



**RESILIENT**  
TOGETHER

**2021**

# RESILIENT TOGETHER

CLIMATE ACTION & RESILIENCE PLAN

*Our Bridge to a Stronger Tomorrow*



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Prepared for the Cities of Beverly and Salem with a grant from the Massachusetts Executive Office of Energy and Environmental Affairs Municipal Vulnerability Preparedness (MVP) Program.

### **CONSULTANT TEAM**

Kim Lundgren Associates, Inc. / Nitsch Engineering, Inc. / Utile





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# LETTER FROM MAYOR CAHILL & MAYOR DRISCOLL

Dear fellow community members,

In spring 2020, the Cities of Beverly and Salem embarked on an ambitious effort to develop a joint climate action plan. *Resilient Together* launched just as the COVID-19 pandemic hit, which has broadened our understanding of resilience and emphasized the importance of working together to face the challenges ahead. As our two Cities act to cut greenhouse gas emissions to achieve carbon neutrality before 2050 and prepare for the unavoidable impacts of climate change, we know that collaboration is our greatest strength.

Through *Resilient Together*, our communities have demonstrated tremendous creativity and commitment to our shared future. Thousands of residents have weighed in via public surveys and virtual engagement platforms on the changes they hope to see. Neighborhood leaders have facilitated conversations about affordable, green housing and clean energy workforce development to ensure that climate action in our cities has equitable outcomes. Local students have organized classmates to envision a healthier environment that promotes physical and emotional well-being.

These and countless other conversations are the foundation for our roadmap: *Resilient Together*. This plan builds on ongoing efforts in both cities

to enhance resource efficiency, switch to cleaner energy, protect our shared natural resources and ecosystems, and rectify the systemic injustices that produce vulnerabilities in the face of intersecting crises, including the climate crisis. Through the goals, actions, and targets that follow, we have developed a shared vision for our resilient future, and explored the technical details needed to get there.

We are proud to share the results of our work, and we look forward to our continued work to implement this plan. With your help, we can ensure that our communities remain thriving, healthy, just, and resilient—together.

Sincerely,



A handwritten signature in black ink that reads "Michael Cahill".

**Michael Cahill**  
Mayor of Beverly



A handwritten signature in black ink that reads "Kimberley Driscoll".

**Kimberley Driscoll**  
Mayor of Salem

Resilient Together would not be possible without the significant contribution of time, effort, and input of many community stakeholders. A very big **thank you** to all residents of Beverly and Salem, as well as the local and regional organizations that actively participated in the year-long process to develop this plan.

## ACKNOWLEDGMENTS

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Michael Cahill, Mayor  
Stephanie Bilotti, Chief of Staff  
Erina Keefe, Sustainability Director  
Eric Barber, City Engineer  
Darlene Wynne, Director of Planning & Community Development  
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### CITY OF SALEM

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Lori Timmerman, National Grid





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- Emily Ullman, Salem School District
- Lorinda Visnick, Beverly School Committee
- Lisa Willwerth, Beverly Solid Waste Reduction Committee
- John Wathne, Salem Bicycle Advisory Committee

### EQUITY PARTNERS

- Beverly Main Streets
- Harborlight Community Partners
- Beverly Bootstraps
- Welcoming Immigrants Network (WIN)

### AMBASSADORS

- Tobey Archibald
- Lizabeth Davis
- Marissa Gabriel
- Fred Hopps
- Carly Mandell
- Meddy Smith
- Joey Wolongevicz

### FOCUS GROUP HOSTS

- Rinus Oosthoek, Salem Chamber of Commerce
- Leslie Gould, Greater Beverly Chamber of Commerce
- Rev. Julie Flowers, Beverly Multifaith Coalition/  
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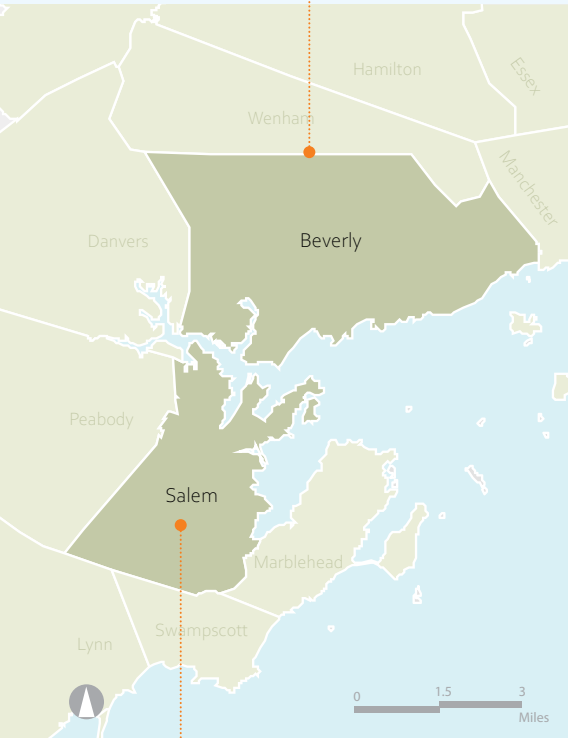
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## BEVERLY

POPULATION  
**41,885**

AREA  
**22.6 SQ. MILES**



## SALEM

POPULATION  
**43,252**

AREA  
**18.3 SQ. MILES**

## RESILIENT TOGETHER VISION

The Cities of Beverly and Salem, through the collective action of *Resilient Together*, will embrace both short-term and long-term solutions that reduce greenhouse gas emissions to achieve carbon neutrality by mid-century while ensuring that our communities are resilient to the impacts of climate change. In doing so, Beverly and Salem will remain inclusive and thriving communities, attractive and accessible to diverse families and businesses, for generations to come.

## EXECUTIVE SUMMARY

The Cities of Beverly and Salem have partnered to create *Resilient Together*: our plan to take collective action in the face of the climate crisis. Along the North Shore, Beverly and Salem form a hub of history, culture, and economic activity. Linked by bridges and a shared rich heritage, Beverly and Salem are also connected by a collective vision for a resilient future in the face of climate change. We are embracing a proactive, collaborative approach in this Climate Action and Resilience Plan to limit climate change to 1.5 degrees Celsius by reducing our greenhouse gas emissions and to build resilience to its unavoidable impacts. We will ensure we remain inclusive and thriving communities that are attractive and accessible to diverse families and businesses.

## A SHARED FUTURE

Our communities are similar in demographics and carbon footprint. We share waterways and transportation routes. We breathe the same air and benefit from the same local natural resources. Through *Resilient Together*, we envision a collective and connected future that is powered by clean, renewable energy and led by communities that are prepared for changing climate conditions. When we are resilient together, we promote local economic growth, protect our natural resources, and minimize our waste through reduction, reuse, and recycling. We will reduce our emissions and build community resilience to intense storms, sea level rise, droughts, floods, and heat waves. We will create equitable solutions and provide access to resources to uplift all our residents. We will strive to build healthy, active, interconnected neighborhoods. We will work together, by sharing knowledge and listening to our neighbors, to build this future for all.



## FOCUS AREAS

Driving the transition to resilient and carbon neutral buildings – new and existing- that are healthier and more affordable to own and operate.

Preparing our communities for emergencies while improving community health through better air quality and access to health care, wellness programs, and healthy foods.

Creating a safe, connected, and accessible transportation system that prioritizes no- and low-carbon mobility, and promotes active lifestyles.

Enhancing drinking water, stormwater, and wastewater infrastructure as well as bridges and streets through green infrastructure and improved maintenance.



**BUILDINGS & DEVELOPMENT**



**NATURAL RESOURCES**



**PUBLIC HEALTH & SAFETY**



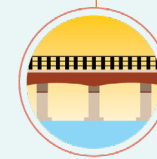
**SOLID WASTE**



**MOBILITY**



**ENERGY**



**INFRASTRUCTURE**

Preserving and enhancing our local biodiversity, tree canopy, water quality, beaches and shorelines, wildlife, and recreational open spaces.

Educating on and delivering effective waste reduction, reuse, recycling, and composting programs and policies.

Implementing policies, programs, and projects that facilitate the early generation and adoption of reliable, clean energy and promote ongoing energy efficiency.

The *Resilient Together* planning process was both launched and completed during the COVID-19 pandemic, which has tested our communities' social and public health infrastructure. It has demonstrated our tremendous resilience, while also shedding light on existing vulnerabilities and systemic inequities which will only exacerbate the impacts of climate change on some community members. Our experiences during the pandemic underscore the urgency, gravity, and also the opportunity of *Resilient Together* to build a more equitable and resilient future for our communities. We know that collaborative and data-driven planning is the foundation for a climate resilient future.

## THIS IS RESILIENT TOGETHER.

*Resilient Together* includes 71 actions across seven focus areas, which offer a roadmap for how our two Cities will address climate change. These focus areas encapsulate the plan, summarizing the areas we will target to create a thriving, inclusive, resilient future for future generations.

## SIX GUIDING PRINCIPLES

Set the foundation for the goals and actions of *Resilient Together*, and for continued planning and implementation. Every action included in this Plan was evaluated through the lens of these principles.



**COMMUNITY RESILIENCE**



**ECONOMIC VITALITY**



**GHG EMISSIONS REDUCTIONS**



**RESTORATION & TRANSFORMATION**



**HEALTH**



**EQUITY**



# BUILDINGS AND DEVELOPMENT

## GOALS

- › The Cities lead by example through adoption of smart, clean, net zero technology in existing and new municipal buildings.
- › All new buildings and major renovations are designed, constructed, and maintained for maximum lifespan, resource efficiency, GHG reduction, and climate resilience.
- › Walkability, connectivity, and social interaction are emphasized through equitable transit-oriented development.
- › Development prioritizes adaptive reuse, brownfield redevelopment, and resilience to protect and restore community historic, cultural, and land assets.
- › The Cities are a model of sustainable, resilient building management focused on excellence in long-term operations and maintenance.

## ACTIONS

### BD-1

Encourage and incentivize property owner participation in deep energy retrofits

### BD-2

Develop energy performance and electrification standards and incentives for new construction and major renovations to encourage progress toward net zero carbon emissions in buildings

### BD-3

Establish requirements for new commercial and multi-family residential properties to include electric vehicle charging infrastructure, eco-roofs, and bike-ped amenities

### BD-4

Adopt the state net zero energy building code

### BD-5

Host, promote, and invest in trainings and collaborative learning for municipal staff, boards/commissions, and building industry partners to support energy efficiency and decarbonization practices, from design to ongoing maintenance

### BD-6

Establish overlay zoning district(s) that establish minimum flood resilience design standards for new construction and existing buildings

### BD-7

Implement energy efficiency upgrades, renewables, and resilience improvements in all municipal properties

### BD-8

Commission a vulnerability assessment of historic buildings

### BD-9

Develop a public education and outreach program about flood protection strategies, Community Rating System, and flood insurance, including the National Flood Insurance Program (NFIP) and Risk Rating 2.0 updates





# ENERGY

## GOALS

- › Regional clean energy will supply 100% of municipal asset operations by 2030 and 100% of community energy by 2040.
- › Renewable energy is accessible to all residents and businesses.
- › Our energy supply is reliable, efficient, safe, and resilient to climate-related disruptions.
- › Clean energy, electrification, and energy storage technology adoption provide new and inclusive workforce development opportunities for our communities.
- › All critical facilities have redundant systems to ensure utilities are supplied for the duration of projected future storm events.
- › The Cities support policies, regulations, and infrastructure that increasingly enable electrification of buildings and transportation.

## ACTIONS

### E-1

Promote residential energy efficiency, renewable energy, and electrification, facilitating participation in state and utility program offerings

### E-2

Identify potential locations for district-scale geothermal microgrids and encourage, support, and incentivize this practice for large developments

### E-3

Develop an education campaign for local businesses on opportunities for energy demand reduction, such as demand response programs and other utility incentives. This education campaign could shift focus, as needed, over time

### E-4

Host existing and establish new training programs for businesses and homeowners on renewable energy and energy storage options

### E-5

Incorporate clean energy education and climate change education into the school curriculum

### E-6

Promote clean alternatives to electrification for difficult-to-electrify properties

### E-7

Evaluate critical municipal facilities to increase energy efficiency and redundancy, exploring opportunities for cleaner and more secure back-up power options, as technologically feasible

### E-8

Advocate for large-scale offshore wind projects and explore feasibility of Cities as anchor institutions for State projects

### E-9

Establish progressively higher percentage requirements for New England region renewable energy projects for standard option green municipal aggregation (GMA) programs and promote "plus" options for 100% regional renewable energy

### E-10

Coordinate with local institutions to provide vocational training programs for clean energy careers

### E-11

Partner with utilities to address gas leaks in supply infrastructure by replacing all cast iron pipe



# INFRASTRUCTURE

## GOALS

- › The Cities' infrastructure assets are designed, constructed, and maintained to optimize integrated systems for efficiency, resilience, and to minimize failure
- › Wastewater, drinking water, and stormwater infrastructure are designed and constructed for water conservation and resilience to projected climate conditions.
- › Infrastructure upgrades are equitably distributed throughout the Cities and prioritized based on greatest need.
- › Major infrastructure is planned, designed, and constructed with consideration of long-term maintenance and life cycle costs, benefits, and emissions.
- › The Cities actively pursue green and nature-based solutions for infrastructure upgrades.

## ACTIONS

### I-1

Implement a computerized maintenance management system (CMMS) to assess public asset conditions, streamline data collection, and estimate asset replacement values

### I-2

Analyze all infrastructure for vulnerability, evaluate for criticality, rank for priority upgrades, and incorporate into asset management and capital planning.

### I-3

Explore financing strategies like stormwater fees to generate needed revenue for infrastructure financing

### I-4

Develop and adopt sustainable and resilient design guidelines for all new site development and infrastructure projects, as well as upgrades/maintenance to existing infrastructure

### I-5

Implement an education and training program for municipal staff (including DPS/DPW, planning staff, administration) on best practices for operations and maintenance of green infrastructure. Make information from these trainings available to the public

### I-6

Create incentives for businesses and residents to convert impervious surfaces to pervious areas

### I-7

Implement resilience upgrades for critical infrastructure assets vulnerable to coastal flooding

### I-8

Establish a long term strategy for public shoreline stabilization structures with an emphasis on nature-based solutions and naturalizing the coast line

### I-9

Conduct a detailed hydrologic and hydraulic model of the cities to understand flood risks

### I-10

Assess vulnerability of telecommunications infrastructure and develop strategy to improve resilience



# MOBILITY

## GOALS

- › The Cities' municipal fleets are 100% zero-emissions by 2030, as technologically feasible.
- › All community members have access to a variety of safe, no- and low- carbon transportation choices.
- › The Cities encourage regional shifts to efficient, resilient, and reliable public transportation systems.
- › Our transportation infrastructure is designed and upgraded for resilience to extreme heat, storms, and flooding.
- › The Cities' roadways, paths, and sidewalks prioritize the needs of users of all ages and physical abilities to create a universally designed mobility system.

## ACTIONS

### M-1

Coordinate efforts with transit and other shuttle providers to prioritize improvements to public transportation operations, including route efficiency, expanded service, last-mile options, shelter/shading improvements, and enhanced affordability

### M-2

Create a public awareness campaign for electric vehicles (EV) and available charging stations locally and throughout the region

### M-3

Enhance and increase awareness of multi-modal connectivity and accessibility options through educational events and enhanced wayfinding

### M-4

Provide bicycle parking, including electric bicycle parking outlets, where feasible, at public parks, schools, and other major activity centers

### M-5

Expand Salem bikeshare into a regional bike share program for Salem, Beverly, and neighboring communities

### M-6

Provide EV charging stations at public parking facilities and on- and off-street locations

### M-7

Conduct a local multimodal and micromobility connectivity study that identifies options for additional bike lanes and other bike/ped connectivity, accessibility, and safety improvements

### M-8

Introduce procurement policies for City-owned vehicles and contracted service vehicles that require low- or zero-carbon options

### M-9

Evaluate and prioritize roadway spending to accommodate all users and encourage pedestrian connectivity and safety

### M-10

Assess transportation network elements for flood risk and other resilience concerns, and implement elevation/protection improvements as needed

### M-11

Advocate for transformational transit electrification and provision of regional rail on the Newburyport/ Rockport commuter rail line, and expansions (additional stations, lines, and intraregional connections)





# NATURAL RESOURCES

## GOALS

- › The Cities protect and enhance existing natural assets to reduce urban heat islands and preserve ecosystem functions.
- › Climate change impacts are a high-level consideration for the planning of all parks, open spaces, forests, and wetlands.
- › All residents, businesses, and visitors have increased access to and are active stewards of our natural resources.
- › Our harbor and waterfront areas are connected to our neighborhoods and downtown, with enhanced resilience to flooding and sea level rise.

## ACTIONS

### NR-1

Encourage sustainable landscaping practices through incentives, education, and volunteer opportunities

### NR-2

Launch an awareness campaign on local natural resources and recreation options, to cultivate respect and a sense of stewardship for the environment

### NR-3

Create a municipal planting policy that requires non-invasive species that are well suited for anticipated climate changes

### NR-4

Educate private landowners, engineers, and developers on flood management through wetland restoration, wide buffer zones, and maintenance driven best management practices

### NR-5

Update wetlands ordinances and/or Floodplain Overlay District Ordinance to protect future flood zones and establish wider flood zone buffers

### NR-6

Analyze opportunities for open space preservation, enhancement, and acquisition of private parcels with high natural and recreational values

### NR-7

Create an inventory, planting, and management plan of all City trees that prioritizes increased tree coverage in high-heat areas and planting of native species

### NR-8

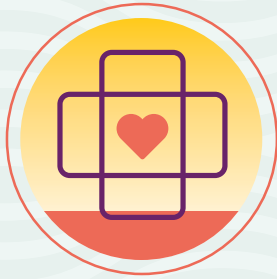
Research, and find opportunities to install, alternatives to impervious surfaces and hardscapes in the city

### NR-9

Use green infrastructure and Low Impact Development (LID) in public open spaces and on other municipal properties

### NR-10

Create a public education program about water conservation and water quality protection to reduce per capita consumption



# PUBLIC HEALTH & SAFETY

## GOALS

- › The Cities' municipal operations are prepared to recover quickly from climate impacts, maintaining service to our community.
- › All community members have close access to fresh, healthy, affordable food, with increased generation of food from local sources.
- › All community members have access to resources and services that promote physical, mental, and emotional well-being.
- › The Cities have in place coordinated response and communications plans to protect residents and visitors in the event of natural disasters or public health crises.

## ACTIONS

### PHS-1

Work with businesses/industry to improve response to extreme weather events and minimize operational downtime

### PHS-2

Develop neighborhood resilience hubs to coordinate and maintain resident well-being as climate impacts intensify

### PHS-3

Ensure that Wi-Fi is accessible throughout Beverly and Salem, particularly in limited-access and low-income neighborhoods

### PHS-4

Expand the "cooling capacity" of Beverly and Salem through investments in heat-reducing infrastructure and materials, as well as cooling initiatives

### PHS-5

Assess gaps or restrictions in zoning codes to overcome any land use restrictions to healthier food options

### PHS-6

Support municipal and community gardens and urban farming

### PHS-7

Develop a pest and vector-borne disease management and communications plan

### PHS-8

Launch a multi-lingual, multi-media education/awareness campaign around public health and safety risks associated with climate change, and support household-level emergency planning and preparedness efforts, particularly in vulnerable communities

### PHS-9

Make citywide emergency communications and notification systems accessible to all residents for a range of climate-events

### PHS-10

Identify all hazardous material storage locations at risk from flooding and assess flood protection options



# SOLID WASTE

## GOALS

- › The Cities will develop waste reduction and management policies and programs that include resource recovery and use of sustainable materials as well as reduction of waste stream toxicity.
- › Beverly and Salem achieve 30% reduction in waste disposal by 2030 and 90% reduction by 2050.
- › Community members are educated and responsible consumers who minimize waste generation and maximize productive reuse.
- › All major capital improvement projects are evaluated with a life cycle assessment.

## ACTIONS

### SW-1

Implement an educational campaign to encourage residents and businesses to reduce and reuse as the highest priority; and to clarify what can be recycled and how

### SW-2

Increase low-cost and publicly accessible collection, reuse, sharing, and recycling opportunities through swap shops, books swaps, community yard sales, repair clinics, shredding events, and collection events for hard-to-recycle waste streams

### SW-3

Work with local restaurants and other businesses to reduce packaging and use of single-use polystyrene or plastics for products they sell/deliver, and to ensure that containers and packaging used by businesses are reusable, recyclable, or compostable to the maximum extent possible

### SW-4

Develop mandatory recycling ordinance for all waste generators and mandatory recycling regulation for private haulers to ensure recycling/composting in multi-family residences and commercial establishments

### SW-5

Measure and track metrics related to waste management and communicate information publicly to encourage improvement

### SW-6

Expand curbside composting, support and educate residents on food waste reduction and home composting, and provide residents access to drop-off composting

### SW-7

Develop a comprehensive program for all municipal buildings and public schools that prioritizes waste reduction and maximizes opportunities for reuse, recycling, and composting, with a strong educational component to ensure successful implementation

### SW-8

Increase dedicated staff time for enforcement of existing waste policies and introduce enforcement mechanisms for new ordinances

### SW-9

Expand sustainable purchasing programs within both cities

### SW-10

Require significant municipal and community events to achieve (near) zero waste. Develop and distribute guidance









## 2009

### SALEM

Energy Efficiency & Conservation Strategy

## 2010

### SALEM

Green Community designation by Massachusetts Department of Energy Resources (DOER)

## 2011

### BEVERLY

Green Community designation by DOER

### SALEM

Hazard Mitigation Plan update



## 2014

Salem Climate Change Vulnerability Assessment & Action Plan and Infrastructure Vulnerability Assessment & Prioritization



## 2015

### BEVERLY

Bicycle Network and Pedestrian Plan

Incentivized curbside compost pick-up service

### SALEM

Open Space & Recreation Plan

City-wide streetlight LED retrofit

## 2016

### BEVERLY

Open Space & Recreation Plan update (adopted in 2008)

### SALEM

100% renewable energy commitment

Community Food Assessment

Opt-Out Green Municipal Aggregation (GMA)

# A STRONG FOUNDATION

*Resilient Together* builds on significant sustainability and resilience accomplishments in both Beverly and Salem. The following timeline summarizes just a small selection of the many past and ongoing programs, policies, and initiatives that have laid the groundwork for *Resilient Together*.



