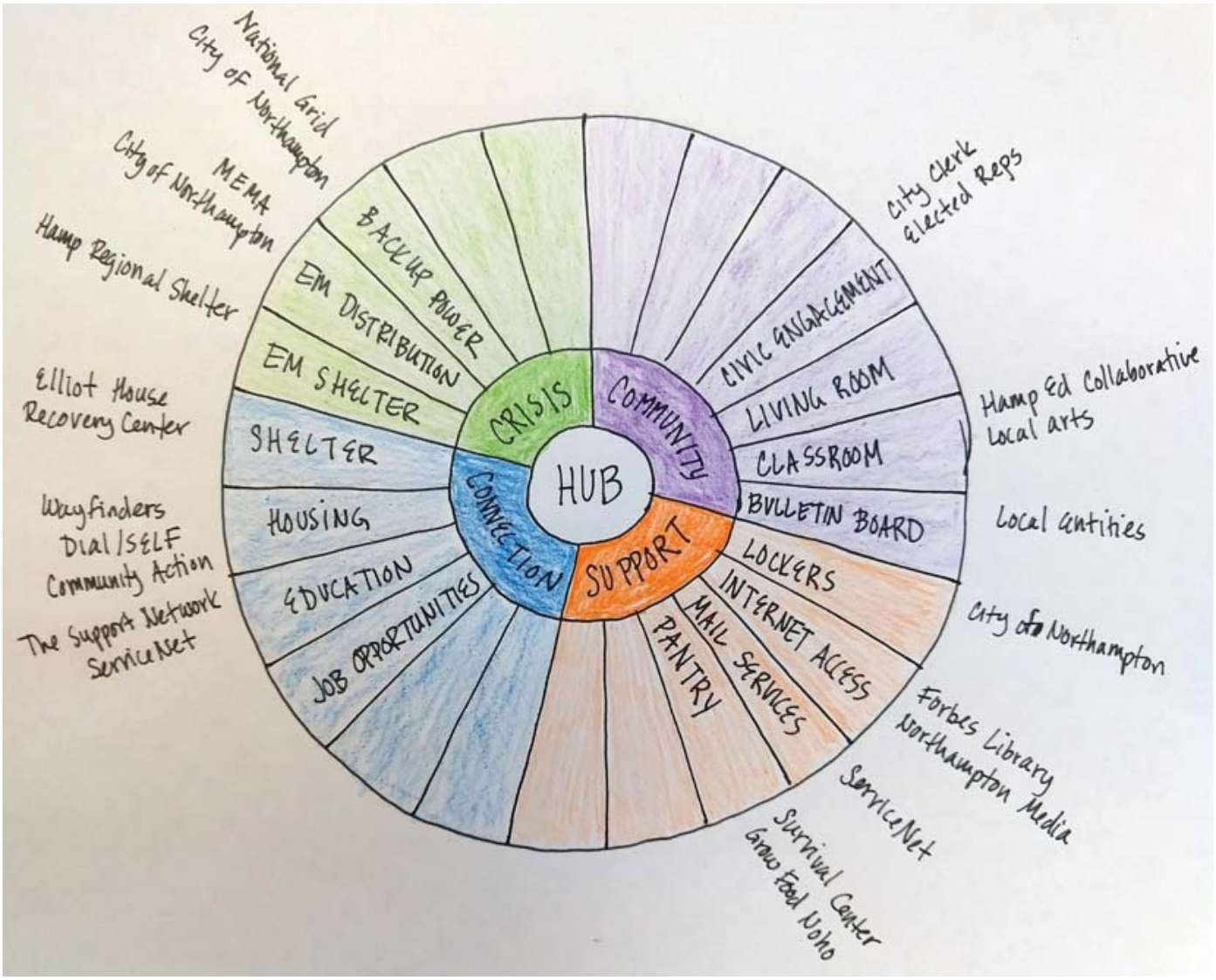
Develop a Northampton Community Resilience Hub

Develop a Community Resilience Hub, a downtown physical facility with a coordinated program for frontline communities and all residents who face chronic and acute stress due to disasters, pandemics, climate change, and other social and economic challenges. It will serve the 1% (people experiencing homelessness and those under severe chronic stress), the 15% (below the poverty line), the 40% (housing-burdened and under chronic stress) and the 100% (those at risk of acute stress, e.g., major storm), by providing access to resource, strong networks, and building social resilience.

Coordinate the Hub and its offerings with the needs and opportunities of shelters and schools to safely house people during extended periods of extreme heat, extreme weather, flooding events, and pandemics to create a coordinated response to such event, in conjunction with the Hampshire County Emergency Sheltering Plan.

