the green worcester sustainability and resilience strategic plan

2020

Appendix

The City *of* WORCESTER

GREEN WORCESTER

Community | Resilience | Sustainability

Green Worcester Sustainability and Resilience Strategic Plan

APPENDIX

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A. **Public Survey Results**

The consultant team included MassINC Polling Group (MPG), a leading non-partisan public opinion research company with offices in Boston and Northampton, Massachusetts. MPG has conducted numerous polls and focus groups on climate and transportation issues across Massachusetts, and is the pollster for WBUR, one of Boston's National Public Radio stations. The public opinion survey was administered by telephone (including mobile numbers) in English and Spanish to a representative group of 606 Worcester residents by MassInc Polling Group.

THE MassINC POLLING GROUP

Opinion Brief | July, 2019

Green Worcester: Resident Priorities, Beliefs, and Actions

City resident survey explores public opinion on the Green Worcester initiative

Residents are on board with the concepts behind Green Worcester

Residents of the City of Worcester are supportive of the aims of making Worcester a greener and more sustainable place. In all, 64% called Worcester becoming a green and sustainable place "very important," while another 25% called it "somewhat important" (Figure 1). That level of priority carries over to policy. Worcester residents support a variety of potential measures which would contribute to making the city a more sustainable place. Many of the activities that could be included in the Green Worcester initiative are prioritized by large majorities of residents.

Respondents were asked to about their priorities for measures to improve the city. Topping the list was cleaning up toxic chemicals at industrial sites - 77% called that a major priority. Tied for second at 73% were reducing air and water pollution along with reducing natural gas leaks. Reducing greenhouse gas production was somewhat lower, with 61% calling it a major priority. This echoes a theme that comes up often in climate change opinion polling, where issues around "pollution" generate more engagement than explicit ties to greenhouse gases or climate change.

At the bottom of the list was creating a home energy rating system, which 31% called a major priority. None of the demographic groups we examined reached a majority calling this issue a major priority. Still, nearly one third of the city call this a major priority, so if undertaken, such a system may draw interest. But there are many other ideas which more residents prioritize.

KEY FINDINGS

The survey finds residents feel favorably toward the idea of Worcester as a green and sustainable city, with 64% calling it very important that the city become a "green and sustainable place" and another 25% calling it "somewhat important".

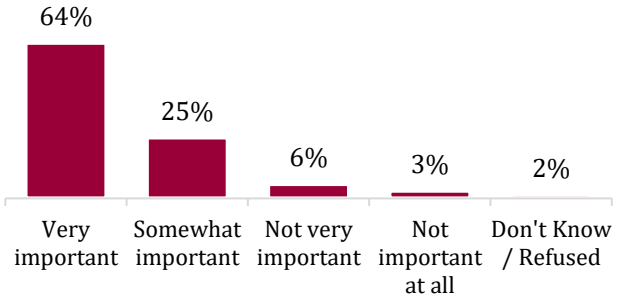
In terms of specific programs, residents would endorse many as "major priorities" for the city. This includes both current programs such as clean up, pollution reduction, and tree planting, as well as ideas for how to make Worcester a more sustainable place in the future.

Concern about climate change is widespread and includes anticipation of a variety of localized impacts in the greater Worcester region.

Residents are already engaging in many green activities on their own, though not motivated by climate change concerns. These activities vary widely by demographic groups in the city.

Residents are less aware of environmental programs the city is currently undertaking, and many seemed not to understand what it would mean for Worcester to be "green" or a "sustainable city". Both suggest a need for educating the public on the issue.

Figure 1: Residents view becoming a green and sustainable city as important



Q: How important is it to you that Worcester works on becoming a city that is "green" and sustainable?

Some of the items showed interesting and useful demographic variation in terms of interest levels. Bicycle and pedestrian infrastructure fell in the middle of the list overall, with 61% calling it a major priority. But among certain groups, it was closer to the top of the list. Lower-income residents (73%), residents in households without cars (71%) and households with children (69%) were particularly likely to rate this item highly. This variation highlights the fact that different activities and policies will be of great interest to certain segments of the city's population and that moving toward greater sustainability will mean different things to different people.

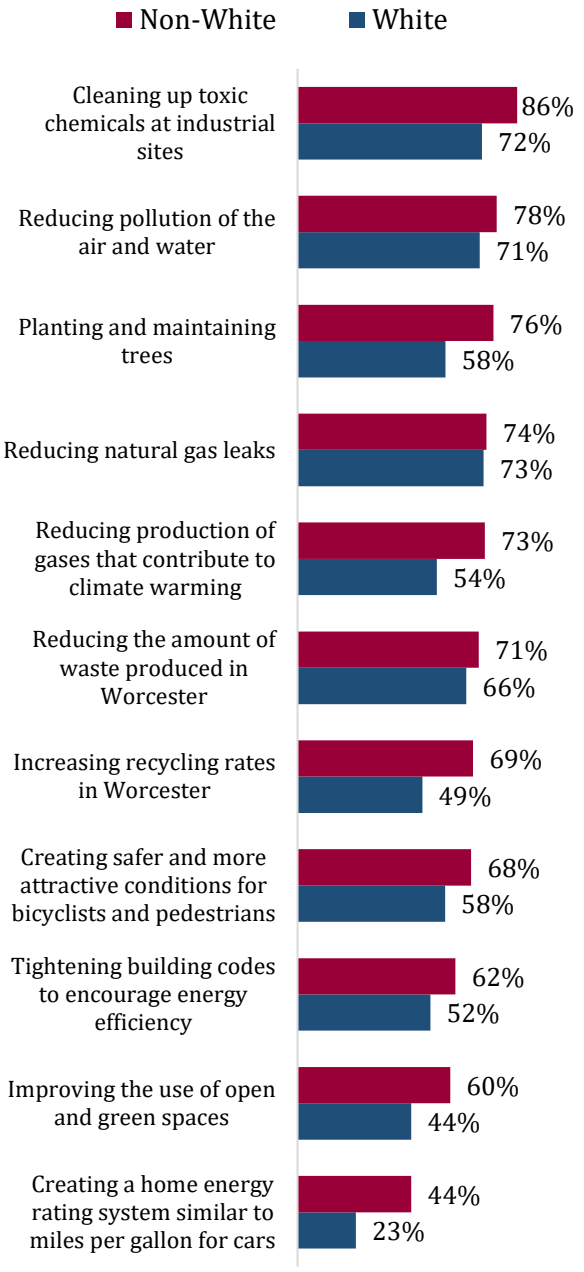
Priority of many Green Worcester issues varies by race and ethnicity

Consistent with much other polling on climate and environmental policy, Worcester's communities of color place a higher level of importance on making the city a green and sustainable place. Among non-white residents, 74% thought this was "very important," compared to 59% of white residents.

Black and Hispanic residents were also more likely to prioritize some (but not all) of the policies included in the poll (Figure 2). For example, 66% of Black residents and 61% of Hispanic residents call improving the use of green and open space a major priority, compared to 44% of white residents. Planting and maintaining trees shows a similar gap, with 58% of white residents calling it a major priority, less than Hispanic residents (80%) or Black residents (77%). Among non-white residents, 73% consider reducing greenhouse gases a major priority; a little more than half (54%) of white resident think similarly.

The finding that non-white residents are more concerned about climate change and more supportive of action is echoed in other polling from across Massachusetts and nationwide. MPG has been conducting polling on climate change since 2011, and has observed similar

Figure 2: Variation in priorities, by race / ethnicity of residents
% calling each a major priority, by race



dynamics throughout that period.[1] This phenomenon also bears out in national polling and polling in other states[2] specific to climate change. As a report on a survey focusing on Latino opinion from the Yale Program on Climate Change Communication put it, "Overall, we find a very consistent pattern: Latinos are much more engaged with the issue of global warming than are non-Latinos."[3] Lake Research Partners reported on a national poll in April 2018, writing, "The strongest awareness and concern comes from those who are the most affected— Latinos and African Americans. They report the highest levels of personal and health effects from climate impacts."[4]

Climate change concern tied to support for environmental policy

Residents are concerned about local impacts of climate change, with 74% of residents saying Worcester and Central Massachusetts will suffer impacts from climate change in the next 2 decades. Just 19% believe the region will not feel any impact. Those concerned about local impacts includes 61% or more of each of the demographic groups examined as a part of survey analysis, so concern is widespread. Looking at demographic variation, residents under 30 (82%) and Hispanic residents (80%) are the most likely to see climate change coming to Worcester.

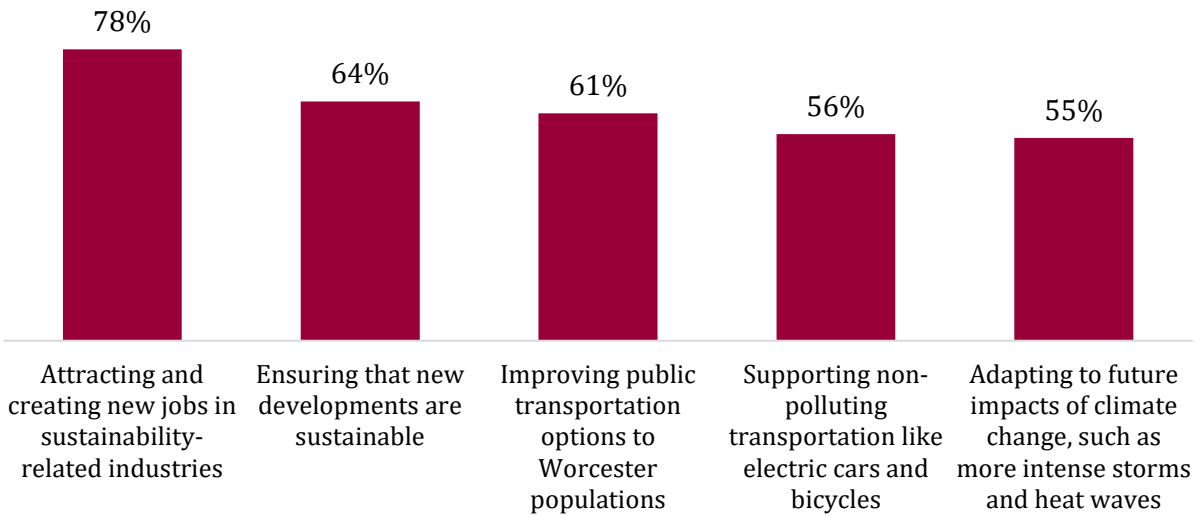
Among those who see local impacts as likely, the most common change residents anticipate is more severe storms throughout the year (78%) as well as extreme heat waves (78%). Also in the top tier of anticipated consequences is more ice and freezing rain storms (70%). In other words, those who see climate change as likely anticipate impacts during both hot and cold times of year.

Other surveys have found those concerned about climate change are often more supportive of environmental policy options. This is true in this survey as well. Those who anticipate the impacts of climate change coming to Worcester are more supportive of the ideas behind Green Worcester. For example, among those who anticipate local climate impacts, 63% prioritize non-polluting transportation options, compared to 31% of those who do not see local impacts. On all but one of the priorities questions (planting trees), those concerned about local impacts are at least nominally more supportive of environmental policies. Given the high percentage of residents who believe climate change is coming, this is encouraging for city leaders looking to advance the cause of Green Worcester.

This support comes with a caveat. In much of our survey work here at MPG, we find that residents are more likely to *support* policies put forth by leaders, but they are unlikely to *demand* them. Climate change and environmental issues more broadly tend not to be at the top of voter priority lists. Even as more and more people express alarm about climate change, other issues continue to be seen as higher priorities. Gallup, who has been polling on the nation's most important problem for decades, finds just 4% of

[1] "Looking for Leadership: Public Opinion in Massachusetts on the Response to Global Warming." Steve Koczela, Ben Forman, and Rich Parr. The Massachusetts Institute for a New Commonwealth, March 2015.
[2] "Californians' Views on Climate Change." Public Policy Institute of California, July 2018.
[3] "Climate Change in the Latino Mind." Anthony Leiserowitz, Matthew Cutler and Seth Rosenthal, Yale Program on Climate Change Communication.
[4] "American Climate Perspectives." Lake Research Partners, April 2018.

Figure 3: Residents' future priorities for sustainability in Worcester
% calling each major priority for making Worcester a more sustainable place in the future



Americans cite an environmental issue of any kind as their top concern.[5]

For civic leaders looking to act on climate change, this means that the onus to act is on them. Residents and voters are not to the point of demanding action. But leaders can act with confidence, knowing residents are open to leaders taking the initiative on green activities and will support a variety of policy options to promote sustainability and fight climate change.

Green jobs top residents' wish list for future sustainability

Residents support a variety of actions which would improve aspects of the city's condition now. But they also want the city to look to its future sustainability as well. Attracting and creating new green jobs was at the top of the list of major priorities for making Worcester a more sustainable place in the future, with 78% calling it a major priority. This concept polls well across demographic groups, with 70% or more of each of the demographic groups calling this a major priority. Green jobs and clean energy consistently poll highly in other surveys around the country as well as here in Massachusetts.

Growing green jobs is an example of a policy with multiple benefits. Some residents will focus on the environmental advantages, while others will prioritize the economic benefits such jobs could bring to Worcester. Indeed, there was little difference in response on this policy between residents who believed in climate change and those who did not. Other research has shown that concern over the environment is often not the only reason people engage in environmentally friendly actions or support environmentally friendly policies. Secondary benefits can be just as important a motivation.

Next on the list of future priorities are expanding access to healthy food and active lifestyles (65%). This was particularly important to residents with lower levels of income and education. Among the lowest income residents, 80% called this issue a "major priority". Priority declined steadily to 55% among the highest

[5] "Most Important Problem." Gallup, September 2018.

income group. Renters are more likely (74%) than homeowners (54%) to prioritize this as a policy goal, as are younger residents, and residents from households without cars.

The next three items on the list of future priorities are ensuring new developments are sustainable (64%), improving transit options (64%) for Worcester residents, and supporting non-polluting transportation options (56%). Last on the list is climate change adaptation, where 55% called it a major priority, although the difference between this and the next lowest item was not statistically significant.

