

EVERETT

SOMERVILLE

CHARLESTOWN

28

CAMBRIDGE

WATERTOWN

DOWNTOWN

East Boston Memorial Park

ALLSTON/
BRIGHTON

CHINATOWN

90

20

Packard's
Corner

Brighton

Tufts Med

90

NEWTON

FENWAY/
KENMORE

SOUTH END

SOUTH BOSTON

BROOKLINE

Brigham
Circle

Ruggles

Mass
Ave

Roxbury
Crossing

Nubian Sq

Newmarket

Joe Moakley
Park

Jackson
Sq

ROXBURY

JFK/UMass

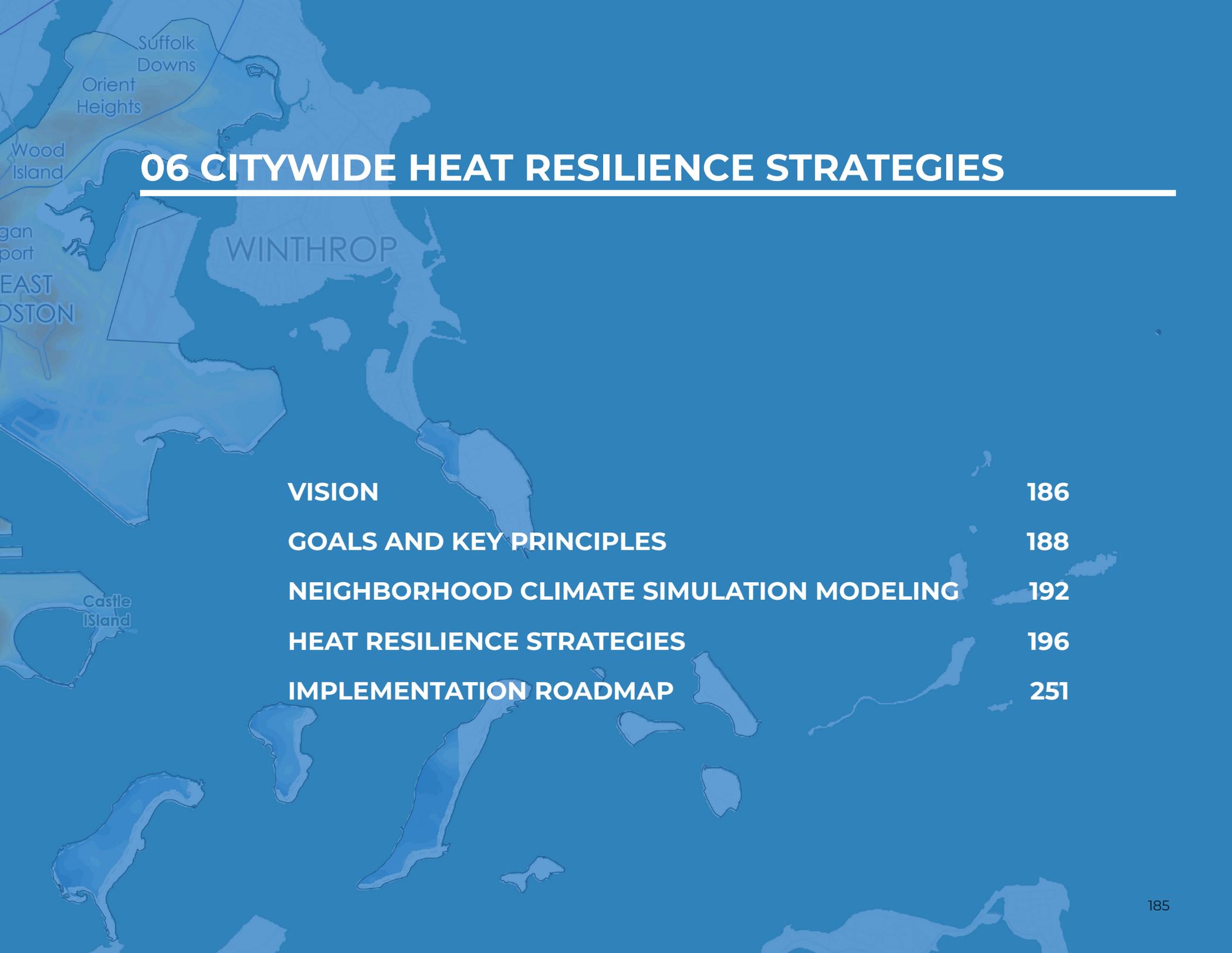
Jamaica
Pond

Uphams
Corner

Savin Hill

JAMAICA
PLAIN

Four Corners/
Geneva



06 CITYWIDE HEAT RESILIENCE STRATEGIES

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VISION

Heat Resilience Solutions for Boston brings together Bostonians' ideas and responds to our communities' priorities.

We can build a more just, equitable, and resilient Boston, while protecting the health and safety of all residents. Delivering on equitable heat resilience requires well-coordinated collaboration across City, state, federal, community, and regional partners. Through leadership and collaboration, Boston can help prepare our communities, buildings, infrastructure, and natural spaces for the impacts of climate change, including extreme heat, while putting Boston on a path to becoming a Green New Deal city.

Building a better, more resilient Boston can create cooler communities and also support broader benefits for justice, equity, and basic improvements to everyday life. Through strategies in the *Heat Plan*, the City of Boston can also help deliver on the broader and complementary goals of the Green New Deal strategy, such as the following:

We should create public cool spots with WiFi during the summer so that people have a place to cool down and hang out outside their hot home.
-City of Boston

I should check in on my older neighbor who lives alone to make sure they can cool themselves down during this heat wave.
-friendly neighbor



- » Improving public health outcomes, including indoor and outdoor air quality
- » Growing new categories of green jobs and workforce opportunities
- » Strengthening social connections and resilience within communities
- » Reducing Boston's greenhouse gas emissions and other pollution and waste
- » Launching policies that improve income, wealth, educational, and racial equity
- » Engaging and involving residents to support community climate leadership
- » Delivering all-of-government, all-of-city operations to take comprehensive climate action
- » Managing and treating stormwater to improve water quality and reduce flooding
- » Ensuring greater comfort and safety for a wider range of transportation options
- » Protecting and expanding high-quality affordable housing options

The strategies presented in this chapter represent the City of Boston's plans to increase heat resilience and address the impacts of climate change. These strategies will help ensure all Bostonians, especially those most disadvantaged and overburdened, can thrive in the face of climate change.



GOALS AND KEY PRINCIPLES

The *Heat Plan* centers Bostonians’ heat experiences with three goals and three key principles that are informed by the vision and insights from Boston communities and stakeholders. The goals define what this plan aims to achieve and address. The strategies that follow will help bring the City of Boston closer to these goals. The key principles provide considerations that will guide the implementation of strategies.



GOALS

Reduce heat vulnerability for Bostonians and recognize the challenges that heat can bring to their quality of life, including negative health outcomes and physical or mental stress.

Reduce Heat Exposure

Reduce indoor and outdoor urban heat exposure, intensity, and duration by enhancing the capacity of the built environment to recover from daytime heat.

Adapt to Heat

Expand choices for staying cool during heat waves and improve awareness of actions residents can take to stay safe and cool.

Reduce Sensitivity and Foster Healthy, Connected Communities

Create healthier, more connected neighborhoods that help reduce underlying social determinants of health that increase heat risk.

KEY PRINCIPLES

Implement heat resilience goals and strategies to align with the following key principles.

Lead with an Environmental Justice and Equity Lens

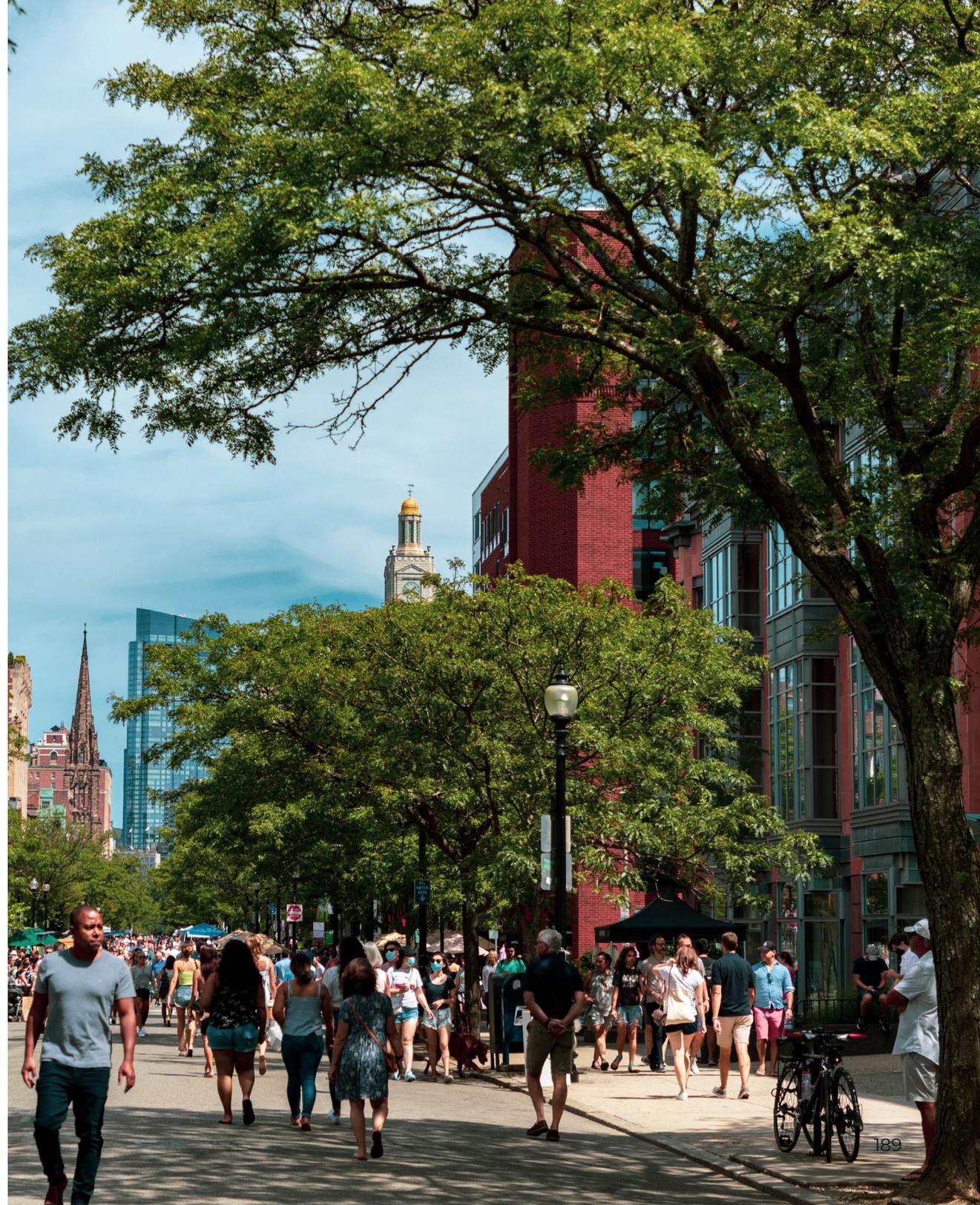
The *Heat Plan* highlights the disproportionate burdens of extreme and chronic heat that coincide with systemic and historical injustices and inequities. This plan provides strategies that are relevant to all neighborhoods and residents of Boston, while providing additional focus on those strategies that can provide relief for those who face the greatest burdens from extreme heat and the greatest barriers to fair, equitable access to cooling and healthy neighborhoods. The plan integrates a wide range of elements to advance environmental justice and equity across Boston, including a focus on the sensitivity and adaptive capacity of residents to climate change. By centering environmental justice and equity, Boston can better address root causes of increased risk and vulnerability in communities who are disproportionately affected by climate change—and ensure the City of Boston equitably protects all residents and effectively addresses the needs of the most overburdened residents.

Prioritize Multiple Benefits

Leverage heat resilience to advance economic opportunity, reduce carbon emissions, increase green spaces, and improve health for Bostonians and our environment.

Use Data-driven Planning

Continue to refine temperature models and utilize them alongside robust community engagement to help inform decisions.



HEAT RESILIENCE BENEFITS

Strategies target multiple facets of the goals and key principles.

The following benefits help to identify how a strategy is working towards the City's goals.

| CATEGORY | CONSIDERATIONS |
|---|---|
| <p>Heat Reduction Is the solution effective at reducing heat exposure for people—especially people with elevated heat risk—and infrastructure by <i>reducing temperatures</i>?</p> | <ul style="list-style-type: none">» Reduction in surface or perceived temperature» People supported, with a focus on people with elevated heat risks» Reduced heat exposure for infrastructure <p><i>Example: Planting trees to provide shade for both people and pathways, reducing perceived and surface temperatures</i></p> |
| <p>Heat Relief Is the solution effective at reducing heat exposure for people—especially people with elevated heat risk—<i>by providing respite from existing heat</i>?</p> | <ul style="list-style-type: none">» Increased options for indoor and outdoor heat relief» Improved access to heat relief» People supported, with a focus on people with elevated heat risks <p><i>Example: A shaded bus stop (outdoor heat relief) or cooling center (indoor heat relief) providing respite</i></p> |
| <p>Increased Adaptive Capacity Does the solution strengthen or improve a person's ability to cool off, such as increasing the accessibility of cooling solutions?</p> | <ul style="list-style-type: none">» Social resilience» Community partnerships <p><i>Example: Increasing wealth or transportation access to cool places, giving people more opportunities to cool off</i></p> |
| <p>Improved Public Health Does the solution reduce heat sensitivity and improve public health to reduce heat-related illness?</p> | <ul style="list-style-type: none">» Improved public health related factors, with the potential to reduce prevalence of chronic health conditions that contribute to elevated risk of heat-related illness <p><i>Example: Improving air quality, which reduces the prevalence of asthma in a community so that when it's hot, it's less dangerous for health</i></p> |

CATEGORY

CONSIDERATIONS

Economic Opportunity

Does the solution help close the wealth gap? Is it creating new economic opportunity, especially for Bostonians who face barriers to employment due to systemic racism and injustices?

- » Educational opportunities and workforce development
- » Job creation, preservation, and improvement
- » Small business, women and minority-owned businesses, and immigrant-owned business support

Example: Creating a job training program for young people that gives them access to jobs at businesses implementing heat resilience strategies

Environmental Benefits

What are the benefits of the solution to the to the health of natural communities and systems over time? Does the solution help reduce environmental pollution?

- » Water and air quality improvements, including stormwater capture
- » Habitat creation and protection
- » Carbon storage
- » Reduced carbon emissions
- » Waste minimization

Example: Adding trees and green infrastructure, which improve air and water quality, and provide cooling with a lower carbon footprint than air conditioning

Environmental Justice and Equity

Does the solution increase the accessibility and affordability of heat relief for overburdened communities? Does the solution help address the drivers of disproportionate exposure to heat?

- » Advances in environmental justice, including addressing disproportionate impacts among residents
- » Strengthened community identity and cohesion, which improves adaptive capacity
- » Recreational and cultural improvements and access
- » Mitigation against displacement or other unintended consequences from heat resilience strategies

Example: Prioritizing heat resilience strategies where needs are highest, especially as a result of past planning injustice

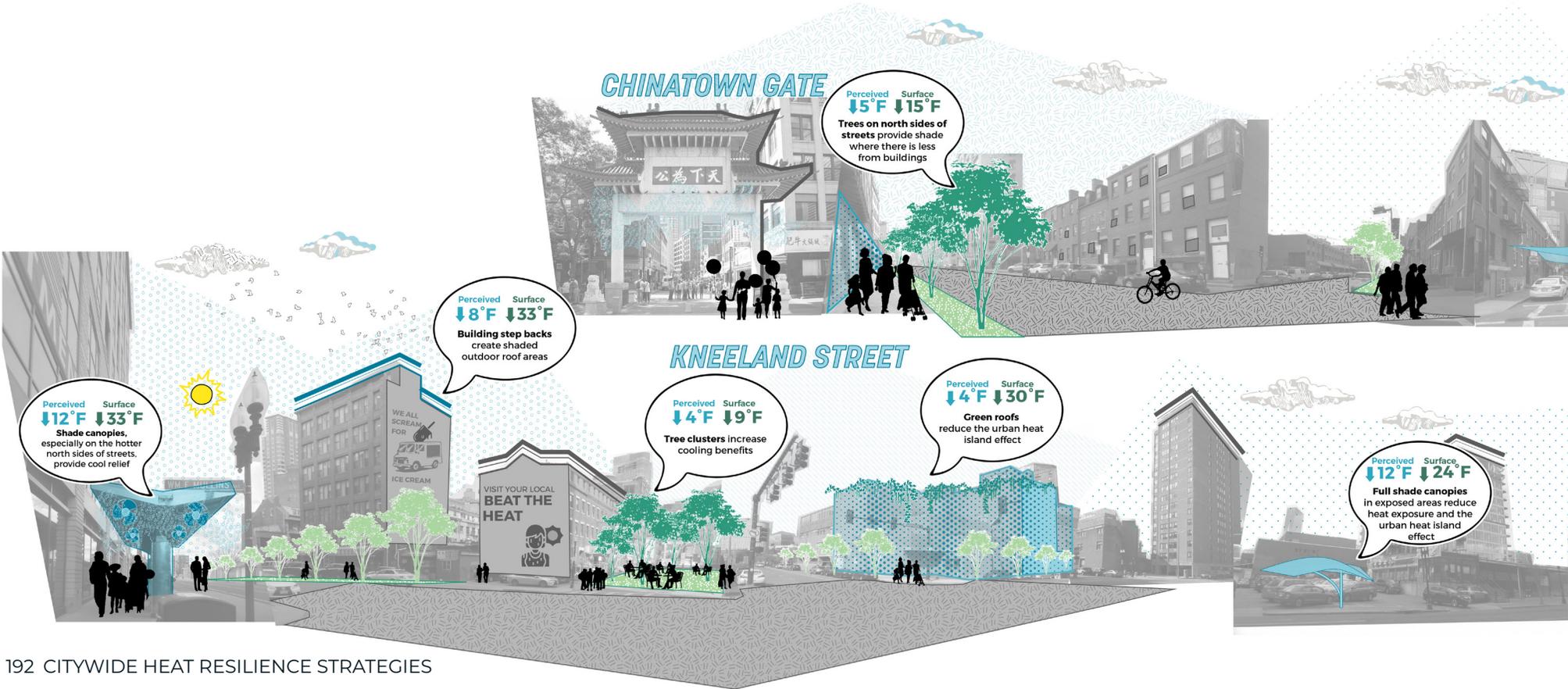
NEIGHBORHOOD CLIMATE SIMULATION MODELING

The citywide heat analysis (Chapter 4) helped to identify urban heat islands across the city. This neighborhood climate simulation model zoomed into a neighborhood scale to give an idea of how effective built strategies might be in lowering surface and perceived temperatures. The project conducted two scenarios to calculate the difference between existing conditions and when heat resilience strategies are applied. While surface temperature gives an idea of how much heat a

surface is absorbing, perceived temperature is equally important because it is the feels-like temperature people experience. Perceived temperature is more reflective of how hot a person might be feeling, which impacts how their body reacts to high heat exposure and heat-related illnesses.