The Community Resilience Hub should be the dependable place for people to go for resources in emergencies, with continuous power, heating and cooling supported by power storage and energy islanding, information, phone charging, mental and physical health care, food and water, and/or other services.

Type: Capital Improvement
Lead: Planning & Sustainability; Mayor; Community Action Pioneer Valley; Central Services (if retained as a City Building)
Time-frame: Mid-term
Cost: $$$



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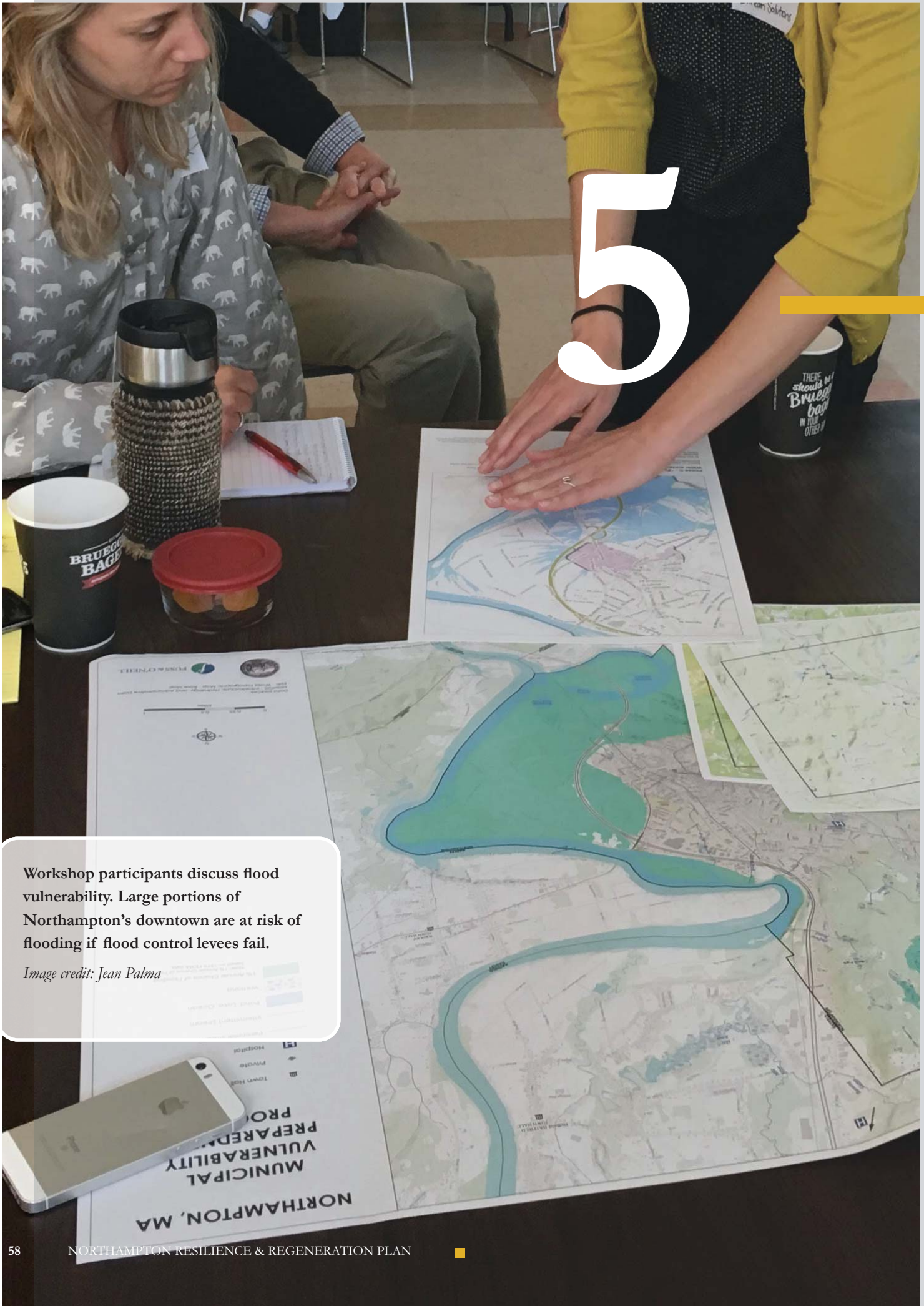


Workshop participants discuss flood vulnerability. Large portions of Northampton's downtown are at risk of flooding if flood control levees fail.