Residents want benefits of sustainability spread around

Worcester residents are not just concerned about what the city does on sustainability, but how those policies are rolled out across the city. The highest priority was ensuring benefits are shared by all populations of the city, including low income and minority populations, with 70% calling this a major priority.

The importance of equity as an overall goal is reflected in other issues throughout the survey. On many items, there was considerable variation by socioeconomic and race factors. Examining these differences in priorities, knowledge and experience will help city leaders ensure Green Worcester recognizes and benefits the full diversity of the city's population.

Other tools in this endeavor may be education and public information campaigns. In all, 67% place major priority on integrating sustainability into school curriculum, while 56% call public information campaigns a major priority.

Residents have all different levels of knowledge about the kinds of things Worcester is already doing. Similarly, they are engaged in a widely varying set of sustainability activities themselves, so these kinds of communications activities could play an important role in encouraging residents to participate in the Green Worcester endeavor.

Residents are aware of some green actions the city is taking, others remain unfamiliar

Residents want to prioritize green policies, but many are unfamiliar with what city government is currently doing in this area (Figure 4). Tree replanting is the top sustainability initiative residents say they are aware of, with 60% saying they know either a great deal or a fair amount about the restoration. Given the visible and long lasting changes to Worcester's landscape caused by the Asian Longhorn Beetle infestation, it is understandable this item is the most widely known.

There are considerable differences in knowledge levels between demographics on this and other items in this question set. The biggest gaps exist along the lines of education level and homeownership. Homeownership is often an indicator of tenure in a given location, since renters tend to move more frequently. They are also typically more closely woven into the

community fabric, and more likely to have heard about the kinds of municipal endeavors covered in this survey. Residents with higher levels of education have heard more about sustainability initiatives relative to those with less education.

Residents are relatively informed about open space in the city. Just over half (55%) report having heard at least a fair amount about the extensive parks and open space in Worcester, and 43% say the same of the Broad Meadow Brook Wildlife Sanctuary. For each of these items, there are also double-digit gaps in

Figure 4: Residents know the most about the Longhorned Beetle infestation; knowledge of other initiatives varies considerably *% who say they have heard at least "a fair amount" about each item*	
Over 30,000 trees have been planted since Asian Longhorned Beetle infestation destroyed many trees in northern Worcester in 2009.	60%
Worcester has 60 parks, 20 lakes and ponds, and about 17% of its area is designated as open space.	55%
Mass Audubon's Broad Meadow Brook Wildlife Sanctuary in Worcester is the largest urban wildlife sanctuary in Massachusetts.	43%
The City replaced 14,000 of its streetlights with LED lights to save energy.	39%
Worcester DPW has been developing an Integrated Plan for long term maintenance of water and sewer infrastructure.	31%
Worcester has over five active watershed groups that work with city government to improve water quality in streams and ponds.	29%
The City has the largest municipally owned solar farm in New England on top of a capped landfill.	26%
In 2018-2019, the City has been working on a plan for adaptation to climate change impacts.	18%
Worcester has a new Blue Space program with a goal of identifying and reducing threats to the quality of city's 20 lakes and ponds.	14%

awareness between the highest and lowest education groupings.

Each of the other items was known by 39% or fewer of city residents, covering a range of activities from efficient streetlights (39%) to water and sewer planning (31%) and the city's Blue Space program (14%). Near the bottom of the list is the city's plan for adaptation to climate change, with just 18% reporting at least a fair amount of knowledge. Even among those who expect local impacts of climate change, just 20% are informed about this plan. There is no pocket of the city's population where information on this initiative is particularly high.

Residents are taking a variety of actions on their own, not only driven by climate change

In addition to municipal initiatives, making Worcester a more green and sustainable place also relies on individual and household behaviors (Figure 5). The most widely adopted behaviors are turning off lights to conserve energy (89% say they do so "most of the time"), recycling (78%), and using energy efficient bulbs (73%). Below these three, there is a sharp drop off to the next tier of activities. About half say they lower the thermostat at night, recycle electronics, avoid single use items, and choose local foods. The least frequent activities are food related, with just 22% reporting composting food scraps, and 27% participating in home or community gardening. Residents may not link these activities with sustainability.

In many instances, these sustainability activities are not evenly distributed across the city's population. In particular, lower income residents are less likely to report engaging in many of the activities included in the survey. While 87% of those reporting household incomes over $100,000 a year say they recycle

Figure 5: Worcester residents on personal action related to sustainability ***% of respondents who said they take each action "most of the time"***					
	Overall	**< $25k**	**$25k to < $50k**	**$50k to <$100k**	**$100k +**
Turn off lights when you leave a room	89%	84%	91%	93%	88%
Recycle paper, plastic, or glass	78%	64%	71%	87%	87%
Replace lightbulbs with energy efficient bulbs, such as LEDs	73%	62%	67%	77%	85%
Lower the thermostat at night in cold weather and raise it in warm weather	52%	41%	53%	52%	65%
Recycle electronics	51%	41%	43%	59%	62%
Avoid one-use/disposable items such as water bottles	50%	53%	46%	52%	48%
Choose locally-produced foods when possible	49%	54%	50%	51%	49%
Conserve water, such as by taking short showers and using rain barrels	42%	57%	38%	39%	43%
Visit Worcester's parks, beaches, or conservation land	33%	32%	32%	30%	38%
Walk or bike, when feasible, rather than drive	31%	35%	35%	31%	26%
Participate in community or home gardening	27%	14%	24%	36%	34%
Compost your food scraps	22%	18%	28%	23%	23%

paper, plastic, and glass "most of the time", only 64% of the lowest income residents say the same. Similar gaps exist on other items in the survey, though not all. This serves as a reminder that gaining resident participation in green activities will involve targeted communications and outreach strategies designed to reach specific audiences.

In terms of green-friendly activities and opinion, this poll follows the contours of broader public opinion. Residents who believe in climate change are more supportive of policy interventions related to sustainability. However, their own actions are not necessarily affected by their beliefs. There are no consistent differences in the prevalence of environmentally friendly actions between those who anticipate impacts of climate change and those who do not. This suggests near-term gains in fighting climate change will come more from systemic policy change and individual behaviors driven by a variety of motivations rather from individual choices driven by concern over the impacts of climate change.

Open-ended question shows residents are not sure what it means to have a "green" or "sustainable" city

The positive findings on the quantitative questions in the survey indicate that residents support many green policies when they are discussed in detail. But an open-ended question at the beginning of the survey offers a note of caution. Many responses to this initial open-ended question indicated that the terms "green" and "sustainable" don't mean much to many residents, especially older residents and those with less education and income. Among others, there is some skepticism that the concepts of "green" or "sustainable" apply to Worcester. The rest of the survey suggests these problems can be overcome with more

Figure 6: Worcester residents' reaction to Worcester as a "green city" *% of respondents who cited each topic in response to open-ended question**	
No reaction / Don't know	32%
Negative comments (Worcester is not a green city, shouldn't be a goal)	15%
Recycling / waste / plastic	11%
Conserving energy / renewable energy	11%
Parks / trees / green space	9%
General positive (City doing good job / moving in right direction)	9%
Other types of sustainability (economic, etc)	9%
Other	8%
Greener transportation	7%
Cleanliness / pollution	7%
Food / agriculture / community gardens	2%
**Totals add up to more than 100% since many comments covered more than one issue.*	

information, but it shouldn't be assumed that most residents know what is meant by "Green Worcester" or the term "sustainable" without context.

When asked for their initial reaction to what the terms "green city" and "sustainable city" might mean for the City of Worcester, many residents came up blank. The largest category of open ended comments (32%) were non-responsive: residents said they either had never heard those terms, didn't know what they meant or how they would relate to the city, or just repeated back the terms without any elaboration. "I don't understand what it means. I've never thought about it," said one resident. Older residents and those with the lowest levels of education and household income were most likely have no reaction to the opening question.

Another 9% interpreted "sustainable" broadly, rather than with an environmental focus, most commonly referring to jobs or economic sustainability. "We have manufacturing and businesses to keep us alive," offered one resident. Once again, older residents were most likely to have non-environmental sense of sustainability. Taken together, 4 in 10 residents either were unfamiliar with the terms or thought they meant something other traditional environmental policy (energy-efficiency, recycling, etc). Public communications and education can help bridge these gaps.

Explaining the terms "green" and "sustainable" is one challenge; another is convincing residents that they are achievable goals for the cities. Some 15% of residents had a negative initial reaction to making Worcester green or sustainable. "I don't think of Worcester as a sustainable city," said one resident. Others seemed unaware of the green policies already in place. "Not very accurate. We recycle, but it's not a place where I see a lot of sustainable initiatives," said another. "We're not there yet. I don't see a lot of green stuff going on." Residents with a bachelor's or advanced degree were more likely to have a negative reaction, as did those with household incomes over $50,000.

A common theme in these comments was that sustainability was worth reaching for, but that the city wasn't there yet. A few, however, rejected it as a goal for the city, calling it "crazy", "stupid", or "ridiculous". These naysayers are definitely a minority of residents. The bigger problem is many residents see Worcester as an old industrial city and have a hard time reconciling that with being a green or sustainable city.

That is not to say that all the comments were negative or off the mark: 11% mentioned conserving or shifting to green energy, most commonly solar. An equal number (11%) mentioned recycling, waste reduction, or reducing plastics, 9% mentioned the city's parks, trees, or green space, and 7% each

mentioned cleaning up the city generally or pursuing greener transportation. Residents under age 50 were more likely to mention clean energy and transportation than were older residents. And 9% offered a general positive comment without specifics. Some of these indicated the city was making progress. "It's becoming a sustainable city and has become more cognizant of the environment," said one resident. Growing that 9% to a larger share of the population could be a goal of a sustained communications efforts around sustainability.

Conclusion

The open-ended responses highlight a communications challenge for city officials looking to advance sustainability in Worcester. The good news is that the rest of the survey suggests a broad openness, and even a level of importance, to making Worcester a green and sustainable place, and to the policies that would achieve those goals.

Overall, residents support the ideas behind the Green Worcester initiative, and many of the present and future policy priorities that could be contained in a new sustainability plan for the city. There is significant room to gain ground in terms of awareness, bringing residents on board with the aims of the initiative. Residents vary widely in what they already know about local sustainability, and even whether they know there is an organized local initiative. In terms of the personal sustainability, there is considerable variation in what actions residents are taking. Each of these represents areas where the Green Worcester initiative could potentially make a difference and help move Worcester toward a green future.

Worcester is fertile ground for green policies; city officials need to plant the seeds of specific policies and then nurture them with dedicated communications and education outreach.

Appendix – Methodology

As a part of the Green Worcester initiative, The MassINC Polling Group conducted a telephone survey of residents in June and July of 2019. The questionnaire was designed collaboratively by The MassINC Polling Group, Larissa Brown + Associates, and staff from the City of Worcester, with comment from the Green Worcester Working Group. Topics included resident priorities regarding improving conditions in Worcester, making it a sustainable city, and sustainability initiatives that could help the city continue to grow greener, as well as views of climate change and related issues. This report summarizes key themes of this telephone survey.

The survey was conducted in English and Spanish by live telephone interviewers in June and July 2019. A total of 606 residents of Worcester were interviewed by Braun Research, Inc. Results were weighted to represent the adult resident population of the city of Worcester based on known and estimated population parameters draw from Census Bureau figures. Demographic parameters included gender, age, race / ethnicity, education and ZIP code. The margin of sampling error is approximately 4 percentage points with a 95 percent level of confidence. The geographic distribution of respondents relative to the general population is shown in the table below.

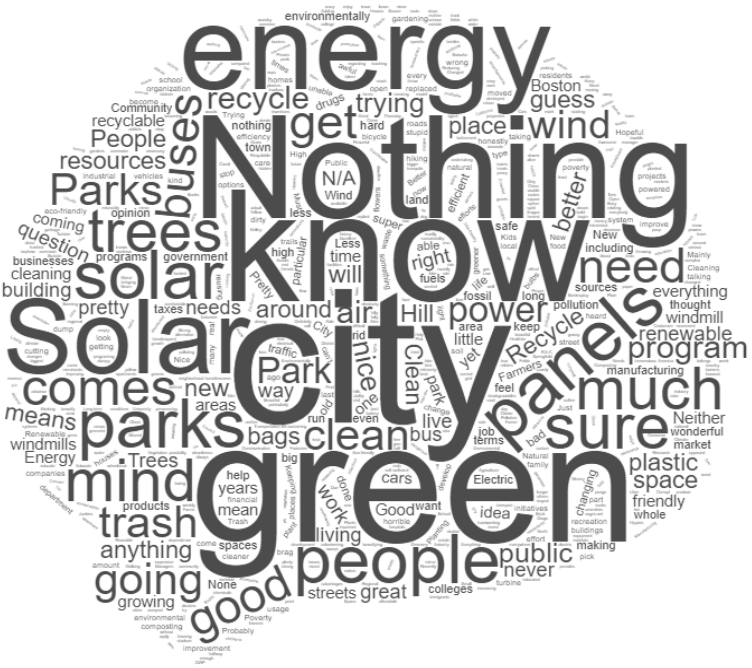
Distribution of population, survey responses by ZIP code			
ZIP Code	**Population**	**Pop. %**	**Weighted %**
01602	23,721	13%	13%
01603	20,722	11%	11%
01604	34,579	19%	18%
01605	25,910	14%	14%
01606	20,831	11%	11%
01607	8,742	5%	5%
01608	3,625	2%	2%
01609	23,886	13%	13%
01610	24,673	13%	13%

For Worcester residents who may wish to participate but who were not called as a part of conducting the initial survey, a copy of the survey will be made available at the City of Worcester's website. Ongoing results of this online survey will be monitored by city staff to ensure all opinions and viewpoints are heard.

Green Worcester Survey of Residents
Topline Results
Survey of 606 Residents of Worcester, Massachusetts
Field Dates: June 26-July 8, 2019

When you think of the terms “sustainable city” or “green city” as it relates to Worcester in particular, what comes to mind?