Based on the citywide daytime and nighttime air temperature results, the project selected Chinatown as the neighborhood to run in this simulation.

However, the results of a strategy's effectiveness can generally apply to other neighborhoods and locations. The team selected areas for the analysis based on streets of concern that came up during community engagement conversations (such as Tyler Street), as well as key landmarks like the Chinatown Gate. The different strategies applied for the cooling strategies scenario include light-colored roads, solar canopy, shade canopy, canopy on roofs, green roofs, and cool roofs. The simulation model also added trees along streets where appropriate.



KEY TAKEAWAYS:

- » Providing **full-shade canopies** reduces perceived and surface temperatures the most.
- » **Green roofs** provide a significant decrease in surface temperature, but not as much decrease for perceived temperature. This can be improved by installing **50% shade canopies** (such as fabric canopies) which could create a cooler environment for people.
- » **Building form** is an important factor, and having a step-back does provide a good amount of relief from heat for people.

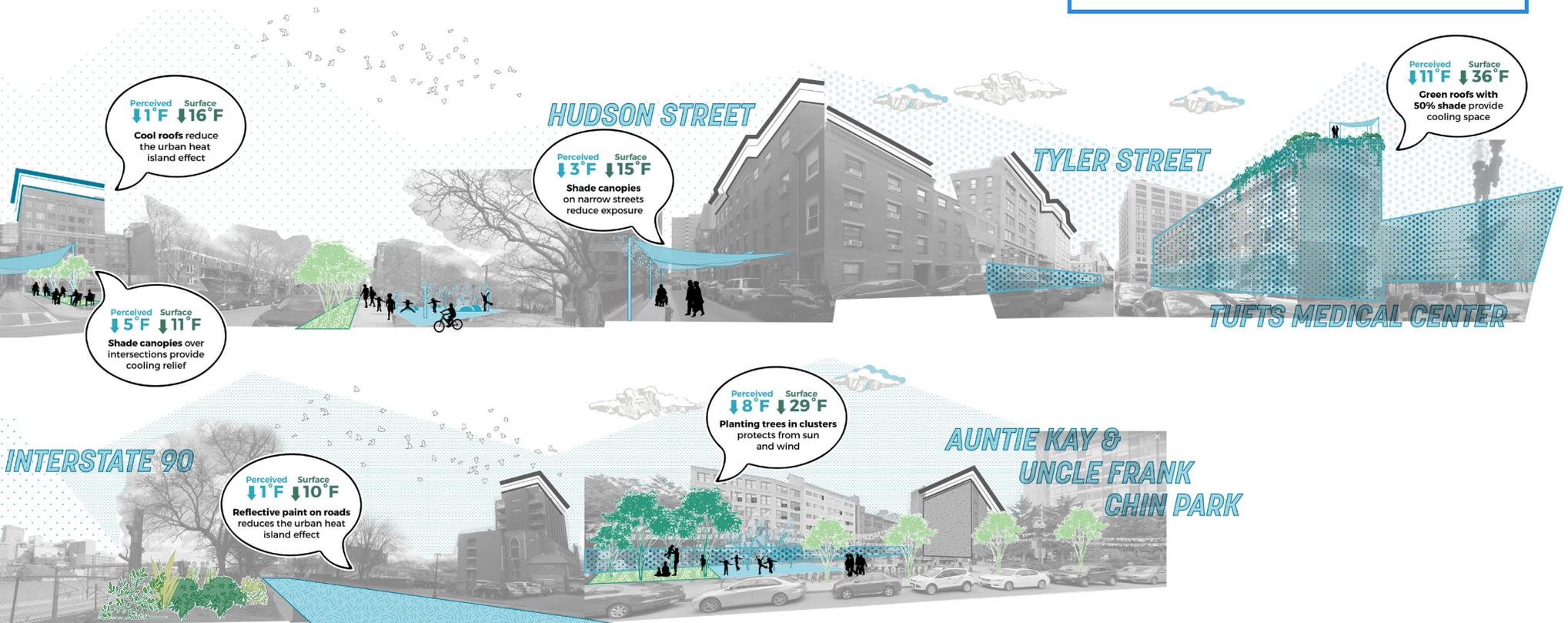
- » **Trees planted on the north side of streets** provide greater cooling benefits, as the north side is usually more exposed to the sun compared to the south side, where buildings provide more shade.
- » **Planting trees in clusters** (rather than spaced out too far) provides a good amount of cooling of surfaces and perceived temperatures.
- » **Light-colored surfaces** or highly reflective surfaces are great at decreasing surface temperature, but they aren't as effective at decreasing perceived temperature.

DEFINING TEMPERATURE

Air Temperature: Influenced by humidity, wind flow, building form, surfaces (ground, walls, and roofs), and the surrounding atmosphere. This report uses typical annual hourly meteorology data for Boston from Logan International Airport. Boston's average summer dry-bulb temperature is 72.5°F.

Perceived Thermal Comfort: What the surrounding temperature feels like to the human body. It takes into account humidity, temperature, and solar and wind exposure.

Universal Thermal Climate Index: Measurement used for perceived thermal comfort. Boston's average summer perceived temperature is 73°F. Summer daytimes are generally warm to hot with moderate to high heat stress (over 86°F).



NEIGHBORHOOD CLIMATE SIMULATION SAMPLE RESULTS

The neighborhood climate simulation model results include maps of surface and perceived temperature for the existing conditions scenario (baseline conditions) and the strategies scenario (with cooling strategies). A detailed analysis of these maps is available in Appendix 2, Technical Memo on Neighborhood Climate Simulation Modeling.

SUMMER AFTERNOON SURFACE TEMPERATURE

BASELINE CONDITIONS

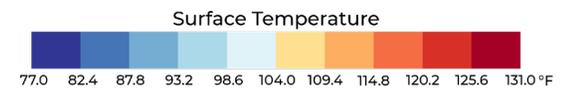


Josiah Quincy Elementary

WITH COOLING STRATEGIES



Josiah Quincy Elementary



The map on the left shows the surface temperature of ground and rooftop surfaces in the existing conditions scenario. The map on the right shows the surface temperature of surfaces after applying a variety of cooling strategies. Generally, the combination of cooling strategies modeled can reduce surface temperatures.

For example, cool roof strategies can greatly decrease surface temperatures, like the rooftop strategies

of cool and green roofs modeled at Josiah Quincy Elementary.

At the ground level, light roads, shade canopies, and trees can also decrease surface temperature, as seen around Chinatown Gate and Beach Street.

SUMMER AFTERNOON PERCEIVED TEMPERATURE

BASELINE CONDITIONS



Josiah Quincy
Upper

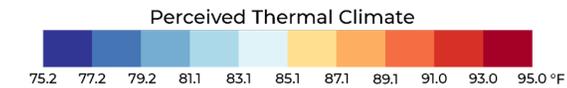
WITH COOLING STRATEGIES



Josiah Quincy
Upper

The map on the left shows the perceived temperature in the existing conditions scenario. The map on the right shows the perceived temperature after applying a variety of cooling strategies. Generally, the combination of cooling strategies modeled can reduce perceived temperatures. Some strategies modeled are more effective than others, but a combination helps to decrease how hot it feels.

Strategies modeled for roofs show that canopies and green roofs are more effective at decreasing



perceived temperatures than light colored roofs (as seen at Josiah Quincy Upper). At the ground level, full shade canopies, building step-backs, and clustered trees are most effective at decreasing perceived temperatures (as seen at the parking lot along Tyler Street).

HEAT RESILIENCE STRATEGIES

HOW TO READ THIS SECTION

The *Heat Plan* includes a wide range of strategies for the City of Boston to take action and address the risks of extreme heat in a changing climate. The heat resilience strategies are organized into two sections: Relief During Heat Waves and Cooler Communities. The *Heat Plan* includes a total of 26 strategies, some of which tackle heat resilience in the short-term, while others are more systemic and may require a longer time frame to see the benefits.

For each strategy, the following elements are included: rationale and description, benefits, next steps. Some strategies also include call-outs describing related programs and additional cost and benefits analysis.

Rationale and Description: A description of why the strategy is relevant to Boston, the goals of the strategy, and steps to address issues or gaps revealed in the heat analysis. For successful implementation, the plan provides key partners and considerations. Since many of the strategies are interconnected and build off each other, the plan identifies related strategies to consider for coordination.

Next Steps: A concise overview of the immediate steps the City will take to implement the strategy.

Heat Resilience Benefits: A ranking of how the strategy targets the multiple facets of the goals and key principles of the *Heat Plan*.

Call Outs: An overview of relevant existing programs, policies, and projects mentioned in the strategy rationale and description.

Heat Resilience Costs and Benefits: An assessment of the costs for three projects—Cool Homes, Cool Schools, and Cool Main Streets. The analysis used a methodology that estimates costs for strategy elements over a 50-year period, including strategy elements such as cool pavements, cool roofs, shade devices, trees, and air conditioners. The *Heat Plan* qualitatively summarizes the benefits of implementing these strategies.

RELIEF DURING HEAT WAVES



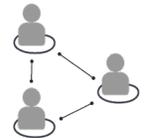
1. OPERATIONS AND COMMUNICATIONS

- 1.1 BOSTON EXTREME TEMPERATURES RESPONSE TASK FORCE
- 1.2 PRE-HEAT WAVE RESOURCES MOBILIZATION
- 1.3 HEAT SENSOR NETWORKS



2. COOLING DURING HEAT WAVES

- 2.1 POP-UP HEAT RELIEF
- 2.2 ENHANCED AND EXPANDED CITY-RUN COOLING CENTERS
- 2.3 CITYWIDE COOLING NETWORK



3. LOOKING OUT FOR NEIGHBORS

- 3.1 EXPANDED COMMUNITY CLIMATE LEADERSHIP
- 3.2 EXTREME TEMPERATURE PLANS FOR OUTDOOR WORKERS



4. AWARENESS, EDUCATION, AND TRAINING

- 4.1 HEAT RESILIENCE PUBLIC EDUCATION CAMPAIGN
- 4.2 HEAT SURVEY
- 4.3 EXPANSION OF GREEN WORKFORCE DEVELOPMENT FOR HEAT RESILIENCE

COOLER COMMUNITIES



5. BUILDINGS

- 5.1 HOME COOLING RESOURCES DISTRIBUTION
- 5.2 COOL ROOFS PROGRAM
- 5.3 HOME ENERGY RETROFITS
- 5.4 AFFORDABLE HOUSING RESOURCES AND RETROFITS
- 5.5 COOL SCHOOLS



6. PARKS, TREES, AND OUTDOOR SPACES

- 6.1 ENHANCED COOLING IN POCKET GREEN SPACES AND STREET-TO-GREEN CONVERSIONS
- 6.2 INCREASED SHADE ON MUNICIPAL SITES
- 6.3 EXPANDED DRINKING FOUNTAIN NETWORK
- 6.4 PLANNING FOR FUTURE PARKS



7. TRANSPORTATION AND INFRASTRUCTURE

- 7.1 COOL COMMUTES
- 7.2 ENERGY RESILIENCE UPGRADES AND MICROGRIDS
- 7.3 COOL MAIN STREETS



8. PLANNING, ZONING, AND PERMITTING

- 8.1 UPDATED CLIMATE RESILIENCY CHECKLIST
- 8.2 HEAT RESILIENCE BEST PRACTICE GUIDELINES
- 8.3 ZONING REVISIONS TO SUPPORT COOLER NEIGHBORHOODS



East Boston Public Library Cool Spot: In summer 2021, the team installed two Cool Spot pilots at the East Boston and Egleston Square Branches of the Boston Public Library. These cool spots worked with the free WiFi zone program to bring misted tents, hammocks, chairs, and tables for the public to hang out and cool off.

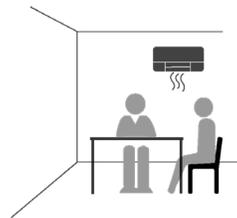
RELIEF DURING HEAT WAVES

Apply a robust, integrated heat-wave response and deepen understanding of heat risks to build awareness, increase access to cooling, support social resilience, and build capacity.

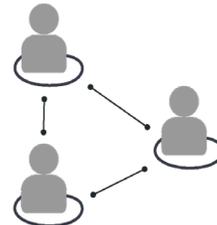
Reducing heat vulnerability for Bostonians and making a more heat resilient city begins with effective communication, education, a tight-knit community, and equitable distribution of resources and access to cooling opportunities. This section includes eleven strategies to improve people's heat experiences.



1. OPERATIONS AND COMMUNICATIONS



2. COOLING DURING HEAT WAVES



3. LOOKING OUT FOR NEIGHBORS



4. AWARENESS, EDUCATION, AND TRAINING



1. OPERATIONS AND COMMUNICATIONS

1.1 BOSTON EXTREME TEMPERATURES RESPONSE TASK FORCE

Form an interdepartmental group that meets regularly to coordinate integrated responses to weather-related climate hazards including extreme temperatures.

RATIONALE AND DESCRIPTION

Boston knows how to mobilize around winter storms. Similarly, a unified all-of-government and all-of-city approach will help advance strategic actions that address chronic high temperature conditions and prepare the city in advance of extreme heat events. The Boston Extreme Temperatures Response Task Force will help increase the effectiveness of the City’s mobilization and response operations. The goal for the task force is to deepen coordination across departments for extreme temperatures response that will positively impact residents’ health and safety outcomes. The OEM and BPHC play critical coordinating roles for emergency response during heat emergencies in Boston.

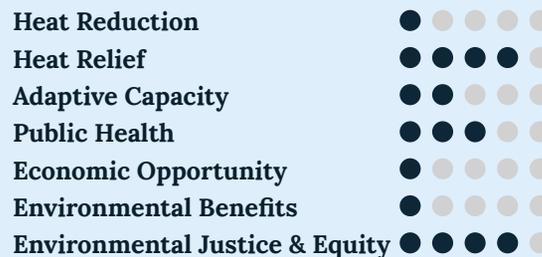
Through engagement with residents, civic organizations, and others, the City will explore ways to most effectively communicate and expand the reach of emergency alerts and resources. For example, communicating neighborhood-specific

heat advisories and emergencies may help residents identify resources specific to their neighborhood or community. The task force will engage a wide range of stakeholders to identify barriers Bostonians face to accessing resources needed for cooling or heating. It will help coordinate resources among public, civic, and private organizations to support Pre-heat-wave Resources Mobilization (Strategy 1.2). Additionally, lessons and best practices from an ad-hoc interdepartmental working group that addressed impacts of extreme summer temperatures and the COVID-19 pandemic (see Strategy 1.1 call out) will inform operations and strategies identified by the Extreme Temperatures Task Force. This will support interdepartmental coordination, messaging on available resources, and help for residents to stay cool in their homes.

NEXT STEPS

The task force will be established and will define roles and goals to inform mobilization around strategic actions. To inform strategic actions and track progress towards goals, the City will identify community needs through needs assessments and progress tracking.

HEAT RESILIENCE BENEFITS



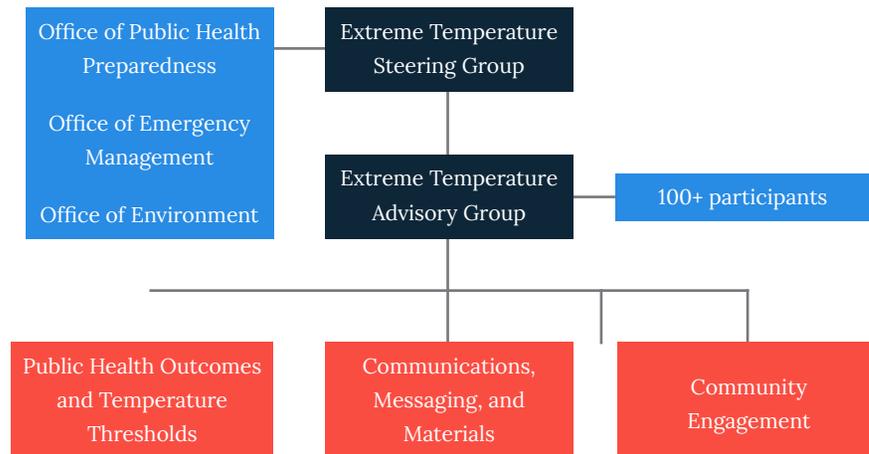
EXTREME HEAT AND COVID-19 WORKING GROUP

An ad-hoc interdepartmental working group to address compounding impacts of extreme summer temperatures and the COVID-19 pandemic was active during the summers of 2020 and 2021. At this time, many indoor and outdoor spaces that would normally provide refuge from extreme summer temperatures were closed. Residents were encouraged to self-isolate at home during quarantine; however, for many residents, staying cool and safe indoors was difficult.

The working group's goals and priorities included identifying critical needs of residents at risk of extreme heat and COVID health impacts, coordinating messaging about open and accessible cooling centers and COVID safety guidelines, helping residents stay cool in their homes through fan and air conditioner giveaways, amplifying information about utilities and rental assistance, and safely reopening cooling resources.

From an operational perspective, the BPHC Extreme Temperatures Response Plan aims to reduce heat-related health risks and outcomes for Boston residents, especially people most vulnerable to extreme heat. The Extreme Temperatures Response Plan shifts management of extreme heat and cold events to the BPHC, including coordination of the respective City of Boston departments, to communicate and engage with communities to enhance preparedness to extreme temperatures.

Planning Structure of the Extreme Temperatures Steering Group



Source: Adapted from Collaborative Planning for Extreme Temperature Response in the City of Boston. Accessed March 2022. <https://delvalle.bphc.org/mod/wiki/view.php?pageid=159>



1. OPERATIONS AND COMMUNICATIONS

1.2 PRE-HEAT-WAVE RESOURCES MOBILIZATION

Preposition resources to support residents and other stakeholders before heat waves.