Image credit: Jean Palma

SECTION FIVE

A Plan Crafted By Northampton

Northampton's Climate Resilience and Regeneration planning process extended from Spring 2018 to early 2021, with a pause during COVID. City staff, the project team, residents, businesses, and organizations worked together to:

- Assess vulnerabilities and strengths to climate change hazards;
- Update the inventory of the city's greenhouse gas emissions;
- Generate a framework for resilience and regeneration actions;
- Develop a strategies to move Northampton forward in reaching our resilience and regeneration goals.

Goals for Inclusive Planning

We aim to create a resilient, regenerative, and carbon neutral community through collaboration and collective action. Climate change will affect some members of our community disproportionately, and taking action will be easier for some people more than others. A robust and implementable plan required a planning process that's inclusive of everyone in the community—especially those that have been traditionally underrepresented in city planning processes.

The city's goal was to connect with diverse community members and stakeholders throughout the development of this plan, including voices that have traditionally been under-represented in community conversations (e.g., low income individuals, people experiencing homelessness, youth, seniors, businesses, and Hispanic/Latinx communities). To connect with these groups, the project team collaborated with partner organizations and community leaders that work within these communities—such as Northampton Neighbors, Northampton Survival Center, ServiceNet, among many others. Twenty-two such organizations and community leaders participated process.

Workshops, Trainings, In-Person Activities, and On-Line Surveys

A. Stakeholder workshops (2018)

The city convened a group of stakeholders—city staff across many departments, representatives from partner organizations, and community members who play key roles in mitigation and adaptation efforts in the city—to participate in a series of stakeholder workshops.

The first set of workshops focused on identifying infrastructural, social, and environmental vulnerabilities to climate change hazards, strengths within the city that can help Northampton adapt, and actions the city can take to increase its resilience. The second workshop focused on generating ideas for the plan around how to reduce community greenhouse gas emissions. The third workshop on the Climate Resilience and Regeneration Framework and a list of potential actions for the plan. The stakeholder group analyzed the actions and identified ways to refine them and improve their impact using the Framework.

B. Public workshops (2018)

Over 170 community members over the course of three public workshops joined the city and project team to discuss ideas for the Climate Resilience and Regeneration Plan. The first workshop included community-led conversations around the following questions: 1) What effects of climate change make you most concerned? 2) What makes Northampton communities strong and what could make them stronger? And 3) What guiding principles do we want to follow when developing strategies for climate resilience and regeneration? These guiding principles helped to create Northampton's Resilience and Regeneration Framework.

Thanks for your time, contributions, and feedback! Over 650 people engaged in the Climate Resilience and Regeneration planning!

The second public workshop included round robin table discussions on ways the city and community members could work together to reduce greenhouse gas emissions across various sectors. The third workshop included round robin table discussions about how a set of draft actions could be improved to achieve greater "co-benefits"—that is, to meet community goals such as equity, economic and cultural vitality, and regional collaboration.

C. Partner organizations training (2018)

The project consultants hosted a training for the plan's Partner Organizations. Participants discussed the chronic and daily stresses felt by many Northampton community members, and how these stresses may be exacerbated by climate change. Participants developed work plans for engaging their constituents in conversations around climate change, adaptation, and preparedness, and were provided with a survey and other materials to support those conversations.

D. Other in-person activities (2018-2019)

Residents also provided their input through:

- Interviews with individuals experiencing homelessness to understand their experiences and thoughts;
- A presentation to the Greater Northampton Chamber of Commerce to engage the business community;
- A preparedness workshop at the Literacy Project, an organization that provides classes for adults completing their high school education and preparing for the workforce;
- A pop-up table at the Northampton Survival Center, an organization that provides food to low-income individuals;
- A focus group with the Northampton Youth Commission and another with the Northampton High School Environmental Club to gather youth input and perspectives.

E. Online platforms (2018-2019)

The project team distributed two surveys through the city's electronic mailing lists, social media, and through Partner Organizations to gather additional input. The first survey asked residents about the climate change related hazards they had already experienced and their understandings of resilience and sustainability. The team also launched an on-line interactive survey. This tool allowed participants to select areas they were most interested in (e.g., climate and energy or health and safety), answer a series of questions about their thoughts and behaviors related to these areas, and prioritize potential actions to include in the Climate Resilience and Regeneration Plan.

F. Energy and Sustainability Commission (2020)

The Commission, with deeply engaged climate change activists, critiqued the plan, read multiple revisions, and eventually endorsed the penultimate draft going to the Planning Board for a formal public hearing and, with whatever amendments the Planning Board makes, ultimate adoption.