No reaction / Don't know	32%
Negative comments (Worcester is not a green city, shouldn't be a goal)	15%
Recycling / waste / plastic	11%
Conserving energy / renewable energy	11%
Parks / trees / green space	9%
General positive (City doing good job / moving in right direction)	9%
Other types of sustainability (economic, etc)	9%
Other	8%
Greener transportation	7%
Cleanliness / pollution	7%
Food / agriculture / community gardens	2%



When it comes to improving conditions in Worcester, how much of a priority do you think each of the following issues *should be* for Worcester city government? How about **READ FIRST?** Would you say that it is a major priority, minor priority, or not a priority? How about **READ NEXT, RANDOMIZE ORDER.** *Note: order sorted for display.*

	Major priority	Minor priority	Not a priority	Don't Know / Refused
Cleaning up toxic chemicals at industrial sites	77%	16%	6%	2%
Reducing pollution of the air and water	73%	21%	5%	1%
Reducing natural gas leaks	73%	17%	7%	2%
Reducing the amount of waste produced in Worcester	67%	24%	7%	2%
Planting and maintaining trees	64%	27%	8%	1%
Reducing production of gases that contribute to climate warming	61%	25%	11%	3%
Creating safer and more attractive conditions for bicyclists and pedestrians	61%	29%	9%	<1%
Increasing recycling rates in Worcester	56%	27%	14%	3%
Tightening building codes to encourage energy efficiency	55%	32%	10%	3%
Improving the use of open and green spaces	50%	29%	15%	7%
Creating a home energy rating system similar to miles per gallon for cars	31%	45%	21%	4%

When it comes to making Worcester a more sustainable place in the future, how much of a priority do you think each of the following issues *should be* for Worcester city government? How about **READ FIRST?** Would you say that it is a major priority, minor priority, or not a priority? How about **READ NEXT, RANDOMIZE ORDER.** *Note: order sorted for display.*

	Major priority	Minor priority	Not a priority	Don't Know / Refused
Attracting and creating new jobs in sustainability-related industries	78%	15%	6%	1%
Expanding residents' access to healthy food and active lifestyles	65%	26%	8%	1%
Ensuring that new developments are sustainable	64%	26%	5%	4%
Improving public transportation options to Worcester populations	61%	29%	9%	2%
Supporting non-polluting transportation like electric cars and bicycles	56%	31%	12%	2%
Adapting to future impacts of climate change, such as more intense storms and heat waves	55%	32%	11%	2%

Thinking about sustainability initiatives in Worcester, how much of a priority do you think each of the following issues *should be* for Worcester city government? How about **READ FIRST?** Would you say that it is a major priority, minor priority, or not a priority? How about **READ NEXT, RANDOMIZE ORDER.** *Note: order sorted for display.*

	Major priority	Minor priority	Not a priority	Don't Know / Refused
Ensuring that sustainability initiatives provide benefits to all populations, including low-income and minority communities	70%	21%	7%	2%
Incorporating sustainability into the curriculum at the city's public schools	67%	20%	9%	3%
Implementing public information campaigns to educate residents about sustainability initiatives.	56%	33%	10%	1%

Do you think Worcester and Central Massachusetts are likely to experience impacts of climate change in the next twenty years?

Yes	74%
No	19%
Don't Know / Refused	7%

ASK ONLY IF YES OR UNSURE TO PREVIOUS QUESTION

Which of the following climate change impacts do you think that Worcester and Central Massachusetts is likely to experience in the next twenty years? **READ SLOWLY, SELECT ALL THAT APPLY.**

Heavy flooding	54%
Extreme heat waves	78%
Drought	54%
More powerful storms in all seasons	78%
More ice or freezing rain storms	70%
Losses to farmers and agriculture in our region	66%
None of the above	1%
Don't Know / Refused	3%

Thinking about your own household, how often do you do the following? **READ FIRST** Would you say you do this most of the time, some of the time, or hardly ever? How about **READ NEXT, RANDOMIZE ORDER.** *Note: order sorted for display.*

	Most of the time	Some of the time	Hardly ever	Not available to me (do not read)	Don't Know / Refused
Turn off lights when you leave a room	89%	7%	3%	<1%	0%
Recycle paper, plastic, or glass	78%	8%	13%	2%	0%
Replace lightbulbs with energy efficient bulbs, such as LEDs	73%	17%	9%	1%	0%
Lower the thermostat at night in cold weather and raise it in warm weather	52%	20%	25%	2%	1%
Recycle electronics	51%	21%	23%	4%	1%
Avoid one-use/disposable items such as water bottles	50%	24%	25%	1%	1%
Choose locally-produced foods when possible	49%	35%	14%	1%	1%
Conserve water, such as by taking short showers and using rain barrels	42%	27%	29%	1%	1%
Visit Worcester's parks, beaches, or conservation land	33%	37%	29%	<1%	0%
Walk or bike, when feasible, rather than drive	31%	29%	39%	2%	<1%
Participate in community or home gardening	27%	21%	45%	6%	0%
Compost your food scraps	22%	12%	59%	5%	2%

Other than what we just talked about, do you take any other actions that make your household more sustainable?

Nothing else	66%
Conserve energy at home	10%
Reuse items, reduce / eliminate waste	6%
Insulation / new windows / MassSave	6%
Conserve water	4%
Change energy source (solar panels, wood stove, natural gas instead of oil)	4%
Other	3%
Don't litter / pick up litter	2%
Smart or energy efficient thermostat / lights / appliances	2%
Use cleaner transportation	1%
Food (local, organic, less meat, grow own food)	1%
Plant or maintain trees / plants	<1%

How much have you heard about these sustainability projects and initiatives in the City of Worcester? How about **READ FIRST** Would you say you have heard a great deal, a fair amount, not very much, or nothing at all? How about **READ NEXT, RANDOMIZE ORDER.** *Note: order sorted for display.*

	A great deal	A fair amount	Not very much	Nothing at all	Don't Know / Refused
Over 30,000 trees have been planted since Asian Longhorned Beetle infestation destroyed many trees in northern Worcester in 2009.	41%	19%	16%	22%	2%
Worcester has 60 parks, 20 lakes and ponds, and about 17% of its area is designated as open space.	24%	30%	15%	30%	<1%
Mass Audubon's Broad Meadow Brook Wildlife Sanctuary in Worcester is the largest urban wildlife sanctuary in Massachusetts.	21%	22%	19%	36%	2%
The City replaced 14,000 of its streetlights with LED lights to save energy.	20%	19%	15%	45%	1%
Worcester DPW has been developing an Integrated Plan for long term maintenance of water and sewer infrastructure.	11%	20%	19%	48%	1%
The City has the largest municipally owned solar farm in New England on top of a capped landfill.	10%	17%	21%	51%	1%
Worcester has over five active watershed groups that work with city government to improve water quality in streams and ponds.	10%	18%	22%	48%	1%
In 2018-2019, the City has been working on a plan for adaptation to climate change impacts	6%	12%	21%	60%	2%
Worcester has a new Blue Space program with a goal of identifying and reducing threats to the quality of city's 20 lakes and ponds.	5%	9%	20%	65%	1%

How important is it to you that Worcester works on becoming a city that is "green" and sustainable?

Very important	64%
Somewhat important	25%
Not very important	6%
Not important at all	3%
Don't Know / Refused	2%

Which one of the following best describes your work situation—employed full time, employed part time, or not currently employed?

Employed full time	52%
Employed part time	12%
Not currently employed	36%
Don't Know / Refused	1%

If not currently employed, are you a student, a homemaker, retired, or temporarily unemployed?

A student	14%
A homemaker	10%
Retired	53%
Temporarily unemployed	19%
Don't Know / Refused	3%

Do you have any children under age 18 in your household?

Yes	31%
No	69%
Prefer not to say	<1%

Do you currently own your home, or rent?

Own	45%
Rent	42%
Live with parents	7%
Live in student housing	1%
Another arrangement	4%
Prefer not to say	1%

How many cars, if any, does your household own? _____

No cars	12%
1 car	36%
2 cars	32%
3 or more cars	19%
Don't Know / Refused	1%

Demographics

Race

White non-Hispanic	63%
Black	10%
Asian	7%
Other	1%
Hispanic	18%
Don't Know / Refused	1%

Age

18 to 29	29%
30 to 49	33%
50 to 69	25%
70+	13%
Prefer not to say	<1%

Gender

Male	48%
Female	52%
Other / prefer not to say	<1%

Education

High School or less	42%
Some college, no degree	29%
College graduate (BA/BS)	17%
Advanced degree	11%
Don't Know / Refused	2%

About the Poll

These results are based on a survey of 606 residents of the City of Worcester, Massachusetts conducted as a part of the Green Worcester initiative. The questionnaire was designed collaboratively by The MassINC Polling Group, Larissa Brown and Associates, and City of Worcester staff. Live telephone interviews were conducted in English and Spanish June 26-July 8, 2019 via both landline and cell phone. Results were weighted to known population parameters for adult residents of Worcester based on age, gender, race and ethnicity, education, and 5 digit ZIP code. The margin of sampling error is approximately 4 percentage points with a 95 percent level of confidence. The poll was sponsored by the City of Worcester.

B. **Resources by Chapter**

This Appendix to the Green Worcester Plan provides two kinds of resources keyed to each of the Chapters of the plan: 1) examples of plans and other documents that may assist in identifying ways to implement the plan, and 2) metrics and standards to measure sustainability and potentially pursue third-party certification for the city or specific projects.

Each section of resources by chapter includes, as relevant, a brief listing of standards or indicators from the evaluation systems below.

LEED for Existing Cities and Communities
LEED, Leadership in Energy and Environmental Design, a program of the nonprofit U.S. Green Building Council, is known for its sustainability ratings for buildings. In 2019, LEED released a new rating and certification program, LEED 4.1 for Existing Cities and Communities. It draws on other rating systems, such as the STAR Communities rating system (STAR stands for "Sustainability Tools for Assessing and Rating Communities" and the organization has merged with LEED), which was developed by and for local governments. Like other programs in the LEED system, certification and professional credentials are offered for a fee, but the basic categories and system are available for free. Massachusetts communities certified under LEED 4.1 are Devens, Cambridge, New Bedford, and Northampton. Each topical section of the Green Worcester Plan includes a brief review of the requirements to meet the LEED v. 4.1 Existing Cities and Communities certification standards. (https://new.usgbc.org/leed-for-cities)

Envision™ Sustainable Infrastructure Framework
Envision is a holistic sustainability rating system and planning guide for civil infrastructure to help communities achieve higher performance infrastructure projects and systems. Created and managed by the Institute for Sustainable Infrastructure (ISI), founded by the American Public Works Association (APWA), the American Society of Civil Engineers (ASCE), and the American Council of Engineering Companies (ACEC), Envision was developed in collaboration with Harvard University's Zofnass Program for Sustainable Infrastructure and Graduate School of Design. Use of the rating system as a self-assessment tool is free, but like LEED, the system offers third-party certification for a fee and a credentialing process for professionals. Many public agencies of all sizes use Envision including the Massachusetts Water Resources Authority (which supplies water to Worcester on an emergency basis only); multiple departments in large cities such as Los Angeles, Austin, Montreal, and New York; public works departments in smaller towns and cities like Wellesley MA, Norwalk CT, and Cedar Rapids IA; and multi-jurisdiction agencies like the U.S Army Corps of Engineers. The Envision v. 3 Guidance Manual describes the system as follows:

> "Community infrastructure development is subject to the resource constraints of multiple departments and agencies, each with different schedules, agendas, mandates, budget cycles, and funding sources. Ratings systems and tools intended for buildings are not designed for this context and cannot adequately assess the extensive external benefits and impacts infrastructure has on a community. Envision

assesses not only individual project performance, but how well the infrastructure project contributes to the efficiency and long-term sustainability of the communities it serves. In this way, Envision not only asks, "Are we doing the project right?" but also, "Are we doing the right project?"
https://sustainableinfrastructure.org/

ISO Standards for Sustainable City Quality of Life

The International Organization for Standardization (ISO) has developed a set of indicators to evaluate the sustainability of city services and quality of life. ISO is an independent organization made up of the standard-setting organizations of 164 countries, including the American National Standards Institute (ANSI). The ISO develops voluntary international standards based on a global consensus to promote the creation of good quality services and products that are safe and reliable. ISO is developing a series of international standards for an integrated approach to sustainable development. This includes ISO 37120:2018, "Sustainable cities and communities – indicators for city services and quality of life." The indicators help "cities learn from one another by allowing uniform comparison across a wide range of performance measure, and…support policy development and priority setting." They are "applicable to any city, municipality, or local government that wants to measure its performance in a comparable and verifiable manner, irrespective of size and location." In 2019, ISO added ISO 37123: 2019–indicators for resilient cities — intended to be used in conjunction with ISO 37120. (The full documents with definitions and methodologies are available for purchase at techstreet.com..) See Brad Kelechava, "Sustainable City Quality of Life Indicators in ISU 37120," American National Standards Institute, blog August 13, 2018, https://blog.ansi.org/2018/08/indicators-sustainable-city-iso-37120-2018/#gref .

B.I - A GREEN HEART FOR WORCESTER: OUR VALUES AND VISION

RESOURCES

Health

"Health in All Policies," Office of the Associate Director for Policy and Strategy, Centers for Disease Control and Prevention (CDC), https://www.cdc.gov/policy/hiap/index.html.