RATIONALE AND DESCRIPTION

As the City of Boston does before major winter storms, additional Citywide plans to mobilize a wider range of resources ahead of extreme heat events can help ensure that all Bostonians can access the resources they need during any extreme weather event. Since the City monitors long-range forecasts for extreme weather, the City can deploy resources before extreme heat events. The City will build on existing efforts to deepen coordination across departments and define concrete, pre-heat-wave action plans to identify and distribute cooling resources and information to residents.

The City will distribute information on how to stay cool at home and in neighborhoods, including the Resource Guides (Chapter 7). Partnerships with community organizations and the use of diverse digital and in-person communications channels will be critical to ensuring information reaches residents and prepares them for upcoming heat events. The City will also explore approaches to share data from long-range forecast monitoring to give community organizations additional time to mobilize their

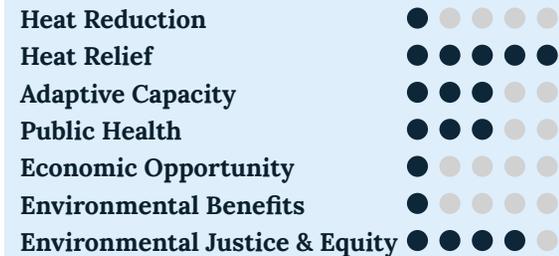
own efforts and to give residents additional time to prepare and seek out resources. Through this strategy, the City aims to integrate activation of coordinated support and prepositioned resources with City, state, and community implementation partners when a heat advisory or heat emergency is likely. For example, the City will explore how the concept of the Healthy Places air conditioner and fan delivery pilot program (see Strategy 1.2 call out) can move forward in the future.

Community partnerships are key to better understanding community needs, meeting these needs, and building community power. The City will identify opportunities to coordinate with and support community-based organizations to build awareness and codevelop additional resources and programs. Prioritization will focus on increasing and improving heat relief for overburdened Bostonians with elevated heat risks. This strategy will be coordinated with the Heat Resilience Public Education Campaign (Strategy 4.1) to disseminate alerts and resources.

Other connections and partnerships to leverage include senior centers and senior housing, schools, daycare facilities, emergency shelters, community health centers, hospitals, congregant shelters, and transportation partners. This strategy will also be coordinated with Enhanced and Expanded City-run

Cooling Centers (Strategy 2.2), so that residents can access cooling resources and information about complementary city services in cooling centers.

HEAT RESILIENCE BENEFITS



NEXT STEPS

Convening Boston's Extreme Temperatures Response Task Force (Strategy 1.1) is a critical next step to operationalize some of the goals identified in this section. Additionally, expanding usage of AlertBoston (the City's emergency alert system), 311 (the City's constituent services system), and other ways to engage residents will build awareness around existing resources in the near-term.

HEALTHY PLACES AIR CONDITIONER AND FAN DELIVERY PILOT PROGRAM

The Healthy Places air conditioner and fan delivery pilot program provided direct support to residents of Boston facing increasing high average temperatures and extreme heat events. In 2021, Boston had 24 days over 90°F and four separate heat waves. Over that summer, the pilot program distributed 400 air conditioning units and 700 box fan units free of charge to income-eligible residents who live in neighborhoods that experience higher average summer temperatures, who did not have the resources to stay healthy and cool during heat waves, and who were more sensitive to heat stress due to their age and chronic health conditions like asthma. The pilot program was developed in collaboration with multiple City departments, commissions, and agencies, including the Environment Department, Age Strong Commission, BPHC, OEM, BHA, and the Public Works Department (PWD).

Fan distribution as part of the pilot Healthy Places initiative in summer 2021



Hampton House Apartments in Roxbury



Eva White Apartments in the South End



1. OPERATIONS AND COMMUNICATIONS

1.3 HEAT SENSOR NETWORKS

Deploy targeted networks of heat sensors to inform ongoing planning and measure progress.

RATIONALE AND DESCRIPTION

Heat sensor networks aim to support heat warnings, inform design guidelines and capital planning decisions that center heat resilience and health equity, and increase education and awareness of heat risk. This strategy supports other initiatives that benefit from a data-driven approach, as it will allow the City the ability to measure trends over time as heat resilience and health equity investments are made. MONUM is a key partner in guiding this strategy, as they work across departments to deploy innovative improvements on streets, online, and in schools using technology and design.

In coordination with residents, civic organizations, data privacy experts, and other key stakeholders, the City will identify opportunities to coordinate with public and private implementation partners to assess potential outdoor and indoor heat sensor deployment sites focused on limited and targeted sites that are directly tied to a specific design guideline or capital planning need of the City. These deployment sites will only gather data that is necessary to allow for localized understanding of outdoor hot spots and

indoor heat exposure, while maintaining the privacy standards of the City. The data collected through this network will be open source, where appropriate, to support research and innovation in compliance with the City’s data standards. Since existing health conditions, like asthma, are exacerbated both by heat and air pollution, the City will also integrate air pollution mitigation and monitoring initiatives.

To support regional heat resilience in Greater Boston, the City will continue to explore additional opportunities to collaborate with regional partners and municipalities on monitoring and modeling that can help inform design guidelines and capital planning decision making in the region.

NEXT STEPS

PWD, in partnership with MONUM and the Environment Department, installed outdoor air quality sensors on street lights along Cummins Highway. Data collected before and after construction will help to understand the impact of the corridor redesign on near-field air quality. The City expects to learn how different built environment conditions, such as green infrastructure, influence air quality on a corridor, as well as how design interventions can affect air quality. Learning from this pilot, the City is exploring other opportunities to install air quality and temperature sensors on street lights and bus stops to better understand the relationship between urban heat, street design, and air pollution, and to inform corridor redesigns and management strategies elsewhere in Boston.

In fiscal year 2022, the Air Pollution Control Commission also piloted a Community Clean Air Grant program to support community-based initiatives to address sources of air pollution in Boston’s neighborhoods. The pilot program sought to provide up to \$50,000 in direct financial support, and offered multilingual application submission and review, over the course of three rounds of review. As examples, the pilot program is supporting two projects in East Boston to monitor air quality in community hubs, home daycares, and homes of

HEAT RESILIENCE BENEFITS

| | |
|---|-----------|
| Heat Reduction | ● ● ● ● ● |
| Heat Relief | ● ● ● ● ● |
| Adaptive Capacity | ● ● ● ● ● |
| Public Health | ● ● ● ● ● |
| Economic Opportunity | ● ● ● ● ● |
| Environmental Benefits | ● ● ● ● ● |
| Environmental Justice & Equity | ● ● ● ● ● |

residents with respiratory issues, in conjunction with the deployment of HEPA filters.

Boston Public Schools (BPS) recently launched the Indoor Air Quality (IAQ) Management Program, which includes thousands of new indoor air quality sensors installed in classrooms across the district to help protect the health and learning outcomes of students. This program records, monitors, and analyzes air quality and temperature in real-time.

The City will continue to explore strategies to define and prioritize sensor locations throughout Boston, with a focus on outdoor and indoor high heat exposure areas and elevated heat vulnerability that will be undergoing capital improvements that could affect heat resilience.

COMPLEMENTARY HEAT MEASURING EFFORTS IN BOSTON

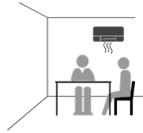
In 2019, the Museum of Science's Wicked Hot Boston program engaged community participants to collect ambient air temperature to investigate extreme heat and urban heat islands throughout the city. In 2021, this program expanded to Wicked Hot Mystic, where volunteer scientists collected high resolution temperature and air quality data within the Mystic River Watershed. Collaboration with the Museum of Science's Citizen Science, Civics, and Resilient Communities (CSCRC) education project can provide additional community engagement and citizen-created data that will improve heat measurement and modeling.



*Wicked Hot Boston's mobile sensor on a car
Source: Museum of Science*

2 COOLING DURING HEAT WAVES

A well-connected and accessible network of trusted community spaces that provide shade or air conditioning is critical to keeping residents safe and out of the heat. Currently, BCYF provides cooling centers across Boston when a heat emergency is declared. Other public community spaces such as libraries, parks, tot sprays, pools, and beaches serve as critical resources that also provide cooling. Additionally, malls, grocery stores, and other community-identified spaces also serve as spaces that residents often frequent to keep cool.



2. COOLING DURING HEAT WAVES

2.1 POP-UP HEAT RELIEF

Create an expanded network of free-to-access cooling locations.

RATIONALE AND DESCRIPTION

In partnership with community organizations, the City will activate public spaces during warmer seasons with pop-ups that provide cooling relief in high exposure areas within communities. Pop-ups are temporary, ad-hoc installations that are used to provide a service or program at the right place and at the time it is needed. The sites can be distribution points for heat resources and opportunities to sign up for emergency alerts. This strategy will engage youth and community organizers, increase social interaction and community building, and engage local economies. Pop-ups will be prioritized in locations that have high heat exposure, especially areas with limited access to green spaces or cooling centers.

Pop-up heat relief locations would provide multiple benefits in addition to heat resilience:

- » Employment opportunities to support the local economy by working with small businesses and community organizations
- » Awareness of and access to additional City services and programs for pop-up attendees
- » An opportunity to celebrate culture, heritage, and identity at each site

NEXT STEPS

In partnership with MONUM, Boston Public Library (BPL) will launch the second year of pop-up Cool Spots at branches in summer 2022. BPL outdoor spaces will expand to nine locations with an emphasis on multi-seasonal placemaking with cooling measures where possible.

To expand pop-up heat relief, the City will distribute pop-up cooling kits to eligible organizations with active summer programming and resident engagement to integrate features like shade and mist tents in their regular programming. The City will continue to explore ways to provide support and resources to communities looking to establish additional pop-ups for heat relief.

HEAT RESILIENCE BENEFITS



SUMMER 2021 COOL SPOTS

In summer 2021, two pop-up Cool Spots were installed by the Environment Department in partnership with MONUM and BPL's broader outdoor WiFi zone pop-ups pilot program. One was located at the Egleston Square Branch in Roxbury, and the other was at the East Boston Branch. These pop-up Cool Spots included shaded tents, misters, hammocks, and seating for people of all ages to enjoy, as well as heat sensors reporting real-time temperature readings.



Hammocks and tents at the East Boston Branch Cool Spot



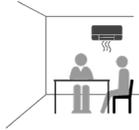
Misters installed under tents at the East Boston Branch



Shade, tables, and chairs at the Egleston Square Branch Cool Spot for people to hang out



Cool Spot and free WiFi zone at the Egleston Square Branch of the BPL



2. COOLING DURING HEAT WAVES

2.2 ENHANCED AND EXPANDED CITY-RUN COOLING CENTERS

Develop dedicated programming and clear messaging for public cooling centers and identify opportunities to expand services.

RATIONALE AND DESCRIPTION

During heat emergencies, designated BCYF community centers become cooling centers in each neighborhood. Cooling centers are open to everyone to cool off inside with air conditioning. Through dedicated programming and other opportunities to enhance and expand cooling centers, utilization of this important resource can grow.

The City will explore a range of options for network expansion, which may include identifying public buildings to serve as additional cooling centers. The City will prioritize areas with higher vulnerability, such as areas with high numbers of residents experiencing homelessness, children, older adults, and other high risk populations. The City will assess whether other public buildings with the appropriate climate controls, such as schools with HVAC systems that are not in session, could serve as cooling centers during heat emergencies. Additionally, the City will explore partnering with property owners and local community organizations to provide resources

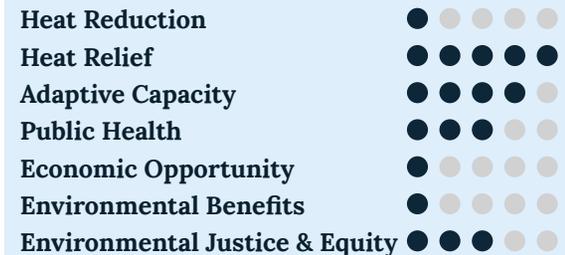
to temporarily repurpose vacant storefronts in neighborhood commercial districts for pop-up storefront cooling spots, and other opportunities to augment pop-up heat relief (Strategy 2.1).

Currently, when cooling centers activate during a heat emergency, existing scheduled activities and programming at BCYF community centers are rearranged or canceled. The City will explore the feasibility of providing free, diversified activities and programming which are co-located with other attractive programs, such as free WiFi spots. To support the capacity of BCYF staff during emergency operations, the City will consider ways to add capacity, such as working with small businesses and community organizers (coordinate with Strategy 4.3: expansion of green workforce development for heat resilience, and Strategy 3.1: expand community climate leadership) to support programming at BCYF cooling centers or Cool Spots. The City will prioritize supporting local women- and minority-owned small businesses, where appropriate, such as in the procurement of goods or services like hiring local educators or artists to run hands-on workshops.

Other improvement opportunities for cooling centers include developing a recognizable and consistent brand to use on exterior signage (for example, sandwich boards) in multiple languages.

The City will explore extending opening hours to accommodate access to cooling during the day and night. This is especially important for people living in neighborhoods that are hot in the day and night, like Chinatown. Transportation has also come up as a barrier to accessing cooling centers. The City will identify gaps in transportation access and work to close them through improvements around cooling centers (such as cool paths, added pedestrian connections to expand access, and other improvements).

HEAT RESILIENCE BENEFITS

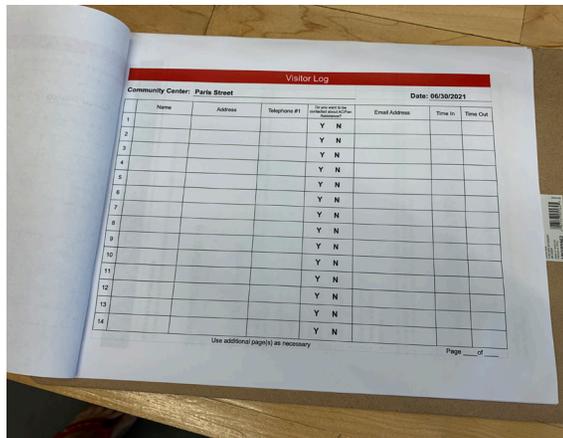


NEXT STEPS

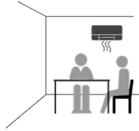
First, the City will conduct an assessment, including a community survey and focus groups, to understand what programming, barriers, and needs should be addressed. An analysis of the results will determine how to address barriers, including how cooling services are provided and whether to prioritize additional indoor cooling opportunities (Strategy 2.3).



BCYF Paris Street served as a cooling center in 2021. Sandwich boards and other advertising strategies can be implemented at cooling centers across the City.



The visitor log at BCYF Paris Street is a much simpler form than a typical registration form for community center use. This might still pose a barrier for some people.



2. COOLING DURING HEAT WAVES

2.3 CITYWIDE COOLING NETWORK

Expand Boston's network of free-to-access outdoor and indoor cooling locations.

RATIONALE AND DESCRIPTION

Project survey results showed that 60% of respondents would like to see more cooling centers in their neighborhood. To expand the existing network of cooling spaces in Boston over time, this strategy aims to create a citywide cooling network that will include several tiers, such as the following:

- » **City cooling centers:** BCYF community centers as official cooling centers with other public buildings where available and needed to close cooling network gaps
- » **Public outdoor spaces:** tot sprays, pools, parks, beaches, and other public outdoor spaces that provide relief from heat
- » **Community cooling partners:** expanded network that provides additional trusted indoor cooling spaces in partnership with organizations like churches, community organizations, businesses, and institutions
- » **Pop-up heat relief spots:** outdoor cool destinations that are deployed and accessible during heat waves offering an impactful role for blocks, individuals, and community organizations, with support from the City

- » **Additional small-scale cool spots:** smaller-scale indoor spaces, pop-up indoor centers in underused areas, kits for residents to support cooling, building-level retrofits for shared cooling areas, and more

The City will explore opportunities to support and expand the capacity of community organizations to participate in the network, providing additional options for cooling relief where people already gather or hang out. Potential opportunities for collaboration include religious institutions, community organizations, local businesses, local health centers, and higher education institutions. BPHC, OEM, and the Office of Neighborhood Services (ONS) are key to ensuring successful implementation of this strategy as they coordinate mutual aid and provide emergency information and overall support for communities and neighborhoods.

The City will define guidelines and priority locations to address existing gaps for each tier of the cooling network, including best practices for hours of operation, amenities, back-up power expectations, staffing, and other resources to ensure network participants have the necessary resources and guidance to help keep residents cool and safe. Consistent signage and branding for participating locations will help residents identify which locations are part of the cooling network.

Priorities for growth and expansion of the citywide cooling network in areas of the city that experience elevated air temperatures will focus on providing relief for Bostonians with elevated heat risk who are disproportionately affected by high-heat days and who may not otherwise have the capacity to obtain access to cooling.

Minimizing barriers to entry, such as cost, providing individual information, and creating a welcoming environment are essential to an expanded cooling network that will be beneficial to the community. The City will develop communication and marketing to promote the citywide cooling network, with consistent, accessible communication and signage. The City will identify opportunities to coordinate with existing well-known programs and emerging initiatives and trusted community organizations, which is complementary with expanded community climate leadership (Strategy 3.1).

NEXT STEPS

The City will assess existing formal and informal networks in the community and neighborhoods to identify community partners and needs for support.