## 2017

### BEVERLY

Coastal Resilience Plan and Infrastructure Vulnerability Assessment

### BEVERLY/SALEM

U.S. Climate Mayors member

### SALEM

Municipal Vulnerability Preparedness (MVP) Community designation

## 2018

### BEVERLY

C40 Deadline (2020 Commitment to develop Climate Action Plan)

Natural Hazard Mitigation Plan (second update, adopted 2006)

City-wide streetlight LED retrofit

Deadline 2020 commitment to joining Cities Race to Zero

### BEVERLY/SALEM

Plastic Bag Ban

### SALEM

Bicycle Master Plan

Municipal Street Tree Assessment Project

1 MW solar array on schools

Launched bikeshare program

## 2019

### BEVERLY

MVP Community designation and report

### SALEM

Imagine Salem

Solarize North Shore Program

## 2020

### BEVERLY

100% renewable energy commitment

First electric school bus in service

4.9 MW solar array with community solar built on former City landfill

Cities Race to Zero commitment

### SALEM

Downtown tree planting project funded by MVP program

Hazard Mitigation Plan Update

## 2021

### BEVERLY

PlanBeverly, the City's Comprehensive Master Plan

### SALEM

Greening the Gateway Cities program to plant 2,000 trees







## WHAT DOES CLIMATE CHANGE MEAN FOR BEVERLY AND SALEM?

Like most Massachusetts communities, Beverly and Salem are already experiencing the harmful impacts of climate change in the form of more frequent and severe storms, flooding, sea level rise, and extreme heat. Through *Resilient Together*, we are working to reduce the emissions that cause climate change, while also preparing our community for changes now and in the future.



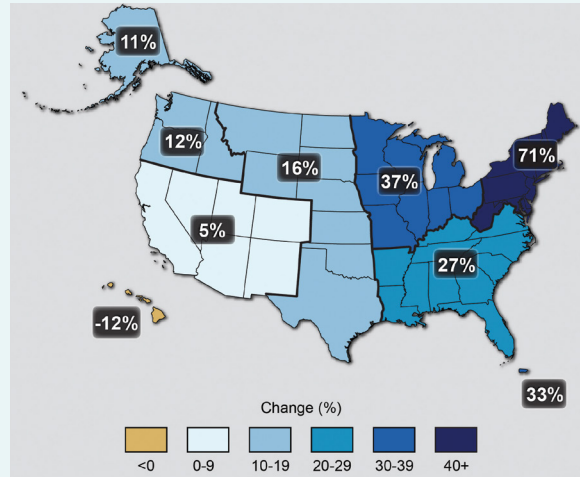
Through *Resilient Together*, we are working to reduce the emissions that cause climate change, while also preparing our community for changes now and in the future.

# CLIMATE CHANGE TRENDS & PROJECTIONS

## EXTREME STORMS

Nor'easters, ice storms, blizzards, hurricanes, and heavy rain events lead to downed trees, power outages, property damage, school and business closures, and flooding (both inland and coastal). Between 1958-2012, the Northeast has seen the largest increase in the amount of precipitation falling in extreme events.

Observed Change in Very Heavy Precipitation<sup>1</sup>

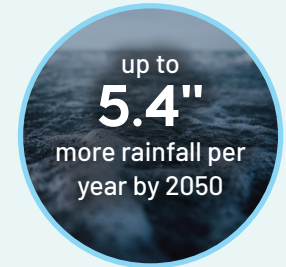


what we have already seen:<sup>2</sup>



**INCREASE IN RAINFALL FROM HEAVY STORM EVENTS**

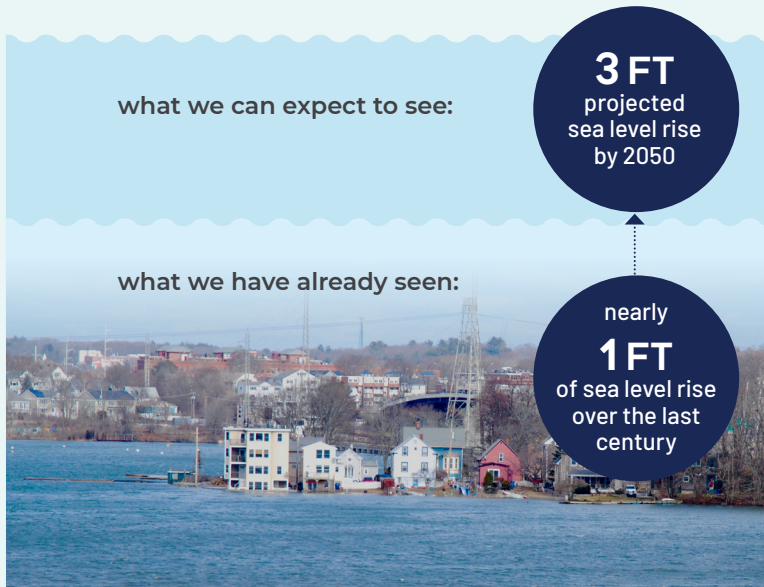
what we can expect to see:



**INCREASE IN RAINFALL PER YEAR, MOSTLY IN WINTER**

## SEA LEVEL RISE<sup>3</sup>

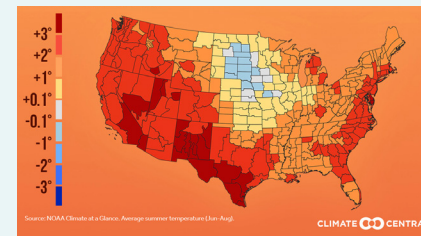
Sea level rise has the potential to increase coastal flooding during storm events, and eventually permanently inundate low-lying areas in Beverly and Salem.



## HEAT WAVES<sup>4</sup>

Heat waves put a heavy strain on electricity grids and increase heat-related illnesses, making it unsafe to work outdoors or in homes without access to cooling.

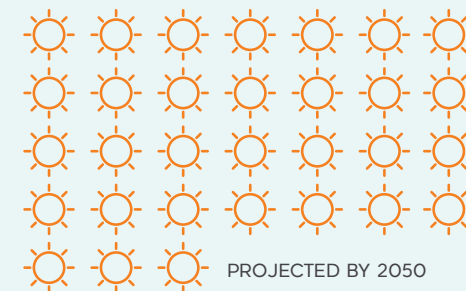
SUMMER WARMING SINCE 1970 (°F)<sup>5</sup>



what we have already seen:



what we can expect to see:

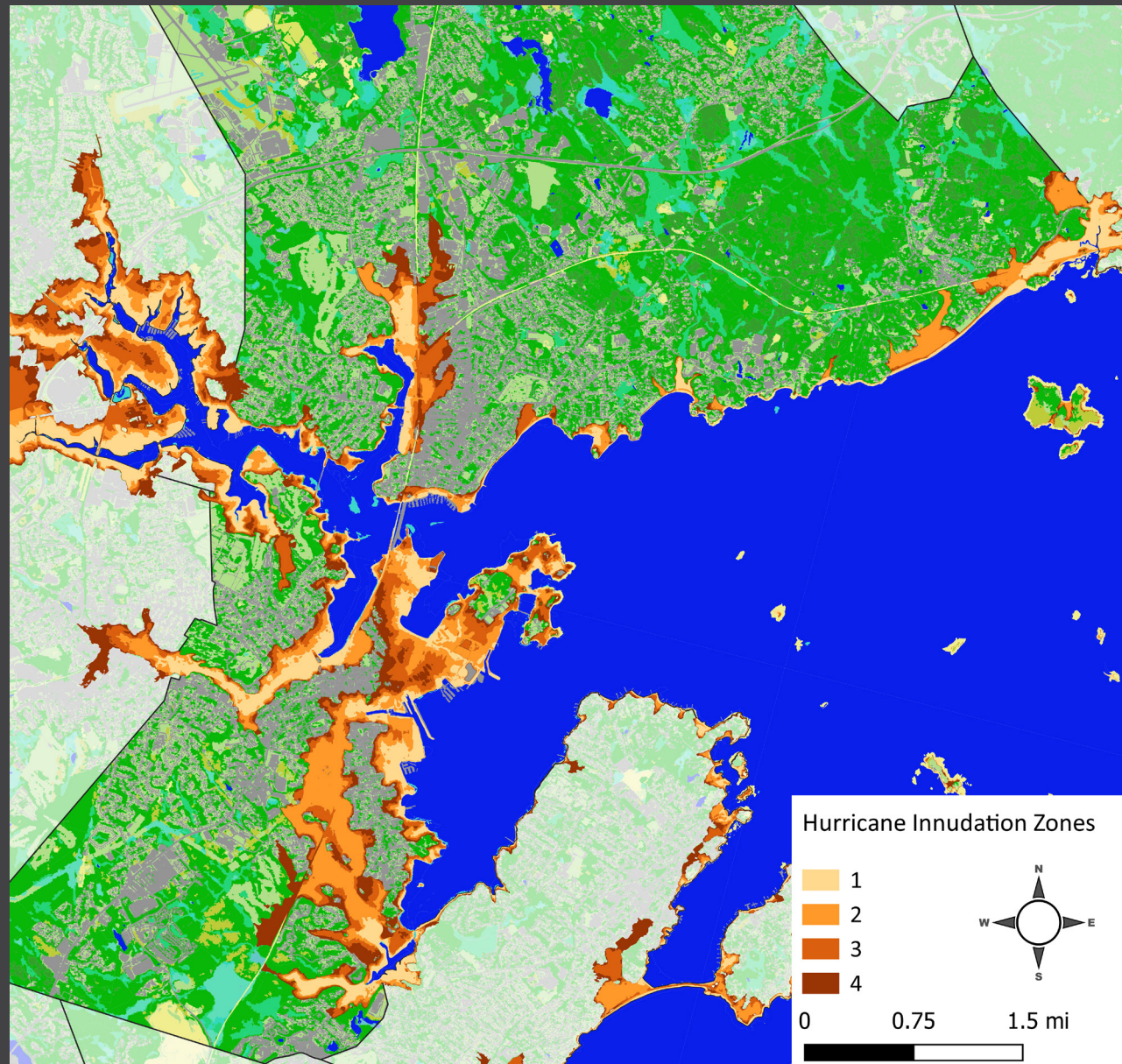




## PREPARING OUR COMMUNITIES FOR FUTURE CLIMATE SCENARIOS

Like many communities along the East Coast of the United States, we are aware that Beverly and Salem are already locked into inevitable rises in sea level and storm surge. This may mean that some portions of our communities that have enjoyed the benefits of waterfront living and commercial activity for generations may need to relocate and/or require significant investment in fortifications. Planning for such contingencies is not something that either City takes lightly. We must balance safety, financial, and often emotional decisions that will best support the long-term resilience of our communities. This plan does not contain all of the answers or solutions for how we will invest in the protection or relocation of vulnerable properties and neighborhoods. What it does do is lay the foundation for understanding our greatest vulnerabilities, start a dialogue with residents and businesses about what our climate future looks like, set us on a path to avoid new development in high-risk areas, and upgrade and protect existing infrastructure. It also places an emphasis on nature-based solutions that can help to protect our coastal neighborhoods for as long as possible. As state, regional, and federal resources become increasingly available to support relocation services where needed, our Cities will continue to engage with our residents and businesses for community-led transitions that support a thriving Beverly and Salem for generations to come.

This image represents worst-case Hurricane Surge Inundation areas for Category 1 through 4 hurricanes striking the coast of Massachusetts. MassGIS. Hurricane Surge Inundation Areas for Category 1 through 4 Hurricanes. Retrieved from <https://docs.digital.mass.gov/dataset/massgis-data-hurricane-surge-inundation-zones>







## HOW ARE WE CONTRIBUTING TO CLIMATE CHANGE?

Mitigating our contribution to climate change means reducing greenhouse gas (GHG) emissions.

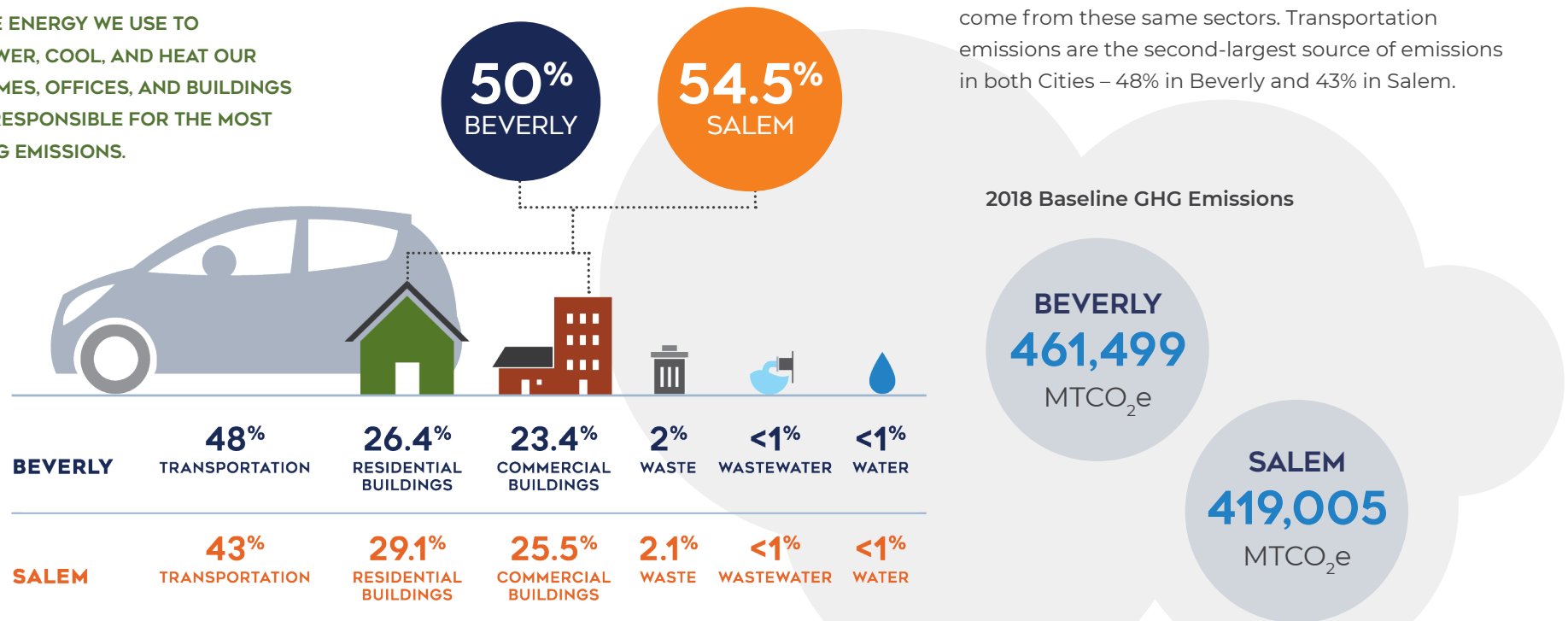
Climate change is caused by increased levels of GHGs in our atmosphere, which trap heat and disrupt our climate's natural cycle. When we burn fossil fuels like coal, natural gas, and oil to power our homes, businesses, and vehicles, we add to the already high levels of GHGs in the atmosphere.

As a part of building *Resilient Together*, we assessed GHG emission sources to identify targeted solutions to reduce these GHGs. This section provides brief highlights from the GHG Emissions Inventory Summary & Forecast, which comprises Appendix C. We measure GHG emissions in terms of metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e).

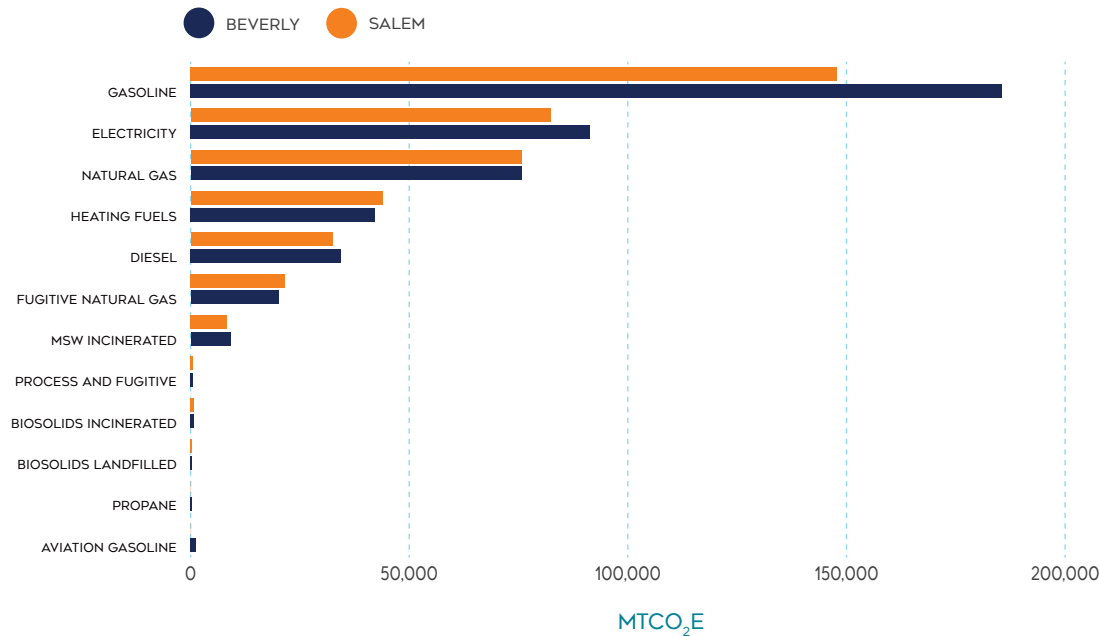
### EMISSIONS BY SECTOR

The majority of Salem's emissions- 54.5% - come from the use of electricity, natural gas, and other fuels in buildings. Approximately half of Beverly's emissions come from these same sectors. Transportation emissions are the second-largest source of emissions in both Cities – 48% in Beverly and 43% in Salem.

THE ENERGY WE USE TO POWER, COOL, AND HEAT OUR HOMES, OFFICES, AND BUILDINGS IS RESPONSIBLE FOR THE MOST GHG EMISSIONS.

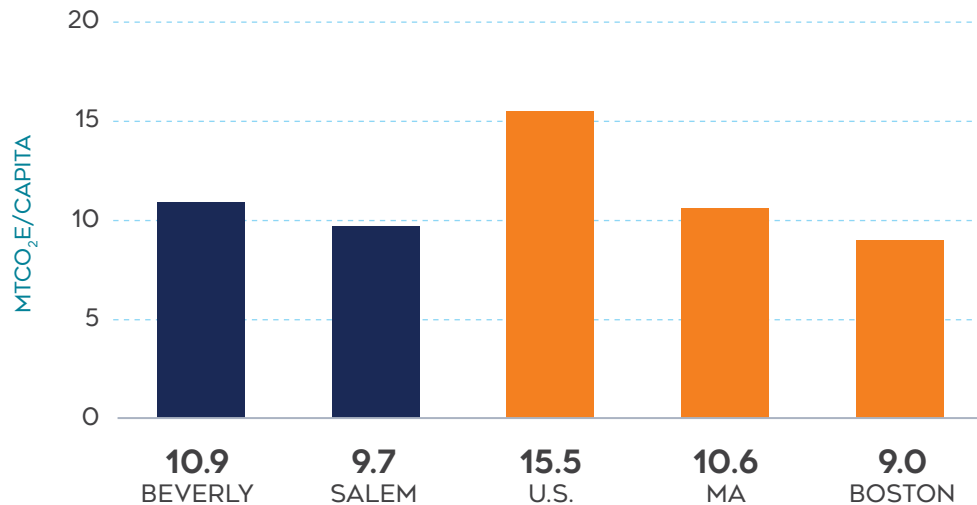


## Emissions by Source



Looking at emissions by source illustrates that gasoline use in vehicles is the single largest source, while building-related emissions are from a combination of electricity, natural gas, and fuel oil combined. Since gasoline has such a large share of overall emissions, improvements in this sector translate into significant reductions at the community scale.

## Per Person Emissions in Beverly & Salem, Massachusetts, and the US



Emissions per person in both communities are lower than the national average. A number of factors contribute to this, including generally cleaner electricity sources than many places in the country as well as higher transit ridership. Beverly is slightly higher than the Commonwealth of Massachusetts, average at 10.9 MTCO<sub>2</sub>e per capita. Salem, at 9.7 MTCO<sub>2</sub>e per capita, falls between the state level average and Boston.

The GHGs covered by this inventory and plan are directly related to local activity and occur within our cities and region. There are other ways to look at our climate impact, such as through the choices we make as consumers around food, clothing, and other goods and services which drive GHGs all over the world. For consumer economies, these emissions can be twice as much as local ones and critical to address in order to achieve global GHG reductions. As the Cities implement this plan, we will look for opportunities where we can reduce GHGs beyond our boundaries, as well as within them.



Beverly and Salem have committed to:

**REDUCING GHGS**  
**50%**  
by 2030

**EXCEEDING THE  
COMMONWEALTH'S  
GOAL TO ACHIEVE**

**CARBON  
NEUTRALITY**  
by 2050

## WHAT DOES THE FUTURE LOOK LIKE?

While many climate changes are inevitable, with bold, rapid action, we can prevent the most extreme impacts to our communities and our ecosystems. Taking action requires support from state and federal governments as well as an understanding of what our communities' emissions will look like, depending on the actions we take.

### STATE & NATIONAL CONTEXT

Making the shift to clean energy, electrifying buildings and transportation systems, modernizing and strengthening the grid – these efforts will all depend on state, regional, and federal climate action. The targets set by *Resilient Together* are interdependent with those of higher levels of government. Successfully hitting our targets helps to fulfill the commitments up through the state to national level. At the same time, actions by those partners will enable us to move faster and farther through funding opportunities, advancing new technologies and aligning action in other ways.

In the first half of 2021, significant commitments, codified into law, were made in Massachusetts. On April 21, 2021, the Biden Administration pledged a target of 50% reductions by 2030 as the US re-enters the Paris Agreement. Agencies are now moving to implement actions that achieve this target. As they create new opportunities to support our plan, Beverly and Salem will be ready to capture associated funding and technical support.