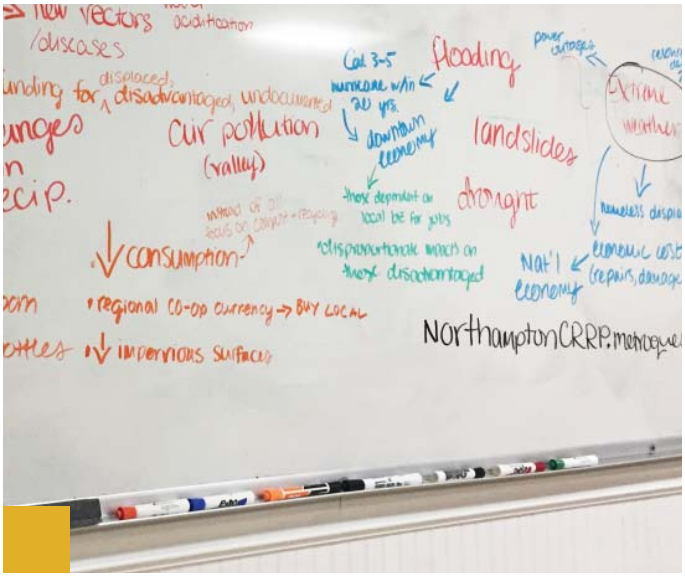
Moving Forward

Through all of these in-person and on-line opportunities, roughly 650 community members provided ideas and input for the development of this Climate Resilience and Regeneration Plan. In addition, numerous public and stakeholder comments and numerous committee conversations informed the plan.

The strategies in this plan outline ways to continue the conversation and avenues for community action and collaboration. The city continues to seek ways to include more diverse voices in shaping Northampton's future, and looks forward to working together in implementing this plan for a more resilient and regenerative Northampton.

After the initial public process, the forum moved to the Energy and Sustainability Commission (for plan endorsement), the Planning Board and a public board public hearing (for plan adoption), and to City Council (for plan endorsement). Each step included public input.

The graphs (below) show the demographic information from our surveys (89% of survey respondents reported their age, race/ethnicity, and housing status).



A Stakeholder workshop discussing climate vulnerability

B Public workshop discussing ways to reduce greenhouse gas emissions

C Preparedness workshop at the Literacy Project

D Public workshop discussing how strategies can achieve wide community benefits

E Focus group with the Northampton Youth Commission

Race / Ethnicity

- White / Caucasian = 92.5%
- Multiple / Other = 4%
- Hispanic / Latinx = 2%
- Asian / Pacific Islander = 1%
- American Indian / Alaska Native = 0.5%

Survey respondents by race and/or ethnicity. Minority representation was strong, given the community demographics, but not as strong as the city would like. Increasing minority representation remains a strong city goal.

Stories from our community

Jason has been in Northampton since 2013. At the time of our interview, he was living in a tent. To prepare for extreme events he makes sure to tie everything down. During cold weather, he wears as much warm clothing as possible. Since he does not have family to stay with, he relies on shelters that are often full, especially the "dry" shelter that he prefers. He notes the need for more shelters and outreach.

Liz had been in Northampton for 37 years at the time of our interview. She has three sons and a daughter and is very artistic, preferring to spend her time singing and drawing. In terms of climate change, she has seen the weather change over the years, including an increase in the intensity of rain events. She mentioned how much she enjoyed an arts festival that occurred recently where the city blocked part of downtown to traffic. She said without cars the air was cleaner and safety was improved. She sees real value in pedestrian-only zones.