PUBLIC COOLING LOCATIONS (NO TOT SPRAYS)

PUBLIC PLACES TO COOL OFF

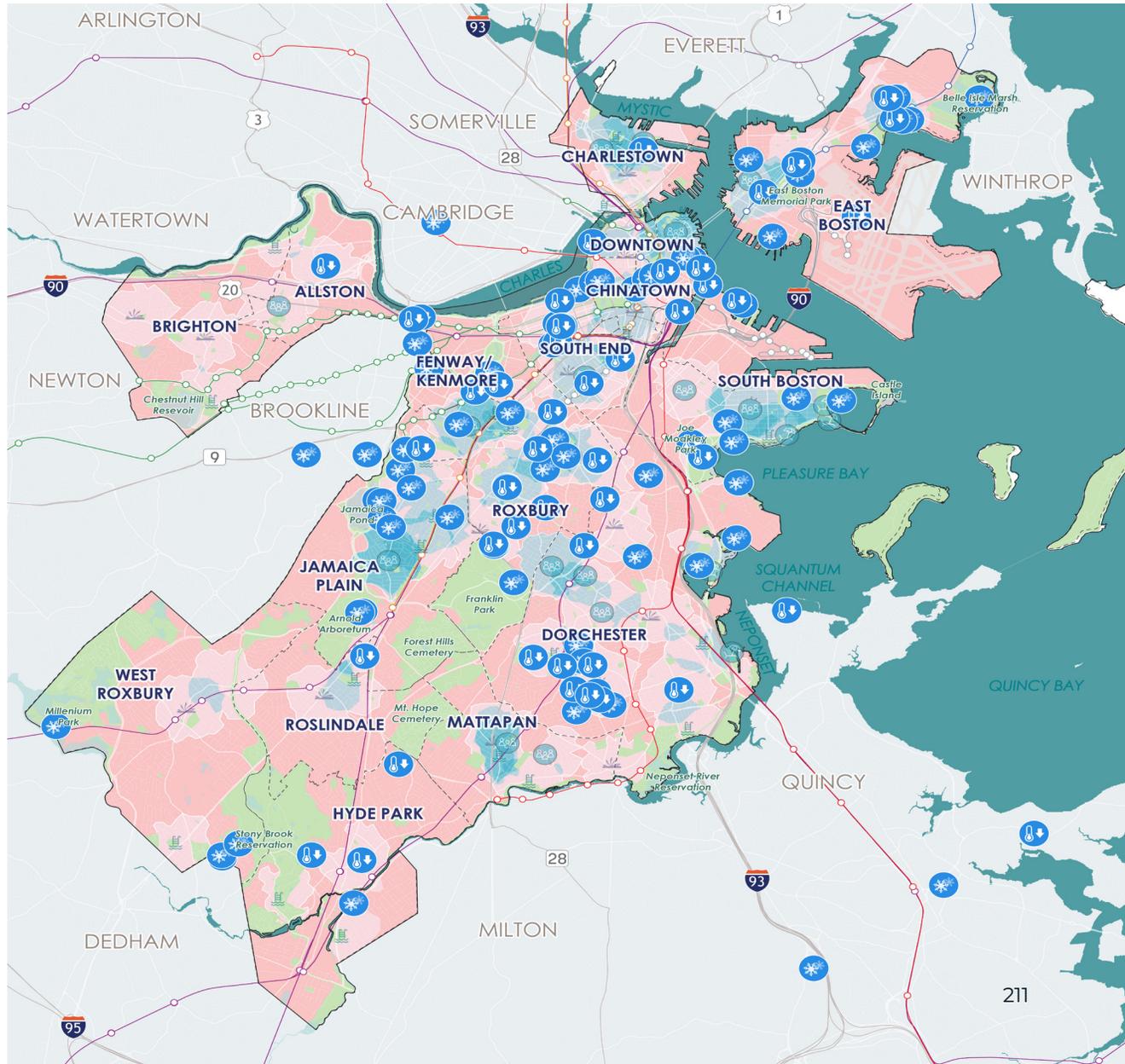
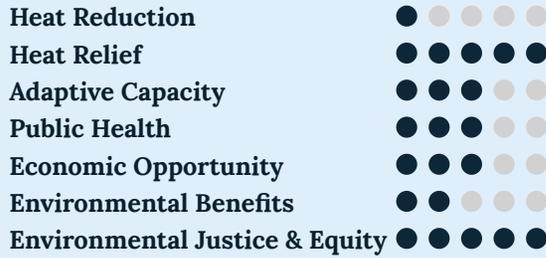
-  Pools (BCYF and DCR)
-  Beaches
-  Libraries
-  Community Centers

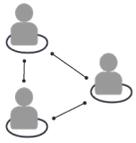
 No Cooling Centers
 More Cooling Centers Within 10-minute Walk

SURVEY RESULTS: WHERE DO YOU...

-  Go to cool off inside
-  Go to cool off outside

HEAT RESILIENCE BENEFITS





3. LOOKING OUT FOR NEIGHBORS

3.1 EXPANDED COMMUNITY CLIMATE LEADERSHIP

Support leadership development and community-identified heat resilience priorities.

RATIONALE AND DESCRIPTION

The effectiveness of heat resilience strategies can be greater when they incorporate partnership approaches across an equally broad range of community leaders, small businesses, young people, and organizations. This strategy aims to broaden involvement in heat resilience strategies, while also providing leadership development opportunities for residents. The Environment Department will expand community climate leadership to support existing community leaders and grow a broader community network of residents with a diverse range of backgrounds and skill sets to promote climate resilience in their neighborhoods. This effort intends to create opportunities for community members to build local ties, strengthen small businesses' ability to foster creative resilience improvements, and expand the network of climate resilience information sharing and action. Trusted local ambassadors will share information about how to stay cool during heat waves to close gaps in the reach of official City communications, along with other climate resilience information.

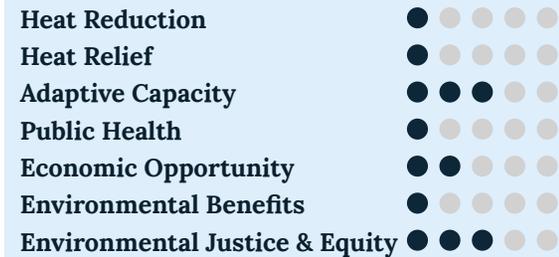
Other anticipated participants of the community climate leadership program include youth leaders and small business owners. This strategy will build upon other local education and climate advocacy programs and heat sensor networks (Strategy 1.3).

For small businesses and nonprofits, this program will be a network-based approach to promoting climate resilience among small businesses. It may include education and preparedness resources, support for resilience operational planning, and guidance on eligibility for grants supporting climate resilience investments and retrofits. This strategy connects to the BPHC's Safe Shops Program, which provides technical assistance to small businesses, and cool Main Streets (Strategy 7.3), which identifies opportunities for cooling interventions in Boston's neighborhood commercial hubs. Interested businesses may become staging points for pre-heat-wave resources mobilization (Strategy 1.2) and offer water and cooling resources during heat waves that also support their customer engagement and retention goals.

Leaders from youth and small business cohorts may meet together a few times annually or during key moments in the year, such as before the summer season begins, to share best practices and build a sense of community among participants. The program

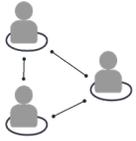
will also support mentorship and help develop career pathways and other learn-and-earn opportunities.

HEAT RESILIENCE BENEFITS



NEXT STEPS

The Environment Department will gauge interest in the broader community, refine the program scope and goals based on feedback, and convene an initial cohort to pilot the program. The City will focus recruitment on people who understand the problem and are being affected most significantly, emphasizing diverse backgrounds among the cohort. Recruitment will proceed through multiple media platforms and languages, with broad reach to provide inclusive participation opportunities.



3. LOOKING OUT FOR NEIGHBORS

3.2 EXTREME TEMPERATURE PLANS FOR OUTDOOR WORKERS

Provide information and guidelines about summer safety for outdoor workers.

RATIONALE AND DESCRIPTION

Outdoor workers are at elevated risk of heat-related illness. They have little flexibility to adjust their work schedule or activities, even during a hot day, and consequently they are particularly vulnerable during a heat wave. In coordination with other state and federal efforts, the City will explore opportunities for developing, where appropriate, local guidelines, plans, best practices, and policies for outdoor employment on hot days. The City will share resources with employers and employees, where appropriate, to increase awareness of ways to reduce heat risk and maintain a safe and healthy workplace.

Information sharing will include providing large construction projects and other outdoor worker employers with best practices information for extreme heat, covering topics such as work hours and breaks, shade, hydration, training for crews to recognize symptoms of heat-related illness, and limits on work during heat waves. These resources will highlight the benefits to the employer of protecting worker health in the heat, including fewer days lost to heat-related illnesses, improved worker retention

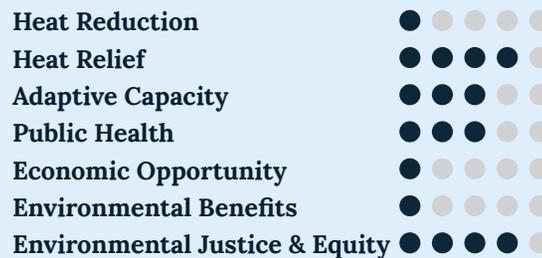
and job satisfaction, and a healthier workforce overall. Additional resources are available in the Occupational Safety and Health Administration (OSHA)'s Heat Illness Prevention campaign, launched in 2011.

The City will seek to engage with the state to help inform state-level policy guiding outdoor work on excessive heat days, such as policies on temperature thresholds, shade, and water provision, and training to recognize heat-related illness symptoms. Additionally, OSHA is in the process of considering a federal heat standard, which will provide further guidance around outdoor worker safety. In October 2021, OSHA issued an Advance Notice of Proposed Rulemaking for Heat Injury and Illness Prevention in Outdoor and Indoor Work Sessions.¹

NEXT STEPS

Through engagement with key stakeholders, such as workforce safety organizations, unions, worker centers, City and state regulators, and others, the City will explore opportunities to provide training, best practice guides, and other resources to vulnerable outdoor workers. Building upon existing methods and identifying additional means of reaching outdoor workers and their employers ahead of a heat wave will be important to increasing awareness.

HEAT RESILIENCE BENEFITS





4. AWARENESS, EDUCATION, AND TRAINING

4.1 HEAT RESILIENCE PUBLIC EDUCATION CAMPAIGN

Launch a multi-pronged public education campaign to increase awareness of heat risks and cooling options.

RATIONALE AND DESCRIPTION

Even though heat is the number one cause of weather-related deaths in the United States, many people are unaware of the dangers of extreme heat. Building on existing City resources for excessive heat, this multi-pronged public education campaign would focus on increasing awareness of heat risks and how to stay cool.

The heat resilience public education campaign will include a broad coalition of public, civic, and private organizations to expand awareness. The core focus of the campaign will be to share the risks of heat, best practice behavior in hot weather, and cooling opportunities through many outlets. The current COVID-19 response and information campaigns provide lessons and best practices that inform how to most effectively share information.

To increase awareness broadly among Boston residents, the public education campaign would take many forms, ranging from signage, television and radio messages, education programs, public art, social media, and more.

Messengers may include youth influencers, teachers, radio and news personalities, primary care physicians, home health aids, and compensated community-based organizations, nonprofits, or small businesses (see also Strategy 3.1, expanded community climate leadership). Information will be available in multiple languages, with culturally adapted content. Importantly, the Public Education Campaign will integrate with other education efforts and City programs to maximize its reach, effectiveness, and consistency with other messages.

Design of the public education campaign will build in opportunities for bidirectional communication with residents to improve actions taken and participate in government decision making, as well as build community capacity around getting engaged in other supportive programs.

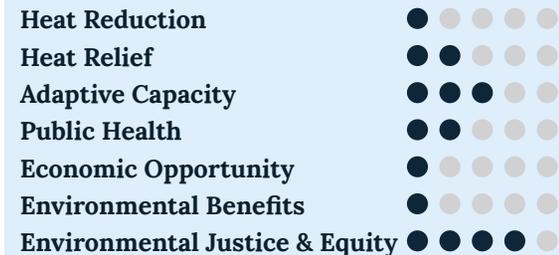
Along with other strategies in the *Heat Plan*, this effort will help expand sign-ups and reach of existing emergency alert communications (AlertBoston) and increase awareness of 311 as a one-stop connection to heat relief resources.

While the campaign will be designed to increase general awareness of heat risks, it will also place a special focus on providing information to residents and workers who are at greatest risk. This could

include distributing information in high-heat neighborhoods, in collaboration with service providers supporting unhoused residents, at construction sites (see also Strategy 3.2, extreme temperature plans for outdoor workers), and to older adults, families with young children, and residents with disabilities or underlying health conditions that increase their health risks in hot weather.

This strategy will be coordinated with the Boston Extreme Temperatures Response Task Force (Strategy 1.1) to utilize established public education channels for pre-heat-wave resources mobilization (Strategy 1.2).

HEAT RESILIENCE BENEFITS



NEXT STEPS

One existing opportunity is to revamp the City's climate leadership program to engage local communities in ways residents can take action on climate and extreme heat. In parallel, the City will assess opportunities to expand sign-ups for AlertBoston, including the feasibility of switching to an opt-out system and including more opportunities for residents to learn about and sign up for AlertBoston when engaging the City in other programs or services.

Finally, the City will review 311's heat-related information and consider expanding language access to extend this citywide resource to additional residents.



The Heat Plan table at the Chinatown Block Party



4. AWARENESS, EDUCATION, AND TRAINING

4.2 HEAT SURVEY

Deploy a citywide survey to measure public perceptions about heat risks and barriers to accessing cooling, and to improve access to resources and services.

RATIONALE AND DESCRIPTION

Tailored resources and assistance programs are critical to ensure all of Boston's diverse communities can access the necessary resources to stay cool. While the danger of heat is perceived as generally underestimated by many residents, the specifics of knowledge and resource gaps—and how they vary across different demographic and cultural lines—are not well known.

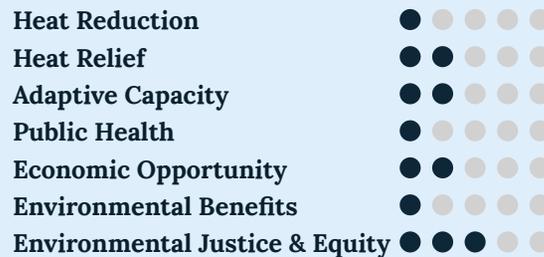
The City will launch a citywide survey, available in multiple languages, to measure public perceptions about heat risks and barriers to accessing cooling. This strategy aims to ensure that City services to stay cool are responsive to community needs. Survey data will allow tracking changes over time and measuring effectiveness. Data will be open access to support research and innovation, in compliance with City of Boston data standards.

This strategy serves as a critical initial step for multiple strategies including pre-heat-wave mobilization resources (Strategy 1.2) and home cooling resources distribution (Strategy 5.1). This strategy would support the creation of more targeted priority messages in the public education campaign (Strategy 4.1).

NEXT STEPS

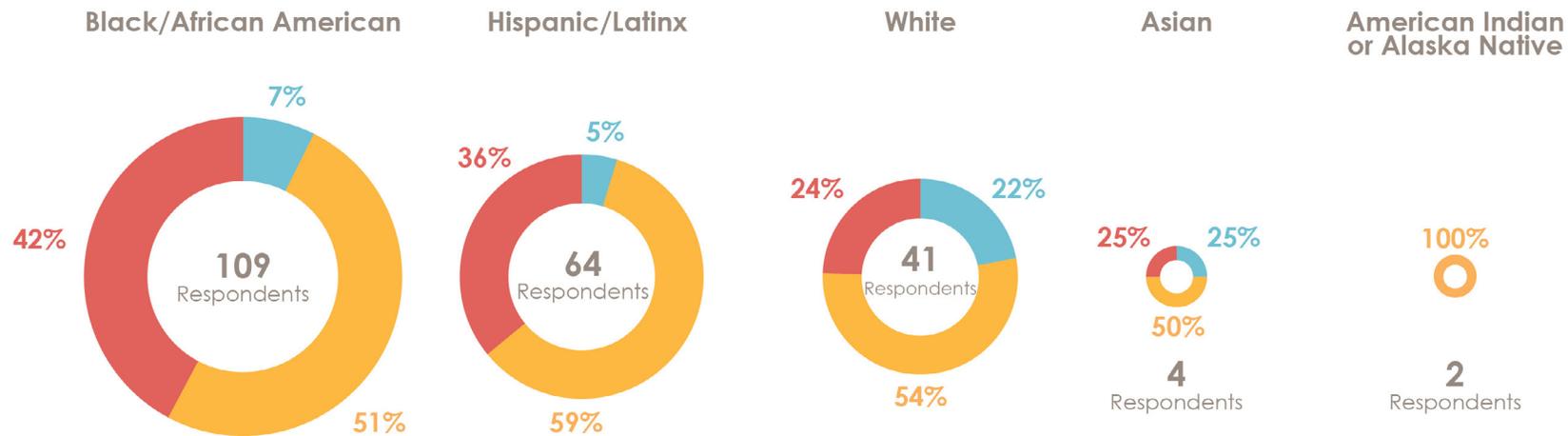
Convening the Boston Extreme Temperatures Response Task Force (Strategy 1.1) is a critical next step to advance the survey. Through the task force, the City will determine data collection goals and survey design.

HEAT RESILIENCE BENEFITS



When it is very hot outside, how often do you feel too hot at home?

Always Sometimes Never



In public surveys conducted during the Heat Plan, the disproportionate exposure of people of color to heat risk in their own homes is visible.

The citywide survey showed that the majority of respondents feel too hot in their home. However, the burden of heat exposure at home falls disproportionately on Black and Latinx communities. Of Black respondents, 42% always feel hot in their home (represented by the red segment in the graph),

while the percentage of white respondents that always feel hot is just over half of that. While 5% of Latinx respondents said they never feel hot in their home (represented by blue in the graph above), the percentage of white respondents that said they never feel hot in their home is about four times higher.



4. AWARENESS, EDUCATION, AND TRAINING

4.3 EXPANSION OF GREEN WORKFORCE DEVELOPMENT FOR HEAT RESILIENCE

Provide career pathways in green jobs including energy retrofits, cool roof installations, and tree planting and maintenance.

RATIONALE AND DESCRIPTION

As the City takes action to meet carbon neutrality goals and build a better, more resilient Boston, new systems and infrastructure will need to be built. These projects will expand new green job opportunities in industries such as building energy retrofits, building operations and maintenance, roadway construction and improvements, tree planting and maintenance, and more. This strategy aims to ensure that the workforce gains the skills needed to support these changes and increased need for capacity in an equitable manner.

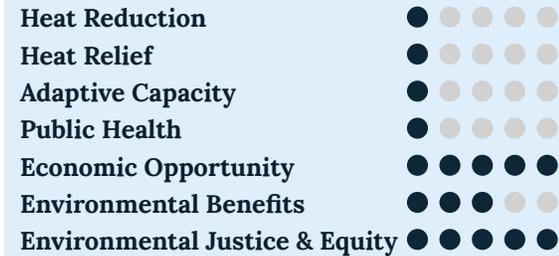
The strategy of expanding green workforce development will require supporting incumbent worker training, creation and support of new career pathways, and buy-in of the full workforce development ecosystem. The City will continue to develop additional green workforce training programs with program participants, such as apprenticeship programs, high schools, community colleges and other higher education institutions, vocational training programs, community-based organizations,

workforce development organizations, and worker centers that already offer workforce training programs. To ensure equity and sustainability, new programs will consider ways to proactively reduce barriers to participation, such as support services for transportation, child care, and language accessibility during training programs.

New programs will look for ways to work with potential employers and industry leaders to understand their needs. This type of outreach can provide a broad range of opportunities through mentorship, internships, fellowships, and employment pathways for program participants, as well as improved hiring practices and talent pipelines for employers facing new and increasing needs for a green workforce.