Other notable efforts in 2020 and 2021 include:

#### MA Decarbonization Roadmap<sup>6</sup>

- › Includes planning scenarios for Massachusetts to achieve net zero carbon emissions by 2050
- › Emphasizes an equitable and affordable transition away from fossil fuels through electrification, efficiency, a decarbonized energy supply, and carbon sequestration

#### Interim Clean Energy and Climate Plan (CECP) for 2030<sup>7</sup>

- › Builds on the Decarbonization Roadmap with specific strategies for how the State will achieve emissions reductions in the coming decade

#### An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy (Bill S.9/S.2995)<sup>8</sup>

- › Provides a legal framework for goals and strategies in the Decarbonization Roadmap and CECP
- › Includes binding GHG reduction targets, an opt-in net zero energy code developed within 18 months, and the purchase of clean energy<sup>9</sup>

#### Net Zero Stretch Energy Code<sup>10</sup>

- › Once final, municipalities in Massachusetts can choose to adopt this code, which would require stricter energy standards for buildings
- › The adoption of this building code would have a significant impact on the Commonwealth's ability to curb GHG emissions from new buildings

#### Transportation Climate Initiative (TCI)

- › Collaborative effort among states in the Mid-Atlantic and Northeast that prioritizes clean transportation investment, emissions reduction from motor vehicles, and transportation justice<sup>11</sup>

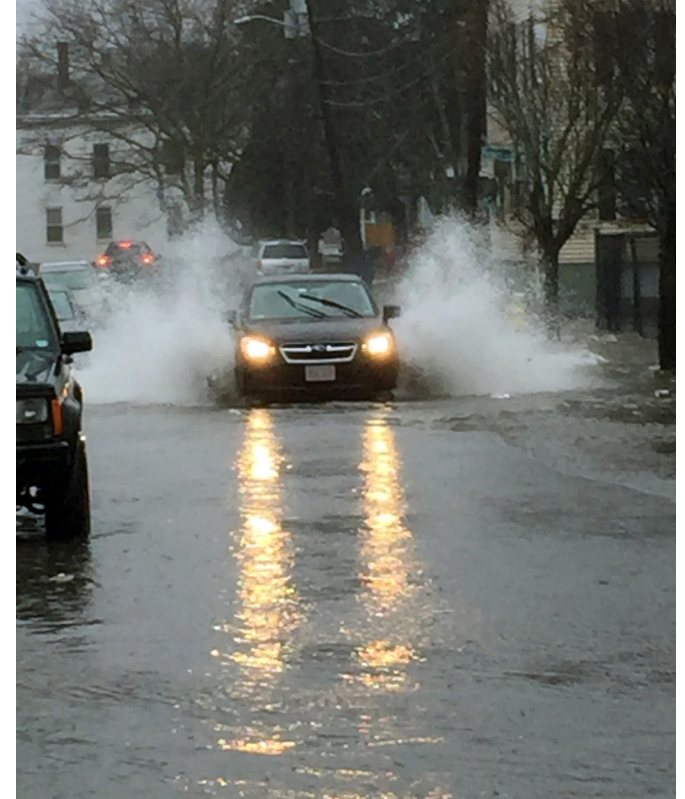
## EMISSIONS FORECAST

GHGs from our communities are not static. Our performance today and in the future is the result of a complex combination of factors including the mix of electricity sources in the region, the number and distribution of jobs and housing both within and around our communities, and the choices we make as individuals and businesses. For *Resilient Together*, the Cities conducted GHG forecasts for business-as-usual (BAU) and decarbonization scenarios to help better understand the implications of these variables.

## BUSINESS-AS-USUAL SCENARIO

In order to change course on GHG emissions, we should know where we are headed if we take no intentional reduction action. Forecasting BAU emissions can help to identify the greatest barriers and opportunities for getting to carbon neutrality.

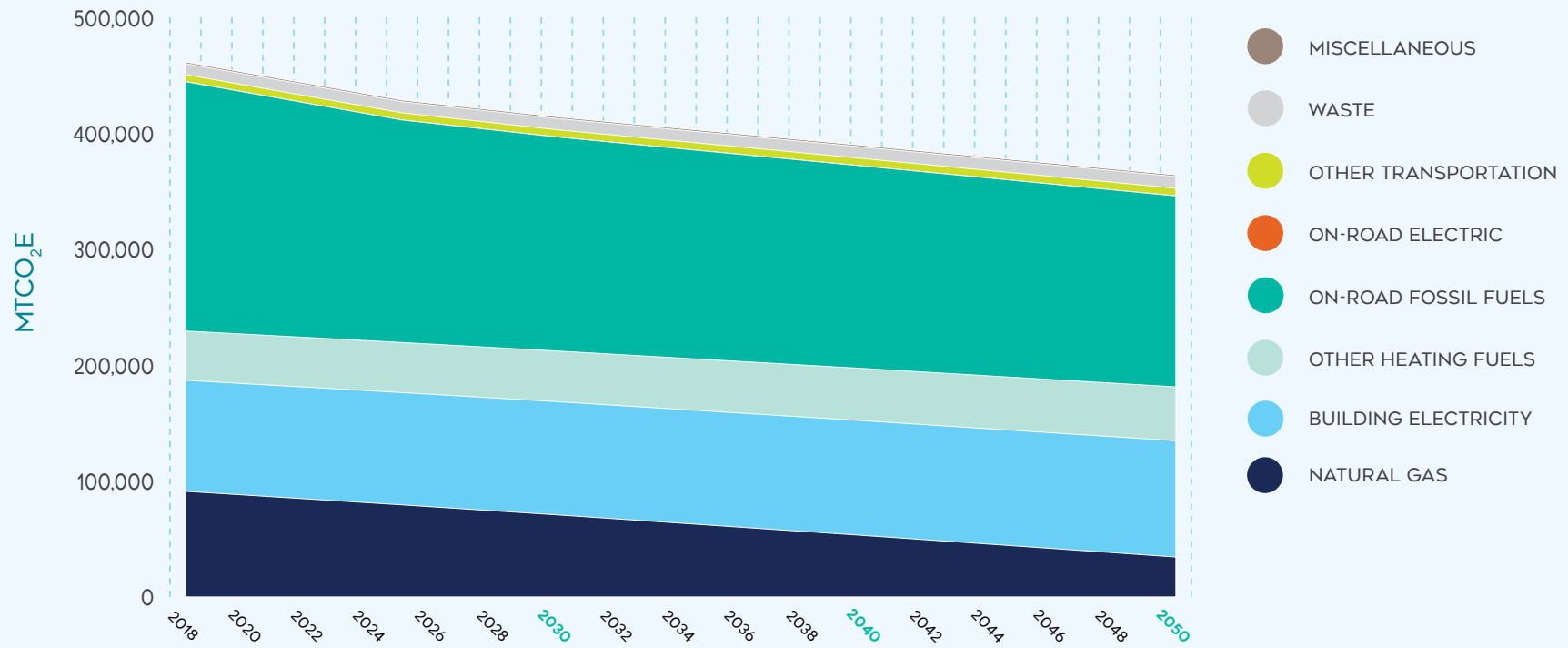
To develop this forecast, we start with the baseline levels of GHGs in Beverly and Salem in 2018. Then, we factor in population and job growth by assuming corresponding growth in residential and commercial activity, the primary sources of GHGs. Expected growth is relatively small in both communities, under 1% per year for both new residents and jobs. At the same time, we expect modest reductions in GHGs from the combined impact of the current Massachusetts Renewable Portfolio Standard and legacy impacts of improved fuel economy standards that would play out in the absence of concerted efforts to electrify transportation.



As depicted in the graph and the table on the following page, if the Cities take no intentional action, the BAU scenario shows the following percent changes by 2030, 2040, and 2050. The largest reductions are within transportation and are relatively higher in Beverly due to Beverly's higher baseline transportation GHGs. Net reductions across all sectors are lower as sectors such as waste and other miscellaneous sources grow with population increases.



### Business-as-Usual Scenario 2018-2050



### Percent Reductions in GHGs from Business-as-Usual Forecast

	SECTOR	2030	2040	2050
<b>Beverly</b>	Building Energy	-8%	-15%	-22%
	Transportation	-14%	-19%	-23%
	All Sectors	-10%	-15%	-21%
<b>Salem</b>	Building Energy	-7%	-12%	-18%
	Transportation	-13%	-17%	-22%
	All Sectors	-9%	-13%	-18%

### Why is there just one forecast here?

The GHG Emissions Inventory performed for Beverly and Salem illustrated several similarities. Although there are some differences in the proportions between a few sources, total GHGs from each community are nearly the same. While the forecast analyses were performed for each community individually, displaying the results graphically shows no perceptible difference between them. All charts happen to display the results for Beverly, but key outcome metrics are displayed for each community individually in tables.



BY 2050:  
**BEVERLY**  
**10,287**  
**SALEM**  
**10,323**

If we are going to meet our GHG reduction goals, here's how many homes we'll have to electrify (assuming a clean grid and local, renewable energy resources):

**Number of Homes to Electrify by Community**

TARGET YEAR	2025	2030	2040	2050
<b>Adoption Rate</b>	10%	20%	65%	95%
<b>Beverly</b>	1,083	2,166	7,038	10,287
<b>Salem</b>	1,087	2,173	7,063	10,323

**DECARBONIZATION SCENARIO:  
 HIGH IMPACT ACTIONS**

Creating deep cuts in GHG emissions will require many actions, but there are a few overarching strategies that are essential to meeting our reduction targets. The Commonwealth of Massachusetts illustrated key pathways to meeting its goals through these overarching strategies in the 2050 Decarbonization Roadmap.<sup>12</sup> We downscaled this analysis to local GHGs to see the impact of accelerating these changes in Beverly and Salem. The following strategies from the 2050 Decarbonization Roadmap are included in the *Resilient Together* decarbonization scenario:

- › **Transition to Clean Electricity.** Relying on a clean regional grid and local, distributed renewable energy resources
- › **Net Zero New Construction.** Ensuring efficient new buildings are designed and maintained to minimize energy use and with the ability to meet energy needs with onsite renewable energy<sup>13</sup>
- › **Building Electrification and Efficiency.** Eliminating the direct use of fossil fuels for heating, cooking, and other uses in all existing buildings; and carrying out deep energy retrofits
- › **Transition to Electric Vehicles.** Ensuring 80% of cars on the road in Massachusetts are zero emissions vehicles (ZEVs)<sup>14</sup> by 2050, assuming a clean grid

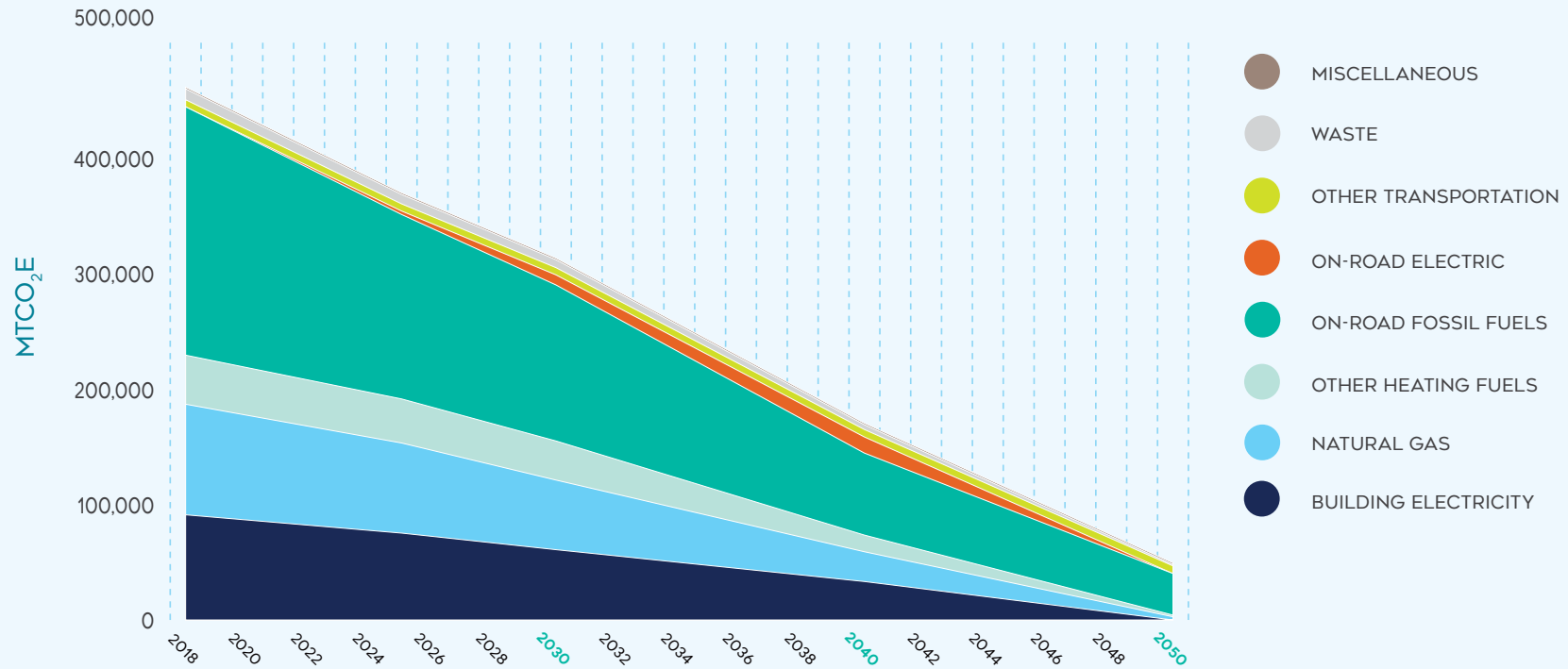
**SUMMARY OF REDUCTIONS**

The relative local impact of these strategies is nearly the same as what the Commonwealth expects, with local gross emissions reduced to just short of 80% by 2050. As we see in this illustration of future GHGs with these actions applied, there are significantly fewer emissions from building energy which are almost completely eliminated by 2050. Transportation emissions are substantially reduced, but some fossil fuel vehicles are projected to still be in use by 2050.

In addition to the high impact actions, readily quantifiable actions like solid waste reduction, eliminating natural gas leaks, and improvements in heavy duty trucks achieve nearly a 90% reduction by 2050, as illustrated in the graph above and the table below. This would leave approximately 10% remaining emissions that may need to be offset in other ways.

There are additional actions in this plan that will work to create even deeper reductions in GHGs. While these actions will be significant contributors in the future, they are difficult to quantify today. Forecasts of GHGs, like weather forecasts, are always evolving as the future comes into better focus. These forecasts are a snapshot, developed around baseline data that is already changing, and we will need to periodically re-inventory GHGs and monitor progress in other ways. As we make structural changes to orient around transit and other mobility options, baseline conditions in terms of the number of vehicles registered locally and how they are used will change.

## Decarbonization Scenario with High-Impact Actions 2018-2050



### Percent Reductions in GHGs from High-Impact Actions

	2025	2030	2040	2050
<b>Beverly</b>	-20%	-32%	-63%	-89%
<b>Salem</b>	-27%	-38%	-66%	-90%

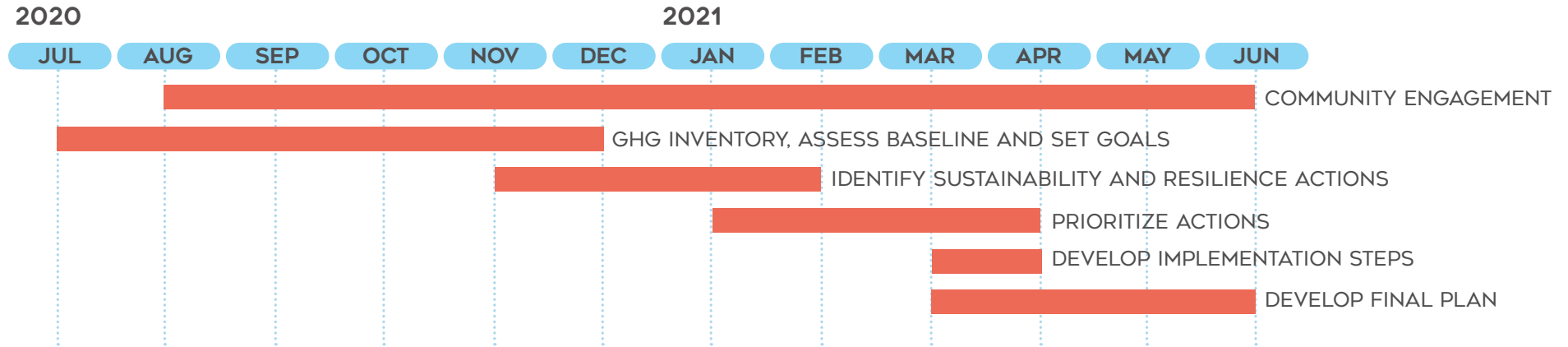
The Cities have set an interim target of 50% GHG reductions by 2030. Meeting this ambitious target is possible—with market-based approaches. With Salem Power Choice and the Beverly Community Electric green municipal aggregation programs, each community could contractually transition the electric

### What's the orange slice that appears in the 2030s and 2040s and then disappears?

This illustrates the GHGs associated with electric vehicles coming online and consuming grid electricity. While electric vehicles are projected to take an increasing share of the total miles traveled each year, the GHGs they create will diminish as grid electricity becomes cleaner.

sector to 100% renewable sources. Under this scenario, each city could claim to have eliminated GHGs from building and transportation-related electricity. Achieving this claim would require that each city have total ownership of renewable energy credits equal to the quantity of electricity consumed.

## Resilient Together Planning Process



## DEVELOPING OUR PLAN

The *Resilient Together* process launched in the summer of 2020. The planning process consisted of five distinct phases that allowed the Cities to first assess existing conditions and projected climate impacts and then develop goals, actions, and metrics based on that data and the input of a wide range of community and municipal stakeholders. Over the course of nearly a year, one which was hindered by a global pandemic and forced the Cities to shift engagement to an entirely virtual approach, the Cities of Beverly and Salem managed to reach over 50,000 utilizing various engagement tools and tactics. In addition to informing the plan, *Resilient Together* engagement focused on ensuring an equitable process and building local capacity to start and foster ongoing conversations on climate change.

## BUILDING LOCAL CAPACITY TO SPARK AND SUPPORT ONGOING CLIMATE CONVERSATIONS

Across eight months of engagement, paid **Ambassadors** invested 725 hours to help gather more than a thousand survey responses, collect 19 personal testimonials, give six presentations to community groups, host a well-attended online panel discussion, hold dozens of conversations with community members, and create an artistic zine. Ambassadors particularly helped reach the youth and young adult population, which makes up around 30% of each of our communities.



**725**  
HOURS



**1,000+**  
SURVEY  
RESPONSES



**19**  
PERSONAL  
TESTIMONIALS



**6**  
PRESENTATIONS

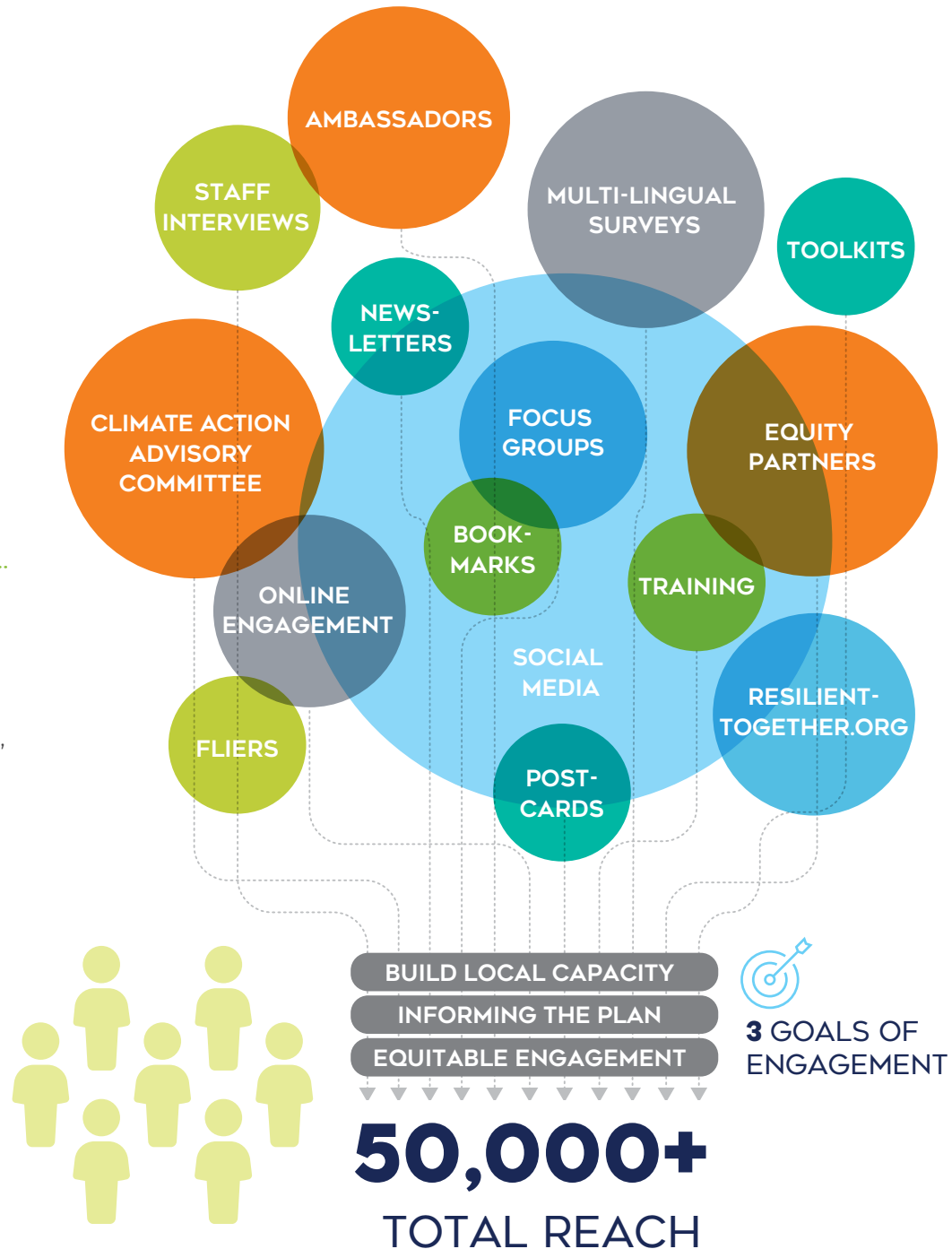


## INFORMING THE PLAN

The **Climate Action Advisory Committee (CAAC)** was responsible for guiding the process and shaping the plan. The 45-member Committee consisted of municipal representatives from both Cities as well as key stakeholders from state and regional agencies, utilities, local colleges and universities, non-profits, businesses, and student and environmental groups. Through three virtual meetings and an online survey, the CAAC provided essential input on goals, action items, and implementation strategies. CAAC members will continue to be champions for the Plan by supporting implementation efforts.