Equity

- City of Boston, *Carbon Free Boston Social Equity Report*, 2019, www.greenribboncommission.org/wp-content/uploads/2019/05/CFB_Social_Equity_Report_WEB.pdf
- City of Providence, *Equity and Sustainability*, 2016. www.providenceri.gov/wp-content/uploads/2017/02/Equity-and-Sustainability-SummaryReport-2-20-reduced.pdf
- Angela Park, *Social Equity in Sustainability: An Equity Scan of Local Government Sustainability Programs*, Urban Sustainability Directors Network (USDN), 2014. https://www.Urban Sustainability Directors Network.org/uploads/cms/documents/Urban Sustainability Directors Network_equity_scan_sept_2014_final.pdf
- NAACP Environmental & Climate Justice Program, *Our Communities, Our Power*, 2019. https://live-naacp-site.pantheonsite.io/wp-content/uploads/2019/04/Our-Communities-Our-Power-TOOLKIT-FINAL.pdf
- Equitable & Just National Climate Platform, 2019, www.ajustclimate.org/#platform

Prosperity

- Muro, Mark, et al., "Advancing Inclusion through Clean Energy Jobs," April 2019, https://www.brookings.edu/wp-content/uploads/2019/04/2019.04_metro_Clean-Energy-Jobs_Report_Muro-Tomer-Shivaran-Kane_updated.pdf;
- Novello, Amanda and Greg Carlock, "Redefining Green Jobs for a Sustainable Economy," The Century Foundation, December 2, 2019, https://tcf.org/content/report/redefining-green-jobs-sustainable-economy/
- Massachusetts Clean Energy Center, *Ten-Year Impact Report, 2010-2020*, https://www.masscec.com/masscecs-ten-year-impact-report
- Boston Redevelopment Authority and USDN, "Triple Bottom Line Calculator," http://www.bostonplans.org/getattachment/838900d5-3b91-4029-aa08-b80e025de66b)
- *"Sustainable Return on Investment" (PDF).* American Public Works Association. HDR, Inc. https://www.apwa.net/library/meetings/sustainability/8412.pdf
- Jeroen Kraaijenbrin, "What The 3Ps Of The Triple Bottom Line Really Mean, " *Forbes* December 10, 2019, https://www.forbes.com/sites/jeroenkraaijenbrink/2019/12/10/what-the-3ps-of-the-triple-bottom-line-really-mean/?sh=7b38d7905143
- **"**Sustainable Return on Investment – Capturing more than economic value**,"** July 11, 2019, Brendle Group, https://www.brendlegroup.com/sustainable-return-on-investment-capturing-more-than-economic-value/
- American Institute of Chemical Engineers, Videos on SROI, https://www.aiche.org/academy/videos/introduction-sustainability-return-on-investment-part-1

INDICATORS, STANDARDS AND METRICS

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

CATEGORY: QUALITY OF LIFE

WellBeing
QL1.1 Improve Community Quality of Life
QL1.2 Enhance Public Health & Safety
QL1.3 Improve Construction Safety
QL1.4 Minimize Noise & Vibration
QL1.5 Minimize Light Pollution
QL1.6 Minimize Construction Impacts

Community
QL3.1 Advance Equity & Social Justice
QL3.2 Preserve Historic & Cultural Resources
QL3.3 Enhance Views & Local Character
QL3.4 Enhance Public Space & Amenities

CATEGORY: LEADERSHIP

Collaboration
LD1.1 Provide Effective Leadership & Commitment
LD1.2 Foster Collaboration & Teamwork
LD1.3 Provide for Stakeholder Involvement
LD1.4 Pursue Byproduct Synergies

Planning
LD2.1 Establish a Sustainability Management Plan
LD2.2 Plan for Sustainable Communities
LD2.3 Plan for Long-Term Monitoring & Maintenance
LD2.4 Plan for End-of-Life

Economy
LD3.1 Stimulate Economic Prosperity & Development
LD3.2 Develop Local Skills & Capabilities
LD3.3 Conduct a Life-Cycle Economic Evaluation

INTERNATIONAL STANDARDS ORGANIZATION (ISO)

- **ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.**

B. II – THE GREEN WORCESTER APPROACH: STEWARDSHIP, TRANSPARENCY, AND ACCOUNTABILITY

RESOURCES

- City of Providence, RI, Sustainability Dashboard https://performance.providenceri.gov/stat/goals/r6yh-954f
- City of Cambridge, MA Sustainability Dashboard https://sustainabilitydashboard.cambridgema.gov/dashboard/
- City of Vancouver, CA, Sustainability https://vancouver.ca/green-vancouver.aspx
- Green City Times, https://www.greencitytimes.com/green-city-times-eye-on-sustainability/; https://www.greencitytimes.com/10-greenest-cities-in-the-world/
- City of Durham, NC Sustainability Dashboard, https://durhamnc.gov/3852/Sustainability-Dashboard

B.III – 100% CLEAN AND AFFORDABLE ENERGY

RESOURCES

- Worcester Climate Action Plan, 2006. www.worcesterenergy.org/leading-by-example/climate-action
- Commonwealth of Massachusetts, Global Warming Solutions Act 10-Year Progress Report, www.mass.gov/progress-towards-reducing-greenhouse-gas-emissions
- Worcester Climate Emergency Resolution, 2019
- Worcester Community Choice (Electric) Aggregation Program, www.masspowerchoice.com/worcester
- City of Boston and Boston University Institute for Sustainable Energy, *Climate Free Boston*, http://sites.bu.edu/cfb/
- Carbon Neutral Cities Alliance, www.carbonneutralcities.org
- Energy Efficiency Impact Report, https://energyefficiencyimpact.org/
- Massachusetts Clean Energy Center, *Ten Year Impact Report*, https://files-cdn.masscec.com/reports/ 10-year-digital-pages%20final%20final.pdf
- *Massachusetts 2050 Decarbonization Roadmap*, 2020, https://www.mass.gov/info-details/ma-decarbonization-roadmap#final-reports-

INDICATORS, STANDARDS AND METRICS

LEED V. 4.1 CITIES AND COMMUNITIES CRITERIA

Energy efficiency and GHG emissions reduction are foundational to the LEED city sustainability criteria. Certification is based on meeting prerequisites and attaining threshold scores in specific areas.

Prerequisites:
- Power access, reliability, and resiliency: 100% coverage; reliability performance monitoring; and power surety and resiliency.
- Energy and GHG emissions management: measure annual energy consumption and GHG emissions for the city (tons CO2e per capita).

Energy Performance Score:
- Calculation based on annual energy consumption from all sectors along with the source of energy, emissions co-efficient for electricity and all fuel types, and total population.

Energy Efficiency:
- Street Lighting and public area lighting, minimum efficiency requirement.
- Water and Wastewater: minimum of 50% of pumps meet federal or international equivalent standards for pump efficiency.
- District Energy Systems: no district energy systems

Renewable Energy:
- Renewables - on-site renewables, new and existing off-site renewables.

Low Carbon Economy:
- GHG intensity: total GHG emission emitted by the city per unit economic output measure in GDP produced by the city.
- Reduction in Carbon intensity: (GHG intensity = total city GHG/Total GDP).

Grid Harmonization:
- Improve operational efficiency and encourage consumer participation in energy use optimization
- Load Optimization: e.g., dynamic pricing to motivate load shifting

- Demand Response: critical peak pricing; critical peak rebate
- Net Metering and Interconnection Policy: adopt or be committed to (meet IEEE or local equivalent standards)

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

CATEGORY: RESOURCE ALLOCATION

ENERGY
RA2.1 Reduce Operational Energy Consumption
RA2.2 Reduce Construction Energy Consumption
RA2.3 Use Renewable Energy
RA2.4 Commission & Monitor Energy Systems

CATEGORY: CLIMATE AND RESILIENCE

EMISSIONS
CR1.1 Reduce Net Embodied Carbon
CR1.2 Reduce Greenhouse Gas Emissions
CR 1.3 Reduce Air Pollutant Emissions

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Greenhouse gas emissions measured in tons per capita (core indicator)
- Total end-use energy consumption per capita (GJ/year) (core indicator)
- Percentage of total end-use energy derived from renewable sources (core indicator)
- Percentage of city population with authorized electrical service (residential) (core indicator)
- Number of gas distribution service connections per 100 000 population (residential) (core indicator)
- Electricity consumption of public street lighting per kilometer of lighted street (kWh/year) (supporting indicator)
- Average annual hours of electrical service interruptions per household (supporting indicator)
- Number of different electricity sources providing at least 5 % of total energy supply capacity
- Electricity supply capacity as a percentage of peak electricity demand
- Percentage of critical facilities served by off-grid energy services

B.IV – CONNECTED GREEN AND BLUE SPACES WITH HEALTHY NATURAL SYSTEMS

RESOURCES

Urban Forestry

- *Urban Forestry Management Plan Toolkit* https://ufmptoolkit.net/
- *OpenTreeMap* (www.opentreemap.com). A free web-based application to create community-based maps. The City could set up a website and invite the public to identify and map trees in Worcester.
- *i-Tree Software for Urban Forest Management (www.itreetools.org).* i-Tree is a free, state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools. Tools of potential interest to Worcester include:
  - i-Tree Canopy offers a quick and easy way to produce a statistically valid estimate of land cover types (e.g., tree cover) using aerial images available in Google Maps. Canopy also estimates values for air pollution reduction and capturing atmospheric carbon. Canopy can be used by urban forest managers to estimate tree canopy cover, set canopy goals, and monitor canopy change over time.
  - i-Tree Streets focuses on the benefits of street trees. Using a sample or complete inventory, Worcester can quantify and put a dollar value on annual environmental and aesthetic benefits of street trees.
  - i-Tree Vue allows uses the freely available National Land Cover Database (NLCD) satellite-based imagery to assess the tree canopy benefits and model potential planting scenarios for benefits.
- University of Vermont Spatial Laboratory Tree Canopy Assessments, www.vtcommunityforestry.org/resources/inventories-management-plans/tree-canopy-assessments

Parks

- *City Parks Alliance* (www.cityparksalliance.org). The City Parks Alliance (CPA), an independent national organization of urban park leaders that serves as a network for civic and community leaders, government agencies, parks and recreation authorities, funders, and other urban parks stakeholders. The organization's mission is to promote the creation of vibrant, healthy parks and green spaces that contribute to community well-being. Among CPA objectives are urban parks advocacy, gathering and sharing best practices, and building partnerships with health, economic, education, environmental and other community development organizations.

INDICATORS, STANDARDS AND METRICS

LEED v. 4.1 Cities and Communities:

- Required:
  - Ecosystem assessment, maps, and planning narrative for parks and natural resources conservation and restoration. (As in the Worcester Open Space and Recreation Plan.)
  - Wetlands Ordinance and State Wetlands Act meet requirements.
  - Easily accessible green space – at least 121 square feet per person
  - Total minimum area of green space – at least 7212 square feet
  - Minimum of 70% of dwelling units have green space within ½ mile walking distance
- Light Pollution Reduction: measurements needed to meet Glare and Sky-Glow requirements

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

CATEGORY: NATURAL WORLD

Siting
NW1.1 Preserve Sites of High Ecological Value
NW1.2 Provide Wetland & Surface Water Buffers
NW1.3 Preserve Prime Farmland
NW1.4 Preserve Undeveloped Land

Conservation
NW2.1 Reclaim Brownfields
NW2.2 Manage Stormwater
NW2.3 Reduce Pesticide & Fertilizer Impacts
NW2.4 Protect Surface & Groundwater Quality

Ecology
NW3.1 Enhance Functional Habitats
NW3.2 Enhance Wetland & Surface Water Functions
NW3.3 Maintain Floodplain Functions
NW3.4 Control Invasive Species
NW3.5 Protect Soil Health

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Square metres of public indoor recreation space per capita (supporting indicator)
- Square metres of public outdoor recreation space per capita (supporting indicator)
- Percentage of areas designated for natural protection (supporting indicator)
- Percentage change in number of native species (supporting indicator)
- Green area (hectares) per 100,000 population (core indicator)

B.V – NET ZERO AND CLIMATE RESILIENT BUILDINGS

RESOURCES

- World Green Building Council. www.worldgbc.org
- US Green Building Council. www.usgbc.org; Massachusetts chapter www.usgbcma.org
- Cambridge Building Energy Use Disclosure Ordinance, www.cambridgema.gov
- High Performance Buildings, https://www.mass.gov/high-performance-buildings
- Mass Save Program, www.masssave.com
- Deep Energy Retrofit Case Study: Massachusetts… https://masslandlords.net/deep-energy-retrofit-case-study-massachusetts-single-family-home/
- Zero Energy Project, https://zeroenergyproject.org/2018/09/23/my-zero-energy-retrofit-beats-my-401k/
- Cook, Jeffrey J., Sydney Forrester, Bryn Grunwald, Jenny Heeter, Clark Henry, and Monisha Shah. 2019. *Up to the Challenge: Communities Deploy Solar in Underserved Markets*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-72575. https://www.nrel.gov/docs/fy19osti/72575.pdf.
- Massachusetts Clean Energy Center, Triple Decker Design Challenge, https://www.masscec.com/triple-decker-design-challenge
- Embodied Carbon in Construction Calculator - free tool to calculate embodied energy in materials. https://www.buildingtransparency.org/en/

INDICATORS, STANDARDS AND METRICS

LEED v.4.1 CITIES AND COMMUNITIES

Requirements:

- Adopt a building performance disclosure policy.
- Adopt a policy for all new construction undertaken by city government to achieve LEED Silver or an equivalent green building certification.
- Provide a minimum of two incentives for private sector LEED or an equivalent green building rating system in the city (permitting time incentives; density incentives; tax credits; permitting fee incentives).
- Identify Compact and Complete Centers (criteria for CCCs include: 1/2 mile of centers of mixed use, density, walkability, transit availability; ADA compliant sidewalks, bikeways, and crosswalks; 90% of buildings in CCCs have access to at least 10 diverse uses; percentage of population residing in CCCs)
- High Priority Site Option: historic preservation and redevelopment promotion. Worcester meets this option with the Historical Commission, historic district and historic site preservation ordinances; also policies to promote redevelopment areas

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Final energy consumption of public buildings per year (GJ/m2) (core indicator)