This strategy would also coordinate with expanded community climate leadership (Strategy 3.1) to upskill or educate community nonprofit members on climate resilience job opportunities, especially women- and minority-owned businesses. New and existing green workforce training programs will incorporate awareness of the dangers of extreme heat and heat stress, and how their industry's work could mitigate the impacts or adapt systems and infrastructures to be resilient to heat. Program participants may become ambassadors in their future role.

HEAT RESILIENCE BENEFITS



WHAT ARE GREEN JOBS?

Green jobs are jobs in the following:

- » Energy efficiency
- » Carbon-reduction
- » Natural resource conservation or climate hazard mitigation sectors

These industries include but are not limited to the following:

- » Construction trades, including weatherization, HVAC, electrical, plumbing, engineering, carpentry, roofing, estimation, and pipefitting
- » Building operations, building automation, and facilities management
- » Green stormwater infrastructure, tree care, and horticulture

Learn more: <https://www.boston.gov/environment-and-energy/green-jobs>

NEXT STEPS

In fiscal year 2022, the City began this process by allocating \$1 million to support the City's Green Jobs initiative² and \$500,000 for mobility jobs. This initial funding was used to expand existing green jobs and mobility jobs training programs implemented by community organizations.

The City has also allocated \$3 million of federal funding received through the American Rescue Plan Act of 2021 for green workforce development. The City is developing a Boston green jobs training program, modeled off the City of Philadelphia's PowerCorpsPHL program. The Boston program will coordinate with related workforce development programs of the Mayor's Office of Workforce Development (OWD) and recommendations coming out of the Boston Parks and Recreation Department (BPRD)'s *Urban Forest Plan*. These programs ensure that the expansion of these training opportunities incorporate wrap-around support services to lower the barriers of entry into the program for participants.



Charlestown Navy Yard

COOLER COMMUNITIES

Create cooler indoor and outdoor environments, buildings, and neighborhoods.

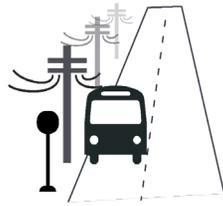
The built environment influences how hot a neighborhood can get during the summer. This section includes 15 strategies to create more energy efficient buildings through retrofits and incentive programs, cooler outdoor spaces for people to enjoy, and policies that encourage future development to contribute to a more heat-resilient city.



5. BUILDINGS



6. PARKS, TREES, AND OUTDOOR SPACES



7. TRANSPORTATION AND INFRASTRUCTURE



8. PLANNING, ZONING, AND PERMITTING

COORDINATION WITH STATE PARTNERS

Continue collaboration with state partners as they incorporate cooling strategies into state-owned infrastructure, policy, and operations.

State-owned and -operated infrastructure—including subway stations, airports, parks, and more—is critical for residents of and visitors to the Boston metropolitan area. Designing for heat resilience can improve people’s heat experience when using these busy facilities, and positively impact neighboring communities as well as the environment. The City seeks to coordinate with the State on the following actions.

OPPORTUNITIES TO COORDINATE TRANSPORTATION INFRASTRUCTURE

- » Identify how opportunities to address heat resilience align with existing or planned capital improvements, such as life safety and ventilation improvements in subway stations.
- » Explore opportunities to coordinate with planned improvements around subway stations to incorporate heat relief and reduction strategies that promote cooling and accessibility along paths.
- » Explore opportunities to implement shaded bus shelter areas at existing bus stops and to expand the bus shelter network in hotter neighborhoods of Boston.

OPPORTUNITIES TO COORDINATE LAND DEVELOPMENT

- » Collaborate to help inform heat resilience strategies in state resiliency guidelines, in addition to existing guidelines on cool and permeable pavement.
- » Collaborate to analyze opportunities to reduce offsite heat impacts of state-owned assets in Boston neighborhoods.
- » Collaborate to explore feasibility of increased tree planting and buffer zones at state-owned properties in Boston neighborhoods to provide shade and heat reduction.

OPPORTUNITIES TO COORDINATE IN PARKS

- » Explore opportunities to expand cooling features, drinking fountains, and other access, safety, and comfort improvements in state-owned parks and open spaces.
- » Collaborate to improve cool walks to parks and between parks.

OPPORTUNITIES TO COORDINATE ON POLICY

- » Explore opportunities to coordinate with the State on building code, sanitary code, and related regulatory opportunities to integrate heat and health into regulatory standards
- » Explore opportunities to coordinate with the State on safety regulations and guidelines for workers and for organizations that serve vulnerable residents such as daycares, senior services, and schools
- » Explore opportunities to inform how heat resilience could be integrated into the State’s existing or planned energy efficiency, public health, and emissions-reduction programs



5. BUILDINGS

5.1 HOME COOLING RESOURCES DISTRIBUTION

Distribute resources to support cooler homes.

RATIONALE AND DESCRIPTION

Despite feeling hot at home, two-thirds of stakeholders from the *Heat Plan* surveys reported staying home on very hot days. Helping people stay cool in their homes is a high-impact way of mitigating individual heat risk, especially for people who have factors that make leaving home more difficult or unsafe. This strategy focuses on distributing resources to support cooler homes. This strategy builds on previous efforts to provide air conditioning and fans to income-eligible residents, older adults, persons with disabilities, and other high-risk residents through the Healthy Places air conditioner and fan distribution during summer 2021.

Active cooling resources such as air conditioners and fans provide short-term and immediate cooling. These resources have an associated energy use, carbon emissions impact, and utility costs. For these reasons, it is critical to ensure the distribution of fans or air conditioners is also integrated with longer-term passive heat and energy retrofits (see Strategy 5.3, home energy retrofits). For example, building weatherization, cool roofs, and trees integrate into building and site design to provide passive cooling.

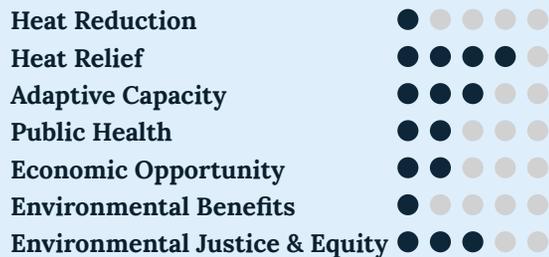
These elements may incur higher costs upfront, but over time, are cost effective and advance resilience and sustainability goals. Additionally, increasing awareness of affordable building retrofit resources, utilities assistance information, and ways to maximize the benefits of active cooling (see Strategy 4.1, heat resilience public education campaign) will support a holistic approach to addressing both immediate needs and long-term resilience.

ONS, BPHC, Environment Department, and OEM, alongside other community-based organizations, are critical to providing resources where they are needed most—residents with greatest heat exposure and sensitivity, and less financial capacity or other adaptive capacity to address their needs to stay safe and cool.

NEXT STEPS

The formation of the Boston Extreme Temperatures Response Task Force (Strategy 1.1) is a key next step. The task force will define an integrated process for pre-heat wave mobilization into the broader heat relief strategy. The task force will identify how to improve speed and targeting of distribution to ensure resources are going to the residents with highest need. Lessons learned from COVID-19 relief efforts as well as other City distribution efforts like food access could also improve implementation of this strategy.

HEAT RESILIENCE BENEFITS





5. BUILDINGS

5.2 COOL ROOFS PROGRAM

Invest in cool roofs to reduce heat: white roofs that reflect solar radiation, green planted roofs that insulate and absorb rainwater, and solar roofs that generate renewable energy and shade.

RATIONALE AND DESCRIPTION

Dark-colored roofs that are exposed to the sun absorb more heat than lighter-colored roofs. In urban spaces, this can often contribute to urban heat island impacts. Implementing cool roofs can reduce localized extreme temperatures.

Results from the online survey show that community members (45% of respondents) would like to see more cool roofs in their neighborhoods. The Environment Department will launch a cool roofs program with the goal of providing grants to a nonprofit organization in Boston to install cool roofs. Over time, the program will support additional job training and green job creation (similar to the NYC CoolRoofs program). The City will assess opportunities for guidelines, incentives, or requirements to encourage property owners and developers to include cool roofs in substantial building improvements and new construction. Buildings in areas with elevated heat

exposure and increased prevalence of Bostonians with heat-related health risks will be prioritized, along with affordable housing that lacks central air conditioning.

This program is also an opportunity to conduct research on the effectiveness of different cool roof strategies. The City will coordinate with heat sensor networks (Strategy 1.3) to identify potential pilot locations for ongoing data collection of cool roof effectiveness.

NEXT STEPS

The City will launch a cool roofs program, which will provide grants to a nonprofit organization to complete cool roof installations on eligible properties. The City will explore additional near-term opportunities to demonstrate large-scale cool roofs on public buildings.

HEAT RESILIENCE BENEFITS

| | |
|---|-----------|
| Heat Reduction | ● ● ● ● ● |
| Heat Relief | ● ● ● ● ● |
| Adaptive Capacity | ● ● ● ● ● |
| Public Health | ● ● ● ● ● |
| Economic Opportunity | ● ● ● ● ● |
| Environmental Benefits | ● ● ● ● ● |
| Environmental Justice & Equity | ● ● ● ● ● |

UNIT COSTS

| Cool Roof Type | Unit Cost |
|---|-----------|
| Flat light-colored roofs + insulation | \$44/SF |
| Pitched light-colored roofs (white asphalt shingles) + insulation | \$13/SF |
| Pitched light-colored roofs (profiled metal roofing) + insulation | \$62/SF |
| Light-colored roofs | \$7/SF |
| Green roofs | \$35/SF |

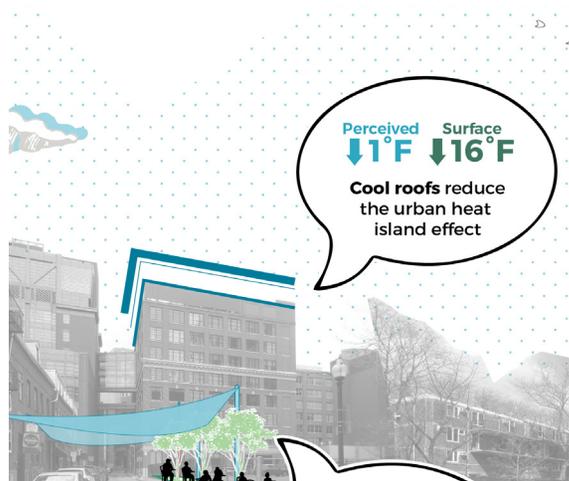
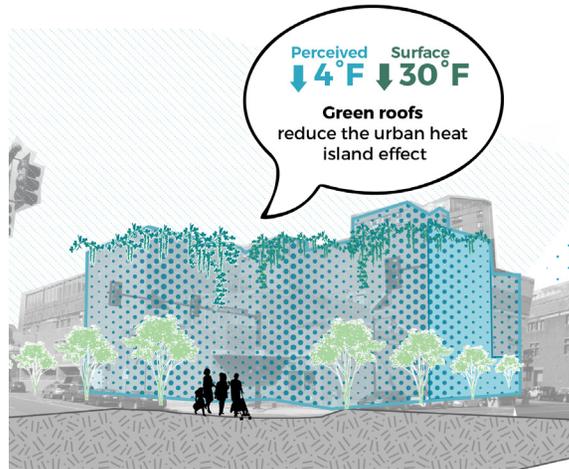
See Appendix 3 Unit Costs for additional details.

NYC COOL ROOFS PROGRAM

Launched in 2009 and transitioned to a training program in 2015, the NYC CoolRoofs program engages nonprofits, city agencies, and building owners to provide volunteers and job seekers with training on installing cool roofs. The program aims to install one million square feet of cool roofs annually by providing cool roof installations at no cost or low cost to eligible buildings, prioritizing nonprofits and affordable housing developments.³

RESULTS FROM THE NEIGHBORHOOD CLIMATE SIMULATION MODEL: COOL ROOFS AND CANOPIES

The results from the neighborhood climate simulation modeling shows that green roofs provide a significant (30°F) decrease in surface temperature, but not as much of a decrease (4°F) in perceived temperature. The decrease in surface temperature can have potential energy saving benefits for heating and cooling buildings as it acts as an insulator. To create a more comfortable outdoor environment, 50% shade canopies (such as fabric canopies) can be added to green roofs that serve as gathering spaces to decrease perceived temperatures by 11°F. Turning dark roofs into white roofs also reduces the surrounding urban heat island by reducing surface temperatures by an estimated 16°F. Solar canopies that provide full shade in an exposed area also reduce heat exposure by decreasing surface temperatures by 24°F and perceived temperatures by 12°F.





5. BUILDINGS

5.3 HOME ENERGY RETROFITS

Improve energy efficiency and indoor thermal comfort, and reduce energy cost burdens by facilitating home energy retrofits.

RATIONALE AND DESCRIPTION

Energy efficiency must go hand in hand with heat resilience for buildings. The 58% of Bostonians who rent their homes face further challenges to accessing efficiency improvements. Residents living in affordable housing, specifically, may have limited opportunities to implement improvements that increase indoor thermal comfort and reduce energy use. The cost of running air conditioning and fans can be a burden to some residents trying to stay cool at home. Additionally, increased need and use of cooling appliances will increase emissions and may introduce strain on the energy grid on very hot days. As extreme heat increases in Boston, integrating energy efficient appliances into existing buildings will help residents reduce operational costs and save energy, while reducing City emissions and increasing energy resilience.

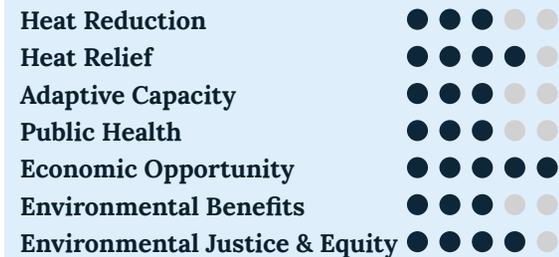
The strategy of home energy retrofits will require collaboration with organizations, state agencies, and community representation. Working with energy

efficiency-focused organizations, the City will share information with residents to highlight existing state and federal incentives, as well as explore strategies to support and incentivize retrofits for eligible rental properties (see Strategy 5.4, affordable housing resources and retrofits). See Chapter 7, Resource Guides, for information on utilities assistance programs. The focus of the strategy is to support both property owners and tenants on ways to invest in resilient energy retrofits to protect resident health and safety while increasing climate resilience.

The City will continue to build and distribute resources with direct outreach to prequalified residents in high-priority areas. Sharing information around home retrofits will support the goals of the heat resilience public education campaign (Strategy 4.1), while connecting property owners with existing City, state, and federal programs that offer significantly subsidized energy retrofits (e.g., the Mayor’s Office of Housing Landlord Incentive Program). Other programs to share information and collaborate with existing or new programs include working with the Low-Income Home Energy Assistance Program participants, as well as Mass Save, which supports insulation improvements, air conditioning purchase and installation, and other measures. The City will also publicize state and federal incentives for installing solar panels. The City’s

existing Retrofit Resource Hub consolidates technical and financial information to help building owners, tenants, and contractors make climate resilience and low-carbon building improvements. The Retrofit Resource Hub serves as a go-to information resource on home energy retrofits for tenants and large- to medium-sized buildings. Through the heat resilience best practices guidelines (Strategy 8.2), the City will explore guidance for retrofits that integrate heat resilience and emissions reduction.

HEAT RESILIENCE BENEFITS



NEXT STEPS

The City of Boston is partnering with Mass Save through their Community First Partnership. Within the next year, the goal is to increase Mass Save’s program participation and achieve 600 projects per year in environmental justice communities across Dorchester, East Boston, Mattapan, and Roxbury with an emphasis on the following priority groups: renters, low- to moderate-income residents, English-isolated residents, and small businesses.

Some people and communities face greater barriers to installing home energy retrofits and wealth-building due to environmental factors and the legacy of past investment decisions. The City will use existing data under the Building Energy Reduction And Disclosure Ordinance (BERDO) to identify and engage with large multi-family affordable residential buildings with higher energy use. By connecting early with organizations who are doing work related to utility affordability, housing affordability, and green jobs, the City aims to further understand existing barriers and resource needs.

COOL TRIPLE-DECKER RESIDENTIAL BUILDING

COSTS

BENEFITS

- | | |
|---|---|
| <ul style="list-style-type: none"> » Trees » Cool roofs: flat » Air conditioning (3 window units/building) » Fabric awnings: windows and porch » Building performance: windows » Blinds | <ul style="list-style-type: none"> » Reduced heat-related mortality » Reduced heat-related hospitalizations » Energy efficiency improvements |
|---|---|

TOTAL COSTS OVER 45 YEARS ONE TRIPLE-DECKER (UNDISCOUNTED 2021\$)

| Category | Cost |
|--------------------|------------------|
| Capital & Design | \$95,660 |
| Annual Replacement | \$4,303 |
| Total Costs | \$289,293 |

Costs include capital costs that consist of preliminary design, engineering, and construction for the first five years, and replacement costs of cooling strategies over 45 years.



5. BUILDINGS

5.4 AFFORDABLE HOUSING RESOURCES AND RETROFITS

In public and affordable housing communities, invest in energy retrofits and climate resilient design.

RATIONALE AND DESCRIPTION

Integrating climate resilience strategies and energy efficiency into building design can reduce fossil fuel usage, while improving indoor air quality and thermal comfort and lowering energy costs for residents. However, the cost of conducting deep energy retrofits may preclude some building owners from accessing these benefits.

Energy efficiency and resilient design can and should be accessible. This strategy aims to advance energy efficiency and resilient design in Boston's affordable housing stock by identifying ways to reduce barriers and increase awareness of retrofit opportunities and their benefits to both owners and tenants.

To increase awareness, the City will develop and distribute resources on how to approach and successfully complete resilient energy retrofits, and share information about existing programs and guidelines to support cooler homes. The guidelines will include ways to integrate energy efficient HVAC systems with passive and nature-based cooling to

maximize benefits. These resources will be developed in partnership with industry experts, academic institutions, community development corporations, and building owners.

In addition to increasing awareness of existing information resources, the City will develop programs for building retrofits through this strategy. By providing incentives for landlords to make upgrades, this strategy aims to increase accessibility of implementing retrofits to support cooler homes for all Bostonians. The Mayor's Office of Housing (MOH) is responsible for developing affordable housing in Boston and works to ensure that renters and homeowners can find, maintain, and stay in their homes. MOH is investing in programs to ensure that all residents have the opportunity to live in more energy efficient and climate resilient homes.