## ENSURING AN EQUITABLE PROCESS

To ensure we could reach some of our most affected audiences, we identified and compensated local community-based organizations -**Equity Partners**- to help understand ongoing needs and make connections between their priorities and climate change. Equity partners were provided training, participated in focus groups and interviews, and promoted Resilient Together through their newsletters and social media.



“

We are prioritizing education and information sharing to increase awareness of climate impact and its relation to migration. We understand climate change impacts most those who are vulnerable and have less capacity/resources to adapt; this means the communities where many of us migrated from, places many of us call home. We want to empower community members with information and tools to influence positive changes both, in their home countries and their host country.

ELSABEL RICON, WELCOMING IMMIGRANTS NETWORK

“

Resilient Together will...provide Workforce development for the jobs of the future.

NAISHA TATIS, RECENT GRADUATE OF BEVERLY HIGH SCHOOL



“

Climate action is absolutely necessary if we want to continue our way of life. Action must be taken by individuals and big businesses alike to take a positive step in helping our environment. I ride my bike in Salem because it is something that I personally can do to better the environment and myself! If more people were to make such a choice, Salem would be much more environmentally friendly!

HANNAH BRADLEY  
SALEM STATE UNIVERSITY STUDENT

“

I grow my own food, support local farms regularly, and recycle and repurpose items in order to decrease what will end up going into landfills. I also support organizations like Mill City Grows, the Food Project, and Salem Y Greenspace. Urban farming is essential to ensure food access for all, especially those neighbors living in food deserts.

KATELYN ADAMS  
ASSISTANT DIRECTOR, DEPARTMENT,  
CENTER FOR CIVIC ENGAGEMENT,  
SALEM STATE UNIVERSITY



“

By working with you, and every member of our community, we will be RESILIENT TOGETHER.

MALCOM TOLOUSE  
BEVERLY RESIDENT







“

Resilient Together will ensure that we remain inclusive and thriving communities for all.

JENNI ESPINAL AND CENEIDA CUETO SILVESTRE - SALEM RESIDENTS

“

I want to take action instead of just complaining. I am in my 20's and my generation is stuck dealing with a climate crisis that was caused by previous generations. I want collective action to work together.

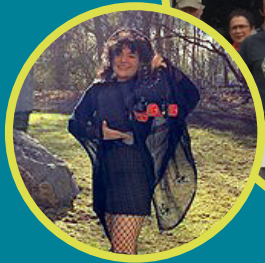
LIZABETH DAVIS, SALEM STATE UNIVERSITY STUDENT AND RESILIENT TOGETHER AMBASSADOR



“

My interest has been to reduce municipal reliance on fossil fuels by formally introducing relevant issues into the municipal dialogue. [Through this, I've] advocated for a high performance new high school.

FRED HOPPS, BEVERLY CLEAN ENERGY ADVISORY COMMITTEE AND RESILIENT TOGETHER AMBASSADOR



### HOPE FOR A RESILIENT FUTURE

We heard clear support for our Cities' climate goals, and also an enthusiasm to embrace energy efficiency and support for city programs and offshore wind developments that can make 100% renewable energy a reality. Residents, particularly renters, and businesses both asked for support from the Cities in learning about, implementing, and paying for clean energy technologies.

Residents are highly aware of new development in both cities, with a desire for development to be affordable, sustainable, resilient to extreme weather, and well-connected to transit. Survey respondents want to see more green buildings and support for vulnerable community members.

“

Knowing that my city values sustainable transportation alternatives like skating, biking, and public transportation in the face of the climate crisis makes me proud to live here.

BRITTANY GIROUX, SALEM STATE UNIVERSITY STUDENT AND ROLLER SKATER





# HOW TO READ THIS PLAN

The following chapters represent the seven focus areas of *Resilient Together*. Each chapter features the following components:



BUILDINGS & DEVELOPMENT



ENERGY



INFRASTRUCTURE



MOBILITY



NATURAL RESOURCES



PUBLIC HEALTH & SAFETY



SOLID WASTE

**INTRODUCTION & GOALS**

FOCUS AREA

GOALS

Provides high-level information on what each focus area is about and what the Cities are striving to achieve

**[FOCUS AREA] TODAY**

[FOCUS AREA] TODAY

“ ”

Captures key baseline data and highlighted accomplishments

## TAKING ACTION

### TAKING ACTION

#### ACTION TYPE

Indicates the **kind** of action (e.g. policy vs. education). Options include:

Policy	Research/Assessment
Zoning	Capital Improvement
Standards/Guidelines	Advocacy/Engagement
Training/Education	Technology/Software

#### TIMEFRAME

Estimated **time** to implement the action. Options include:

**SHORT:** 1-2 years  
**MEDIUM:** 3-5 years  
**LONG:** >5 years

#### COST

Estimated **cost** to implement the action. Options include:

**LOW:** Existing resources or under 10K  
**MEDIUM:** <\$100K  
**HIGH:** >\$100K

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
----	-------------	--------	-------------	---------------------	-----------	------

#### ID

Unique identification number for the action

#### ACTION

Brief summary of the action

#### DESCRIPTION

Details of the action and why it matters

#### IMPLEMENTATION LEAD

Which City Department(s) will “champion” the action past the planning stage

Provides context for the key actions and presents their details in a summary table organized by several categories

## TRACKING PROGRESS

### METRIC TABLE - EXAMPLE

METRIC	BEVERLY BASELINE	SALEM BASELINE	2030 TARGET	2050 TARGET

Presents key metrics, baseline data for each City, and 2030/2050 targets. Various actions may correspond to a single metric and target.



## BUILDINGS & DEVELOPMENT

Driving the transition to resilient and carbon neutral buildings—new and existing—that are healthier and more affordable to own and operate.

### GOALS

- › The Cities lead by example through adoption of smart, clean, net zero technology in existing and new municipal buildings.
- › All new buildings and major renovations are designed, constructed, and maintained for maximum lifespan, resource efficiency, GHG reduction, and climate resilience
- › Walkability, connectivity, and social interaction are emphasized through equitable transit-oriented development
- › Development prioritizes adaptive reuse, brownfield redevelopment, and resilience to protect and restore community historic, cultural, and land assets
- › The Cities are a model of sustainable, resilient building management focused on excellence in long-term operations and maintenance



As the largest source of GHGs in Beverly and Salem, buildings represent the greatest opportunity for emissions reductions. We can achieve these reductions in buildings through energy efficiency upgrades, utilizing electric heat pumps for both existing buildings and new construction, and incorporating on-site renewable energy where feasible. Electrification of buildings is critical for building decarbonization because as the Commonwealth's grid gets cleaner from increasing renewable energy sources, emissions from all-electric buildings can approach net zero. In addition to greenhouse gas reductions, these upgrades can have a measurable improvement on operational costs and comfort in buildings. In Beverly and Salem, we must also ensure that all buildings, including the Cities' historic building stock, are resilient in the face of a changing climate, and that future development is planned in a way that promotes connectivity and access to transit.

## BUILDINGS & DEVELOPMENT TODAY

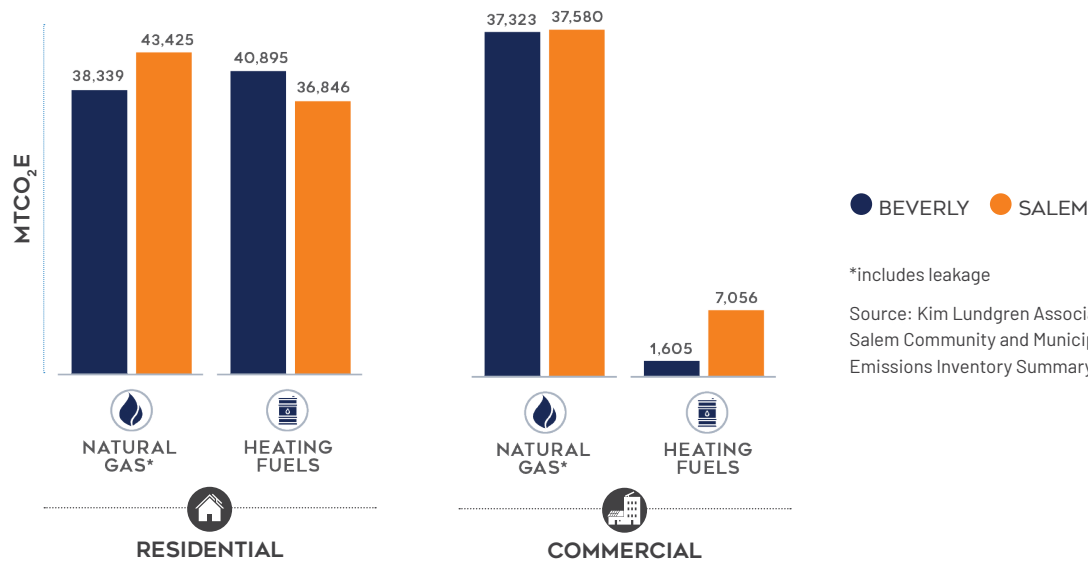
Buildings are the single largest source of greenhouse gas emissions in Beverly and Salem, comprising 50% and 55% of the Cities' GHG emissions, respectively. The majority of these emissions comes from the combustion of fossil fuels such as natural gas and fuel oil, which are the prevalent sources of heating in the Cities' existing small-scale residential buildings. These existing homes are typically over 80 old and are heated by forced air or hot water, which are systems that present varying degrees of challenges and opportunities for conversion to heat pumps. GHG emissions in commercial buildings are mostly from electricity and natural gas.<sup>15</sup> Additionally, many buildings in Beverly and Salem are at risk of coastal flooding, including historic sites such as the House of Seven Gables.



“Harborlight Community Partners is committed to creating housing that is energy efficient. An example of this is [the Hardy Street Project]... we just completed in Beverly, MA. Six units of deeply affordable family housing in a building that is nearly net zero.”

BETHANY BLAKE,  
HARBORLIGHT COMMUNITY  
PARTNERS

Residential and Commercial Emissions from Buildings by Energy Type





# HIGHLIGHTS

Recent initiatives in Beverly and Salem have made strides in advancing energy efficiency and resilience in buildings and development.



Approximately **350 units** within one mile of the commuter rail station have been built since 2010.

Approximately **450 more** of these transit-oriented units are under construction.

## ENERGY EFFICIENCY PROJECTS AND SAVINGS

Efficiency projects for city-owned buildings in both Beverly and Salem such as retro-commissioning, energy management systems, and envelope improvements, have achieved greenhouse gas emissions reductions of nearly 2,000 metric tons of carbon dioxide (MTCO<sub>2</sub>e). Private development projects such as the Waring School in Beverly, the first independent school in Massachusetts to certify a Passive House building, are setting an example for highly energy-efficient, net zero-ready design.

 **2,000**  
METRIC TONS OF  
CO<sub>2</sub> REDUCED

## GREEN COMMUNITY DESIGNATION

Both cities have received Green Community Designation and grants to improve energy efficiency in buildings. In Beverly, this includes a number of schools and the Main Library; in Salem, examples include the Bates Elementary School, Carlton Innovation School, and the Salerno Automotive Technical Center at Salem High School.



## NET ZERO CONSTRUCTION

Beverly has constructed a nearly net zero police station with a geothermal electric heating and cooling system. The City has plans for a rooftop and parking lot canopy solar system to provide electricity behind the meter.



## ZONING FOR PRESERVATION AND ADAPTIVE REUSE

In Beverly, zoning and permitting encourages preservation and adaptive reuse, including for municipal buildings such as the **Briscoe Middle School**, which is being converted to affordable senior housing. Adaptive reuse can reduce embodied greenhouse gas emissions from new building materials.



© Harborlight Community Partners and Beacon Communities

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## CASE STUDY

### INCENTIVES FOR NET ZERO READY BUILDINGS

The Somerville Zoning Ordinance provides incentives in the form of zoning relief for new developments that meet the definition of Net Zero Ready or 100% Affordable. Incentives include increased residential density. To qualify as a Net Zero Ready Building in Somerville, the project must have no on-site combustion for HVAC and cooking (with exceptions) and certify either through the Passive House Institute US (PHIUS), or as Zero Carbon through the International Living Future Institute. While only recently passed, these incentives are already influencing several multifamily housing developments to pursue net zero ready standards.

City of Somerville. (2019). Somerville Zoning Ordinance. Retrieved from <https://www.somervillezoning.com/>

## TAKING ACTION

Achieving the Cities' Buildings & Development goals will require concerted efforts around education and awareness, existing building assessments, and policy tools such as zoning updates and new guidelines and standards to support building resilience and decarbonization.

The Cities will proactively work to develop a culture built upon best management practices, asset tracking and monitoring, maintenance excellence, and proactive approaches to extending assets' life cycle. The culture will extend through all levels of government.

At the policy level, the Cities can use zoning to incentivize the development of net zero energy buildings, to establish requirements for eco-roofs and electric vehicle charging infrastructure, and to set up a zoning overlay district for projects at risk of coastal flooding to adhere to minimum resilience standards. The Cities will lead by example on their own buildings implementing energy efficiency and resiliency improvements on public assets. The following table outlines a range of actions the Cities will undertake to achieve its goals for buildings and development.





## BUILDINGS & DEVELOPMENT ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
BD-1	Program/ Education	Encourage and incentivize property owner participation in deep energy retrofits.	Reduce barriers for participation in, and actively recruit, homeowners and business owners for deep energy retrofits (over 40% energy use reduction) that are compatible with historic fabric. Clarify incentives and document retrofits through case studies.	Planning Depts, Sustainability	Medium	\$\$
BD-2	Standards/ Guidelines	Develop energy performance and electrification standards and incentives for new construction and major renovations to encourage progress toward net zero carbon emissions in buildings.	The Cities will develop incentives for new construction and major renovations that achieve net zero and net zero ready performance standards, such as Passive House. These standards and incentives will encourage highly efficient, sustainable buildings, not only in advance of the Cities' adoption of a forthcoming net zero stretch code, but also in the medium- and long-term, should provisions such as full electrification be missing from the new stretch code.	Planning Depts, Sustainability	Short	\$\$
BD-3	Policy	Establish requirements for new commercial and multi-family residential properties to include electric vehicle charging infrastructure, eco-roofs, and bike-ped amenities.	The Cities will require electric vehicle charging infrastructure and bike-ped amenities in new commercial and multi-family (5+ units) developments, which will promote the use of EVs and alternative modes of transportation for residents and employees. An eco-roof policy will require the integration of solar-installed or solar-ready roofs, green roofs, or white roofs, which will promote a range of benefits from reducing carbon emissions to mitigating urban heat islands and stormwater runoff.	Planning Dept, Sustainability	Short	\$\$
BD-4	Policy	Adopt the state net zero energy building code.	The building energy code is a critical tool in making advancements toward net zero and net zero-ready new buildings, but in Massachusetts, the base code and stretch code amendments are established at the state level. The Cities will play their part in adopting the zero-energy stretch code to improve occupant health, cut carbon emissions, and make buildings more operationally efficient. The Cities will create development incentives to encourage net zero energy and net zero ready new construction in the near term.	Planning Depts, Sustainability	Medium	\$
BD-5	Training/ Education	Host, promote, and invest in trainings and collaborative learning for municipal staff, boards/commissions, and building industry partners to support energy efficiency and decarbonization practices, from design to ongoing maintenance.	The Cities will seek, promote, and invest in learning opportunities in conjunction with industry leaders (developers, contractors, etc.) to advance the awareness and adoption of energy efficient and clean energy building design, construction, and maintenance. The Cities will incorporate asset management best practices into trainings and focus on workforce development to bolster a proactive maintenance driven culture.	Planning Depts, Sustainability	Short	\$\$



## BUILDINGS & DEVELOPMENT ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
<b>BD-6</b>	Zoning	Establish overlay zoning district(s) that establish minimum flood resilience design standards for new construction and existing buildings.	The Cities will create zoning overlay districts for areas at risk of coastal flooding to promote climate readiness for new and existing buildings.	Planning Depts	Medium	\$\$
<b>BD-7</b>	Capital Improvement	Implement energy efficiency upgrades, renewables, and resilience improvements in all municipal properties.	The Cities will evaluate public buildings for energy efficiency and resilience upgrades, implement upgrades, and produce case studies and communicate best practices to community members and other municipalities.	Public Services, Schools	Medium	\$
<b>BD-8</b>	Research/ Assessment + Standards/ Guidelines	Commission a vulnerability assessment of historic buildings.	The Cities will facilitate vulnerability assessments for historic buildings to understand the climate risks and resilience-building opportunities.	Planning Depts	Medium	\$\$
<b>BD-9</b>	Training/ Education	Develop a public education and outreach program about flood protection strategies, Community Rating System, and flood insurance, including the National Flood Insurance Program (NFIP) and Risk Rating 2.0 updates.	The Cities will devote resources to raising awareness about coastal flood vulnerabilities to buildings and the measures building owners can take to make their properties more resilient. Consider strategies to facilitate managed retreat or relocation.	Engineering Depts, Planning Depts, Sustainability	Medium	\$



## TRACKING PROGRESS

Measuring our success over time is crucial to ensuring that we achieve the *Resilient Together* goals for Buildings & Development. The following metrics represent just some of the data we'll be tracking in the coming months and years to understand how we're doing. The Cities plan to track progress toward these targets annually.

METRIC	BEVERLY BASELINE	SALEM BASELINE	2030 TARGET	2050 TARGET
<b>GHG emissions from buildings (MTCO<sub>2</sub>e)</b>	229,363	228,347	Beverly: 155,000 Salem: 154,000	Beverly: 4,200 Salem: 4,700
<b>Energy use from buildings (MMBtu)</b>	3,030,712	3,045,141	Beverly: 2,698,000 Salem: 2,674,000	Beverly: 1,348,000 Salem: 1,326,000
<b>Number of gas/oil heated commercial properties<sup>1</sup></b>	604	1,305	Beverly: 480 Salem: 1,040	0

### Notes

- \* Source of all baseline data, unless otherwise specified: Beverly and Salem Community and Municipal 2018 Greenhouse Gas Emissions Inventory.
- 1 Derived from each Community Assessor's Database
- 2 U.S. Department of Energy. Low-Income Energy Affordability Data Tool.  
Retrieved from <https://www.energy.gov/eere/slsc/low-income-energy-affordability-data-lead-tool>.  
Low income defined as 0-30% of Area Median Income.

### ADDITIONAL METRICS FOR CONSIDERATION

Number of net zero buildings

Number of insulation upgrades in households and businesses

Number of households receiving deep energy retrofits (Mass Save)

Aggregate electricity savings from efficiency programs (MWh)

Number of gas/oil heated residential properties

Percent of income spent on utilities by low-income households









# ENERGY

Implementing policies, programs, and projects that facilitate the early generation and adoption of reliable, clean energy and promote ongoing energy efficiency.

## GOALS

- › Regional clean energy will supply 100% of municipal asset operations by 2030 and 100% of community energy by 2040
- › Renewable energy is accessible to all residents and businesses
- › Our energy supply is reliable, efficient, safe, and resilient to climate-related disruptions
- › Clean energy, electrification, and energy storage technology adoption provide new and inclusive workforce development opportunities for our communities
- › All critical facilities have redundant systems to ensure utilities are supplied for the duration of projected future storm events

The Cities support policies, regulations, and infrastructure that increasingly enable electrification of buildings and transportation. Energy is both one of our greatest opportunities for carbon reduction and one of our assets most at risk from climate extremes. Strategies that reduce demand for fossil energy – such as deep efficiency retrofits and replacing fuel-based systems in buildings and industrial processes with electric systems, will dramatically slash greenhouse gas emissions when paired with an electrical grid that is also free of fossil fuel generation. Pairing emission-cutting strategies with on-site renewable energy generation, energy storage, and microgrids will increase resilience for critical facilities to weather climate impacts and power outages.

Investments in efficient, resilient technologies and systems have numerous co-benefits including workforce development and local economic opportunities. These strategies also reduce energy costs, make housing more affordable, and protect vulnerable community members from power outages and shutoffs.



### Emissions from Electricity

Nearly 20% of total GHG emissions in Beverly and Salem come from electricity. Electricity generation in New England currently relies heavily on natural gas, which is less polluting than fossil fuels like coal, but still generates GHGs until we shift to clean, renewable electricity.

Kim Lundgren Associates. (2020). Beverly and Salem Community and Municipal 2018 Greenhouse Gas Emissions Inventory Summary Report.

## ENERGY TODAY

Fossil-fuel based systems, such as space heating and water heating in buildings, and gasoline and diesel in cars and trucks, will need to be converted to electricity to make any meaningful impact on our overall carbon footprint. As systems are electrified, the power grid also needs to shed its own reliance on fossil fuels, requiring a rapid integration of renewable energy into the National Grid portfolio.

The current fuel mix for generating electricity still contributes almost 20% to our communities' carbon footprints.

19.8%  
BEVERLY

19.7%  
SALEM





# HIGHLIGHTS

Fortunately, programs and initiatives in both Beverly and Salem, alongside state and utility programs, are reducing fossil fuel consumption, driving a transition to local renewable energy sources, promoting energy efficiency, and hardening the systems of our critical facilities.



## MUNICIPAL SOLAR PROJECTS

On a former landfill in Beverly, **14.3 acres** of solar panels provide enough electricity to power **745 homes** for a year—a third of that power is reserved for Beverly Public Schools.

### SOLARIZE MASSACHUSETTS CAMPAIGNS

In both 2014 and 2019, Salem participated in these campaigns, resulting in 59 solar photovoltaic (PV) systems installed on homes and businesses. Salem is partnering with the Towns of Nahant and Swampscott to launch Solarize North Shore, making it easier and more affordable for residents and businesses to install solar PV, air-source heat pumps, and solar hot water.

### Solar Power

Beverly has almost 800 PV solar energy installations. Salem has nearly 600.



### ENERGY EFFICIENCY INITIATIVES

In Salem, these initiatives provide an estimated annual savings of nearly \$750,000 and the equivalent carbon emissions reduction of 669 passenger vehicles driven for one year. Beverly has also completed dozens of major energy efficiency projects for schools, libraries, and outdoor and street lighting.