B.VI - SUSTAINABLE TRANSPORTATION CHOICES

RESOURCES

- Massachusetts Pedestrian Transportation Plan, 2019
- Massachusetts Bicycle Transportation Plan, 2019
- Massachusetts Municipal Resource Guide for Walkability, 2019
- Massachusetts Municipal Resource Guide for Bikeability, 2019
- Central Massachusetts Metropolitan Planning Organization (CMMPO), Regional Pedestrian Plan, 2018
- CMMPO, Regional Bicycle Plan, 2018
- National Association of City Transportation Officials (NACTO) publishes best practice guides including, the *Urban Street Design Guide*, *Urban Bikeway Design Guide*, *Transit Street Design Guide*, *Bike Share Station Siting Guide*, and *Urban Street Stormwater Guide,* https://nacto.org/publications/design-guides/
- NACTO, *Curb Appeal: Curbside Management Strategies for Improving Transit Reliability*, https://nacto.org/tsdg/curb-appeal-whitepaper/
- ITE, Curbside Management Practitioners Guide, https://www.ite.org/pub/?id=C75A6B8B-E210-5EB3-F4A6-A2FDDA8AE4AA
- National Academies of Sciences, Engineering, and Medicine 2019. *Fast-Tracked: A Tactical Transit Study*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25571 .
- Maaza C. Mekuria et al., *Low-Stress Bicycling and Network Connectivity*, Mineta Transportation Institute, Report 11-19 (May 2012), https://transweb.sjsu.edu/sites/default/files/1005-low-stress-bicycling-network-connectivity.pdf
- Healthiest Practices Open Streets http://www.healthiestpracticeopenstreets.org/
- Open Streets Project Toolkit https://openstreetsproject.org/open-streets-toolkit/
- Worcester Regional Research Bureau (WRRB), *City on the Move: An Overview and Assessment of Worcester's Transportation Needs*, Report 18-07, September 2019
- WRRB, *The Implications of a Fare-Free WRTA*, May 2019
- Walker, Jarrett. *Human Transit*. Island Press, 2012.
- The state offers a toolkit for starting a Walking School Bus: https://www.mass.gov/service-details/safe-routes-to-school-encouragement. See also: Starting a Walking School Bus. http://www.walkingschoolbus.org/
- *Carbon Free Boston Summary Report* 2019. https://www.greenribboncommission.org/wp-content/uploads/2019/01/Carbon-Free-Boston-Report-web.pdf

INDICATORS, STANDARDS AND METRICS

LEED V. 4.1 – CITIES AND COMMUNITIES

- Transportation performance score: calculate daily VMT (Vehicle Miles Traveled); calculate transportation performance score based on total annual VMT and population data
- Access to Quality Transit: mode split for commuting; quality of transit facilities (e.g., shelters); intermodal connectivity (3 or more modes); minimum frequency of trips
- Alternative fuel vehicles: electric charging stations; alternative fuel stations (non-gasoline, low-polluting fuels)
- Smart mobility and transportation policy: at least four policies such as transit to have Passenger Information System; GPS; synchronized signals and transit signal priority; real time parking management systems; electronic toll collection systems; RFID technology for logistics and/or public transportation
- Identify Compact and Complete Centers (CCC-1/2 mile of centers of mixed use, density, walkability, transit availability; ADA compliant sidewalks, bikeways, and crosswalks; 90% of buildings in CCCs have access to at least 10 diverse uses; percentage of population residing in CCCs)

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

CATEGORY: QUALITY OF LIFE

Mobility
QL2.1 Improve Community Mobility & Access
QL2.2 Encourage Sustainable Transportation
QL2.3 Improve Access & Wayfinding

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Kilometers of public transport system per 100,000 population (core indicator)
- Annual number of public transport trips per capita (core indicator)
- Percentage of commuters using a travel mode to work other than a personal vehicle (supporting indicator)
- Kilometers of bicycle paths and lanes per 100,000 population (supporting indicator)
- Transportation deaths per 100,000 population (supporting indicator)
- Percentage of population living within 0.5 km of public transit running at least every 20 min during peak periods (supporting indicator)
- Average commute time (supporting indicator)

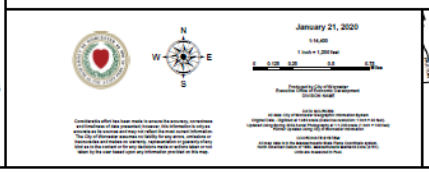
Frequency of Inbound WRTA Routes

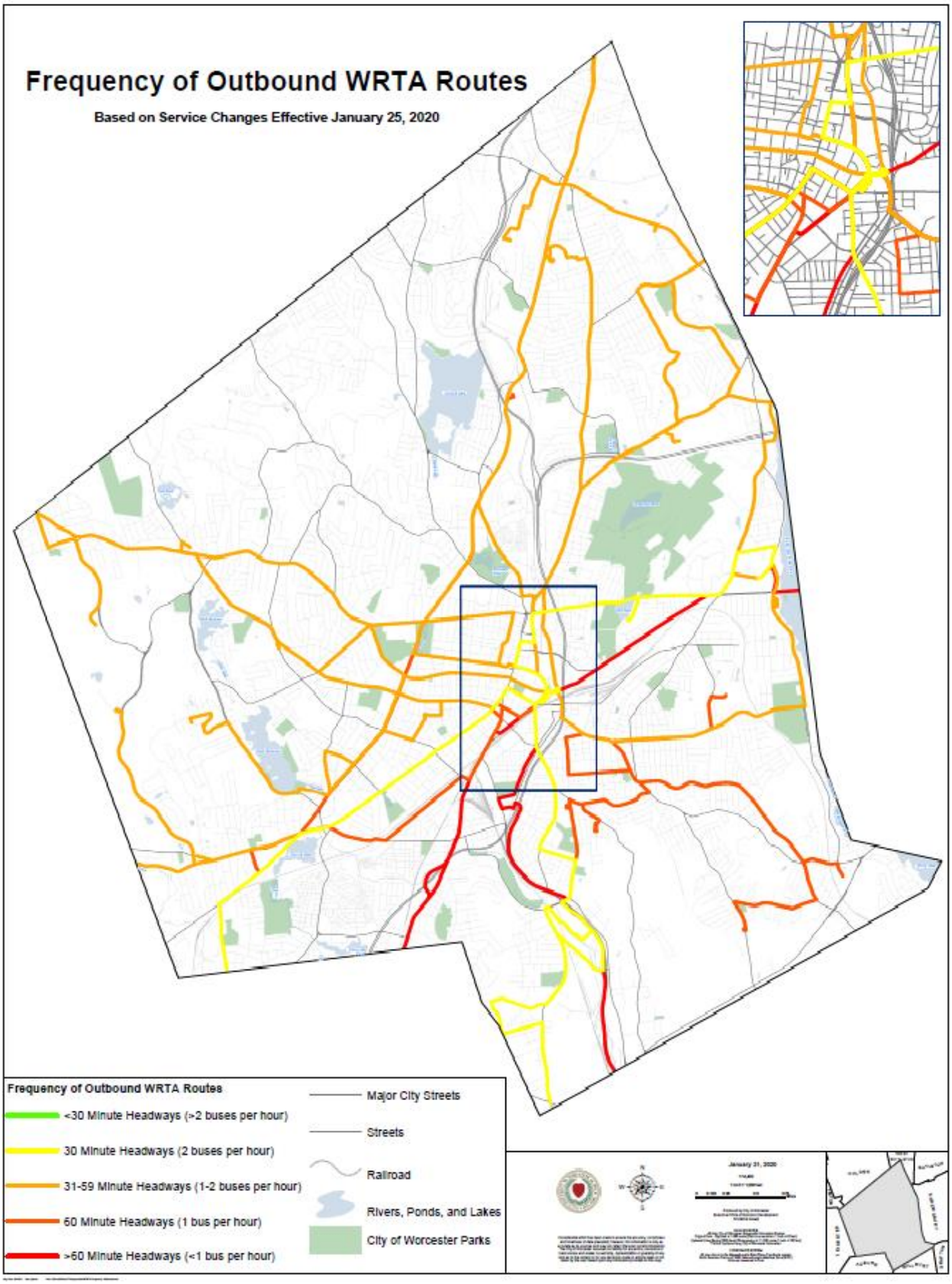
Based on Service Changes Effective January 25, 2020

Frequency of Inbound WRTA Routes

- <30 Minute Headways (>2 buses per hour)
- 30 Minute Headways (2 buses per hour)
- 31-59 Minute Headways (1-2 buses per hour)
- 60 Minute Headways (1 bus per hour)
- >60 Minute Headways (<1 bus per hour)

- Major City Streets
- Streets
- Railroad
- Rivers, Ponds, and Lakes
- City of Worcester Parks




Frequency of Outbound WRTA Routes
Based on Service Changes Effective January 25, 2020
Frequency of Outbound WRTA Routes
<30 Minute Headways (>2 buses per hour)
30 Minute Headways (2 buses per hour)
31-59 Minute Headways (1-2 buses per hour)
60 Minute Headways (1 bus per hour)
>60 Minute Headways (<1 bus per hour)
Major City Streets
Streets
Railroad
Rivers, Ponds, and Lakes
City of Worcester Parks

B.VII - ONE WATER – INTEGRATED WATER MANAGEMENT

RESOURCES

- US Water Alliance, "One Water Roadmap: The Sustainable Management of Life's Most Essential Resource," (2016), www.uswateralliance.org/sites/uswateralliance.org/files/publications/Roadmap%20FINAL.pdf
- City of Worcester, Integrated Water Management Plan, October 2019, http://www.worcesterma.gov/cww/integrated-plan.pdf
- Secino, B. J., Merchant, B. P., Marsan, C. B., & Racine, R. K. (2018). *Stormwater Runoff Reduction on the Worcester Polytechnic Institute Campus*. Retrieved from https://digitalcommons.wpi.edu/iqp-all/5205
- Green Jobs Academy, www.greenjobsacademy.org
- Philadelphia Green City, Clean Waters Program, www.phila.gov/water/sustainability/greencitycleanwaters/Pages/default.aspx

INDICATORS, STANDARDS AND METRICS

LEED V. 4.1 CITIES AND COMMUNITIES

- Water Access and Quality – prerequisites met by Worcester
  - Public water supply; drinking water quality; treated wastewater quality; policy to comply with NPDES stormwater regulations
  - Water Performance
  - Measure daily per capita domestic water consumption – met
  - Water performance score based on per capita consumption and total population
  - Integrated Water Management – maintain water balance
  - Requirement met by 2019 IWM plan
- Stormwater Management
  - Mitigate flooding using low-impact development and green infrastructure; demonstrate that 35% of land area has designated green stormwater providing bioretention and infiltration services that are interconnected.
- Smart Water Systems
  - Annual water audit; adopt strategies for automation of water supply system for at least 50% of total water supply network

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

CATEGORY: RESOURCE ALLOCATION

Water
RA3.1 Preserve Water Resources
RA3.2 Reduce Operational Water Consumption
RA3.3 Reduce Construction Water Consumption
RA3.4 Monitor Water Systems

CATEGORY: NATURAL WORLD

Siting
NW1.2 Provide Wetland & Surface Water Buffers

Conservation
NW2.2 Manage Stormwater

NW 2.4 Protect Surface & Groundwater Quality

Ecology
NW3.2 Enhance Wetland & Surface Water Functions
NW3.3 Maintain Floodplain Functions

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Percentage of city population with potable water supply service (core indicator)
- Percentage of city population with sustainable access to an improved water source (core indicator)
- Total domestic water consumption per capita (liters/day) (core indicator)
- Compliance rate of drinking water quality (core indicator)
- Total water consumption per capita (liters/day) (supporting indicator)
- Average annual hours of water service interruptions per household (supporting indicator)
- Percentage of water loss (unaccounted for water) (supporting indicator)
- Percentage of city population served by wastewater collection (core indicator)
- Percentage of city's wastewater receiving centralized treatment (core indicator)
- Percentage of population with access to improved sanitation (core indicator)
- Compliance rate of wastewater treatment (supporting indicator)

B.VIII - TOWARDS ZERO WASTE

RESOURCES

- City of Cambridge Zero Waste Master Plan (2019) https://www.cambridgema.gov/Departments/publicworks/Initiatives/zerowastemasterplan
- San Francisco Zero Waste Case Study, https://www.epa.gov/transforming-waste-tool/zero-waste-case-study-san-francisco
- Austin (TX) Resource Recovery Master Plan (2011) www.austintexas.gov/zerowaste
- Vancouver (BC) Zero Waste 2040 (2018) www.council.vancouver.ca/20180516/documents/pspc2a.pdf
- City of San Antonio Recycling and Resource Recovery Plan, 2013 update www.sanantonio.gov/Portals/0/Files/SWMD/About/RecyclingResourceRecoveryPlan.pdf
- NASPO (National Association of State Purchasing Agents) Green Purchasing Guide, https://www.naspo.org/green/index.html
- Massachusetts Environmentally Preferable Purchasing, https://www.mass.gov/environmentally-preferable-products-epp-procurement-programs
- Sustainable Procurement Policies Roadmap, www.ecocenter.org/sustainable-procurement-policies-roadmap
- Urban Sustainability Directors Network (USDN), *The Buck Stops Here: Sustainable Procurement Playbook for Cities,* http://responsiblepurchasing.org/purchasing_guides/playbook_for_cities/rpn_Urban Sustainability Directors Network_playbook_for_cities.pdf
- City of Portland (OR) Sustainable Procurement Policy 2018 www.portlandoregon.gov/brfs/article/695574
- Kate O'Neill, *Waste.* Medford MA: Polity Press, 2019.
- Ellen MacArthur Foundation, *The New Plastics Economy Global Commitment 2019 Progress Report*, www.newplasticseconomy.org/assets/doc/Global-Commitment-2019-Progress-Report.pdf

INDICATORS, STANDARDS AND METRICS

LEED v. 4.1 CITIES AND COMMUNITIES

The LEED standards for waste are in six categories: Solid Waste Management, Waste Performance, Special Waste Streams, Responsible Sourcing for Infrastructure, Material Recovery, and Smart Waste Systems. The intent is to manage all waste streams, including industrial, biomedical, and household hazardous waste. Waste management performance is based on all these waste streams, not just residential waste.