Programs through this strategy may include the following:

- » Energy retrofits, including weatherization and heat pump installation, which can provide energy-efficient indoor comfort improvements in both summer and winter seasons (utilizing resources developed under Strategy 5.3, home energy retrofits)
- » Air conditioner installation for tenants with additional subsidies (such as utility bill assistance) for income-qualified residents
- » Exterior shade improvements like trees and awnings

HEAT RESILIENCE BENEFITS



NEXT STEPS

Early implementation opportunities the City will explore include incorporating heat resilience metrics and best practices into planned redevelopment and renovation projects. Additionally, the City will continue to share information on existing resources for affordable housing owners and renters and explore developing additional City resources, including programs that reduce the cost of improvements for eligible buildings.

COOL LARGE MULTI-FAMILY RESIDENTIAL BUILDING

COSTS

BENEFITS

| | |
|---|---|
| » Trees | » Reduced heat-related mortality |
| » Cool roofs | » Reduced heat-related hospitalizations |
| » AC: building-wide air conditioning system | » Energy efficiency improvements |
| » Steel parking canopy | |
| » Cool pavements | |
| » Freestanding fabric awnings | |
| » Building performance enhancements (e.g., windows) | |
| » Blinds | |

TOTAL COSTS OVER 45 YEARS ONE LARGE MULTIFAMILY HOUSING BUILDING (UNDISCOUNTED 2021\$)

| Category | Cost |
|--------------------|----------------|
| Capital & Design | \$9.8M |
| Annual Replacement | \$573.202 |
| Total Costs | \$35.5M |

Costs include capital costs that consist of preliminary design, engineering, and construction for the first five years, and replacement costs of cooling strategies over 45 years. A large multifamily housing building in this analysis was defined as a building with 80 units.



5. BUILDINGS

5.5 COOL SCHOOLS

Improve energy efficiency, indoor and outdoor thermal comfort, and outdoor shading in schoolyards, and promote education about heat resilience.

RATIONALE AND DESCRIPTION

Exposure to high heat in schools affects a child’s ability to learn and be successful in a classroom setting. A study found that relative to school days with temperatures in the 60s (°F), each additional school day with temperatures in the 90s (°F) reduces achievement by one-sixth of a percent of a year’s worth of learning.⁴ To ensure that all Boston youth can thrive in cool and safe learning environments, the cool schools strategy proposes building additional design guidelines and resources to support the following strategies:

- » Building envelope and HVAC energy efficiency capital improvements and retrofits
- » Shaded schoolyards, natural and built shading, trees, and design for breezes
- » Solar canopies and shade structures for parking
- » Locations for outdoor heat sensors
- » Water stations with bottle fillingⁱ
- » Cool roofs (see Strategy 5.2)

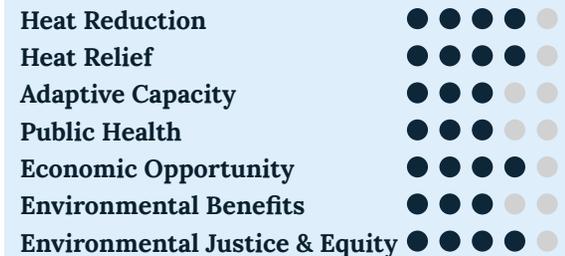
BPS, the Public Facilities Department (PFD), and the Environment Department are critical to ensure successful implementation of this strategy. The City will explore opportunities, where appropriate, to make energy efficiency upgrades, emissions reduction, and climate resilience elements (such as solar and cool roofs) through Renew Boston Trust (RBT).ⁱⁱ Planned capital projects and annual programs offer opportunities for integrating heat resilience and improved indoor and outdoor comfort at schools and schoolyards. A co-benefit of the cool schools strategy is that upgraded schools could also double as cooling shelters for neighborhood residents in underserved areas when school is out of session (see Strategy 2.3, citywide cooling network). As part of the heat resilience best practices guidelines (Strategy 8.2), the City will develop resources and guidance that support heat resilience for climate-ready schools.

BPS has also recently launched a program that installs IAQ sensors in all classrooms in schools.⁵ The sensors not only collect information about air quality, but also temperature and relative humidity. BPS’s leadership in building out a comprehensive sensor network in Boston schools may create a teaching opportunity for children to learn about the relationship between heat and air quality, and to collaborate with heat sensor networks (Strategy 1.3). The City will analyze data from IAQ sensors installed through the BPS Indoor

Air Quality and Ventilation Plan to inform the heat resilience best practices guidelines (Strategy 8.2). The temperature comfort standard for BPS is 68 to 78°F.⁶ Schools that regularly fall above this threshold can then be identified for opportunities for creating cooler indoor environments.

The teaching environment in schools is also an opportunity for bringing heat resilience education into children’s homes. For example, youth science programs with heat sensors, or lessons on how to incorporate heat resilience best practices at home are potential educational programs that can support greater climate literacy and engagement. Heat and climate resilience could also integrate into existing curriculums, building upon the BPS Healthy and Sustainable Schools program and the Office of Health and Wellness’ efforts.

HEAT RESILIENCE BENEFITS



ⁱ BPS received a recent grant from EPA program for \$6.2M for water fountains and bottle filling stations.

ⁱⁱ Renew Boston Trust is an existing initiative that conducts energy audits and installs energy conservation measures in municipal buildings.

NEXT STEPS

The City is pursuing energy efficiency and resiliency in the City owned buildings. RBT is an ongoing initiative that facilitates energy conservation measures like installing efficient LED light bulbs or water conservation upgrades that reduce the amount of water used. These upgrades are made in schools, community centers, libraries, parks, and police and fire stations across Boston. The City will identify opportunities to integrate appropriate resilience investments into City-owned buildings within the RBT portfolio.

COOL SCHOOLS

| COSTS | BENEFITS |
|----------------------------|---|
| » Trees | » Avoided reduction in lifetime income due to fewer school days missed |
| » Cool roofs | » Avoided head of household income lost due to fewer school days missed |
| » HVAC upgrades | » Improved learning and achievement |
| » Steel canopies | » Improved energy efficiency |
| » Cool pavements | » Reduction in heat-related health issues |
| » Drinking fountains | |
| » Energy-efficient windows | |
| » Blinds | |
| » Steel parking canopy | |
| » Cool pavement | |

TOTAL COSTS OVER 45 YEARS (UNDISCOUNTED 2021\$)

| Category | Cost |
|--------------------|---------------------|
| Capital Costs | \$3,916,762 |
| Replacement Costs | \$8,376,404 |
| Total Costs | \$12,293,166 |

Costs include capital costs that consist of preliminary design, engineering, and construction for the first five years, and replacement costs of cooling strategies over 45 years. A cool school in this analysis was defined as an average public school with 425 students enrolled and no HVAC system installed.



6 PARKS, TREES, AND OUTDOOR SPACES

Boston's green spaces and outdoor open spaces are critical to the city's network of cooling resources.

Trees and outdoor green spaces are among the most effective nature-based heat mitigation strategies. Trees reduce temperatures by providing shade and through ambient cooling radiated from their leaves. Green spaces, tot sprays, pools, and waterfronts provide outdoor places to find relief on hot days. Of the 225 survey respondents who shared the cooling interventions they would like to see in their neighborhood, 59% said more tree plantings, 51% wanted to see more gardens, and 54% said more green spaces.

Boston's green network exists across land in private and public ownership. The City, the state, nonprofits organizations, developers, and other property owners all play a critical role in preserving existing trees, expanding the urban forest, and improving comfort in outdoor spaces.

BPRD is leading the way in implementing cooling features and shade through park renovations, including through the ongoing Urban Forest Plan process to set a vision for expanding and preserving the City's tree canopy. Additionally, BPRD's Parcel Priority Plan will identify opportunities to grow the network of permanently protected open space in Boston. These forthcoming paths will provide additional strategies to employ cooling strategies in parks and open spaces in Boston and increase and maintain the City's tree canopy. BPRD maintains more than 2,000 acres of Boston's diverse park system with another 2,500 acres managed by the State Department of Conservation and Recreation. BPRD properties include playgrounds and athletic fields, two golf courses, squares, fountains, game courts, urban wilds, and a number of historic and active cemeteries. BPRD is responsible for the care of trees within those parks and over 38,000 street trees. In addition, BPRD, Boston Conservation Commission, and other departments also manage Boston's 29 urban wilds. Goals for these important natural areas include long-term stewardship and permanent protection. These provide passive recreation, environmental education, and preservation of ecological value. Heat resilience is among many needs BPRD balances

in planning for the future of the system. Current projects to improve heat resilience have included adding tot sprays, misters, and interactive water elements at existing parks in areas not served by water elements today.

As part of the *Heat Plan* and BPRD's community engagement, stakeholders have raised priorities of expanding cool outdoor spaces, developing maintenance partnerships, preserving existing tree canopy, supporting the preservation and expansion of the tree canopy during the development review process, increasing safety and safe access to parks, and supporting parks expansion and equity strategies in the context of displacement and the need for additional affordable housing in Boston.

Expanding parks, trees, vegetation, and open space will be a team effort

Improving the natural cooling capacity of our cities will require partnerships across public and private sectors. Expanding the park system is only one piece of the puzzle. Planning for more vegetation around the city in an intentional manner can deliver multiple benefits, including cooling, air quality, stormwater, and more. There are many ways to increase vegetation that each present different opportunities and constraints in terms of investment and policy, as well as long-term public access, ownership, and the on-the-ground experience.





6. PARKS, TREES, AND OUTDOOR SPACES

HOW WILL BOSTON GROW THE URBAN FOREST?

Urban Forest Plan (UFP)

Trees are critical to cooling the City. The UFP will outline Boston's vision for a 20-year vision for canopy protection and expansion across all property types, understanding that canopy care and management is an all-hands-on-deck effort. The UFP outlines goals and priorities for the urban forest, solutions to overcome challenges to maintenance and expansion, and strategies to expand awareness and engagement.

HOW WILL BOSTON MAINTAIN AND EXPAND ITS PARKS SYSTEM?

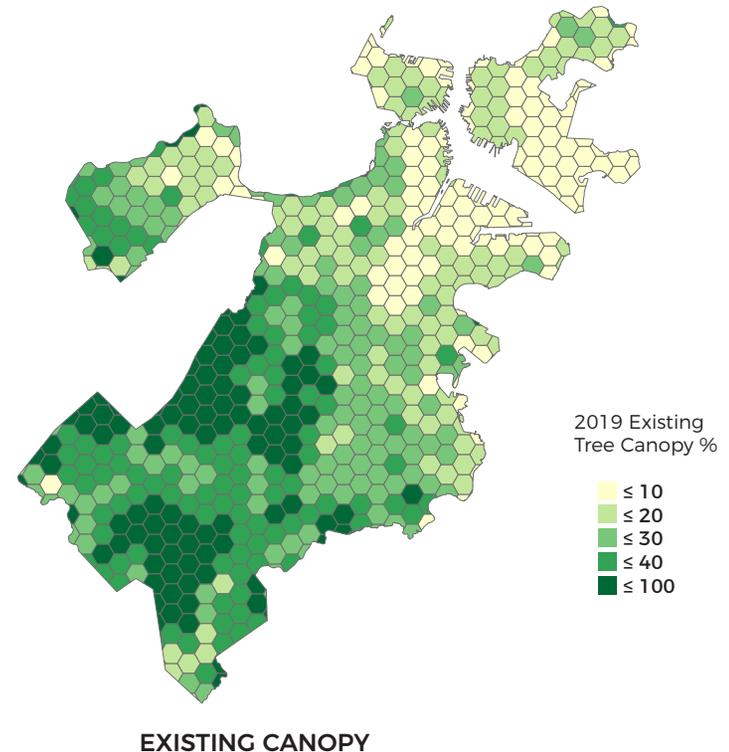
The *Heat Plan* is part of a broader set of initiatives—Healthy Places—to expand cooling, open space access, and a sustainable urban forest. Together these plans will build a safe, healthy, resilient, and accessible city for everyone. Strategies in these complementary efforts will provide further guidance on how urban forests, parks, and open space can support cooling.

Open Space and Recreation Plan (OSRP)

The OSRP outlines the needs of stewarding and improving the park system based on public input, analysis of existing resources, and demographics factors. The OSRP is a state-mandated plan that provides the most comprehensive overview of the state of the park system. The plan looks at park needs broadly, including maintenance, shade trees, climate resilience, development pressure, recreation, park access, design, and more. The plan also informs critical priorities and action items for Boston's park system.

Parcel Priority Plan (PPP)

The PPP focuses on one aspect of the OSRP's comprehensive park system vision: expanding access to the park system through acquisition and protection. Developing a park system expansion program will both meet residents' needs and align with City goals, including climate resilience and environmental justice.



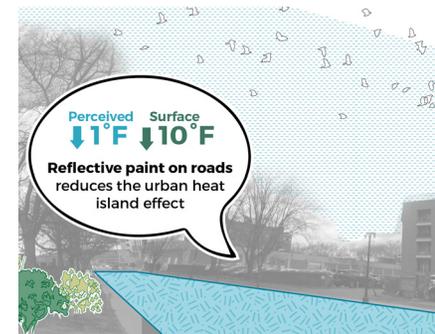
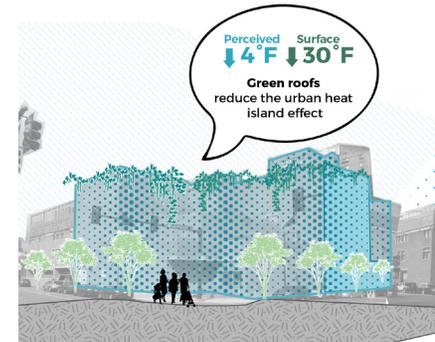
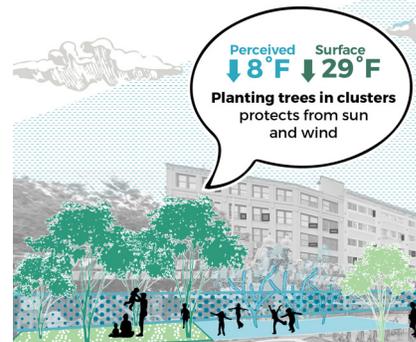
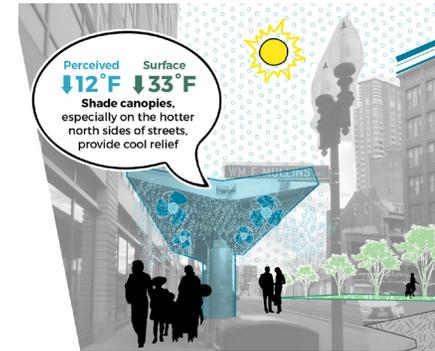
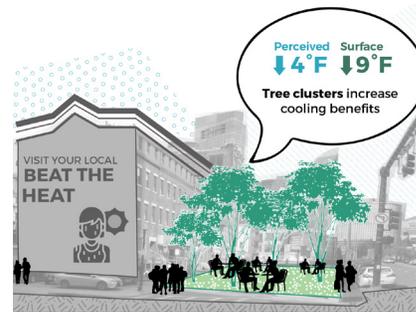
Graphic from the Urban Forest Plan team



RESULTS FROM THE NEIGHBORHOOD CLIMATE SIMULATION MODEL: TREES AND OUTDOOR SPACES

The *Heat Plan* presents quantitative findings of the cooling effect of trees and green spaces. Existing efforts to add canopy trees and shade structures provide cooling. The neighborhood urban climate modeling shows that planting trees in clusters can increase the cooling benefits. The impact of a medium tree canopy cluster in a sun- and wind-exposed grass open space demonstrated a larger decrease in surface temperatures (30°F) and perceived temperature (8°F) compared to trees that were more spaced apart (8°F and 3°F reduction in surface and perceived temperatures, respectively). In addition, full shade structures can reduce the effect of heat more significantly than a fabric shade canopy that still lets some light through. The decrease in perceived temperature (12°F) under a full shade canopy in an exposed area is more than two times higher than if it were a 50% shade canopy (only 5°F reduction).

Existing efforts to replace dark impervious paved surfaces with lighter color, pervious, and vegetated surfaces reduce surface and perceived temperatures. The neighborhood urban climate modeling shows that vegetated surfaces reduce surface and perceived temperatures more than highly reflective surfaces. The impact of a highly reflective surface is mainly in surface temperature (10°F reduction, compared to only a 1°F drop in perceived temperature), while vegetated surfaces see a larger decrease in both surface temperature (reduction of 29°F) and perceived temperature (reduction of 4°F).





6. PARKS, TREES, AND OUTDOOR SPACES

6.1 ENHANCED COOLING IN POCKET GREEN SPACES AND STREET-TO-GREEN CONVERSIONS

Integrate opportunities to add new green space into street improvement projects.

RATIONALE AND DESCRIPTION

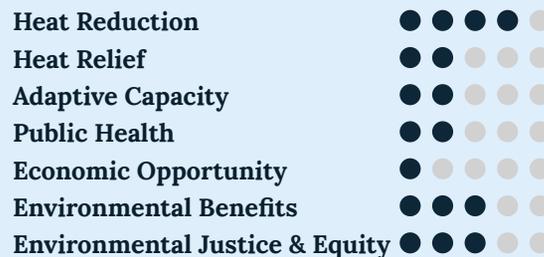
Green space, especially with trees, is one of the most effective ways to increase neighborhood thermal comfort. Yet, available space for tree plantings and new parks can be limited, especially in the densest neighborhoods. This strategy focuses on identifying additional green spaces to address heat vulnerability in the densest neighborhoods with the highest heat vulnerability that are underserved for existing park access and tree canopy.

Some immediate projects will be advanced by aligning with existing corridor studies and capital projects that are already identified and funded. Other publicly-accessible shaded or green open spaces are often created or preserved during development review processes (see Strategy 8.3, zoning revisions to support cooler neighborhoods).

The City will assess opportunities to add pocket parks and other critical green infrastructure along and adjacent to streets, where appropriate. Streets today experience a range of competing pressures—cars, parking, bike infrastructure, stormwater

infrastructure, rideshare drop-off, deliveries, emergency access needs, and service vehicles. It's critical to maintain the safety of streets for all users, the ability of emergency services to respond effectively, and the services and amenities valued by residents and businesses. The City will analyze opportunities for repurposing existing pavement, where appropriate. For example, street conversions or parking space consolidation and replacement, and the reuse of vacant lots or other underutilized spaces into new cool parks, pocket parks, or other green infrastructure especially in dense, high-heat areas. The City will consider opportunities to include plantings, misting, mini tot sprays, and shaded seating in appropriate areas, balancing other needs and uses to provide cooling and other public health and safety benefits (e.g., safer streets or slower neighborhood streets). These green spaces can also serve as new social spaces that strengthen community connections.