**SALEM**  
**\$750,000**

SAVINGS ANNUALLY

CARBON EMISSIONS  
REDUCTION  
EQUIVALENT OF

**669**

PASSENGER VEHICLES  
PER YEAR



### GREEN MUNICIPAL AGGREGATION PROGRAMS

Green municipal aggregation (GMA) is highly impactful in reducing emissions from electricity. Salem PowerChoice is a GMA program that uses bulk purchasing power to offer residents and businesses an unobtrusive path to renewable, local electricity sources. Community members pay fixed, lower rates by purchasing power together and support the local clean energy economy. All National Grid accounts in Salem are automatically enrolled in the default program offering, which provides 100% renewable energy. Beverly is launching their GMA, Beverly Community Electric, in 2021.



# 100%

## CLEAN ENERGY

BEVERLY AND SALEM  
HAVE BOTH COMMITTED  
TO 100% CLEAN ENERGY  
FOR MUNICIPAL  
OPERATIONS.



© Block Island Wind Farm, Credit: Chris Bentley (CC BY-NC-ND 2.0)

### TAKING ACTION

Informed and bold policy, significant financial and technical support, and community member education is necessary to meet the Cities' goals of providing accessible, clean, renewable energy sources, adopting energy efficient systems, and electrifying our buildings and transportation. The Cities can capitalize on the support of the many residents who were surveyed for *Resilient Together* that were eager to allocate resources to renewable energy and energy efficiency projects, as well as focus group participants who were interested in reducing utility bills but weren't sure where to start.

Creating pathways to clean energy careers will strengthen and diversify the local economy and speed

the uptake of efficiency, resiliency and renewable energy measures. The Cities will partner with existing National Grid and Mass Save programs to maximize reach, while expanding education for local customers.

To tackle the more difficult transitions, the Cities will seek out partners to host demonstration projects of geothermal, microgrid, and energy storage technologies. The Cities will also stay engaged in state and national policy-making to advocate for large-scale programs and projects, like utility-scale renewable energy installations and efficiency incentive programs, that enable local action. The following actions outline Salem and Beverly's path to a clean energy future that is smart, resilient, and carbon-free.



## ENERGY ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
E-1	Advocacy/ Engagement	Promote residential energy efficiency, renewable energy, and electrification, facilitating participation in state and utility program offerings.	Coordinating communications is crucial to the success of residential adoption of energy upgrades. The Cities will launch a coordinated, branded program to promote residential energy efficiency, renewable energy (inclusive of wind, solar, solar hot water, and geothermal technologies), and electrification. As part of this program, the Cities will facilitate participation among homeowners, landlords, and tenants in state and utility program offerings such as Mass Save, MassCEC, National Grid, and PACE.	Sustainability Depts	Short	\$\$\$
E-2	Research/ Assessment	Identify potential locations for district-scale geothermal microgrids and encourage, support, and incentivize this practice for large developments.	The Cities will evaluate potential locations for district-scale geothermal microgrids, targeting campuses and larger facilities in public and private sectors. They will identify technical, logistical and financial barriers to implementing microgrids. The Cities will encourage and incentivize geothermal microgrids in large redevelopments and subdivisions.	Engineering Depts	Short	\$\$
E-3	Training/ Education	Develop an education campaign for local businesses on opportunities for energy demand reduction, such as demand response programs and other utility incentives. This education campaign could shift focus, as needed, over time.	The Cities will develop a campaign to educate local businesses on energy demand reduction opportunities. They will provide information on energy management technologies and strategies and the costs and benefits. They will also provide information on utility demand response programs and incentives.	Planning Depts	Short	\$
E-4	Training/ Education	Host existing and establish new training programs for businesses and homeowners on renewable energy and energy storage options.	The adoption of clean energy technologies and available programs by residents is critical to achieving community energy goals. The Cities will ensure that business owners and homeowners understand renewable energy and energy storage technologies and available programs and incentives. They will facilitate or host programs or develop and deliver new programs. The Cities will support residential and commercial tenants to access these technologies by ensuring training of commercial and residential landlords as well as training tenants on community solar options.	Sustainability Depts	Medium	\$\$
E-5	Training/ Education	Incorporate clean energy education and climate change education into the school curriculum.	Climate change education for all ages can ensure that the next generation is informed and prepared to meet the challenges of climate disruption. The Cities will work with public and private schools, community centers, and enrichment/after-school programs to incorporate age-appropriate clean energy and climate change education into curricula for K-12.	Schools	Short	\$





## ENERGY ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
E-6	Advocacy/ Engagement	Promote clean alternatives to electrification for difficult-to-electrify properties.	The Cities will identify technology alternatives to electrification that can be used in properties requiring cost-prohibitive infrastructure changes. They will create technology demonstration projects. The Cities will also identify applicable incentives.	Planning Depts	Medium	\$\$\$
E-7	Capital Improvement	Evaluate critical municipal facilities to increase energy efficiency and redundancy, exploring opportunities for cleaner and more secure back-up power options, as technologically feasible.	The Cities will identify critical municipal facilities and complete an investment-grade audit to identify energy efficiency and redundancy. They will revisit cleaner and more secure emergency back-up power options as an alternative to diesel generators, as technologically and financially feasible.	Engineering Depts	Short	\$\$
E-8	Advocacy/ Engagement	Advocate for large-scale offshore wind projects and explore feasibility of Cities as anchor institutions for State projects.	Partnerships and advocacy are valuable strategies to accelerate clean energy projects in the region. The Cities will work with legislators, advocacy groups, and private sector developers to encourage offshore wind and seek to proactively develop/ attract businesses that support offshore wind manufacturing, construction, maintenance and related activities.	Building Depts	Short	\$\$
E-9	Policy	Establish progressively higher percentage requirements for New England region renewable energy projects for standard option green municipal aggregation (GMA) programs and promote "plus" options for 100% regional renewable energy.	Sourcing local, renewable energy is a way to reduce emissions while supporting the local energy economy. The Cities will establish progressively higher percentage requirements for New England region renewable energy projects for standard option green municipal aggregation (GMA) programs. They will promote "plus" options for 100% Class I Renewable Energy Credits (RECs) from New England to grow the regional renewable energy economy.	Planning Depts	Medium	\$\$
E-10	Training/ Education	Coordinate with local institutions to provide vocational training programs for clean energy careers.	Supporting clean energy careers is an important action to strengthen the local energy economy and create opportunities for sustainable technical jobs. The Cities will promote and support regional vocational training and continuing education programs, such as for green construction, electrical technicians, and manufacturing. They will identify the need for additional programming, recruiting, and incentives; support for special populations; and employer recruiting and incentives. They will create clear and celebrated career pathways from kindergarten through job placement.	Schools, Economic Development	Long	\$\$\$
E-11	Capital Improvement	Partner with utilities to address gas leaks in supply infrastructure by replacing all cast iron pipe.	The Cities will motivate gas utilities to perform gas leak detection and mapping throughout its local and regional distribution infrastructure. They will incentivize utility replacement of cast iron gas pipes, which are responsible for the majority of leaks. The Cities will evaluate permitting requirements to encourage leak reduction.	Engineering Depts	Medium	\$\$



## TRACKING PROGRESS

Measuring our success over time is crucial to ensuring that we achieve the *Resilient Together* goals for Energy. The following metrics represent just some of the data we'll be tracking in the coming months and years to understand how we're doing. The Cities plan to track progress toward these targets annually.

METRIC	BEVERLY BASELINE	SALEM BASELINE	2030 TARGET	2050 TARGET
<b>% of municipal energy that relies on clean energy<sup>1</sup></b>	16% (2018)	21% (2018) <sup>3</sup>	100%	100%
<b>Local renewable energy capacity (MW)<sup>2</sup></b>	13 (2018)	6 (2018)	Beverly: 50 Salem: 53	Beverly: 114 Salem: 133

### Notes

- \* Source of all baseline data, unless otherwise specified: Beverly and Salem Community and Municipal 2018 Greenhouse Gas Emissions Inventory.
- 1 Internal records
- 2 MassCEC Production Tracking System Data and Reports (2018). Retrieved from <https://www.masscec.com/data-and-reports>
- 3 Salem purchases renewable energy at rate of 5% above the Massachusetts Clean Energy Standard in any given year

### ADDITIONAL METRICS FOR CONSIDERATION

Percent of community energy that relies on clean energy

Percent of buildings electrified with high efficiency heat pumps

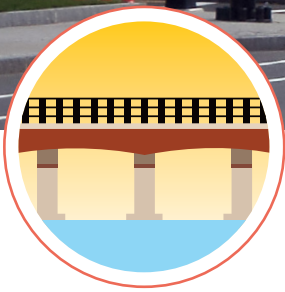
Percent of buildings with battery backup

Number of public EV charging stations per capita







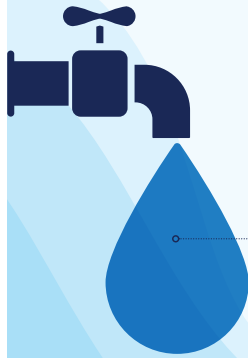


# INFRASTRUCTURE

Enhancing drinking water, stormwater, and wastewater infrastructure as well as bridges and streets through green infrastructure and improved maintenance.

## GOALS

- › The Cities' infrastructure assets are designed, constructed, and maintained to optimize integrated systems for efficiency, resilience, and to minimize failure
- › Wastewater, drinking water, and stormwater infrastructure are designed and constructed for water conservation and resilience to projected climate conditions
- › Infrastructure upgrades are equitably distributed throughout the Cities and prioritized based on greatest need
- › Physical infrastructure also serves as social or recreational space (places where people can safely connect and engage) wherever possible
- › Major infrastructure is planned, designed, and constructed with consideration of long-term maintenance and life cycle costs, benefits, and emissions, as well as life cycle assessment
- › The Cities actively pursue green and nature-based solutions for infrastructure upgrades



**SALEM & BEVERLY**

USE  
**3.5 BILLION**  
GALLONS OF  
DRINKING  
WATER PER  
YEAR.<sup>17</sup>

Infrastructure is what makes our cities function. Whether it be the roads we drive on, the sidewalks we walk on, or the pipes that bring us clean drinking water, infrastructure consists of the physical structures and facilities that keep our community going. Strong infrastructure systems also keep us and our environment healthy by cleaning our drinking water and treating stormwater as it leaves our pipes. Climate change is increasingly putting our infrastructure systems under threat. As it gets hotter, our electrical grid must meet increasing energy demands. As our cities grow, our roads see more wear and tear, a process exacerbated by temperature fluctuations between hot and cold. Climate change is also leading to stronger storms, higher sea levels, and more extreme precipitation events. Together, all of these changes mean that our infrastructure must change too.

**INFRASTRUCTURE TODAY**

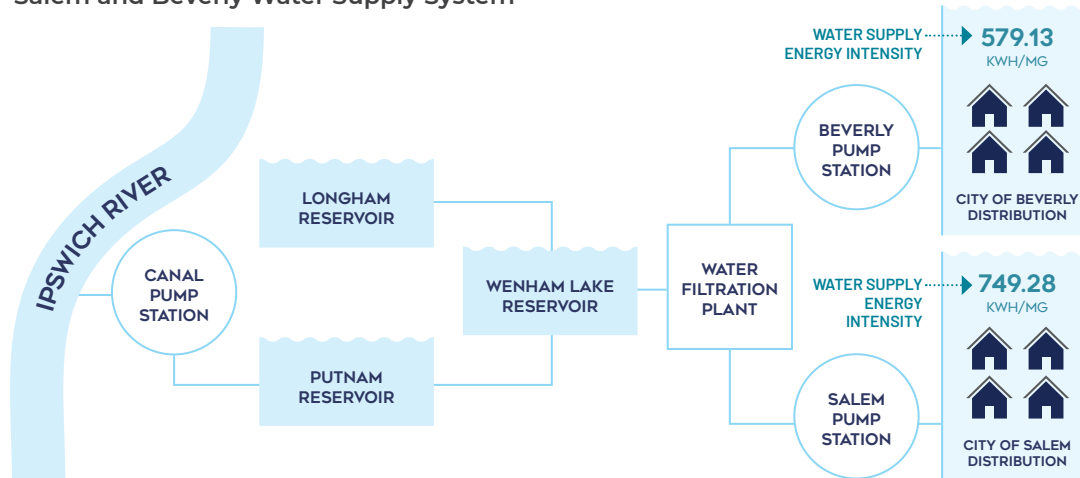
Infrastructure is not something that many residents may be passionate about—it's normally considered out of sight, out of mind. However, a robust and sustainable infrastructure system is one of the key ways for our cities to become resilient to climate change. For example, under current conditions, there is an approximate 5% chance that flood water levels would flood the Margin Street Stormwater Pump Station in any given year. By 2030, the chance is 50%, and by 2070, there is a 100% chance of the pump station being affected. If the pump station fails, that means our homes, businesses, and roads are more likely to flood.

Infrastructure operations and maintenance is an ongoing obligation of cities, led by staff in the Engineering and Public Services Departments. These staff help operate and maintain hundreds of miles of different pipe systems that carry our drinking water, sewage, and stormwater. They also maintain our roads and sidewalks. The following facts and figures highlight just a small number of the critical elements of infrastructure maintenance and investment in both cities.

**DRINKING WATER SUPPLY**

This water is drawn from a complex system of connected reservoirs and pump stations that draw water from the Ipswich River during the winter season. The reservoirs, which include the Wenham Lake Reservoir, Putnamville Reservoir, and Longham Reservoir, ensure that no water is pulled from the river during the dry season, which helps protect the river's ecosystem.

**Salem and Beverly Water Supply System**



Source: Salem & Beverly Water Supply Board; KLA

**Pumping water takes energy!<sup>16</sup>**

Salem has higher emissions because it has to pump water farther from the Wenham Lake Reservoir than Beverly does. Reducing water consumption can help the cities meet their emissions reduction targets while also conserving water supply.

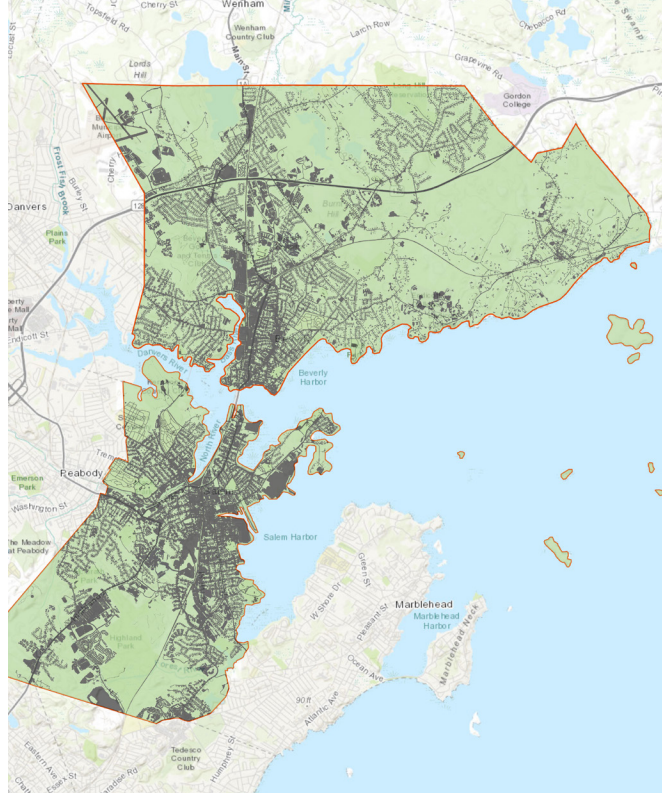




## COMBINED HEAT AND POWER AT THE SOUTH ESSEX SEWERAGE DISTRICT

The mission of the South Essex Sewerage District is to protect the public health of the District's residents and enhance the quality of the region's water resources by providing safe, efficient and reliable wastewater collection, conveyance, treatment and disposal. Energy use at this facility has improved significantly over the past two decades: between 2001 and 2012, efficiency investments at the South Essex Sewerage plant have saved 7.4 million kWh and 67,000 Decatherms. The new combined heat and power system, which went online in January of 2020, supplies all electricity used onsite while using gas for thermal loads and provides backup power in case of grid failure. This new system allows the treatment plant to generate its own electricity and remain operational in the case of power outages, reducing risk of untreated wastewater being released into the harbor.

Source: South Essex Sewerage District. (2020). Retrieved from <https://www.sesd.com/projects/completed/> and [http://www.newea.org/wp-content/uploads/2020/02/13-AC20\\_MRibeiro.pdf](http://www.newea.org/wp-content/uploads/2020/02/13-AC20_MRibeiro.pdf)



## GREEN INFRASTRUCTURE

Reducing impervious, paved areas like sidewalks and asphalt and replacing them with permeable surfaces like porous concretes, is one way that cities can reduce their stormwater management burdens by enabling water to be reabsorbed into the ground. Pairing these upgrades with other biological functions of green infrastructure, like rain gardens and tree pits, can help improve water quality and reduce urban heat island effect.

Pumping wastewater to the South Essex Sewerage District wastewater treatment plant also takes energy – 436,695 kWh<sup>18</sup> to be exact! Green infrastructure can reduce the amount of energy required for pumping stormwater by retaining it as close to where it lands as possible and filtering it through natural processes. Aerial imagery provided by MassGIS shows that Salem

has approximately 63% impervious area, whereas Beverly has 23% impervious area. Implementing strategies to increase porous areas can help address multiple climate resilience and emissions reduction challenges simultaneously.

## TAKING ACTION

Creating a resilient infrastructure network for both cities requires a combination of targeted policies, substantial capital investments, and public support for necessary improvements. Whether it be new fees to generate revenue for necessary upgrades, investing in new asset management tools and protocols, or going in on collaborative grant opportunities for shared water and sewer infrastructure, the Cities can work to become more resilient together. Although many of the infrastructural actions outlined below are directed towards city staff, there are many opportunities for public engagement: whether that means creating new jobs through green infrastructure training programs or developing community outreach for water conservation and quality initiatives, infrastructure is one of the many things that keeps our communities connected.

Beverly and Salem will create a resilient infrastructure system by improving stormwater management and wastewater treatment facilities, implementing green infrastructure, maintaining our bridges, roads, and sidewalks through twenty-first century asset management systems, and creating new financing mechanisms and proactive, preventative, predictive, and precision maintenance to ensure the long-term sustainability of infrastructural investments.





# HIGHLIGHTS

Recent efforts in Beverly and Salem have advanced the Cities' ongoing management and resilience of infrastructure assets to best serve our communities.



## STORMWATER MANAGEMENT AND FLOOD CONTROL

Salem has a number of projects in its 5-year capital improvement pipeline to control flooding and improve drainage, including the Mill Creek Flood Warning System, Hayseville Pump Station improvements, Madrona SSO Capacity Improvements, and Rosie's Pond Flood Control Project.

### COASTAL RESILIENCE

Both Cities have Coastal Resilience Plans that identify critical infrastructure vulnerabilities and adaptation strategies to help neighborhoods and businesses adapt to rising sea levels and storm surge. For example, in Salem, a Seaport Economic Development Council grant allocated \$1 million for harbor resilience projects. Beverly also received \$48,000 through the MVP Action Grant Program for repairs to its commercial fishing pier.

#### SALEM

**\$1,000,000** GRANT

HARBOR RESILIENCE PROJECTS

#### BEVERLY

**\$48,000** GRANT

COMMERCIAL FISHING PIER REPAIRS



### ASSET MANAGEMENT

Both Cities have begun cataloging their infrastructural systems into high-tech asset management systems that improve the efficiency of operations and maintenance schedules.

### UPGRADING WATER INFRASTRUCTURE

In Beverly, ongoing water main replacement and gate valve replacement citywide has the goal of replacing 1% of total pipeline length every year (\$1,000,000/year). There is also an ongoing project to replace 4,000 gate valves, some of which are over 100 years old!

#### BEVERLY

**4,000** GATE VALVES

WILL BE REPLACED. SOME ARE **100 YEARS OLD!**



## INFRASTRUCTURE ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
I-1	Technology/ Software	Implement a computerized maintenance management system (CMMS) to assess public asset conditions, streamline data collection, and estimate asset replacement values, considering, as appropriate, life cycle assessment.	A comprehensive computerized maintenance management system (CMMS) is a functional way to plan, implement, operate, and maintain infrastructure systems. The Cities will streamline their infrastructure systems in order to most efficiently and effectively identify operations and maintenance projects, protocols, and prioritization for infrastructure financing and repairs. The CMMS system should be linked to and inform the capital plan.	Engineering Depts	Short	\$\$\$
I-2	Research/ Assessment	Analyze all infrastructure for vulnerability, evaluate for criticality, rank for priority upgrades, and incorporate into asset management and capital planning.	Beverly and Salem share a significant amount of critical infrastructure, including utilities through the South Essex Sewerage District and the Salem/Beverly Water Supply Board, road infrastructure, and bridges. The Cities will work to thoroughly analyze their own assets as well as work together to analyze their mutual interdependencies and foster collaborative action, whenever possible, to ensure the resilience of critical assets in both communities simultaneously.	Public Services, Engineering Depts	Long	\$\$\$
I-3	Policy	Explore financing strategies like stormwater fees to generate needed revenue for infrastructure financing.	Stormwater infrastructure planning, design, and maintenance is expensive. With increasing climate risks, generating the needed revenue to pay for critical improvements to increase the stormwater system's resilience is imperative. The Cities will build local autonomy, reduce burdens on the stormwater system, decrease urban heat island effect, and improve water quality by generating revenue through stormwater fees calculated by impervious surface area on private properties or other means as determined practicable.	Mayor's Office	Medium	\$\$
I-4	Standards/ Guidelines	Develop and adopt sustainable and resilient design guidelines for all new site development and infrastructure projects, as well as upgrades/maintenance to existing infrastructure.	The Cities will adopt sustainable and resilient site development and infrastructure design guidelines that incorporate climate projections for Massachusetts for at least 2070 and focus on resilient and sustainable design, operations, and maintenance best practices. The Cities will work to ensure all infrastructure meets updated standards as determined by their life cycle replacement timeline.	Public Services	Short	\$\$



## INFRASTRUCTURE ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
I-5	Training/ Education	Implement an education and training program for municipal staff (including DPS/DPW, planning staff, administration) on best practices for operations and maintenance of green infrastructure. Make information from these trainings available to the public.	Green infrastructure is a highly effective way for cities and their communities to increase their resilience and adapt to climate change. While green infrastructure has been around for some time, it has not been widely used, and new information is constantly becoming available to improve standards and define best practices. The Cities will take the opportunity to provide public and private education and training to inform all developers, engineers, contractors, and residents and stakeholders on the benefits of, and stormwater regulation for green infrastructure implementation.	Engineering Depts	Long	\$\$
I-6	Policy	Create incentives for businesses and residents to convert impervious surfaces to pervious areas.	Many public assets such as roads, sidewalks, and public buildings have impervious surfaces, but impervious areas are often found on private property. The Cities will create incentives for private property owners to convert impervious surfaces to pervious areas, which will improve water quality, reduce the burden on city stormwater infrastructure, and improve quality of life for everyone in the community.	City Councils, Planning Depts	Long	\$\$\$
I-7	Capital Improvement	Implement resilience upgrades for critical infrastructure assets vulnerable to coastal flooding.	The Cities have identified critical infrastructure plans through their Hazard Mitigation Plans, but additional steps are needed to identify and implement resilience upgrades to reduce vulnerabilities based on climate projections.	Engineering Depts	Long	\$\$\$
I-8	Policy	Establish a long term strategy for public shoreline stabilization structures with an emphasis on nature-based solutions and naturalizing the coast line.	As sea levels rise and storm surge threats intensify, coastal cities like Beverly and Salem must take dramatic action to protect their shorelines. Increasingly, nature-based solutions that restore coastal habitats like wetlands are shown to have powerful results for stabilization while providing other benefits like habitat creation and water quality improvements. The Cities will work to review public properties located on the coast and consider alternatives to grey infrastructure stabilization solutions.	Engineering Depts	Long	\$\$
I-9	Research/ Assessment	Conduct a detailed hydrologic and hydraulic model of the cities to understand flood risks.	In order to better understand their vulnerability to flooding, sea level rise, and storm surge, the Cities will commission a detailed hydrologic and hydraulic study and model that can inform future resilience actions.	Engineering Depts	Medium	\$\$\$
I-10	Research/ Assessment	Assess vulnerability of telecommunications infrastructure and develop strategy to improve resilience.	Telecommunications infrastructure is increasingly the lifeline of local economies. It also keeps people connected and our emergency operations up and running. The Cities will review local telecommunications infrastructure and work with telecom providers to improve the resilience of systems to the impacts of climate change, including extreme weather.	Engineering Depts, Police, Fire, IT	Medium	\$\$





## TRACKING PROGRESS

Measuring our success over time is crucial to ensuring that we achieve the *Resilient Together* goals for Infrastructure. The following metrics represent just some of the data we'll be tracking in the coming months and years to understand how we're doing. The Cities plan to track progress toward these targets annually.