Total survey participants

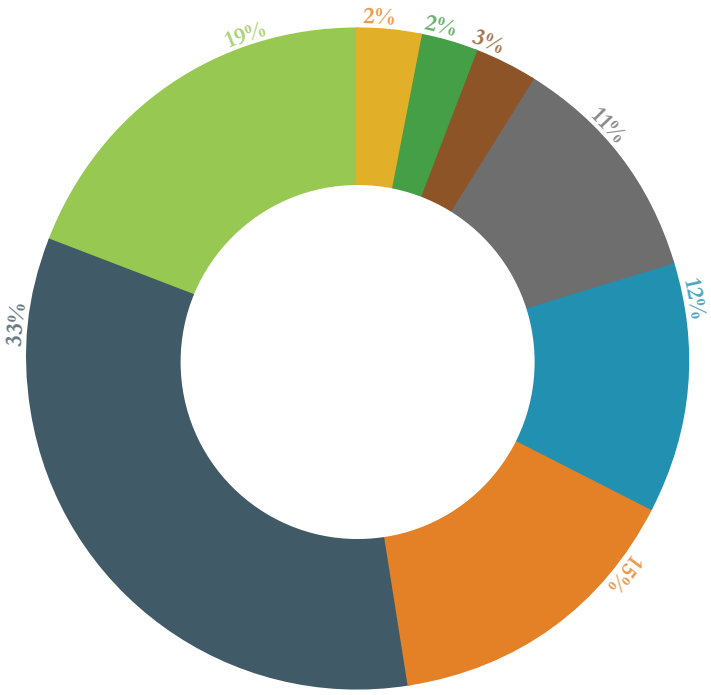
160 participants in survey 1

116 participants in survey 2

The surveys reached people from a range of demographics, The majority of respondents, however, were white, over the age of 65, and own a home. Many of the in-person activities were designed to expand the city's reach to different demographics. Increasing minority representation in city planning processes remains a strong city goal.

Age

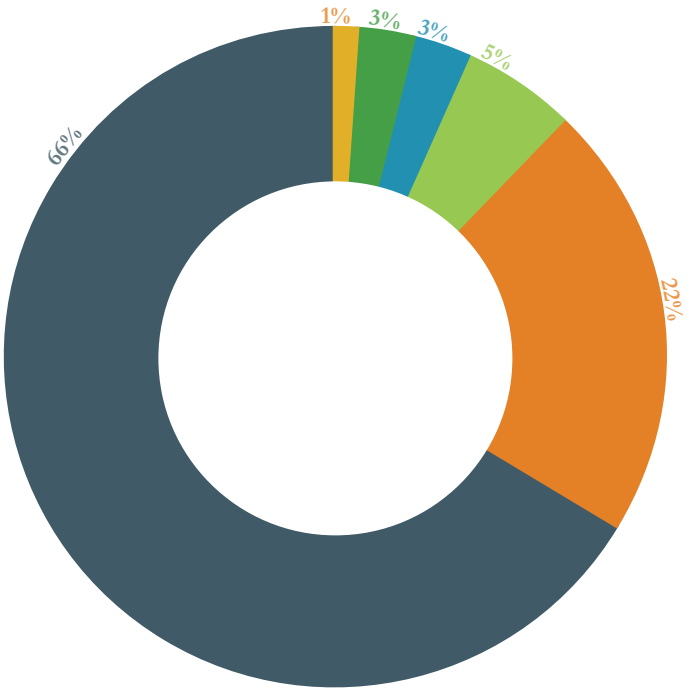
- Under 18 = 3%
- 18 to 24 = 3%
- 25 to 34 = 3%
- 35 to 44 = 11%
- 45 to 54 = 12%
- 55 to 64 = 15%
- 65 to 74 = 33%
- Over 75 = 19%



Survey respondents by age. While all age groups were represented, the majority of respondents were over age 65.

Housing Status

- Homeowner = 66%
- Renter = 22%
- Other = 5%
- Live with family/friends = 3%
- Live in institutional facility = 3%
- Currently without permanent housing = 1%



Survey respondents by housing status. While a variety of housing statuses were represented, the majority of respondents were homeowners.

Northampton City Hall (above)
Main and Pleasant Streets (below)
1936 flood.
Image: Forbes Library

LINKS

all of the documents or links to the documents below are available at www.ResilienceRegeneration.com

A. Mayor's Executive Order for Carbon Neutrality by 2050

B. Mayor's Executive Order: Greenhouse Gas Impacts of HVAC Improvement Projects

C. City Council Resolution Opposing the Expansion of Gas Infrastructure and Calling for Increased Development and Implementation of Renewable and Clean Energy Sources (Resolution R-18.170)

D. City Council Resolution in Support of 100 Percent Renewable Energy (Resolution R-18.003)

E. City Council Resolution Calling on the Massachusetts Legislature to Establish Carbon Pollution Pricing to Curb Climate Change

F. City Council Resolution Opposing Provisions of H.3854 that "would not raise the net metering cap sufficiently to allow Northampton's solar plans to proceed" and "would decrease the net metering compensation to the wholesale rate and would allow the utilities to impose a mandatory minimum monthly charge..."

G. City Council Resolution for Transparency and Public Representation Regarding Natural Gas Infrastructure (Resolution 15.451)

H. Full Climate Resilience and Regeneration Framework

I. Full Greenhouse Gas Inventory

J. Full Carbon Neutral Pathway Analysis

K. Full Infrastructure Resilience Memo

L. Full Carbon Sequestration Memo

M. Northampton's Community Resilience Building Summary Report (2018 updated 2020)

N. The Nature Conservancy's Resilient and Connected Landscapes Map

SUSTAINABLE NORTHAMPTON

Comprehensive Plan, January 2008