HEAT RESILIENCE BENEFITS



HOW DO COMPLETE STREETS AND POCKET PARKS WITHIN THE PUBLIC RIGHT-OF-WAY RELATE TO PARK SYSTEM EXPANSION?

“Lands which are primarily used for transportation are not typically classified as open space (i.e., roads and right-of-ways), but these spaces can offer public value for active and passive uses in addition to their transportation services... Transform[ing] this traditional infrastructure into green infrastructure offer[s] multiple benefits for city residents including plantings, gathering areas, bikeways, and walkways in addition to traditional transportation and utility needs. The roadway system has the potential to provide green connections to and between parks which enhances the value of all open spaces. In some ways, these links between green space and roadway space increase the value of each as shade; pedestrian access and animated activity nodes are spread throughout the city.”⁷⁷

-2015-2022 Open Space and Recreation Plan



6. PARKS, TREES, AND OUTDOOR SPACES

6.2 INCREASED SHADE ON MUNICIPAL SITES

NEXT STEPS

The City will continue to coordinate across relevant departments to integrate green infrastructure into planned capital improvement projects along streets and other publicly-owned assets.

Lead by example by ensuring municipal sites are supporting and contributing to cooler neighborhoods.

RATIONALE AND DESCRIPTION

This strategy looks for opportunities for the City to lead by example by increasing shade on City-owned sites. Increasing shade on municipal sites will improve indoor and outdoor thermal comfort, reduce energy use in buildings through shade and passive cooling, and support off-site cooling effects for the surrounding neighborhood.

This strategy proposes a suite of elements that can be implemented on municipal properties to reduce heat exposure, including tree planting, shade structures, and solar canopies. The heat resilience best practice guidelines (Strategy 8.2) process will also help to identify elements on municipal properties to incorporate heat resilience strategies. Based on the results of the neighborhood climate model, full-shade structures (including solar canopy) should be used, as the decrease in perceived temperature is two times higher than a shade canopy (like a fabric shade) that would allow about 50% of light to pass through. To measure progress towards heat reduction goals and

the effectiveness of planting strategies, the City will explore the strategic installation of heat sensors at appropriate sites. These sensors would be integrated into the heat sensor network (Strategy 1.3). Large parking lots and garages with uncovered rooftop parking, and other properties with low vegetation are example locations to prioritize.

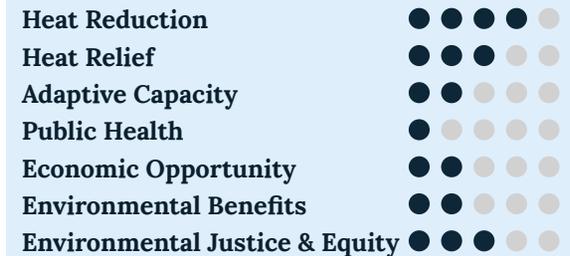
NEXT STEPS

The City will analyze the portfolio of municipal sites to identify sites that have high exposure and low vegetation, and prioritize municipal sites that are regularly visited by constituents to maximize public benefits.

ONGOING PLANS THAT OFFER OPPORTUNITIES TO FURTHER ADVANCE HEAT RESILIENCE:

- » Coastal Resilience Plans
- » Neighborhood Plans
- » Open Space and Recreation Plan 2022-2028
- » Urban Forest Plan
- » Parcel Priority Plan
- » Corridor Studies
- » Complete Streets Projects

HEAT RESILIENCE BENEFITS





6. PARKS, TREES, AND OUTDOOR SPACES

6.3 EXPANDED DRINKING FOUNTAIN NETWORK

Increase public access to water with additional drinking fountains and water bottle fillers in areas with high heat exposure.

RATIONALE AND DESCRIPTION

Staying hydrated is an important action during heat waves, yet some communities may have less access to outdoor drinking fountains to stay cool while outside. This strategy focuses on adding more drinking fountains and water bottle fillers in parks and open spaces, especially in parks with active recreation features where heat exposure is high. The City will also evaluate locations to identify priority locations for additional features such as pet-friendly fountains.

Drinking fountain installation requires identifying existing potable water supply lines, and installing new potable water lines, meters, back-flow preventers, and frost-protection.

NEXT STEPS

Data on existing drinking fountain locations is limited, so an initial step is to develop a dataset of locations across parks and open spaces in Boston. To identify gaps and inform implementation, the City will complete an analysis of heat risk alongside the existing infrastructure analysis.

HEAT RESILIENCE BENEFITS





6. PARKS, TREES, AND OUTDOOR SPACES

6.4 PLANNING FOR FUTURE PARKS

Enhance and enlarge Boston’s network of resilient community parks.

RATIONALE AND DESCRIPTION

Parks play critical roles in resident health and wellbeing, social connections, ecological health, and resilience, including cooler communities. The City’s goal is to enhance and enlarge Boston’s network of resilient community parks. It looks to do this first by identifying where the park system might expand, and then evaluating policies, funding, and processes that can realize that vision. BPRD aims to take the capital-funded Parcel Priority Plan and transform it into a long-term program called Planning for Future Parks. The goal is to invest in a dedicated park system expansion program with an emphasis on permanent protection and public access. This effort is envisioned to go beyond the pocket parks described in Strategy 6.1 and aspires to expand park access even in densely populated areas.

As neighborhoods develop and grow in density, the City will continue to provide access to high quality parks throughout Boston alongside that growth. The City aims to lay out a vision that recognizes a diverse landscape in terms of culture, environmental justice, climate change, and development pressure.

Expanding the park system will rely on acquisition or protection by BPRD as well as other departments, state agencies, nonprofits, private landowners, and more.

A strong public park system relies on the following:

- » Renovating our existing park system to better serve existing and new needs
- » Acquiring or protecting new parklands and natural areas to fill in gaps where there are no such spaces, or to enhance existing spaces where there is growing population pressure
- » Increasing funding for high quality park maintenance to match growing maintenance responsibilities

BPRD has established the Open Space Acquisition Program to proactively acquire land. With initial funding from the Community Preservation Act, BPRD can begin to negotiate the purchase of land for future open spaces in a timely manner. Sites may be donated to BPRD, purchased from a property owner, or transferred to BPRD from another City department.

NEXT STEPS

The City has launched a long-term visioning plan to prioritize parcels of land to acquire and protect for public use. The next step to launching this strategy includes completing the visioning process and integrating this planning into the 2022-2028 Open Space and Recreation Plan.

HEAT RESILIENCE BENEFITS

| | |
|--------------------------------|-----------|
| Heat Reduction | ● ● ● ● ● |
| Heat Relief | ● ● ● ● ● |
| Adaptive Capacity | ● ● ● ● ● |
| Public Health | ● ● ● ● ● |
| Economic Opportunity | ● ● ● ● ● |
| Environmental Benefits | ● ● ● ● ● |
| Environmental Justice & Equity | ● ● ● ● ● |



7 TRANSPORTATION AND INFRASTRUCTURE

TRANSPORTATION, CORRIDOR, AND STREETS PROJECTS AND PLANS IN THE FIVE FOCUS NEIGHBORHOODS

Projects under the umbrella of the City's Streets Cabinet, consisting of the Boston Transportation Department (BTD) and PWD, are able to address heat resilience through street trees, reduced blacktop roadway surface, shaded bus shelters, benches, and, where maintenance is possible, planted areas along sidewalks and medians. Citywide initiatives that are focused on maintaining a state of good repair, such as roadway resurfacing and sidewalk repairs (the Walkable Streets program). District yards and municipal lots are annual programs that also provide opportunities for heat resilience measures.

The following is a list of select projects led by the Streets Cabinet in the five focus areas of the *Heat Plan*, which can offer opportunities to employ cooling strategies in these neighborhoods.

Major corridor projects include the following:

- » Blue Hill Avenue including Mattapan Square up to Grove Hall
- » Cummins Highway
- » Melnea Cass Boulevard
- » Warren Street and Malcolm X Boulevard, connecting Nubian Square to Grove Hall and Roxbury Crossing respectively
- » Columbus Avenue from Jackson Square to Ruggles
- » Bennington Street and Day Square
- » Massachusetts Avenue (Melnea Cass to Columbia Road) and Theodore Glynn Way
- » Columbia Road

Design and construction work is also ongoing at specific locations, including the following:

- » Egleston Square and Amory Street
- » Eagle Square
- » Neighborhood Slow Streets zones (various)
- » Roxbury Safe Routes to Schools Safety Project

Transportation Action Plans currently undertaken by BTD and the Mayor's Office of Planning/BPDA that will result in design and construction projects in the coming years include the following:

- » Bowdoin Geneva Action Plan
- » PLAN: Mattapan
- » PLAN: Nubian Square
- » PLAN: Glovers Corner



28 RIDE FOR FREE

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7. TRANSPORTATION AND INFRASTRUCTURE

7.1 COOL COMMUTES

Create cooler commutes through shaded bus stops, cool pathways, and other mobility improvements.

RATIONALE AND DESCRIPTION

In Boston, almost half of all workers take public transit (31.4%), walk (14.6%), or bike (2.2%) to work.⁸ Shaded places to wait at bus stops are critical to reduce direct exposure for residents and visitors who use public transportation. Results from an online survey show that community members (61% of respondents) would like to see more shaded bus stops in their neighborhoods. This strategy aims to implement cooling strategies benefitting public transit riders, including a focus on cooler bus stops along high-use routes in areas with elevated heat exposure and limited street tree cover.

To increase shade and cooling at bus stops and create cooler commutes, the City will seek to collaborate regionally to consider elements like the following:

- » Bus shelters that promote safety and accessibility
- » Increased tree planting around bus stops where possible to increase shade in the long-term
- » Misters or cooling fans during heat waves, similar to the City of Phoenix’s light rail surface level stops which have misting stations

- » Targeted outreach and awareness around existing cooling resources through analysis of bus passenger data for least and most used bus stops on days during heat waves
- » Operational and service improvements to reduce heat exposure for riders and improve level of service

Moving to and from bus and other transit stops is also part of the cool commute experience and provides an opportunity to integrate cooling into accessible walking paths and bike lanes. These cool routes could make walking to transit stops more comfortable for regular bus riders or for residents looking to find cool spaces outside of their homes. Well-coordinated implementation with the state and related City departments is critical to integrating cool commutes with planned transportation improvements for redesign and reconstruction projects and ongoing improvement programs.

HEAT RESILIENCE BENEFITS

| | |
|---|-----------|
| Heat Reduction | ● ● ● ● ● |
| Heat Relief | ● ● ● ● ● |
| Adaptive Capacity | ● ● ● ● ● |
| Public Health | ● ● ● ● ● |
| Economic Opportunity | ● ● ● ● ● |
| Environmental Benefits | ● ● ● ● ● |
| Environmental Justice & Equity | ● ● ● ● ● |

NEXT STEPS

2022 marks the 20th anniversary of the SL4 and SL5 routes of the Silver Line. In celebration, BTD will facilitate a community-wide design challenge for a bus stop this fall. The design that best meets the site-specific criteria and integrates heat resilient design elements like shade, temperature and air quality sensing, and strategic reflective coatings, will inform the implementation of a new bus shelter.

ONGOING PLANS THAT OFFER OPPORTUNITIES TO ADVANCE HEAT RESILIENCE:

- » Neighborhood plans
- » Corridor studies
- » Complete Street projects



7. TRANSPORTATION AND INFRASTRUCTURE

7.2 ENERGY RESILIENCE UPGRADES AND MICROGRIDS

Implement energy grid upgrades, district energy microgrids, and other strategies to reduce risk of power outages during heat waves.

RATIONALE AND DESCRIPTION

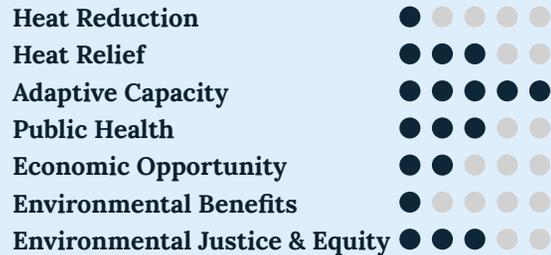
Boston will see an increasing number of extreme heat days with more households and buildings using air conditioning to stay cool. Extreme heat strains the power grid, increasing the chance of power outages (see Infrastructure Vulnerabilities in Chapter 3). Building on Climate Ready Boston’s Strategy 7.1 to conduct feasibility studies for community energy solutions, the City will identify critical building loads and needs and develop a microgrid strategy that works to support those loads during periods of outages. Extreme heat factors including areas of high heat exposure in combination with social vulnerability metrics will be integrated into identification and prioritization of microgrid locations. The process used for the Chinatown Community Microgrid Feasibility Assessment (2021) provides a good model for engaging communities early in the process and educating them about how microgrids can benefit the community.

This work will be tightly coordinated with implementation of the Boston Smart Utilities Policy.

NEXT STEPS

The Mayor’s Office of Planning/BPDA, in partnership with BPHC, OEM, and the MassCEC Clean Energy and Resiliency (CLEAR) Program⁹ conducted an assessment to analyze the cost and system design of resilient facilities in Mattapan. The assessment evaluated critical loads and feasibility for microgrid solutions to reduce the economic impacts of power outages and utilities service. Mayor’s Office of Planning/BPDA will release the assessment report in 2022.

HEAT RESILIENCE BENEFITS



EXISTING MICROGRID STUDIES AND RELATED PROGRAMS AND STANDARDS:

- » Chinatown Community Microgrid Feasibility Assessment
- » Boston Community Energy Study
- » Boston Smart Utilities Program
- » Microgrid Ready Building Design
- » Zero Net Carbon Standard and Energy Efficiency Goals

CHINATOWN COMMUNITY MICROGRID FEASIBILITY ASSESSMENT 2021

Through the MassCEC Community Microgrids Program, the Chinatown Community Microgrid Feasibility Assessment aimed to not only increase access to clean energy technology, but also foster social cohesion. Community members were involved from the beginning of the project, empowering them to influence the design, contracting, and operation of the microgrid resources.¹⁰



7. TRANSPORTATION AND INFRASTRUCTURE

7.3 COOL MAIN STREETS

In streets and public spaces, reduce localized extreme heat and increase access to cooling resources while supporting local businesses.

RATIONALE AND DESCRIPTION

The strategy of cool Main Streets aims to advance heat resilience and support local businesses. This strategy includes integrating resilient design with programmatic and educational elements. The Office of Small Business Development and the Boston Main Streets Foundation are critical in successfully implementing this strategy. The Office of Small Business Development works with business owners and entrepreneurs to provide tools and guidance needed to support thriving business in Boston.

The cool Main Streets strategy encourages physical improvements, such as using cool pavements and light-colored pavement treatments, identifying cool roof locations, and shading pedestrian pathways and parking areas. Programmatic and education elements include resource distribution and pop-up cooling serves to increase awareness of and access to cooling resources.

The cool Main Streets strategy integrates multiple heat strategies to help deliver climate-ready streets.

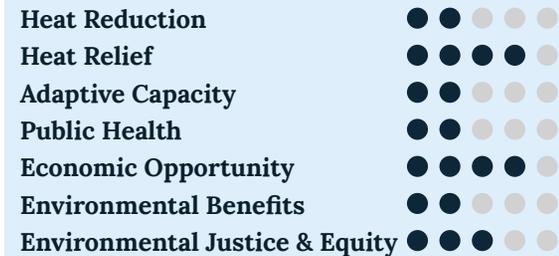
Cool Main Streets builds on cool commutes (Strategy 7.1), which includes nearer-term strategies like shaded and misting bus stops, as well as longer-term strategies focused on planned transportation improvements like square and street redesign and street reconstruction projects. Through the cool Main Streets strategies, the City will explore collaboration with small businesses and local community groups to provide resources to activate public gathering spaces. These spaces can serve as cooling resource distribution points and mobile cooling pop-ups as part of the pre-heat-wave resources mobilization (Strategy 1.2) and pop-up heat relief (Strategy 2.1). This is also an opportunity for expanded community climate leadership (Strategy 3.1) to build local ties and promote heat resilience, possibly training heat ambassadors to look out for people with signs of heat stress and direct them to a nearby cooling resource.

To support local small businesses implementing cooling strategies, the City will consider creating a grant program for awnings, umbrellas, and other shade devices, prioritizing businesses located in higher-heat areas that are income-eligible, women- and minority-owned, and participants in expanded community climate leadership (Strategy 3.1).

Additionally, the City will continue to incorporate cooling strategies into the Complete Streets initiative

through the Neighborhood Slow Streets initiative. The Neighborhood Slow Streets initiative aims to improve street safety through small scale improvements,¹¹ such as road diets and narrow lane widths that expand sidewalk dimensions to accommodate street trees and plantings. When dimensions are too narrow for street trees, the City will consider guidelines for shade structures with seating and green infrastructure opportunities.

HEAT RESILIENCE BENEFITS



NEXT STEPS

The City will explore near-term opportunities to integrate resilient design into ongoing and future studies and capital projects, and develop a process to identify areas to pilot cooling strategies for streets.

ONGOING PLANS THAT OFFER OPPORTUNITIES TO FURTHER ADVANCE HEAT RESILIENCE

- » Neighborhood plans
- » Corridor studies
- » Complete Streets projects
- » Open Space and Recreation Plan
- » Urban Forest Plan

TOTAL COSTS OVER 45 YEARS (UNDISCOUNTED 2021\$)

| Category | Cost |
|--------------------|---------------|
| Capital Costs | \$834,954 |
| Replacement Costs | \$46,628 |
| Total Costs | \$2.9M |

Costs include capital costs that consist of preliminary design, engineering, and construction for the first five years, and replacement costs of cooling strategies over 45 years. A cool Main Street in this analysis was generalized to a 100-foot east-west street. The minimum width between the buildings includes two 12-foot lanes, two 10-foot parking lanes, two 5-foot bicycles lanes, and two 6-foot sidewalks.

COOL MAIN STREETS

COSTS

BENEFITS

- | | |
|---|---|
| <ul style="list-style-type: none"> » Trees, spaced 20 feet apart, alternating on each side of corridor, shading street and sidewalk » Shade canopy-storefront awnings, both sides of corridor, 60 feet of length (not necessarily continuous) » Cool bus stop: pavement marking, one side of corridor, 80 feet by 10 feet » Cool drive lanes, two center lanes » Cool bus stop: 6-foot by 8-foot bus shelter with pavement » Cool on-street parking pavement, 10-foot wide roadway shoulders, both sides » Shade awning over street (fabric), one 50 feet by 20 feet, at a crosswalk » Green roofs, one building rooftop area » Cool roofs, on all non-green roofs, SRI value greater than 72 » Roof canopy (permanent), one location | <ul style="list-style-type: none"> » Decreased perceived temperature, » Better quality of life (including mental and physical wellbeing) » Economic and workforce development » Education and saving of resources for communities » Improved energy efficiency for buildings along corridor » Reduction in heat-related health issues |
|---|---|

8 PLANNING, ZONING, AND PERMITTING

It is necessary to understand the impact that developments have on ambient temperature and surface temperature in order to ensure that new development and redevelopment contributes to the reduction of localized extreme temperatures. Development review is an opportunity to encourage heat resilience measures that provide relief during heat waves and long-term benefits of heat reduction. By integrating provisions for heat resilience, new developments can mitigate heat impacts, improve thermal comfort, and increase enjoyment of public spaces in Boston. The Mayor’s Office of Planning/ Boston Planning and Development Agency (BPDA) and Inspectional Services Department are critical to successful implementation of these strategies.