METRIC	BEVERLY BASELINE	SALEM BASELINE	2030 TARGET	2050 TARGET
<b>Annual water use (billions of gallons/year)</b>	1.1 billion	1.9 billion	65 gallons per capita per day <sup>1</sup>	65 gallons per capita per day
<b>Number of natural gas Leaks<sup>2</sup></b>	142 (2020)	71 (2020)	0	0

### Notes

- \* Source of all baseline data, unless otherwise specified: Beverly and Salem Community and Municipal 2018 Greenhouse Gas Emissions Inventory
- 1 Massachusetts Water Resources Commission. (2019). Policy for Developing Water Needs Forecasts for Public Water Suppliers and Communities and Methodology for Implementation. Residential Water Use Target. (2018) Retrieved from <https://www.mass.gov/files/documents/2018/10/09/waterneedsforecast-policymethod.pdf>
- 2 Heet. (2020). Gas Leak Maps. Retrieved from <https://heet.org/gas-leaks/gas-leak-maps/>.

### ADDITIONAL METRICS FOR CONSIDERATION

Percent of critical assets upgraded for resilience

Impervious surface area (% of total area)

Energy intensity of water supply and treatment (kWh/MG)

Percent of gas distribution pipes modernized (e.g., with PVC)

Roads in good repair (pavement condition index)









## MOBILITY

Creating a safe, connected, and accessible transportation system that prioritizes no- and low- carbon mobility, and promotes active lifestyles.

### GOALS

- › The Cities' municipal fleets are 100% zero-emissions by 2030, as technologically feasible
- › All community members have access to a variety of safe, no and low carbon transportation choices
- › The Cities encourage regional shifts to efficient, resilient, and reliable public transportation systems
- › Our transportation infrastructure is designed and upgraded for resilience to extreme heat, storms, and flooding
- › The Cities' roadways, paths, and sidewalks prioritize the needs of users of all ages and physical abilities to create a universally designed mobility system





“Climate change affects so much around us, from our natural ecology where humans live, to the land where our food is grown. Biking is a simple way for me to commute in Salem, enjoy time in the outdoors, and exercise. The paths around Salem have been critical in feeling safe on the roads when cycling.”

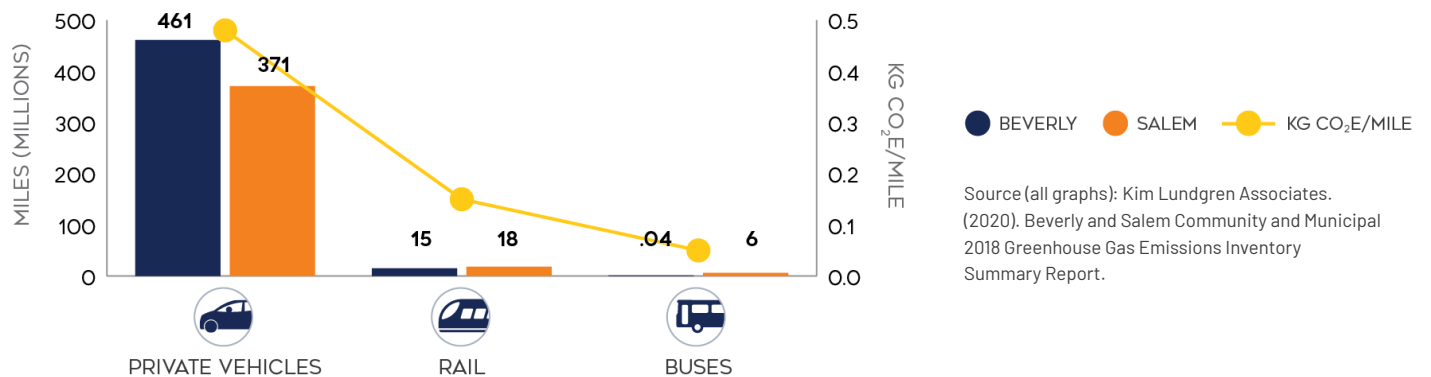
JACKIE DE HAAN

Despite recent improvements, transportation continues to be one of the greatest sources of GHG emissions in Massachusetts. As of 2017, more than 30% of all carbon dioxide emissions in the Commonwealth were transportation-related.<sup>19</sup> While manufacturers are offering more electric vehicle choices and electrical energy sources are becoming cleaner, embracing a more holistic vision for multi-modal transportation is essential to reducing overall emissions. Pedestrian and bike networks represent not only a positive zero-carbon alternative, but they can also play an important role in the overall health of residents, encourage low-impact development patterns, and contribute to the vibrancy of the public realm. With investment and coordination, the existing public transportation networks can be improved to complement pedestrian and bike infrastructure, deliver safe and clean alternatives for last-mile mobility, and provide auto-free options for residents.

## MOBILITY TODAY

Transportation accounts for almost half of the total GHGs in Beverly and Salem, with personal vehicles being a primary contributing factor. Personal vehicles are carbon intensive and pollute more per mile compared to public transit. In Beverly and Salem, 95% of the transportation emissions are generated while driving gasoline vehicles to work, school, and around town.<sup>20</sup> Drivers of private vehicles travel approximately 446 million miles more than rail and buses in Beverly and 353 million more miles in Salem. Despite current reliance on personal vehicles, the Cities are well poised to diversify transportation modes by capitalizing on their relative walkability and existing transit networks, and efforts are already underway to reduce emissions and encourage alternative modes of transportation. Strengthening and promoting transit use and automobile alternatives, as well as transit-oriented development, are critical ways to improve mobility and reduce transportation emissions. Where public transportation is not viable, prioritizing pedestrian and bicycle infrastructure and facilitating EV use are imperative.

Total Miles and Carbon Intensity by Mode



Source (all graphs): Kim Lundgren Associates. (2020). Beverly and Salem Community and Municipal 2018 Greenhouse Gas Emissions Inventory Summary Report.



# HIGHLIGHTS

Fortunately, ongoing initiatives across both Cities are working to improve mobility by promoting bicycles, walking, and public transit over single-occupancy vehicles, enhancing convenient and reliable transit options for all users, prioritizing transit-oriented development over the development of open space in outer suburban areas, and encouraging the transition to electric vehicles by providing more charging stations.



## ELECTRIC VEHICLES

Beverly operates one EV school bus, two school resource officer EVs, and several hybrids. Both Cities have installed electric vehicle charging stations at various municipal parking lots and schools and are working to increase their ownership of electric vehicles.

## COMPLETE STREETS

Both Beverly and Salem have Complete Streets policies and projects underway including the reconstruction of **Cabot Street** and upgrades to Boston, Bridge, and Goodhue streets. Complete Streets policies aim to rebuild the City's street system for all transportation modes, and for all people regardless of age, ability, and income.



## BICYCLE INFRASTRUCTURE AND PROGRAMMING

Both Beverly and Salem are working to improve bicycle infrastructure. The City of Salem is exploring bikeshare opportunities with Bluebikes after their contract with Zagster ended in 2020.



## MICROMOBILITY

Through the Salem for All Ages Action Plan, the City of Salem and the Friends of Salem Council on Aging received a grant to study the feasibility of an intra-city shuttle for people of all ages and abilities.

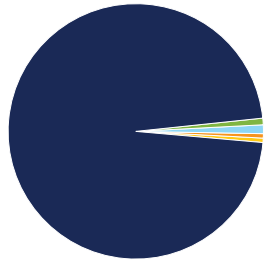


## SAFE ROUTES TO SCHOOL

Schools in Salem and Beverly actively participate in the Safe Routes to School (SRTS) Program, which works to increase safe biking and walking among elementary and middle school students.

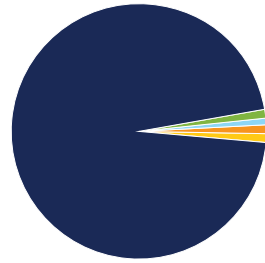


### Beverly Transportation Emissions Sources



- AIR TRAVEL / **.6%**
- MARINE VESSELS / **.9%**
- TRAIN / **1.4%**
- BUS / **.1%**
- PRIVATE VEHICLES / **97%**

### Salem Transportation Emissions Sources



- SALEM FERRY / **.218%**
- MARINE VESSELS / **1.98%**
- TRAIN / **1.8%**
- BUS / **.002%**
- PRIVATE VEHICLES / **96%**

Personal vehicles are responsible for the vast majority of transportation emissions in both Cities.

## STREET TALK DATA-DRIVEN MAINTENANCE

Beverly uses a data-driven approach to nearly double the lifespan of streets by using asset management software to analyze pavement conditions and prioritize street repair. During major road projects, the City upgrades infrastructure and evaluates opportunities for pedestrian and bike infrastructure in alignment with Complete Streets policies. The City also incentivizes the gas utility to upgrade gas pipes from cast iron to a safer and more reliable material.

## TAKING ACTION

Achieving the Cities' mobility goals will require collaboration and coordination between transit providers, continued research, dedicated funding, and active communication and education with the community. It is critical that the Cities work closely with regional transit providers like CATA, NSTMA, MBTA, and MassDOT to expand shuttle services and electrify regional rail on the Newburyport/Rockport commuter rail line. The Cities will need to coordinate with MassDOT's and the MBTA's resiliency efforts to understand and communicate how the commuter rail and other transportations assets are vulnerable to the changing climate. To encourage residents and visitors to transition to alternative modes of transportation, the Cities will need to dedicate resources and future funding to improve the safety and availability of those modes. This can include the implementation of a bikeshare program, improvements to the quality and quantity of bike lanes, and increases in the availability of EV charging stations. Through public awareness campaigns and active communication, the Cities can amplify the benefit of purchasing EVs, car sharing, utilizing public transportation over driving, and encouraging biking and walking. Community engagement and education is crucial to the effort to reduce transportation emissions. The following table outlines a range of actions the Cities will undertake to achieve its goals for mobility.

Salem residents within 10-minutes of the commuter rail or ferry.

**20%**  
WALKING DISTANCE



**70%**  
BIKING DISTANCE







## MOBILITY ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
M-1	Advocacy/ Engagement	Coordinate efforts with transit and other shuttle providers to prioritize improvements to public transportation operations, including route efficiency, expanded service, last-mile options, shelter/shading improvements, and enhanced affordability.	Public transportation networks are a critical ingredient in the Cities' overall goal of reducing automobile dependence. Through partnerships with regional shuttle providers (CATA, NSTMA, MBTA, MassDOT, etc.), as well as with private businesses, the Cities will optimize, prioritize, and coordinate the various local and regional public transportation networks to improve multi-modal choices and service in Beverly and Salem. As more varied modes of transportation are promoted through this plan, a well-coordinated system of shuttles, buses, and trains can play an important role in supporting a broader network of mobility options.	Beverly: Planning Dept  Salem: Traffic & Parking Dept	Long	\$\$\$
M-2	Advocacy/ Engagement	Create a public awareness campaign for electric vehicles (EV) and available charging stations locally and throughout the region.	Through a public awareness campaign, the Cities will amplify the growth of EV use by promoting awareness of charging stations and by reducing the perceived "barriers to entry" for residents considering switching from gas to electric. The campaign is imagined to be both informational as well as promotional and will target residents who may be less aware of the financial and environmental benefits of EV's and the growing infrastructure that supports them.	Sustainability	Short	\$
M-3	Advocacy/ Engagement	Enhance and increase awareness of multi-modal connectivity and accessibility options through educational events and enhanced wayfinding.	The Cities will leverage other mobility actions by taking steps to educate the public on transportation options. Measures include educational and promotional events, as well as a signage program to increase awareness about EV charging stations, bike share locations, and public transportation schedules and locations. It is important that the educational events and signage communicate the connectivity between alternative forms of mobility.	Beverly: Planning  Salem: Traffic & Parking Dept	Short	\$
M-4	Capital Improvement	Provide bicycle parking, including electric bicycle parking outlets, where feasible, at public parks, schools, and other major activity centers.	This action seeks to leverage those areas under control by the Cities for expanding bicycle infrastructure related to parking, sharing, and charging. An increase in bicycle infrastructure will aid in an increase in ridership among all abilities.	Beverly: Public Services  Salem: Traffic & Parking Dept	Medium	\$\$
M-5	Capital Improvement	Expand Salem bikeshare into a regional bike share program for Salem, Beverly, and neighboring communities.	Bicycle share programs work best at scale. While Salem is beginning to update their bikeshare program, Beverly and surrounding communities will assess the feasibility of a regional program. The feasibility study will include data collection on ridership and funding opportunities.	Beverly: Planning  Salem: Traffic & Parking Dept	Medium	\$\$



## MOBILITY ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
M-6	Capital Improvement	Provide EV charging stations at public parking facilities and on- and off-street locations.	The Cities will expand and diversify locations available for EV charging. Increased EV use and ownership are tied to the perception of the availability of charging stations. The Cities can build off of their publicly owned parking lots and streets to implement a number of high visibility options.	Beverly: Public Services Salem: Traffic & Parking Dept	Long	\$\$\$
M-7	Research/ Assessment	Conduct a local multimodal and micromobility connectivity study that identifies options for additional bike lanes and other bike/ped connectivity, accessibility, and safety improvements.	The Cities will focus on the critical analysis and planning for the long-term implementation of bike infrastructure. The study will identify not only opportunities for new bike lanes, but will analyze their potential impact on supporting multimodal travel more broadly and refined metrics for defining goals and success.	Beverly: Planning Salem: Traffic & Parking Dept	Short	\$
M-8	Policy	Introduce procurement policies for City-owned vehicles and contracted service vehicles that require low- or zero-carbon options.	This action seeks to reduce the carbon footprint of both City-owned vehicles and City contracted vehicle-related services. As the number of auto-makers developing electric vehicles increases, the Cities will have greater opportunities to modify their procurement policies in favor of hybrid and electric vehicles.	Purchasing	Short	\$
M-9	Capital Improvement	Evaluate and prioritize roadway spending to accommodate all users and encourage pedestrian connectivity and safety.	In prioritizing pedestrian safety and accessibility, the Cities will be supporting a foundational element in the overall plan to promote multi-modal transportation. Visible signs of pedestrian safety improvements not only provide greater levels of security, comfort and access, but also serve as an ongoing way to promote the Cities' commitment to reducing their carbon footprint. The action will result in city-specific and equitable strategies for long term prioritization and budgeting.	Beverly: Engineering, Public Services, Planning Salem: Engineering, Sustainability	Long	\$\$\$
M-10	Research/ Assessment	Assess transportation network elements for flood risk and other resilience concerns, and implement elevation/ protection improvements as needed.	Coordinate with MassDOT efforts to understand how transportation assets are vulnerable to sea level rise, storm surge, extreme heat, and increased precipitation. Understanding and preparing to address future risks will make both Cities more financially sustainable.	Beverly: Planning, Engineering Salem: Traffic & Parking Dept	Medium	\$\$
M-11	Advocacy/ Engagement	Advocate for transformational transit electrification and provision of regional rail on the Newburyport/ Rockport commuter rail line, and expansions (additional stations, lines, and intraregional connections).	Beverly and Salem both benefit from regional rail. Encouraging the electrification of the system would result in improved energy efficiency, lower emissions, and lower operating costs.	Beverly: Planning, Mayor's Office; Salem: Traffic & Parking Dept	Long	\$



## TRACKING PROGRESS

Measuring our success over time is crucial to ensuring that we achieve the *Resilient Together* goals for Mobility. The following metrics represent just some of the data we'll be tracking in the coming months and years to understand how we're doing. The Cities plan to track progress toward these targets annually.

METRIC	BEVERLY BASELINE	SALEM BASELINE	2030 TARGET	2050 TARGET
<b>Total GHG emissions from transportation sector (MTCO<sub>2</sub>e)</b>	221,237	180,263	Beverly: 150,000 Salem: 123,000	Beverly: 42,000 Salem: 38,000
<b>Single occupancy mode share (%)<sup>1</sup></b>	71.3%	64.6	Beverly: 52% Salem: 48%	21%
<b>Zero emissions/electric vehicle ownership<sup>2</sup></b>	< 100	< 100	5,000 per city	20,000 per city
<b>Number of vehicle crashes involving cyclists and pedestrians<sup>3</sup></b>	11 (2018)	19 (2018)	0	0
<b>% of population within walking distance to fixed transit<sup>4</sup></b>	41%	25%	Increasing through transit-oriented development	

### Notes

\* Source of all baseline data, unless otherwise specified: Beverly and Salem Community and Municipal 2018 Greenhouse Gas Emissions Inventory.

1 U.S. Census Bureau. (2018). American Community Survey 5-Year Estimates.

2 Estimated from 2016 Statewide EV Registrations.

3 MassDOT. Crash Query and Visualization. Retrieved from <https://apps.impact.dot.state.ma.us/cdv/>

4 Massachusetts Housing Partnership Center for Housing Data. (2020). Transit-Oriented Development Explorer. Retrieved from <https://mhpcenterforhousingdata.shinyapps.io/todex/>

### ADDITIONAL METRICS FOR CONSIDERATION

Municipal fleet that is low or zero emissions (%)



Peabody Essex Museum

**WILD DESIGNS**  
May 26, 2018-August 4, 2018  
Featured in The Doty Brown Art & Nature Center  
Discover how creative innovators are turning to nature for new ideas and smart solutions to human challenges.  
Presented by SPIRIT  
PE|M Peabody Essex Museum





## NATURAL RESOURCES

Preserving and enhancing our local biodiversity, tree canopy, water quality, beaches and shorelines, wildlife, and recreational open spaces.

### GOALS

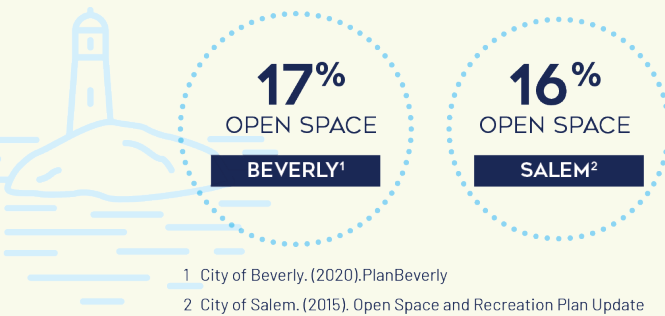
- › The Cities protect and enhance existing natural assets to reduce urban heat islands and preserve ecosystem functions
- › Climate change impacts are a high-level consideration for the planning of all parks, open spaces, forests, and wetlands
- › All residents, businesses, and visitors have increased access to and are active stewards of our natural resources
- › Our harbor and waterfront areas are connected to our neighborhoods and downtown, with enhanced resilience to flooding and sea level rise

Climate change threatens our natural resources in the form of coastal erosion from sea level rise, damage to trees from extreme storms, and shifting growth patterns of local plant and animal species (as well as invasive species). These impacts have real consequences for our human communities too, affecting the viability of beaches where we relax, the natural areas where we seek refuge, and the quality of the air and water we need to survive. Furthermore, our

communities will increasingly rely on healthy natural resources to adapt to climate change. Wetlands protect us from flooding, while trees and open space help us cool off as temperatures and extreme heat events increase. We are deeply connected to our natural resources in Beverly and Salem and beyond. *Resilient Together* will help us build on existing efforts to maintain and enhance this healthy connection, into the future.

## NATURAL RESOURCES TODAY

### Open Space (% of city area)



**83%**

of Salem residents are within a 10-minute walk of a park.