Solid Waste Management

- Prerequisite: 100% coverage of all types of buildings/city population by waste management services
- Prerequisite: Solid Waste Management Plan--sorting of waste in a minimum of types – organic, recyclables, e-waste, other. Source segregation or central sorting facility; compliance with federal or state regulations on waste storage and collection; waste handling and processing facility – composting of organic waste; recyclables sorted into a minimum of six categories; materials recovery facility – send materials to produce recycled products; divert a minimum of 35% of construction and demolition waste from city government infrastructure works

Waste Performance

- Measure total weight of waste and total waste diverted from landfills or incineration for minimum most recent calendar year. Performance score based on data and population.
  - Waste to energy counts as waste diversion if facility meets European Commission directives

  Special Waste Streams Management
  - Required – report waste streams generated and % diverted.
  - Responsible Sourcing for Infrastructure
    - Encourage use of products for which life cycle information is available and that have been extracted and sourced in a responsible manner.
    - Meet at least one of following for at least 20% of total value of permanently installed top 3 materials used in infrastructure: extended producer responsibility; leadership extraction practices-material reuse; leadership extraction practices-recycled content; leadership extraction practices-other USGBC approved program

  Material Recovery
  - Intent to recover from the waste stream materials which have a have value and provide mechanisms for collection and channelization to producers – move towards circular economy
  - Extended Producer Responsibility facilities to collect and store
  - Mandate a manufacturers or producer's Extended Producer Responsibility (ERP) policy – address e-waste, packaging; guideline on collection, etc.; mandate to collect at least 10% of total annual waste generated (e waste)
  - Non-recyclable Waste Generation Reporting: waste stream study and reporting; dialogue with identified producers

  Smart Waste Management Systems
  - Improve operational efficiency
  - Pneumatic transport systems
  - Loading stations, transport network underground; central waste handling facility; Smart Bins and Route Optimization: ultrasonic sensors in municipal bins; optimize fleet routing for waste collection

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

CATEGORY: RESOURCE ALLOCATION

Materials
RA1.1 Support Sustainable Procurement Practices
RA1.2 Use Recycled Materials
RA1.3 Reduce Operational Waste
RA1.4 Reduce Construction Waste
RA1.5 Balance Earthwork On Site

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Percentage of city population with regular solid waste collection (residential) (core indicator)
- Total collected municipal solid waste per capita (core indicator)
- Percentage of the city's solid waste that is recycled (core indicator)
- Percentage of the city's solid waste that is disposed of in a sanitary landfill (core indicator)

- Percentage of the city's solid waste that is treated in energy-from-waste plants (core indicator)
- Percentage of the city's solid waste that is biologically treated and used as compost or biogas (supporting indicator)
- Percentage of the city's solid waste that is disposed of in an open dump (supporting indicator)
- Percentage of the city's solid waste that is disposed of by other means (supporting indicator)
- Hazardous waste generation per capita (tonnes) (supporting indicator)

B.IX – SUSTAINABLE FOOD SYSTEMS

RESOURCES

- USDA Urban Agriculture Tool Kit
  https://www.ams.usda.gov/sites/default/files/media/urbanagriculturetoolkit.pdf
- BBC *Climate change food calculator: What's your diet's carbon footprint?*
  https://www.bbc.com/news/science-environment-46459714
- *Food's Carbon Footprint* http://www.greeneatz.com/foods-carbon-footprint.html
- Springfield, MA – Wellspring Harvest commercial hydroponic greenhouse.
  https://wellspring.coop/co-op-businesses/greenhouse-cooperative

  For profit, worker-owned cooperative business. Greenhouse sales began in August 2018. Investment fund raised money for construction and startup capital. Jobs and profit sharing for employees Eds and Meds as a market.. Institutional markets can provide stable, large scale demand which will enable greenhouses to build the capacity to produce at scale, and therefore at more affordable prices.

INDICATORS, STANDARDS AND METRICS

LEED V. 4.1 CITIES AND COMMUNITIES

- The Cities and Communities LEED rating does not include food production criteria.
- Options for LEED v. 4.0 Neighborhood Development (large subdivisions or new towns):
  - Neighborhood gardens – provide permanent and viable garden space in a development project.
  - CSA – purchase community-supported agriculture shares for at least 80% of dwelling units for at least 2 years
  - Proximity to farmers market – project is within walking distance of a farmers' market.

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Total urban agricultural area per 100,000 population (core indicator)
- Amount of food produced locally as a percentage of total food supplied to the city (supporting indicator)
- Percentage of city population undernourished (supporting indicator)
- Percentage of city population that is overweight or obese — Body Mass Index (BMI) (supporting indicator)

B.X – POLLUTION PREVENTION

RESOURCES

- NASPO (National Association of State Procurement Officials) Green Purchasing Guide, https://www.naspo.org/green/index.html
- Massachusetts Environmentally Preferable Purchasing, https://www.mass.gov/environmentally-preferable-products-epp-procurement-programs
- Sustainable Procurement Policies Roadmap, www.ecocenter.org/sustainable-procurement-policies-roadmap
- Urban Sustainability Directors Network (USDN), "The Buck Stops Here: Sustainable Procurement Playbook for Cities," http://responsiblepurchasing.org/purchasing_guides/playbook_for_cities/rpn_Urban Sustainability Directors Network_playbook_for_cities.pdf
- City of Portland (OR) Sustainable Procurement Policy 2018 www.portlandoregon.gov/brfs/article/695574

INDICATORS, STANDARDS AND METRICS

LEED V. 4.1 – CITIES AND COMMUNITIES

- See Transportation and Materials Management sections.

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

CATEGORY: RESOURCE ALLOCATION

Materials
RA1.1 Support Sustainable Procurement Practices
RA1.2 Use Recycled Materials
RA1.3 Reduce Operational Waste
RA1.4 Reduce Construction Waste
RA1.5 Balance Earthwork On Site

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Fine particulate matter (PM2.5) concentration (core indicator)
- Particulate matter (PM10) concentration (core indicator)
- Greenhouse gas emissions measured in tonnes per capita (core indicator)
- NO2 (nitrogen dioxide) concentration (supporting indicator)
- SO2 (sulfur dioxide) concentration (supporting indicator)
- O3 (ozone) concentration (supporting indicator)
- Noise pollution (supporting indicator)

B.XI - CLIMATE CHANGE RESILIENCE

RESOURCES

- Worcester Hazard Management Plan
- Worcester Municipal Vulnerability Preparedness Plan, 2019.
- www.resilientma.org

INDICATORS, STANDARDS AND METRICS

LEED v. 4.1 CITIES AND COMMUNITIES

- Vulnerability and capacity assessment including identification of geophysical, hydrological, climatological, meteorological, biological, social, technological, industrial, transport, and pollution impacts; risk identification, risk assessment, most exposed and affected sectors. Set adaptation and mitigation goals for at least the top two natural and man-made hazards.
- Resilience Plan meeting at least two of the following: climate adaptation and mitigation strategies; emergency planning and preparedness; strategies for early warning systems; critical infrastructure location; policy intervention for building structures; capacity building.

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

CATEGORY: CLIMATE AND RESILIENCE

Resilience
CR2.1 Avoid Unsuitable Development
CR2.2 Assess Climate Change Vulnerability
CR2.3 Evaluate Risk & Resilience
CR2.4 Establish Resilience Goals and Strategies
CR2.5 Maximize Resilience
CR2.6 Improve Infrastructure Integration

INTERNATIONAL STANDARDS ORGANIZATION

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities.

- Percentage of city population covered by multi-hazard early warning system
- Percentage of emergency responders who have received disaster response training
- Percentage of local hazard warnings issued by national agencies annually that are received in a timely fashion by the city
- Number of hospital beds in the city destroyed or damaged by natural hazards per 100,000 population
- Number of active and temporary waste management sites available for debris and rubble per square kilometer
- Percentage of emergency responders in the city equipped with specialized communication technologies able to operate reliably during a disaster event
- Number of evacuation routes available per 100,000 population

- Percentage of city population that can be served by city food reserves for 72 hours in an emergency
- Percentage of the city's population living within one kilometer of a grocery store
- Percentage of city area covered by publicly available hazard maps
- Pervious land areas and public space and pavement built with porous, draining materials as a percentage of city land area
- Percentage of city land area in high-risk zones where risk-reduction measures have been implemented
- Percentage of city departments and utility services that conduct risk assessment in their planning and investment
- Annual number of critical infrastructures flooded as a percentage of critical infrastructure in the city
- Annual expenditure on water retention measures as a percentage of city prevention measures budget
- Number of different sources providing at least 5 % of total water supply capacity
- Percentage of city population that can be supplied with drinking water by alternative methods for 72 hours

B.XII – SUSTAINABILITY, RESILIENCE, AND GREEN EDUCATION IN ALL POLICIES

RESOURCES

- David Godschalk and David Rouse, *Sustaining Places: Best Practices for Comprehensive Plans*, PAS Report 578, Chicago: American Planning Association, 2015.

INDICATORS, STANDARDS AND METRICS

LEED v. 4.1 CITIES AND COMMUNITIES

- Requirement – comprehensive demographic narrative and maps; track and measure living standards metrics – education, median gross rent, Gini coefficient, median household income, unemployment rate, median Air Quality Index (AQI), violent crime per capita.
- Trend improvements: improvements in four of seven socioeconomic metrics
- Distributional Equity: equitable per capita income; equitable workforce mobility; graduation rate equity: equitable employment; access and proximity
- Environmental Justice: identify priority environmental justice conditions; identify priority areas.
- Housing and Transportation Affordability: comprehensive housing policy; at least 60% of households compared to National Typical would spend less than 45% of income on housing + transportation
- Civic and Community Engagement: both high tech and high touch; inclusion of traditionally unrepresented or underrepresented groups; appointments to boards and commissions reflect gender, racial and ethnic diversity; 51% of survey respondents believe they can have a positive impact on community and/or at least 80% report positive levels of neighborhood cohesion
- Civil and Human Rights: policy-based mission statement to promote discrimination-free quality of life; ensure voting rights of all eligible voters; integrate community policing and procedural justice into Police Department operations; local officer or Commission on Human Rights

ENVISION™ SUSTAINABLE INFRASTRUCTURE FRAMEWORK

Planning
LD2.1 Establish a Sustainability Management Plan
LD2.2 Plan for Sustainable Communities
LD2.3 Plan for Long-Term Monitoring & Maintenance
LD2.4 Plan for End-of-Life

INTERNATIONAL STANDARDS ORGANIZATION (ISO)

ISO 37120: Sustainable cities and communities – indicators for city services and quality of life and ISO 37123–indicators for resilient cities. Below are indicators for general planning in addition to those listed in other chapters.

Economy

- City's unemployment rate (core indicator)

- Assessed value of commercial and industrial properties as a percentage of total assessed value of all properties (supporting indicator)
- Percentage of persons in full-time employment (supporting indicator)
- Youth unemployment rate (supporting indicator)
- Number of businesses per 100 000 population (supporting indicator)
- Number of new patents per 100 000 population per year (supporting indicator)
- Annual number of visitor stays (overnight) per 100 000 population (supporting indicator)
- Commercial air connectivity (number of non-stop commercial air destinations) (supporting indicator)
- Percentage of city population living below the international poverty line (core indicator)
- Percentage of city population living below the national poverty line (supporting indicator)
- Gini coefficient of inequality (supporting indicator)

Education

- Percentage of female school-aged population enrolled in schools (core indicator)
- Percentage of students completing primary education: survival rate (core indicator)
- Percentage of students completing secondary education: survival rate (core indicator)
- Primary education student–teacher ratio (core indicator)
- Percentage of school-aged population enrolled in schools (supporting indicator)
- Number of higher education degrees per 100 000 population (supporting indicator)

Finance

- Debt service ratio (debt service expenditure as a percentage of a city's own-source revenue) (core indicator)
- Capital spending as a percentage of total expenditures (core indicator)
- Own-source revenue as a percentage of total revenues (supporting indicator)
- Tax collected as a percentage of tax billed (supporting indicator)

Governance

- Women as a percentage of total elected to city-level office (core indicator)
- Number of convictions for corruption and/or bribery by city officials per 100 000 population (supporting indicator)
- Number of registered voters as a percentage of the voting age population (supporting indicator)
- Voter participation in last municipal election (as a percentage of registered voters) (supporting indicator)

Health

- Average life expectancy (core indicator)
- Number of in-patient hospital beds per 100 000 population (core indicator)
- Number of physicians per 100 000 population (core indicator)
- Under age five mortality per 1 000 live births (core indicator)
- Number of nursing and midwifery personnel per 100 000 population (supporting indicator)
- Suicide rate per 100 000 population (supporting indicator)

Housing

- Jobs–housing ratio (supporting indicator)Percentage of city population living in inadequate housing (core indicator)
- Percentage of population living in affordable housing (core indicator)
- Number of homeless per 100 000 population (supporting indicator)
- Percentage of households that exist without registered legal titles (supporting indicator)

Safety

- Number of firefighters per 100,000 population (core indicator)
- Number of fire-related deaths per 100,000 population (core indicator)
- Number of natural-hazard-related deaths per 100,000 population (core indicator)
- Number of police officers per 100,000 population (core indicator)
- Number of homicides per 100,000 population (core indicator)

- Number of volunteer and part-time firefighters per 100,000 population (supporting indicator)
- Response time for emergency response services from initial call (supporting indicator)
- Crimes against property per 100,000 population (supporting indicator)
- Number of deaths caused by industrial accidents per 100 000 population (supporting indicator)
- Number of violent crimes against women per 100,000 population (supporting indicator)

Culture and Sports

- Number of cultural institutions and sporting facilities per 100,000 population (core indicator)
- Percentage of municipal budget allocated to cultural and sporting facilities (supporting indicator)
- Annual number of cultural events per 100,000 population (e.g., exhibitions, festivals, concerts) (supporting indicator)

Telecommunications

- Number of internet connections per 100,000 population (supporting indicator)
- Number of mobile phone connections per 100,000 population (supporting indicator)

C. Memorandum on Sustainability Frameworks and Example City Sustainability Plans

MEMORANDUM

TO: Green Worcester Working Group
FROM: Larissa Brown, Principal, Larissa Brown + Associates (LBA)
RE: Sustainability Frameworks and Example City Sustainability Plans

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The City of Worcester has engaged Larissa Brown + Associates (LBA) to assist in developing a Sustainability Strategic Plan (SSP) for the City. The project is led by the City's Energy and Asset Management Division (EAM) and advised by a Green Worcester Working Group (GWWG) made up of City staff, representatives of local organizations, and several interested individuals. The planning process also includes interviews, focus groups, and public meetings.