8. PLANNING, ZONING, AND PERMITTING

8.1 UPDATED CLIMATE RESILIENCY CHECKLIST

Ensure new development assesses heat resilience impacts and benefits.

RATIONALE AND DESCRIPTION

Article 37 provides standards and guidance to support green buildings and climate-resilient construction (see Strategy 8.1 call out). To further integrate heat resilience into Article 37, the City will incorporate updated temperature projections into the Climate Resiliency Checklist. The updated Climate Resiliency Checklist will ask proponents to assess heat resilience in development proposals and identify opportunities to increase heat resilience onsite, increase the thermal comfort of pedestrians and other adjacent users, and improve access to cooling spaces and resources within and adjacent to the proposed development.

NEXT STEPS

The City will update the Climate Resiliency Checklist to include provisions for heat resilience.

ARTICLE 37 AND CLIMATE RESILIENCY GUIDELINES:

“Boston Zoning Code Article 37, Green Buildings (Article 37) and the Climate Resiliency – Review Policy Update (Resiliency Policy) ensure that major building projects are planned, designed, constructed, and managed to minimize adverse environmental impacts; conserve natural resources; are resilient to climate change; promote a more sustainable city; and enhance the quality of life in Boston. All proposed projects subject to or electing to comply with Zoning Article 80B, Large Project Review are subject to the requirements of Zoning Article 37 and the Resiliency Policy.”

–Article 37 Green Building and Climate Resiliency Guidelines

HEAT RESILIENCY BENEFITS

| | |
|--------------------------------|-----------------|
| Heat Reduction | ● ● ● ● ● ● ● ● |
| Heat Relief | ● ● ● ● ● ● ● ● |
| Adaptive Capacity | ● ● ● ● ● ● ● ● |
| Public Health | ● ● ● ● ● ● ● ● |
| Economic Opportunity | ● ● ● ● ● ● ● ● |
| Environmental Benefits | ● ● ● ● ● ● ● ● |
| Environmental Justice & Equity | ● ● ● ● ● ● ● ● |



8. PLANNING, ZONING, AND PERMITTING

8.2 HEAT RESILIENCE BEST PRACTICE GUIDELINES

Create guidelines to incorporate heat resilience strategies into future buildings, building retrofits, and their sites.

RATIONALE AND DESCRIPTION

Property owners planning new construction or renovation may be interested in reducing energy use and creating cooler indoor and outdoor spaces, but may not be aware of what design strategies and best practices may be most effective to improve heat resilience. This strategy proposes the development of best practice guidelines to incorporate heat resilience strategies into the design of new and existing development. Anticipated audiences include property owners, developers, and design teams. Heat resilience best practice guidelines would complement the existing Coastal Flood Resilience Design Guidelines. The Mayor’s Office of Planning/BPDA will lead this strategy in collaboration with the Environment Department.

The heat resilience design strategies identified would reference relevant national standards and best practices, as well as applicable flood mitigation co-benefits. By implementing these strategies, new

construction and renovation projects would save energy in summer, improve indoor and outdoor thermal comfort for site occupants, and where possible, provide a net negative effect on offsite temperatures.

The best practices should include guidance on topics like the following:

- » Passive design strategies
- » Building massing and orientation
- » Types, effectiveness, and cost of pavement and building materials (roofing, facades, insulation, windows, window treatments, awnings, etc.)
- » Site landscaping, including tree and vegetation location considerations for the highest reduction in climate comfort
- » Retrofitting existing buildings to improve indoor comfort for building occupants
- » Ways to track heat indicators and metrics (see Strategy 1.3, heat sensor networks)
- » Strategies for public buildings
- » Preferred strategies for building typologies serving vulnerable residents such as schools, medical centers, and senior facilities

HEAT RESILIENCE BENEFITS

| | |
|---|-----------|
| Heat Reduction | ● ● ● ● ● |
| Heat Relief | ● ● ● ● ● |
| Adaptive Capacity | ● ● ● ● ● |
| Public Health | ● ● ● ● ● |
| Economic Opportunity | ● ● ● ● ● |
| Environmental Benefits | ● ● ● ● ● |
| Environmental Justice & Equity | ● ● ● ● ● |

NEXT STEPS

The City will launch a process to develop heat resilience design guidelines, including focus groups of technical experts, developers, and industry stakeholders.



8. PLANNING, ZONING, AND PERMITTING

8.3 ZONING REVISIONS TO SUPPORT COOLER NEIGHBORHOODS

Ensure new development supports neighborhood heat resilience.

RATIONALE AND DESCRIPTION

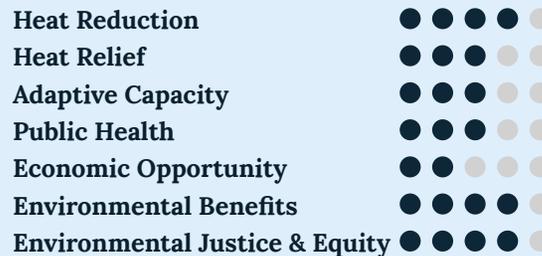
Boston’s path to become a Green New Deal city includes efforts to utilize zoning and land use to further the goals of equity, resilience, zero waste, and carbon neutrality. Through this strategy, the City seeks to encourage improvements over time to reduce heat impacts throughout Boston. This strategy presents a suite of approaches that the City will assess for further consideration, including an overlay district approach and citywide zoning code refinements.

Expanding Heat Resilience Through Article 80 (Development Review)

Article 80 provides guidelines for the development review process (see Strategy 8.3 call out). To further heat resilience through the Article 80 process, the City will consider how a temperature analysis, similar to analyses required for wind and shadow, should be integrated into the review process. Coordination with the Smart Utilities Policy to support these goals is key as the policy oversees review of utility infrastructure.

The City will explore quantifiable metrics for heat exposure to determine benchmarks for heat reduction. Standards such as ASHRAE heat resilience standards can serve as a reference for exploring potential standards for indoor cooling. The neighborhood-scale modeling and other similar efforts can also serve as a resource for expected effects of design typologies on outdoor thermal comfort. Strategy 8.2, heat resilience best practices, will be a complimentary resource, providing recommendations on potential heat mitigation strategies. National standards and best practices can inform heat mitigation strategies.

HEAT RESILIENCE BENEFITS



ARTICLE 80

“Adopted in 1996 ... to provide clear guidelines for the development review process relating to large projects (adding/constructing more than 50,000 square feet), small projects (adding/constructing more than 20,000 square feet and/or 15+ net new residential units), planned development areas (new overlay zoning districts for project areas larger than 1 acre), and institutional master plans (projects relating to academic and medical campuses). The Article 80 process may include, but is not limited to, review of a project’s impacts on transportation, public realm, the environment, and historic resources. ... Public input is encouraged throughout a project’s review timeline.”¹²

-Mayor’s Office of Planning/BPDA Glossary

Overlay District Approach

An overlay district is a regulatory tool that applies standards in specific areas to guide land use and development. This approach targets additional standards where they are most needed to achieve a specific public purpose. In Boston, there are different types of overlay districts with provisions including but not limited to historic preservation, industrial use, and climate resilience. For climate resilience, the City adopted Article 25A Coastal Flood Resilience Overlay District (CFROD) into the Zoning Code in 2021.

Article 3, Section 3-1A(p) allows for the creation of resilience overlay districts.¹³ The City will assess the appropriateness of an overlay district approach for achieving the goals of heat resilience and, if appropriate and effective, explore the development of a comprehensive community process for a heat resilience overlay district to build on previous climate resilience zoning. A significant consideration in whether to develop an overlay district would be how and which areas of elevated heat risk should be defined. While CFROD uses the extent of future flood risk to define the boundaries of the overlay district, a different strategy may be needed to determine boundaries and thresholds for extreme heat, as all of Boston experiences extreme summer temperatures. Specific studies would be needed to define metrics for elevated extreme heat risk to define potential

overlay district boundaries, which may follow along commuting corridors, specific hotspots in Boston, or other areas of heat exposure for high risk residents, as determined through future study.

Other Zoning Code Refinements

Some zoning adjustments may be appropriate citywide as all parts of Boston are within an urban heat island and experience excessive heat temperatures during heat waves, compared to non-urbanized areas. Other zoning adjustments may be more appropriate within an overlay district, where excessive heat temperatures are even more extreme and frequent. Under this strategy, the City will undertake a review of existing zoning for any potential barriers and opportunities for heat resilience. This review will also consider potential changes to allow and encourage actions that would improve thermal comfort and reduce the urban heat island effect. Examples of zoning adjustments could include the following:

- » Allowing dimensional standard flexibility for shade elements, especially on rooftops, similar to an effort already underway for height exemptions for rooftop solar
- » Considering adopting more stringent shade, reflectivity, and open space requirements, either citywide or in areas within the heat overlay district

The City will explore how performance standards and baseline temperatures for heat resilience might be defined for buildings and land use types. This would include defining thresholds to apply of performance standards for new construction and renovations.

Implementation of this strategy must consider the relationship with existing zoning and land use requirements, such as shadow requirements and Chapter 91, which includes provisions for public access to the waterfront. Over time, as the climate shifts, winters are likely to gradually get warmer, but cold snaps are still likely to occur. Integration of heat-related zoning must also consider year-round performance and consider specific design elements that provide both cold and hot weather benefits.

NEXT STEPS

An initial first step includes a regional summit or focus group conversations with various stakeholders to learn from existing related policies and discuss opportunities to integrate heat resilience provisions in the zoning code.

BOSTON HEAT COLLABORATION

The Mayor's Office of Planning/BPDA and Boston University (BU) are working together to explore the cooling effect of different surfaces on land surface temperature across Boston. Coordination with this effort to provide additional data and metrics for heat will be valuable to improving heat models that aim to identify and estimate the most effective cooling strategies.

CITY OF CAMBRIDGE COOL FACTOR

In February 2022, the City of Cambridge released the Climate Resilience Zoning Task Force report. The report presented the task force's recommendations to further integrate flooding and heat mitigation into the Cambridge Zoning Ordinance. Among these recommendations, the task force presented the creation of a performance-based Cool Factor and corresponding new standards to reduce urban heat island impacts. The Cool Factor calculates a weighted score based on site features including shade, cool surface, and planting elements to complement traditional zoning, which includes provisions for open space and permeability. This proposed approach would allow developers the flexibility to choose which strategies are appropriate for their site to meet the minimum Cool Score. If integrated into the Cambridge Zoning Ordinance, the Cool Factor may generally apply to alterations to buildings of 25,000 square feet or more and new development of any size.¹⁴

SHADE DESIGN STANDARDS

The city of Tucson, Arizona, zoning code includes design standards for shade along streetscapes. The code applies to public and private rights-of-way, new development, and redevelopment projects. The Rio Nuevo Area Zoning Design Standards includes the following shade requirement:

“Shade shall be provided for at least 50% of all sidewalks and pedestrian pathways as measured at 2:00 p.m. on June 21 when the sun is 82° above the horizon (based on 32°N latitude). Shade may be provided by arcades, canopies, or shade structures, provided they and their location and design characteristics are compatible with the prevailing and design context of the street and the architectural integrity of the building.”¹⁵

IMPLEMENTATION ROADMAP

APPROACH

The implementation of heat resilience strategies is organized into catalytic projects, near-term projects, and long-term solutions. The plan's strategies provide a framework for improved heat resilience across Boston. The timing of implementation considers the impact of each strategy, as represented by the evaluation criteria, the level of coordination needed, ownership and jurisdiction, regulatory review and other factors. Community priorities, articulated by the CAB and through feedback from broader community engagement as well as ongoing and future City initiatives, informed the proposed implementation timeline.

CATALYTIC PROJECTS

Catalytic projects seek to address areas of high vulnerability and immediate need, while informing future strategies and projects. They are identified and prioritized for implementation based on the need for mitigating heat vulnerability, concurrent initiatives and partnerships, and if it is a critical next step to advance related strategies.

ANNUAL PREPARATION FOR EXTREME HEAT

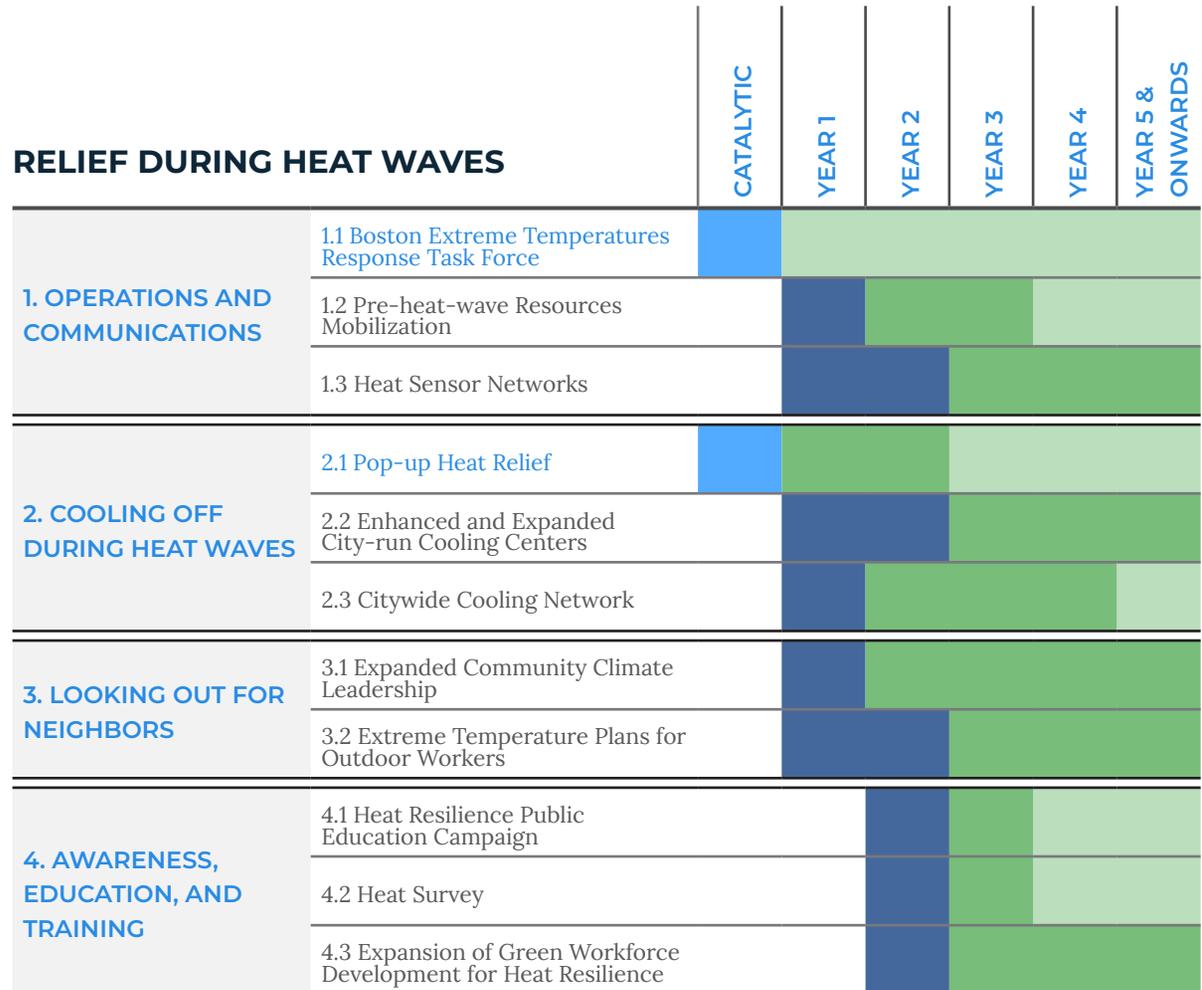
Building heat resilience in Boston means the City will need to get ready before the summer months and be prepared to launch strategies during the summer. To build annual preparation for summer heat into citywide planning, the timeline integrates timing for some strategies into a pre-heat preparation period and summer implementation.

TIMELINE

The timeline summarizes the implementation period of the heat resilience strategies described in the preceding section. Catalytic projects are shown in bright blue. Strategies and programs with a planning and preparation period followed by an implementation period are depicted in dark blue and green, respectively. Ongoing programs are depicted in light green, showing periods of ongoing monitoring and evaluation.

LEGEND

- Catalytic Project
- Design, Development, and Pilots
- Implementation
- Ongoing Program, Monitoring, and Evaluation



COOLER COMMUNITIES

| | | CATALYTIC | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 & ONWARDS |
|--------------------------------------|---|-----------|--------|--------|--------|--------|------------------|
| 5. BUILDINGS | 5.1 Home Cooling Resources Distribution | | | | | | |
| | 5.2 Cool Roofs Program | | | | | | |
| | 5.3 Home Energy Retrofits | | | | | | |
| | 5.4 Affordable Housing Resources and Retrofits | | | | | | |
| | 5.5 Cool Schools | | | | | | |
| 6. PARKS, TREES, AND OUTDOOR SPACES | 6.1 Enhanced Cooling in Pocket Green Spaces and Street-to-Green Conversions | | | | | | |
| | 6.2 Increased Shade on Municipal Sites | | | | | | |
| | 6.3 Expanded Drinking Fountain Network | | | | | | |
| | 6.4 Planning for Future Parks | | | | | | |
| 7. TRANSPORTATION AND INFRASTRUCTURE | 7.1 Cool Commutes | | | | | | |
| | 7.2 Energy Resilience Upgrades and Microgrids | | | | | | |
| | 7.3 Cool Main Streets | | | | | | |
| 8. PLANNING, ZONING, AND PERMITTING | 8.1 Updated Climate Resiliency Checklist | | | | | | |
| | 8.2 Heat Resilience Best Practice Guidelines | | | | | | |
| | 8.3 Zoning Revisions to Support Cooler Neighborhoods | | | | | | |