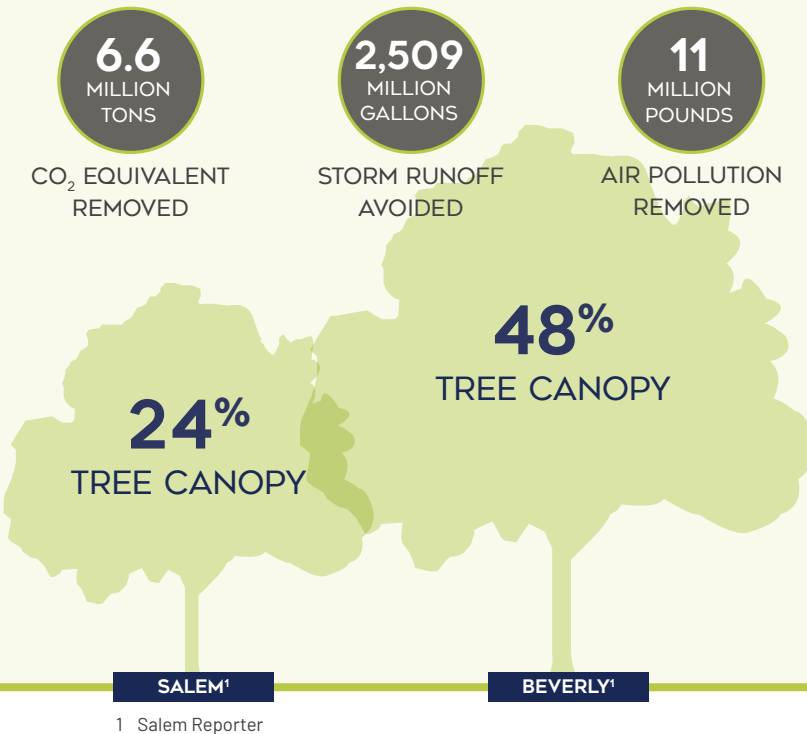
**73%**

of Beverly residents are within a 10-minute walk of a park.

### Tree Canopy

#### THE POWER OF TREES (ESSEX COUNTY)

Source: U.S. Forest Service i-Tree County Tool



Trees, in particular, are a crucial natural resource, particularly in urban areas. They help filter our air and remove carbon dioxide. They absorb water, preventing flooding when it rains. Trees also help to mitigate the urban heat island effect, reducing the intensity of extreme heat over time, and provide shade to those seeking relief.

Unfortunately, high-quality natural resources are not always equitably distributed across neighborhoods. Throughout the *Resilient Together* engagement process, both Beverly and Salem residents have expressed desires for expanded access to waterfront areas, improved accessibility to parks for all ages and abilities, and better connections to and within open space around the Cities.





# HIGHLIGHTS

Through existing planning efforts, policy, and regional partnerships, Beverly and Salem are already prioritizing the protection and enhancement of open space and natural vegetation.



## TREE PLANTING INITIATIVES

Beverly was awarded a grant through MAPC in 2020 to plant and maintain 70 public trees. Salem has support from Massachusetts Department of Conversation and Recreation for its Tree Planting Program to plant 2,000 new trees on private property and 400 trees on City property. Both Cities' efforts are helping to mitigate heat and improve air quality.



## OPEN SPACE IMPROVEMENTS

Both Cities are establishing stewardship programs to encourage participation in open space improvements and maintenance activities to help reduce and provide refuge from urban heat island impacts.

## CONSERVATION COMMISSIONS

The Cities' Conservations Commissions work hard to support public education, policy development, and development that protects the natural resources in Beverly and Salem.



## WETLANDS PROTECTION

Beverly and Salem each have wetlands protection mechanisms: Beverly, through its Wetlands Protection Ordinance and Floodplain Overlay District, and Salem, through its Wetland Protection & Conservation Ordinance and Wetlands and Flood Overlay District.



## WATER QUALITY MONITORING

Staff and volunteers with Salem Sound Coastwatch, a local non-profit organization, have been carrying out regular monitoring of water in and around Beverly and Salem as part of their Clean Beaches and Streams Program. The program supplements regular water quality testing performed by both Cities' Boards of Health, which ensures that residents have safe drinking water and recreational water resources.





## TAKING ACTION

To enhance existing natural resource planning and preservation efforts, *Resilient Together* prioritizes a mix of educational, research, land use, and policy interventions. Education and incentives for residents can encourage sustainable landscaping practices, water conservation, improved flood management, natural resource stewardship, and expanded use of recreational resources. Legal mechanisms like wetland ordinance updates can help to preserve valuable open space. Green infrastructure education for private landholders and low-impact development on municipal property can support water retention and filtration. Finally, updated plans for tree planting and invasive species management will help protect natural resources as the climate changes.

© David Alden-St. Pierre



## NATURAL RESOURCES ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
NR-1	Training/ Education	Encourage sustainable landscaping practices through incentives, education, and volunteer opportunities.	Landscaping practices can consume large amounts of water and use chemicals that lead to negative water quality impacts. The Cities will minimize these harmful environmental impacts by encouraging sustainable landscaping practices through partnerships with existing organizations that promote green practices and community-led gardening initiatives.	Planning Depts, Public Services	Medium	\$\$
NR-2	Advocacy/ Engagement	Launch an awareness campaign on local natural resources and recreation options, to cultivate respect and a sense of stewardship for the environment.	An appreciation for nature—and all of its many benefits—goes a long way in building a commitment to protecting it. Through events, media, and other programming, and working closely with partners, the Cities will further publicize their existing natural resources and recreation option with a focus on stewardship and regeneration.	Parks & Recreation	Short	\$
NR-3	Policy	Create a municipal planting policy that requires non-invasive species that are well suited for anticipated climate changes.	An invasive species is any organism that is not native to a particular area. They tend to reproduce quickly, harming native species and decreasing the area's biodiversity. To combat this issue, the Cities will establish a planting policy for municipal properties that requires non-invasive species that will continue to thrive despite a changing climate.	Public Services, Parks & Recreation	Short	\$
NR-4	Training/ Education	Educate private landowners, engineers, and developers on flood management through wetland restoration, wide buffer zones, and maintenance driven best management practices.	Climate change is bringing more intense storm events and higher risk of flooding, and this action seeks to minimize property damage and pollution of waterways caused by harmful runoff. After updating wetlands ordinances, the Cities will work with private landowners, developers, and contractors to promote flood management best practices including design, construction, operations, and long term maintenance.	Planning, Engineering Depts	Short	\$\$
NR-5	Zoning	Update wetlands ordinances and/or Floodplain Overlay District Ordinance to protect future flood zones and establish wider flood zone buffers.	Climate change is bringing more intense storm events and higher risk of flooding, which can lead to property damage and pollution of waterways caused by harmful runoff. The Cities will examine and update their respective wetlands and floodplain ordinances to ensure future flood zones are protected. Establishing wider flood zone buffers will be a core component of accounting for growing areas of flood risk.	Planning, Building Depts	Medium	\$\$\$
NR-6	Research/ Assessment	Analyze opportunities for open space preservation, enhancement, and acquisition of private parcels with high natural and recreational values.	Open space provides numerous ecological, public health, and climate mitigation benefits, including habitat protection, air filtration, natural cooling capabilities, and flood mitigation. To ensure we continue to reap these benefits, the Cities will explore opportunities for additional open space preservation (e.g., conservation restrictions), and park development with an emphasis on flood-prone areas and private lands with high natural value (i.e. wildlife habitat, potential for passive outdoor recreation, coastal flooding protection). The Cities will explore funds to purchase such properties or restrictions. The Cities will also explore transformative opportunities, such as naturalization or “undevelopment” for community gardens, pocket parks, etc.	Planning Depts	Long	\$\$\$





## NATURAL RESOURCES ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

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ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
NR-7	Standards/ Guidelines	Create an inventory, planting, and management plan of all City trees that prioritizes increased tree coverage in high-heat areas and planting of native species.	Trees provide benefits—such as air filtration, cooling capacity, carbon sequestration, and increased stormwater infiltration—that are critical as we face the impacts of a changing climate. An inventory and management plan of all City trees will allow us to maintain and enhance those benefits by prioritizing tree coverage in areas prone to high-heat and prioritizing native species that are better equipped for the changing climate. The management plan should consider issues such as how to address trees nearing their expected life span and mechanisms for replacement of damaged trees on private lands.	Tree Wardens	Medium	\$\$
NR-8	Research/ Assessment	Research, and find opportunities to install, alternatives to impervious surfaces and hardscapes in the city.	Impervious surfaces and hardscapes, such as parking lots, roads, and sidewalks, reduce an area's ability to absorb stormwater, leading to harmful runoff into waterways and increased flood risk. The Cities will research alternatives to traditional impervious surfaces and find opportunities to install such alternatives, especially in flood-prone areas.	Engineering, Public Service Depts	Medium	\$\$\$
NR-9	Capital Improvement	Use green infrastructure and Low Impact Development (LID) in public open spaces and on other municipal properties.	Green infrastructure is a cost-effective, nature-based approach to managing stormwater that provides additional community benefits, such as water purification and biodiversity. The Cities plan to lead by example by prioritizing green infrastructure and low impact development in public open spaces and other municipal properties. Green infrastructure, in appropriate areas, could include creative solutions such as space for food production and gardening.	Engineering, Public Services Depts	Long	\$\$\$
NR-10	Training/ Education	Create a public education program about water conservation and water quality protection to reduce per capita consumption.	Climate change is changing Massachusetts' precipitation cycles, leading to more frequent and extreme drought conditions. More extreme storms can also lead to harmful runoff that degrades water quality. The Cities will spearhead an education program for residents about water conservation and water quality protection as it relates to the Salem-Beverly water supply and nearby water resources. The program could also expand efforts to distribute water saving fixtures. The Cities will collaborate with the Salem-Beverly Water Board to manage water use and set per capita consumption targets.	Engineering Depts	Short	\$



## TRACKING PROGRESS

Measuring our success over time is crucial to ensuring that we achieve the *Resilient Together* goals for Natural Resources. The following metrics represent just some of the data we'll be tracking in the coming months and years to understand how we're doing. The Cities plan to track progress toward these targets annually.

METRIC	BEVERLY BASELINE	SALEM BASELINE	2030 TARGET	2050 TARGET
% preserved open space in community	17% (2019) <sup>1</sup>	16% (2015) <sup>2</sup>	Increasing	Increasing
% tree canopy cover <sup>3</sup>	56% (2016)	38% (2016)	Increasing	Increasing

### Notes

- 1 City of Beverly. (2021). PlanBeverly. Retrieved from <https://www.beverlyma.gov/606/PlanBeverly-Comprehensive-Master-Plan>
- 2 City of Salem. (2015). Open Space and Recreation Plan Update. Retrieved from [https://www.salem.com/sites/g/files/vyhlf3756/f/uploads/1\\_-\\_open\\_space\\_recreation\\_plan\\_2015-2022\\_update.pdf](https://www.salem.com/sites/g/files/vyhlf3756/f/uploads/1_-_open_space_recreation_plan_2015-2022_update.pdf)
- 3 MassGIS. (2016). Land Use/Land Cover data layer. Retrieved from <https://docs.digital.mass.gov/dataset/massgis-data-2016-land-coverland-use>

### ADDITIONAL METRICS FOR CONSIDERATION

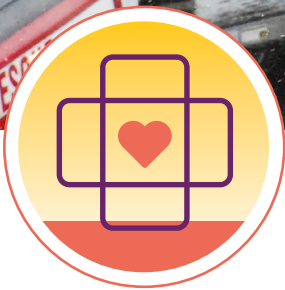
Percent of population within a 10-minutes walk of a park/open space

Percent of public tree planting sites occupied









## PUBLIC HEALTH & SAFETY

Preparing our communities for emergencies while improving community health through better air quality and access to health care, wellness programs, and healthy foods.

### GOALS

- › The Cities' municipal operations are prepared to recover quickly from climate impacts, maintaining service to our communities
- › All community members have close access to fresh, healthy, affordable food, with increased generation of food from local sources
- › All community members have access to resources and services that promote physical, mental, and emotional well-being
- › The Cities have in place coordinated response and communications plans to protect residents and visitors in the event of natural disasters or public health crises



“I’m taking action through cultivating healthy, connected, environmentally sustainable community and fighting for food justice by teaching people how to grow their own food!”

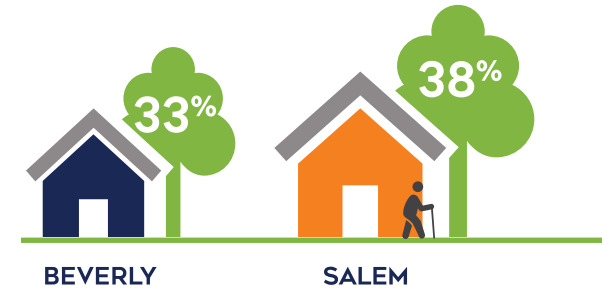
MARISSA GABRIEL

Healthy, connected, and well-resourced communities are increasingly important as climate change impacts intensify. Climate change is already testing our ability to prepare for and respond to more intense storms and stressors like extreme heat, as well as the increasing risk of vector borne diseases like eastern equine encephalitis (EEE). Furthermore, as the COVID-19 pandemic has emphasized, populations historically barred from accessing adequate resources are most vulnerable to prolonged and acute stressors. Maintaining public health and well-being means expanding access to and strengthening the services we need to adapt and thrive, from affordable medical treatment and healthy food to safe shelter and emergency care.

### PUBLIC HEALTH & SAFETY TODAY

Climate change impacts in the U.S. are already disproportionately harming communities of color, low-income communities, migrants, individuals with disabilities and physical/emotional health conditions, unhoused individuals, and other marginalized populations.<sup>21</sup> The Centers for Disease Control and Prevention’s Social Vulnerability Index (SVI) provides a score for U.S. Census tracts based on the themes of socioeconomic status, household composition/disability, race/ethnicity/language, and housing/transportation.<sup>22</sup> This tool can help municipal decision makers understand the spatial distribution of vulnerable populations in their communities and allocate resources to combat climate impacts accordingly. Scores range from 0, indicating lowest vulnerability, to 1, indicating highest vulnerability.

### Seniors Over 65 Who Live Alone



Source: U.S. Census Bureau. (2019). American Community Survey 1-Year Estimates.

Five Census tracts in Salem have scores above 0.5, indicating moderate vulnerability. One tract has a score of 0.86, indicating high vulnerability. Supporting our most vulnerable neighbors in the face of climate change is critical to our resilience and core to the actions within this plan element.

Beverly and Salem have comparable senior populations; individuals over the age of 65 represent between 16-17% of the population in both cities. With seniors’ increasing desire to age in place<sup>23</sup> and approximately one-third of seniors over 65 living alone,<sup>24</sup> access to medical help and other basic services, particularly during extreme events like heat waves and extreme storms, is paramount.





# HIGHLIGHTS

Understanding the gravity of these risks, the Cities are already leading efforts to prepare for the public health and safety implications of climate change impacts; expanding access to emergency response services; and ensuring all populations, particularly vulnerable communities, can access basic resources.



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## COMMUNITY GARDENS

Urban farms, community gardens, and gardening and gleanings groups in both cities partner with community members to provide local, healthy food. Examples include Salem Food for All, Salem Community Gardens, Mack Park Food Farm, and Maitland Mountain Farm.

## EMERGENCY COMMUNICATION SYSTEMS

Both Beverly and Salem have Emergency Communication Systems to notify residents of emergencies or public health risks immediately, via text or phone call.

BEVERLY



SALEM



## REGIONAL EMERGENCY RESPONSE: MA TASK FORCE 1

Federal Emergency Management Agency (FEMA) Massachusetts Task Force 1 (MA-TF 1) Urban Search and Rescue Team (US&R) is located in Beverly. A local branch of FEMA's National Urban Search and Rescue System, MA-TF1 is a rescue organization made up of firefighters, medics, engineers, and technical rescue technicians from municipalities throughout New England. They serve as the region's first responders in an emergency.

Source: MA Task Force 1. Urban Search & Rescue. Retrieved from: <http://matf.org/>



## COOLING CENTERS

During a heat advisory or other extreme heat event, Beverly and Salem open cooling centers in locations such as the Salem Community Life Center and the Beverly Public Library to provide residents with a safe place to cool down.



## MASS IN MOTION

Salem participates in a statewide movement to promote healthy eating and active living. Through Mass in Motion, the Massachusetts Department of Public Health works with 60 municipal governments and community partners to implement local initiatives. In Salem, this includes improved farmers market access, school gardens, and the Safe Routes to Schools and Parks initiative.





## TAKING ACTION

The Public Health & Safety actions within *Resilient Together* call for increased educational, material, and technical support from the Cities for businesses, neighborhoods, and residents to better understand and prepare for extreme weather events. Improved access to basic communications infrastructure like Wi-Fi and emergency notification services (multi-lingual and multi-media), as well as expansion of heat-reducing infrastructure and services, will help communities respond to acute stressors. Reducing the risk of harm resulting from flooding or other impacts to infrastructure (e.g., hazardous material storage), as well as the increased prevalence of vector-borne diseases, will require improved coordination across municipal boundaries. Finally, removing any barriers to accessing healthy, local foods while actively supporting expansion of community farming, will boost community well-being and local economies.

## CASE STUDY RESILIENCE HUBS

Collaborating with local partners, the City of Cambridge created a business plan for the Cambridge Community Center (CCC) and Margaret Fuller House to serve as Resilience Hubs. The plans focus on assessing and incorporating climate resilience into the community organizations' existing programs and capacities.

City of Cambridge. (2019). CCC Business Plan Retrieved from: <https://www.mass.gov/doc/cambridge-community-center-resilience-hub-business-plan/download>. Margaret Fuller House Business Plan Retrieved from: <https://www.mass.gov/doc/margaret-fuller-house-resilience-hub-business-plan/download>





## PUBLIC HEALTH & SAFETY ACTION TABLE

SHORT= 1-2 YEARS MEDIUM= 3-5 YEARS LONG=5+ YEARS

\$= EXISTING RESOURCES OR <\$10K \$\$= <\$100K \$\$\$= \$100K OR MORE

ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
PHS-1	Advocacy/ Engagement	Work with businesses/industry to improve response to extreme weather events and minimize operational downtime.	The Cities will work to understand the experiences of local businesses and industry with past extreme weather events while also educating around and planning for climate impacts. Small and minority-owned businesses will be a focus of outreach. This work can integrate into City efforts to expand and support their broader emergency planning and outreach efforts.	Fire, Public Services	Long	\$\$
PHS-2	Advocacy/ Engagement	Develop neighborhood resilience hubs to coordinate and maintain resident well-being as climate impacts intensify.	The Cities will work with local partners to establish hubs that feature services (e.g., emergency communications, shelter), programming (e.g., preparedness trainings), and infrastructure (e.g., back-up, renewable power) to support communities for daily use, as well as leading up to, during, and following emergencies.	Health	Short	\$\$\$
PHS-3	Capital Improvement	Ensure that Wi-Fi is accessible throughout Beverly and Salem, particularly in limited-access and low-income neighborhoods.	In partnership with internet providers, the Cities can work to expand infrastructure and introduce tiered pricing or free options for communities struggling to access WiFi. A particular focus should be placed on infrastructure and enhanced access, beyond existing hot spots, for families with school-aged children, particularly in light of remote learning (which schools may continue to rely on in the case of school closures, even following the COVID-19 pandemic)	Public Services	Medium	\$\$\$
PHS-4	Capital Improvement	Expand the "cooling capacity" of Beverly and Salem through investments in heat-reducing infrastructure and materials, as well as cooling initiatives.	Investments in heat-reducing infrastructure and materials could include replacing pavement with vegetation, green infrastructure, or cool paving materials; and installing green and reflective roofs. The Cities will work to increase the number and geographic distribution of shade structures and trees, respite areas, water fountains, cooling centers, and splash pads in parks. In light of the anticipated increase in extreme heat events due to climate change, the Cities will also expand educational efforts in advance of major heat events and distribution of water and other supplies during these events.	Sustainability, Engineering Depts	Medium	\$\$\$
PHS-5	Zoning	Assess gaps or restrictions in zoning codes to overcome any land use restrictions to healthier food options.	Zoning codes in Beverly and Salem may currently prohibit urban farming or other land development to support urban agriculture. A full review of policies to determine any prohibitive provisions, as well as opportunities for creative solutions (e.g., fruit-bearing street trees) could support enhanced access to fresh and locally-grown foods.	Planning Depts	Short: 1-2 years	\$
PHS-6	Advocacy/ Engagement/ Zoning	Support municipal and community gardens and urban farming.	In addition to more traditional models of community gardens, the Cities will support community gardens that enhance local professional development opportunities, regenerate unused spaces/ infrastructure (e.g., vacant lots, accessory structures, shipping containers), and employ innovative techniques or technologies (e.g., hydroponics, ocean farming). Support could come in the form of technical resources, personnel, zoning amendments, and/or grant-writing and funding support.	Health, Sustainability, Planning Depts	Medium	\$\$



## PUBLIC HEALTH & SAFETY ACTION TABLE

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ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
PHS-7	Training/ Education	Develop a pest and vector-borne disease management and communications plan.	This action will address the increased risks of vector-borne diseases such as Lyme, West Nile virus, and EEE virus due to warming temperatures and increased temperature extremes in the region. It will also address the shifting populations of insect pests and decreased efficacy of tools to manage insect pests resulting in potential damage to crops and food security. Management efforts will consist of prevention as well as organized response to potential outbreaks, coupled with a comprehensive public information campaign to involve residents in management efforts.	Health	Medium	\$\$
PHS-8	Training/ Education	Launch a multi-lingual, multi-media education/awareness campaign around public health and safety risks associated with climate change, and support household-level emergency planning and preparedness efforts, particularly in vulnerable communities.	This two-part action will involve 1) unified and consistent messaging from the municipalities around climate change risks that impact aspects of life ranging from mental health to physical safety; and 2) efforts to develop and advertise financial and technical support for specific residential planning and preparedness activities. For both aspects of this action, emphasis will be placed on publicizing existing resources and information, using City resources to fill any gaps, and ensuring that all efforts are not just accessible to, but also actively serve, low-income communities, communities of color, immigrant communities, and other communities who will be most impacted by climate change.	Health, Engineering Depts, Sustainability	Medium	\$\$
PHS-9	Training/ Education	Make citywide emergency communications and notification systems accessible to all residents for a range of climate-events.	Both Beverly and Salem have emergency communications systems, but not all residents are aware of these systems or best served by them. The systems can be enhanced to include multilingual, audio-visual in-person, phone, email, text, and social media alerts. Furthermore, the Cities should plan to accommodate increased use of- and traffic on- these systems for the full extent of climate impacts (e.g., poor air quality and extreme heat in addition to storms or flooding) that the region is expecting to see.	Emergency Management, Public Services	Short	\$
PHS-10	Research/ Assessment	Identify all hazardous material storage locations at risk from flooding and assess flood protection options.	The Cities will ensure that flood maps are up-to-date with the most recent climate projections (FEMA maps use historical data). An inventory of all hazardous material storage locations mapped against these flood locations would then reveal any vulnerabilities at specific sites requiring further protections ranging from barriers, to elevation, to relocation of storage sites.	Fire, Engineering	Short	\$\$\$





## TRACKING PROGRESS

Measuring our success over time is crucial to ensuring that we achieve the *Resilient Together* goals for Public Health & Safety. The following metrics represent just some of the data we'll be tracking in the coming months and years to understand how we're doing. The Cities plan to track progress toward these targets annually.