An early task in creation of the SSP is to identify a framework for the plan that includes a sustainability vision, the categories and topics to be addressed, and a set of sustainability goals for Worcester. The purpose of this memorandum is to inform the members of the GWWP about the state of practice in sustainability planning as shown in sustainability rating systems and recent examples of sustainability and climate change action plans from other municipalities. The GWWP meeting scheduled for July 31, 2019 will be conducted as a workshop for GWWP members to work together to identify preferred elements of a vision and the topic areas most suitable for the Worcester SSP. Documents discussed in this memo can be found in the following Google drive: https://drive.google.com/drive/folders/1CJ-7Hzm3zdABXa6O25fGQX5LlZLzgZx-?usp=sharing.

I. BACKGROUND

A. Sustainability Planning and Activities in Worcester

Worcester has a Climate Action Plan (CAP) completed in 2006, which included a community and municipal greenhouse gas (GHG) inventory, emissions reduction targets, and a set of actions to achieve the targets. Following some of the recommendations of the CAP, the City created the EAM, and has focused the majority of its sustainability efforts on increasing the energy efficiency of City buildings and increasing the amount of energy provided by renewable energy, including installation of the largest municipally-owned solar array in New England. This focus on an energy-efficiency program, encompassing city-owned buildings, street lights, renewable energy installations, and installation of LED lighting in municipal parking, parks, and streetlights has resulted in estimated life-cycle savings of $164 million (two dollars in savings for every dollar of investment) as well as a reduction of municipal electrical use and associated GHG emissions.

The City met its targets for reduced GHG emissions (11% below 2002 levels by 2010) and increased use of renewable electricity for municipal operations (20% by 2010). In addition, the City was one of the first communities to qualify as a Green Community under the state's Green Communities Act, enacted in 2008, and has benefited from state funding for energy efficiency projects. With its very large inventory of municipal facilities, the City fell somewhat short of the state's Green Community target of reducing emissions from municipal operations by 20% by 2015 but, given the context, still performed quite well. In addition to recommendations on reducing GHG emissions from buildings, the 2006 CAP included related recommendations in categories such as transportation, recycling, open space and trees, community outreach and so on, some of which have been less consistently implemented.

A partial update of the CAP, including an updated GHG inventory, was prepared in 2013 to guide the City's sustainability work for the next five years in seven topic areas:

- Building Energy
- Municipal Operations
- Waste
- Transportation
- Consumption
- Green Infrastructure
- Community

In addition to new goals, targets, and action items to build on the City's energy efficiency and renewable energy initiatives focused on buildings, the draft CAP update included a significant expansion of goals and actions to reduce GHG emissions from transportation, waste management, food consumption, and materials management. Moreover, the update added more discussion of potential climate change impacts, including goals and actions to provide the sustainability benefits of open space, green infrastructure, and street tree planting. The draft plan also touched on the need to include social equity considerations "for true sustainability in the city," by connecting other agencies and community organizations to the climate action and sustainability agenda.

The much-commented "Worcester renaissance" after a long transition from traditional industry now offers the prospect of enhanced private and public investment in the City. Moreover, like many older cities, basic infrastructure is at the end of its design life and must be upgraded to meet 21st century standards, requiring costly investments. This is the moment to invest in future-oriented state of the art systems. As cities around New England and the country plan for sustainability, climate change adaptation, and resilience, and take steps to implement their plans, they are not only improving quality of life for their residents, they are increasing their economic competitiveness and long-term prosperity and success.

The present planning process is intended to update and broaden the CAP to provide Worcester with an integrated sustainability vision, a set of goals and measurable targets, strategies to achieve the vision and goals, action items for the short, medium, and long term, and a governance system for implementation, including collaboration with non-municipal entities. Related municipal plans are also under development. A Municipal Vulnerability Preparedness (MVP) priority plan, including a vulnerability assessment of five sites, will be completed in summer 2019 and the results of that process will be integrated into the SSP. Designation of Worcester as an MVP community by the state will make it eligible for state funding for climate resilience projects. The City is working on an Integrated Water Management Plan related to EPA-mandated stormwater and water system permits which is expected to be in draft form by Fall 2019. An update to the City's 2013 Open Space and Recreation Plan is also expected to be submitted for state approval in 2020 to meet requirements for eligibility for state funding. Finally, the City intends to develop the first new comprehensive plan in over thirty years, probably beginning in 2020 The SSP developed in the present project will influence and be incorporated into the comprehensive plan. In addition, the City is launching a neighborhood revitalization plan for the Green Island neighborhood associated with the construction of Polar Stadium and mixed-use development projects in the Canal Street area. This area of focused investment and revitalization may offer opportunities in the near term to pilot and demonstrate Worcester's commitment to sustainability.

B. The Constituency for Sustainability in Worcester

Building and strengthening the constituency for sustainability is important to the success of the SSP. A telephone survey was administered in late June and early July 2019 to 606 Worcester adult residents to gauge attitudes towards sustainability and climate change topics and knowledge of Worcester sustainability-related projects. The survey respondent group was weighted to be representative of the Worcester population—for example, with 18% of respondents identifying as Hispanic.

One of the first questions in the survey asked respondents what comes to mind when they hear the terms "sustainable" or "green" city. About a third could not come up with anything at all. However, by the end of the survey, after being asked about their reaction to potential policies and actions, respondents were overwhelmingly positive about becoming a sustainable city. When asked "How important is it to you that Worcester become a city that is "green" and "sustainable?", 64% answered "Very important" and 25% answered "Somewhat important." That means that nearly ninety percent of respondents think that sustainability is important to Worcester's future. When presented with a list of potential future sustainability goals and asked whether they should be major, minor, or not a priority, the item "Attracting and creating new jobs in sustainability-related industries," received the highest level of support, identified by 78% of the respondents as a major priority. While a majority of respondents overall were positive about Worcester becoming more sustainable, respondents who identified as people of color and lower income were more supportive of Worcester becoming a more sustainable city than whites. At the same time, when asked how much they know about sustainability initiatives already underway in Worcester, most respondents did not know much about what the City and other groups are doing. An important aspect of this project is to help expand and deepen the constituency for sustainability actions through defining a vision for sustainability and marketing existing sustainability accomplishments and initiatives.

C. Creating a Framework for Green Worcester

The first task is to develop an overall framework for the plan—one that is ambitious and visionary, grounded in the reality of Worcester conditions while creating opportunities to take advantage of funding and other assistance to move more rapidly towards incorporating sustainability and climate change resilience into Worcester's renaissance, its everyday operations, and its identity.

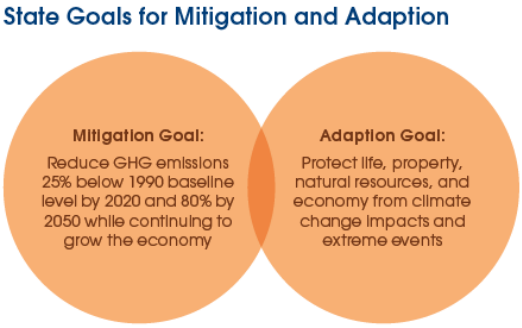
II. HOW SHOULD WE DEFINE SUSTAINABILITY?

A. Defining Sustainability and Resilience

The simplest definition of sustainability—which has survived the test of time--is a set of policies and practices that results in meeting the needs of present generations without compromising the ability of future generations to meet their own needs. It includes promoting healthy environmental systems and habitats and supporting conditions for continued ecosystem services. Ecosystem services are the benefits to humans provided by a healthy ecosystem, for example, food and water, flood and disease control, and nutrient cycling. Climate change affects many aspects of sustainability and is now generally included in sustainability planning, although climate change action plans (like Worcester's) are sometimes created separately and may include broader sustainability elements. "Resilience" is the term often used in discussing climate change actions. Climate change resilience is the ability of a community to adapt and thrive in the face of extreme events and stresses. Resilient communities anticipate risks, plan to limit their impacts and adopt strategies that integrate all community systems – civic, environmental, social and economic – to support recovery and growth. The concepts of sustainability

and climate change resilience are increasingly used as if they are interchangeable.The SSP will seek to use definitions of sustainability and resilience that are short, easily understood, imageable (with graphics) and reflective of the vision and themes of the plan.

In the coming decades, Massachusetts is expected to experience significant increases in temperature, both in summer and winter; increased annual average precipitation, though with important seasonal differences, such as more frequent and damaging ice storms and floods; earlier peak spring streamflow; more frequent droughts; changes in forest composition; changes in insect populations; and a longer growing season.[1] Worcest can benefit from state assistance in climate change mitigation, (the legislature passed a $1.3 billion bond on July 25, 2019 for city and town climate change projects), but the city will also find that the state raises expectations with new sustainability and climate change standards.



B. Themes and Topics for the Worcester Sustainability Plan

While all sustainability plans include a core set of categories—typically energy, waste, transportation, water, natural resources, and climate change—today they often also include attention to an array of quality of life and equity issues such as health, food systems, the economy, culture, and civic participation.

III. BEST PRACTICES FRAMEWORKS AND SYSTEMS

Sustainability rating systems for buildings emerged in the 1990s. In the last decade, several sustainability rating systems at the community scale have been developed. Examination of these rating systems indicates the range of attributes and characteristics that communities now use in sustainability and climate change planning, in identifying targets and goals, and in measuring progress.

A. STAR Communities Rating System www.starcommunities.org

STAR COMMUNITIES
SUSTAINABILITY TOOLS FOR ASSESSING & RATING COMMUNITIES

First released in 2012, the STAR Community Rating System (STAR) was developed by and for local governments to serve as a sustainability evaluation system, encompassing economic, environmental,

[1] For details see MAPC, Metro Boston Regional Climate Change Adaptation Strategy Report, 2014, (http://www.mapc.org/sites/default/files/RCCAS_full_report_rev_8-28-14.pdf)

and social performance measures. Organized as a menu of goals, objectives and evaluation measures, the STAR system allows communities to define and customize a data-driven approach to sustainability. Massachusetts communities that have used the STAR system and become certified include Devens, Cambridge, and Northampton.

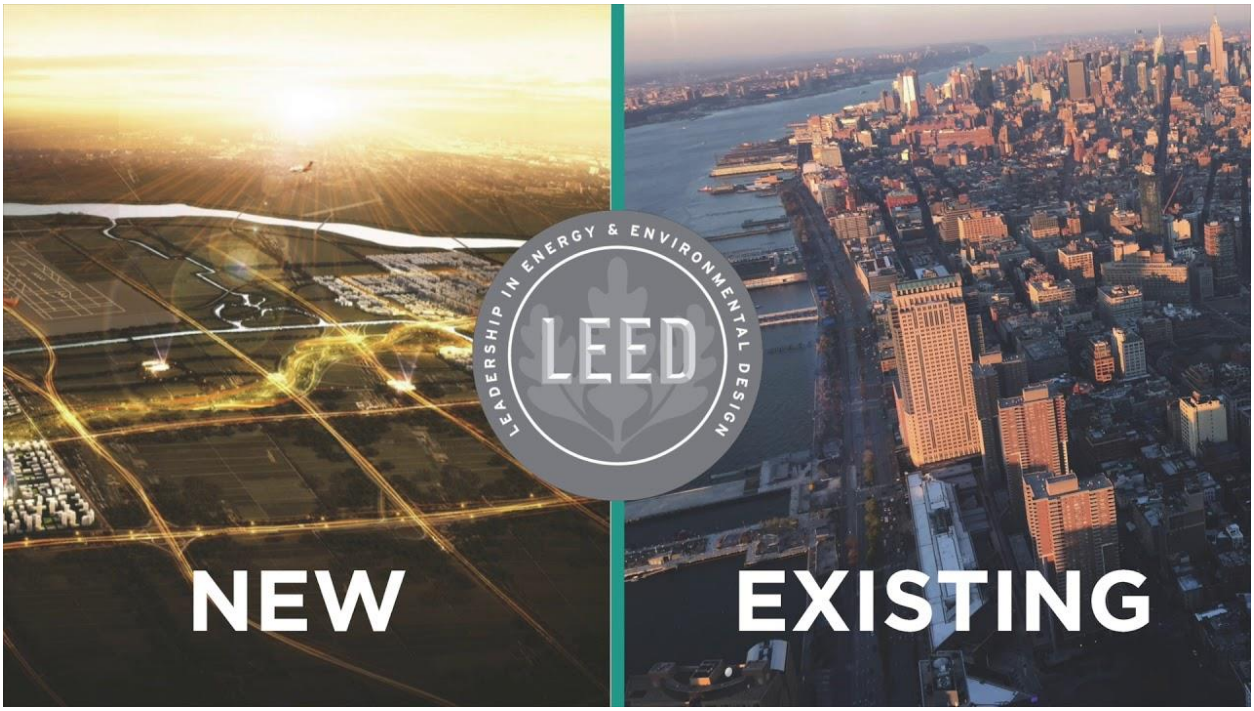
There are seven sustainability themes and an additional category called "Innovation and Process" to promote and recognize exemplary processes and innovation. These theme areas cover a broad array of topics and together constitute a comprehensive range of issues that would typically be found in a community master plan or comprehensive plan. The themes are:

- Built Environment: Quality, choice, and access where we live, work and play
- Climate and Energy: Increase efficiency, reduce impact
- Economy and Jobs: Quality jobs, shared prosperity
- Education, Arts and Community: Vibrant, connected and diverse culture
- Equity and Empowerment: Inclusion and access for all community members
- Health and Safety: Strong, resilient, and safe
- Natural systems: Protect and restore the resources of life

Built Environment	Climate & Energy	Economy & Jobs	Education, Arts & Community	Equity & Empowerment	Health & Safety	Natural Systems
Ambient Noise & Light	Climate Adaptation	Business Retention & Development	Arts & Culture	Civic Engagement	Active Living	Green Infrastructure
Community Water Systems	Greenhouse Gas Mitigation	Green Market Development	Community Cohesion	Civil & Human Rights	Community Health & Health System	Invasive Species
Compact & Complete Communities	Greening the Energy Supply	Local Economy	Educational Opportunity & Attainment	Environmental Justice	Emergency Prevention & Response	Natural Resource Protection
Housing Affordability	Industrial Sector Resource Efficiency	Quality Jobs & Living Wages	Historic Preservation	Equitable Services & Access	Food Access & Nutrition	Outdoor Air Quality
Infill & Redevelopment	Resource Efficient Buildings	Targeted Industry Development	Social & Cultural Diversity	Human Services	Indoor Air Quality	Water in the Environment
Public Spaces	Resource Efficient Public Infrastructure	Workforce Readiness		Poverty Prevention & Alleviation	Natural & Human Hazards	Working Lands
Transportation Choices	Waste Minimization				Safe Communities	

STAR Merges with LEED. In 2017 STAR Communities merged with the U.S. Green Building Council (USGBC), the home of the LEED (Leadership in Energy and Environmental Design) certification system, and no longer exists as a stand-alone certification system. In 2019, a new rating and certification system, drawing on STAR, LEED, and other rating systems, such as the SITES system for sustainable landscapes was released: LEED 4.1 for Cities and Communities.