METRIC	BEVERLY BASELINE	SALEM BASELINE	2030 TARGET	2050 TARGET
<b>% of low-income neighborhoods with public WiFi coverage</b>	New metric	New metric	100%	Increasing city-wide
<b>Heat stress emergency department visits</b>	14 per 100,000 visits (2016 in Essex County) <sup>1</sup>		Minimize with increased heat	

### Notes

<sup>1</sup> Massachusetts Department of Public Health. (2016). Massachusetts Environmental Public Health Tracking. Retrieved from <https://matracking.ehs.state.ma.us/Health-Data/index.html>

### ADDITIONAL METRICS FOR CONSIDERATION

Number of contacts signed up for critical communications

Percent of households that are food insecure









## SOLID WASTE

Educating and delivering effective waste reduction, reuse, recycling, and composting programs and policies.

### GOALS

- › The Cities will develop waste reduction and management policies and programs that include resource recovery and use of sustainable materials as well as reduction of waste stream toxicity and GHG emissions
- › Beverly and Salem achieve 30% reduction in waste disposal by 2030 and 90% reduction by 2050
- › Community members are educated and responsible consumers who minimize waste generation and maximize productive reuse





“I recycle...and use a reusable water bottle to ensure I do not contribute to plastic waste.”

GRACE JEWKES

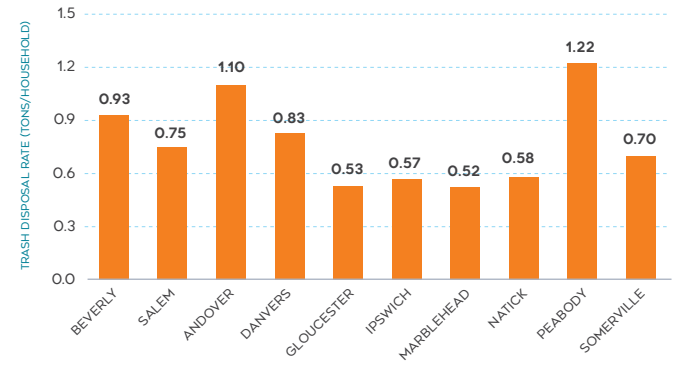


Effective solid waste management in Beverly and Salem is not just about properly recycling or disposing of the materials we no longer need. It's also about reducing unnecessary consumption and making smart purchasing decisions, which influence the resources that get used, as well as what we ultimately throw out. By creating opportunities for resource regeneration and reuse, we can prevent the GHG emissions and pollution associated with the transportation and incineration of our trash. Furthermore, with global restrictions on contamination in recent years, local recycling costs are increasing from around \$0/ton to over \$100/ton,<sup>25</sup> straining municipal budgets. Hauling fees for trash add up, too. By reducing what we consume, we can help our residents, businesses, and governments save money to be used for better purposes.

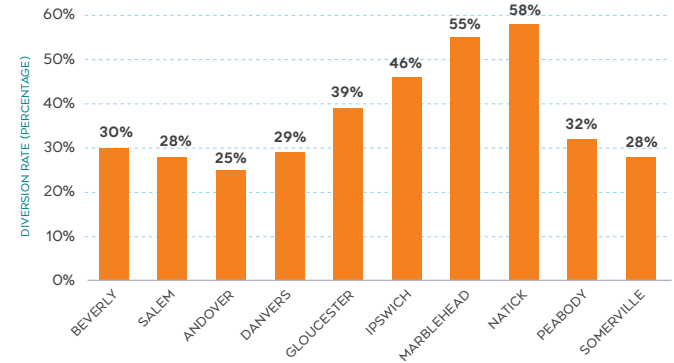
### SOLID WASTE TODAY

Like many municipalities around Massachusetts, Beverly and Salem face challenges encouraging residents to consume less and divert reusable materials away from trash, while also keeping recycling contamination to a minimum. On average, every household in Beverly throws away 0.93 tons of waste each year. In Salem, the disposal rate is 0.75 tons per household each year. In 2018, each city's diversion rate, or the amount of recycled material as a percentage of total generated, was 30% in Beverly, and 28% in Salem.<sup>26</sup>

### Disposal Rate (2018)



### Diversion Rate (2018)



Source (both charts): MassDEP. (2018). Recycling & Solid Waste Data for Massachusetts Cities & Towns. Retrieved from <https://www.mass.gov/lists/recycling-solid-waste-data-for-massachusetts-cities-towns>

Note: Number of households reflects households served by municipal trash program. Construction and demolition waste not included.





# HIGHLIGHTS

Fortunately, ongoing initiatives across both cities are working to reduce overall consumption, boost the sharing economy, and increase opportunities to collect specialized waste streams.



© Mack Park Food Farm

## COMPOST AND COMMUNITY AT LOCAL FARMS

Mack Park is the official host of the drop-off station where Salem residents can bring their compostables for free. It's also a great example of a regenerative solution to waste that keeps valuable resources in our local economy and food system. When residents drop off their kitchen scraps, staff and volunteers do the hard work of turning it into compost, which is then used to grow fresh vegetables for community members. To top it off, Mack Park food farm is located on the site of an unused baseball area, making use of vacant land in a way that benefits people and the planet.



### COMPOSTING

Both Cities offer opt-in composting programs to reduce the weight of household trash (which reduces tipping fees) while producing a nutrient-rich fertilizer. Beverly residents can sign up for paid subscription curbside pick-up and receive a \$20 rebate on the annual trash fee. Salem's program allows residents to bring food waste to select locations around the city for free, like Mack Park. Residents can also compost on their own or sign up for paid subscription services (beyond the incentivized service, in Beverly's case).



### COLLECTION EVENTS

Both Cities hold events in partnership with local organizations to repair and/or collect materials that are trickier to recycle. Beverly has an annual electronic waste event and year-round textile collection at the schools. Salem has quarterly electronic waste events, book swaps, and repair clinics. A reciprocity agreement allows residents from either city to attend the other's household hazardous waste collection events, specifically, to maximize participation.



### OPPORTUNITIES FOR REUSE AND RESOURCE-SHARING

Community organizations and informal groups hold their own events, such as clothing swaps, or maintain platforms like Buy Nothing and Freecycle to upcycle used household items. Beverly Bootstraps and other local organizations resell gently-used clothing and other items at a low cost. Reusing and keeping materials in our local economy avoids the purchase of new items, which often use valuable raw materials and natural resources for production and shipping.

### SINGLE-USE PLASTIC BAG BANS

Both Cities have restricted the use of single-use plastic bags by all retail establishments. By preventing the use of single-use plastics, the Cities are encouraging reuse over disposal and reducing disposal of this environmentally persistent material.



## TAKING ACTION

Achieving the Cities' waste reduction goals will require a combination of targeted policy, widespread education and technical support, smart data management, and implementation of effective programs. While many residents surveyed as part of *Resilient Together* are excited to reduce their consumption, share resources, and recycle more if given the right tools, not all residents have the time, money, or interest to prioritize it. The Cities can work to place some of the impetus on haulers to provide the necessary infrastructure through supporting state legislation and enacting local ordinances. The Cities can also support residents and businesses to rethink their consumption practices, while providing technical and/or financial assistance as recycling and composting requirements become more stringent. Furthermore, the Cities can lead by example in public facilities, at public events, and through purchasing and procurement behavior. Throughout the efforts to come, increasing the Cities' capacity both to track important metrics and to enforce existing and future policy will be crucial to overall success. The following actions offer a pathway to a regenerative, near-zero waste future.

## CASE STUDY DEVENS ECO-EFFICIENCY CENTER

The Devens Eco-Efficiency center is a nonprofit that provides low and no-cost services enabling resource conservation and waste prevention. It emerged out of the local regulatory and permitting authority's (Devens Enterprise Commission's) efforts to recognize environmental stewardship among businesses in town. The Center runs "The Great Exchange," a program focused on circular economy and resource recovery.

Source: Devens Eco-Efficiency Center. <https://devensecoefficiencycenter.wordpress.com/>





## SOLID WASTE ACTION TABLE

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ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
SW-1	Training/ Education	Implement an educational campaign to encourage residents and businesses to reduce and reuse as the highest priority; and to clarify what can be recycled and how.	Mirroring the US EPA's waste management hierarchy, this public educational campaign will prioritize messaging around source reduction and reuse, followed by recycling as a second-best option. Campaign targets (e.g., specific businesses or neighborhoods) will be shaped by data on which materials are the greatest challenges for residents and waste haulers, as well as what waste/recycling streams offer the greatest opportunity for impact. The campaign will also include messaging around the opportunities to minimize waste when purchasing new products – in terms of the recycled content and option to minimize packaging. The Cities will ensure the campaign is multilingual, widespread, and accessible for different age groups and learners.	Beverly: Sustainability  Salem: Waste Reduction Coordinator	Short	\$\$
SW-2	Training/ Education	Increase low-cost and publicly accessible collection, reuse, sharing, and recycling opportunities through swap shops, books swaps, community yard sales, repair clinics, shredding events, and collection events for hard-to-recycle waste streams.	The sharing economy offers opportunities both to reduce waste and to build community. The Cities will invest in additional recycling events for specific waste streams that cannot be recycled through curbside pick-up (e.g., polystyrene, rigid plastic, and electronics) while also supporting and promoting existing sharing and reuse opportunities throughout the cities.	Beverly: Engineering, Sustainability  Salem: Waste Reduction Coordinator	Medium	\$\$
SW-3	Advocacy/ Engagement	Work with local restaurants and other businesses to reduce packaging and use of single-use polystyrene or plastics for products they sell/deliver, and to ensure that containers and packaging used by businesses are reusable, recyclable or compostable to the maximum extent possible.	Many businesses use excessive and difficult-to-recycle packaging when reusable, compostable, or minimal packaging options are available. Plastics, in particular, lack a consistent recycling market, are a persistent form of litter, and take hundreds of years to decompose when disposed in a landfill. Reduction of packaging and single-use plastics and polystyrene will require collaboration with local businesses to provide 1) education around the value of using alternative containers and packaging; 2) opportunities to voice challenges and actively shape solutions; and 3) financial support (e.g., bulk procurement) for the purchase of alternative packaging options.	Beverly: Sustainability  Salem: Waste Reduction Coordinator	Medium	\$
SW-4	Policy	Develop mandatory recycling ordinance for all waste generators and mandatory recycling regulation for private haulers to ensure recycling/composting in multi-family residences and commercial establishments.	Enforcing recycling is difficult in places where the Cities don't manage waste disposal. Despite statewide bans on disposal of many recyclable items such as paper, cardboard, glass and metal cans, and certain plastic bottles, apartment buildings, businesses, and commercial complexes are not required to provide access to recycling or composting options. This presents a significant barrier to the community's waste reduction efforts. Mandatory recycling ordinances can improve access to recycling options for renters, while also pushing private haulers to change their behavior.	Beverly: Sustainability  Salem: Waste Reduction Coordinator	Medium	\$



## SOLID WASTE ACTION TABLE

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ID	ACTION TYPE	ACTION	DESCRIPTION	IMPLEMENTATION LEAD	TIMEFRAME	COST
SW-5	Research/ Assessment	Measure and track metrics related to waste management and communicate information publicly to encourage improvement.	Consistent data tracking of diversion rates, contamination rates, and optional program participation (e.g., curbside composting) is critical to understanding the efficacy of solid waste actions as well as targeting areas for improvement. Furthermore, sharing these waste data and metrics will enhance citywide awareness and accountability to achieving waste goals.	Public Services	Medium	\$
SW-6	Training/ Education	Expand curbside composting, support and educate residents on food waste reduction and home composting, and provide residents access to drop-off composting.	Food waste accounts for more than 25 percent of the waste stream in Massachusetts. Impactful strategies to remove food from our waste streams are 1) changing purchasing and consumption behavior, 2) redirecting edible food to people in need through donation, and 3) composting. The Cities will start by expanding voluntary and incentivized programs, with educational components rolled out alongside broader waste reduction and recycling education campaigns as well exploring food share tables. Ultimately, the Cities should introduce mandatory curbside compost pick-up for residents, with appropriate support for low-income and rental communities.	Beverly: Engineering, Sustainability  Salem: Waste Reduction Coordinator	Medium	\$\$\$
SW-7	Training/ Education	Develop a comprehensive program for all municipal buildings and public schools that prioritizes waste reduction and maximizes opportunities for reuse, recycling, and composting, with a strong educational component to ensure successful implementation.	This program would require a thorough assessment of the greatest opportunities for reduction (e.g., unnecessary packaging or purchase of single-use materials) and gaps in the current recycling options. By first focusing on municipal facilities, the Cities can demonstrate the feasibility of specific programs and solutions for the broader community. This action can also be developed in coordination with SW-10 (zero waste event guidance).	Beverly: Sustainability  Salem: Waste Reduction Coordinator	Medium	\$\$\$
SW-8	Policy	Increase dedicated staff time for enforcement of existing waste policies and introduce enforcement mechanisms for new ordinances.	The Cities will designate new enforcement staff, rather than simply increasing the number of hours that a particular staff member spends enforcing a given waste policy if not already full time. All new waste ordinances will be reviewed to ensure the inclusion of enforcement mechanisms (e.g., fees for noncompliance).	Mayor's Office	Medium	\$\$\$
SW-9	Policy	Expand sustainable purchasing programs within both cities.	Sustainable purchasing programs would build on existing practices in both cities to designate recommendations and/or requirements for procurement of both goods and services. The program could include provisions such as local sourcing, standards around recycled content rates or third-party green product certifications, or toxics reduction standards (e.g., for cleaning products).	Procurement, Purchasing	Short	\$
SW-10	Standards/ Guidelines	Require significant municipal and community events to achieve (near) zero waste. Develop and distribute guidance.	Targeting large events for waste reduction is a visible way to engage the community in zero-waste strategies and education. The Cities can pilot, communicate, and scale zero-waste events that engage members of the community to shape both the process and accompanying guidance for a community-wide zero-waste mandate. The event permitting process could serve as the mechanism for implementation of the community-wide mandate.	Beverly: Sustainability  Salem: Waste Reduction Coordinator	Long	\$





## TRACKING PROGRESS

Measuring our success over time is crucial to ensuring that we achieve the *Resilient Together* goals for Solid Waste. The following metrics represent just some of the data we'll be tracking in the coming months and years to understand how we're doing. The Cities plan to track progress toward these targets annually.

METRIC	BEVERLY BASELINE	SALEM BASELINE	2030 TARGET	2050 TARGET
<b>% of households actively participating in composting program</b>	2.5% (2020)	4% (2020)	Beverly: 30% Salem: 30%	Beverly: 90% Salem: 90%
<b>% recycling contamination</b>	28% (2020)	8% (2020)	0	0
<b>Waste disposed (tons/year)<sup>2</sup></b>	11,914 (2018)	11,270 (2018)	Beverly: 3,573 Salem: 3,381	Beverly: 1,191 Salem: 1,127

### Sources

- 1 Beverly Solid Waste Reduction Committee. (2021, Jan 19). Recommendations Report.
- 2 MassDEP. (2018). Recycling & Solid Waste Data for Massachusetts Cities & Towns.  
Retrieved from <https://www.mass.gov/lists/recycling-solid-waste-data-for-massachusetts-cities-towns>

### ADDITIONAL METRICS FOR CONSIDERATION

Percent of recycling/  
diversion/compost  
rate

Percent of  
households routinely  
recycling



ON AVERAGE, EACH BEVERLY AND  
SALEM RESIDENT DISPOSES OF  
NEARLY 1,200 POUNDS OF WASTE  
EVERY YEAR!\*

Source: Kim Lundgren Associates. (2020). Beverly and Salem Community and Municipal 2018 Greenhouse Gas Emissions Inventory Summary Report.









# APPENDICES

GLOSSARY

ADDITIONAL REFERENCES

ENDNOTES



# GLOSSARY

**Adaptation:** How we prepare our community for the impacts of climate change. This includes actions like ensuring buildings are more flood resistant and locating new buildings outside of flood zones, and planting trees to absorb excess heat during the summer. Even if we stopped emitting greenhouse gases today, we would still experience changes to our climate based on our past emissions, so we will need to pursue both mitigation and adaptation actions together.

**Biodiversity:** Refers to the variety of life that can be found, including plants and animals, and the communities they form and their habitats. This is a measure of the health of an ecosystem.

**Carbon intensity:** A measure of how much carbon dioxide a particular activity produces. The more “carbon intense” something is, the more it contributes to climate change.

**Carbon Neutrality:** When greenhouse gas emissions are balanced by an equivalent quantity of greenhouse gas removals.

**Chronic Stressors:** A challenge faced on a day-to-day basis. Chronic stressors can include financial stressors (e.g., low wages), social stressors (e.g., isolation), health stressors (e.g., chronic illness), or environmental stressors (e.g., low water quality). These stressors can exacerbate, or be exacerbated by, impacts of climate change.

**Circular Economy:** Refers to an economic system that aims to keep products and materials in use, design out waste and pollution, and regenerate natural systems.

**Climate:** The weather conditions prevailing in an area in general or over a long period, from months to thousands of years.

**Climate Change:** A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

**Green Municipal Aggregation:** A program Towns and Cities can use to switch everyone on basic electric service over to cleaner energy. Community members pay fixed, lower rates by purchasing power together.

**Complete Streets:** Roadways that make it safer and easier for users of all ages, abilities, and modes to get around. These streets typically have design elements that include bus lanes, sidewalks, accessible signaling, curb extensions, and street trees or other vegetation.

**Composting:** A process that breaks down food, yard, and other organic waste to form a nutrient-rich soil. Composting prevents the release of methane- a potent greenhouse gas- during decomposition.

**Decarbonization:** The process of achieving zero carbon dioxide emissions by reducing our reliance on fossil fuels.

**Drought:** A period of abnormally dry weather long enough to cause a serious hydrological imbalance.

**Ecosystem Services:** The many and varied benefits to humans provided by the natural environment and healthy ecosystems. Benefits include clean air and water, pollination of crops, and the mitigation of extreme storm events, among others.

**Equity:** The inclusion, empowerment, and equitable access of project benefits for a diverse range of populations and stakeholders.

**Flooding:** Water submerging land quickly and over prolonged periods due to increased precipitation and intense storms.

**Green Infrastructure:** Infrastructure that includes nature-based solutions like native plants, and trees, and water retention systems such as grassed swales and green roofs.

**Greenhouse Gas Emissions:** Greenhouse gases (GHG) provide a “blanket” in our atmosphere that trap heat and regulate the Earth’s temperature. When we burn fossil fuels to power our homes, businesses, and automobiles, and place material in our landfill to decompose, we increase the level of greenhouse gases. This increase has created a much thicker “blanket” resulting in higher average global temperatures that have led to disruptions in the Earth’s climate.

**Hazard:** The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.

**Hazardous Waste:** Waste that has properties that make it dangerous to dispose of because it is capable of causing harm to humans or the environment, such as paint thinners, chemical fertilizers, or batteries.

## GLOSSARY [CONTINUED]

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**Heat Advisory:** An alert that local leaders issue to notify the public of dangerously high temperatures.

**Heat Wave:** A prolonged period of excessively hot and sometimes also humid weather relative to normal climate patterns of a certain region. In Massachusetts, a heat wave is three or more days above 90 degrees Fahrenheit.

**Impacts:** Effects on natural and human systems of extreme weather and climate events and of climate change.

**Impervious Surface:** Surfaces that are covered by water-resistant materials, such as asphalt on roads and sidewalks, that do not allow rainfall to seep into the ground. Buildings and compacted soil are also surfaces that disrupt water infiltration and lead to runoff.

**Intense Storms:** Extreme weather events with heavy precipitation (rain or snow) and wind.

**Mitigation:** The steps we take to reduce our contribution of GHGs into the atmosphere. This includes switching from fossil fuels to renewable sources, taking steps to reduce our energy use, and reducing the amount of waste we send to the landfill.

**Passive House:** A set of principles for sustainable design and construction that emphasize a high degree of energy efficiency, resilience, air quality, and comfort. High-performance materials and design techniques help put buildings on a path toward zero carbon emissions by eliminating up to 90% of a building's energy use.

**Preparedness:** Taking steps to ensure our communities are ready for shock events (e.g., developing an emergency plan and training citizens for how to respond).

**Renewable Energy:** Energy produced with non-fossil fuel, renewable sources, such as the sun, wind, waves, and geothermal heat.

**Resilience:** The ability of our residents, businesses, and municipal operations to prepare, mitigate, adapt, and endure shocks and chronic stressors. The resilience of our community depends on both our mitigation and adaptation actions.

**Shocks:** A significant event that disrupts the day-to-day and requires action.

**Stormwater:** Stormwater is water runoff from rain events that flow over land or impervious surfaces and does not reabsorb into the ground.

**Sustainability:** Balancing resource efficiency, social well-being, and environmental stewardship while equitably meeting the needs of a growing community and thriving economy.

**Tree Canopy:** In an urban setting, this refers to the area of a city that is shaded by trees. This shade offers benefits, like by lowering temperatures in the summer, and also provide habitat for wildlife.

**Urban Heat Island Effect:** The difference in temperature in urban areas compared to nearby rural areas caused by the presence of more roads, sidewalks, and buildings and the absence of trees and green spaces.

**Vulnerability:** The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change.

**Vulnerable Populations:** The individuals or groups of individuals identified as being exposed to, having high sensitivity to, and low adaptive capacity to existing or projected changes in climate and their associated impacts. Often includes the economically disadvantaged, elderly, youth, minorities, and the socially isolated.

**Water Energy Nexus:** Describes the resource-intensive relationship between energy use and water. Energy generation uses a significant amount of water and a large amount of energy is required to pump, treat, transport, and store water.

**Walk Score:** A measure of how pedestrian-friendly a community is that accounts for information such as the distance to local shops and the presence of sidewalks.

**Wetlands:** Land where water covers the soil, like marshes or swamps, which are rich natural habitats for many species of plants and animals and provide valuable benefits.



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