B. LEED 4.1 for Existing Cities and Communities https://new.usgbc.org/leed-v41#cities-and-communities



The nonprofit U.S. Green Building Council (USGBC) began by developing environmental standards for buildings in the 1990s and is the most well-known certification system for "green building"—Leadership in Energy and Environmental Design (LEED). Criticized for its focus on new individual buildings that neglected the environmental impacts of locations that might result in higher transportation emissions, the USGBC has begun to address this issue in LEED 4.1, the most recent set of LEED evaluation systems. As noted above, LEED 4.1 for Existing Cities and Communities, incorporates many aspects of STAR and other systems. The LEED system is organized to offer certification and professional credentials for an (expensive) fee, but the basic categories and system are available for free.

This system has eight categories plus Integrated Planning and Leadership, Green Building Policy and Incentives, Innovation, and Regional. Five of the LEED categories focus on core sustainability topics: Natural Systems and Ecology; Transportation and Land Use; Water Efficiency; Energy and Greenhouse Gas Emissions; and Materials and Resources. A sixth category, called Quality of Life covers a broader set of topics relevant to social, economic, and civic sustainability and resilience. The Innovation category offers credits for new approaches to sustainability and resilience, and the Regional category gives credit for attention to regionally specific issues, such as the differences between arid and wet environments. The thematic topics and credit areas are:

Natural systems and ecology

- Ecosystem Assessment
- Green Spaces
- Natural Resources Conservation and Restoration
- Light Pollution Reduction
- Resilience Planning

Transportation and land use

- Transportation Performance
- Compact, Mixed Use and Transit Oriented Development
- Transportation Choices
- Alternative Fuel Vehicles
- Smart Mobility
- Historic Preservation and Preferred Locations

Water efficiency

- Water Access and Quality
- Water Performance
- Stormwater Management
- Smart Water Systems

Energy and greenhouse gas emissions

- Power Access, Reliability and Resiliency
- Energy Performance
- Energy Efficiency
- Distributed Energy Resources
- Clean and Green Power
- Smart Energy Systems

Materials and resources

- Solid Waste Management
- Waste Performance
- Responsible Sourcing for Infrastructure
- Extended Producer Responsibility
- Smart Waste Management Systems

Quality of life

- Quality of Life Performance
- Equitable Development
- Public Health
- Poverty Alleviation
- Environmental Justice
- Affordable Housing
- Civic and Community Engagement
- Emergency Management and Response
- Civil and Human Rights

Innovation

- Innovation

Regional priority

- Regional Priority

C. Envision™ Sustainable Infrastructure Framework

https://sustainableinfrastructure.org/

Envision is a holistic sustainability rating system and planning guide for civil infrastructure to help communities achieve higher performance infrastructure projects and systems. Created and managed by the Institute for Sustainable Infrastructure (ISI), founded by the American Public Works Association (APWA), the American Society of Civil Engineers (ASCE), and the American Council of Engineering Companies (ACEC), Envision was developed in collaboration with Harvard University's Zofnass Program for Sustainable Infrastructure and Graduate School of Design. Use of the rating system as a self-assessment tool is free, but like LEED, the system offers third-party certification for a fee and a credentialing process for professionals. Many public agencies of all sizes use Envision including the Massachusetts Water Resources Authority (which supplies water to Worcester on an emergency basis only); multiple departments in large cities such as Los Angeles, Austin, Montreal, and New York; public works departments in smaller towns and cities like Wellesley MA, Norwalk CT, and Cedar Rapids IA; and multi-jurisdiction agencies like the U.S Army Corps of Engineers.

The Envision v. 3 Guidance Manual describes the system as follows:

> "Community infrastructure development is subject to the resource constraints of multiple departments and agencies, each with different schedules, agendas, mandates, budget cycles, and funding sources. Ratings systems and tools intended for buildings are not designed for this context and cannot adequately assess the extensive external benefits and impacts infrastructure has on a community. Envision assesses not only individual project performance, but how well the infrastructure project contributes to the

Energy	Water	Waste	Transportation	Landscape	Information
Distribution	Treatment	Solid waste	Airports	Public Realm	Telecom
Hydroelectric	Distribution	Recycling	Roads / Highways	Parks	Cables
Coal	Capture / Storage	Hazardous	Bikes / Pedestrians	Ecosystem Services	Internet
Natural Gas	Stormwater	Waste	Railways	Natural Infrastructure	Phones
Wind	Flood Control	Collection & Transfer	Transit	Environmental Remediation	Data Centers
Solar	Nutrient Management		Ports		Sensors
Biomass			Waterways		

efficiency and long-term sustainability of the communities it serves. In this way, Envision not only asks, "Are we doing the project right?" but also, "Are we doing the right project?"

Envision is organized around five categories, 14 subcategories, and 64 indicators.

- **Quality of Life**: Wellbeing, Mobility, Community.
  - Alignment with community goals
  - Incorporation into existing community networks
  - Long term benefit to the community
  - Community engagement in the decision-making process
- **Leadership**: Collaboration, Planning, Economy.
  - Communication and collaboration from the beginning within project teams
  - Involvement of a wide variety of people in creating ideas for the project
  - Understanding of the long-term, holistic view of the project and its life cycle.
- **Resource Allocation**: Materials, Energy, Water.
  - Resources are the assets that are needed to build infrastructure and keep it running.
  - Broadly concern about with the quantity, source, and characteristics of these resources and their impacts on the overall sustainability of the project.
  - Resources addressed include physical materials (both those that are consumed and that leave the project), energy, and water use. These resources are finite and should be treated as an asset to use respectfully.
- **Natural World**: Siting, Conservation, Ecology.
  - Infrastructure projects have an impact on the natural world around them, including habitats, species, and nonliving natural systems.
  - The natural systems around us perform critical functions called ecosystem services that provide us with clean air, clean water, healthy food, and hazard mitigation.
  - The way a project is located within these systems and the new elements they may introduce to a system can create unwanted impacts on these ecosystem services.
  - This section addresses how to understand and minimize negative impacts while considering ways in which the infrastructure can interact with natural systems in a synergistic, positive way.
- **Climate and Resilience**: Emissions, Resilience.
  - Minimize emissions that may contribute to climate change and other short- and long-term risks
  - Ensure that infrastructure projects are resilient: informed, resourceful, robust, redundant, flexible, integrated, and inclusive.

Quality Of Life
14 Credits

WELLBEING
QL1.1 Improve Community Quality of Life
QL1.2 Enhance Public Health & Safety
QL1.3 Improve Construction Safety (N)
QL1.4 Minimize Noise & Vibration
QL1.5 Minimize Light Pollution
QL1.6 Minimize Construction Impacts (N)

MOBILITY
QL2.1 Improve Community Mobility & Access
QL2.2 Encourage Sustainable Transportation
QL2.3 Improve Access & Wayfinding

COMMUNITY
QL3.1 Advance Equity & Social Justice (N)
QL3.2 Preserve Historic & Cultural Resources
QL3.3 Enhance Views & Local Character
QL3.4 Enhance Public Space & Amenities

QL0.0 Innovate or Exceed Credit Requirements

Leadership
12 Credits

COLLABORATION
LD1.1 Provide Effective Leadership & Commitment
LD1.2 Foster Collaboration & Teamwork
LD1.3 Provide for Stakeholder Involvement
LD1.4 Pursue Byproduct Synergies

PLANNING
LD2.1 Establish a Sustainability Management Plan
LD2.2 Plan for Sustainable Communities (N)
LD2.3 Plan for Long-Term Monitoring & Maintenance
LD2.4 Plan for End-of-Life

ECONOMY
LD3.1 Stimulate Economic Prosperity & Development
LD3.2 Develop Local Skills & Capabilities
LD3.3 Conduct a Life-Cycle Economic Evaluation (N)

LD0.0 Innovate or Exceed Credit Requirements

Resource Allocation
14 Credits

MATERIALS
RA1.1 Support Sustainable Procurement Practices
RA1.2 Use Recycled Materials
RA1.3 Reduce Operational Waste
RA1.4 Reduce Construction Waste (N)
RA1.5 Balance Earthwork On Site

ENERGY
RA2.1 Reduce Operational Energy Consumption
RA2.2 Reduce Construction Energy Consumption (N)
RA2.3 Use Renewable Energy
RA2.4 Commission & Monitor Energy Systems

WATER
RA3.1 Preserve Water Resources
RA3.2 Reduce Operational Water Consumption
RA3.3 Reduce Construction Water Consumption (N)
RA3.4 Monitor Water Systems

RA0.0 Innovate or Exceed Credit Requirements

Natural World
14 Credits

SITING
NW1.1 Preserve Sites of High Ecological Value
NW1.2 Provide Wetland & Surface Water Buffers
NW1.3 Preserve Prime Farmland
NW1.4 Preserve Undeveloped Land

CONSERVATION
NW2.1 Reclaim Brownfields (N)
NW2.2 Manage Stormwater
NW2.3 Reduce Pesticide & Fertilizer Impacts
NW2.4 Protect Surface & Groundwater Quality

ECOLOGY
NW3.1 Enhance Functional Habitats
NW3.2 Enhance Wetland & Surface Water Functions
NW3.3 Maintain Floodplain Functions
NW3.4 Control Invasive Species
NW3.5 Protect Soil Health

NW0.0 Innovate or Exceed Credit Requirements

Climate and Resilience
10 Credits

EMISSIONS
CR1.1 Reduce Net Embodied Carbon
CR1.2 Reduce Greenhouse Gas Emissions
CR1.3 Reduce Air Pollutant Emissions

RESILIENCE
CR2.1 Avoid Unsuitable Development
CR2.2 Assess Climate Change Vulnerability
CR2.3 Evaluate Risk & Resilience (N)
CR2.4 Establish Resilience Goals and Strategies (N)
CR2.5 Maximize Resilience
CR2.6 Improve Infrastructure Integration

CR0.0 Innovate or Exceed Credit Requirements

Rewritten
(N) New

D. American Planning Association – Sustainable Places

The American Planning Association (APA) recently published a guide to comprehensive planning, "Sustainable Places: Best Practices for Comprehensive Plans," structured by six principles that include sustainability-related goals:

- **Livable Built Environment**: Ensure that all elements of the built environment, including land use, transportation, housing, energy, and infrastructure, work together to provide sustainable, green places for living, working, and recreation, with a high quality of life
- **Harmony with Nature**: Ensure that the contributions of natural resources to human well-being are explicitly recognized and valued and that maintaining their health is a primary objective.
- **Resilient Economy**: Ensure that the community is prepared to deal with both positive and negative changes in its economic health and to initiate sustainable urban development and redevelopment strategies that foster green business growth and build reliance on local assets.
- **Interwoven Equity:** Ensure fairness and equity in providing for the housing, services, health, safety, and livelihood needs of all citizens and groups.
- **Healthy Community**: Ensure that public health needs are recognized and addressed through provisions for healthy foods, physical activity, access to recreation, health care, environmental justice, and safe neighborhoods.
- **Responsible Regionalism**: Ensure that all local proposals account for, connect with, and support the plans of adjacent jurisdictions and the surrounding region.[2]

IV. EQUITY AND ENVIRONMENTAL JUSTICE IN SUSTAINABILITY PLANNING

The concept of environmental justice emerged in the 1980s when low-income and communities of color began to fight the location of toxic waste sites in their communities. Analysis showed that race was the most important factor influencing the siting of toxic waste facilities, and it continues to be the case that environmental hazards and pollution are disproportionately found in these communities. In addition, these communities are more vulnerable to adverse impacts for a variety of reasons such as larger populations of children and elderly people who are more sensitive to health impacts; location in flood plains, industrial zones, and adjacent to

> In the Envision rating system, one of the indicators in the Quality of Life category is "Advance Equity and Social Justice," with a good description of its importance: "'Equity and social justice' refer to the responsibility of a society to ensure that civil and human rights are preserved and protected for each individual, and that all persons are treated equally and without prejudice regardless of race, color, wealth, religion (creed), gender, gender expression, age, national origin (ancestry), disability, marital status, sexual orientation, or military status. This includes "environmental justice," which refers to the fair treatment and meaningful engagement of all people with regard to environmental protection….Equitable and just systems of infrastructure development are opportunities to strengthen social cohesion, raise awareness, and further develop the social support systems that increase resilience." (Envision v. 3 Guidance Manual, p. 48)

[2] David Godschalk and David Rouse, *Sustaining Places: Best Practices for Comprehensive Plans*, PAS Report 578, Chicago: American Planning Association, 2015.

highways, where land values are lower; historic patterns of residential segregation; and people have fewer resources to withstand or recover from environmental stresses.[3]

In 1994, Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations") incorporated environmental justice into requirements for federally funded projects. The Environmental Protection Agency (EPA) defines environmental justice as:

> "The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.
>
> - Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies.
> - Meaningful involvement means: People have an opportunity to participate in decisions about activities that may affect their environment and/or health. The public's contribution can influence the regulatory agency's decision. Community concerns will be considered in the decision-making process, and decision makers will seek out and facilitate the involvement of those potentially affected."[4]

The EPA has developed EJScreen, a mapping tool that displays environmental and demographic indicators and combines it into a set of 11 EJ indexes to identify geographic areas with environmental justice concerns.[5] A social vulnerability index (SoVI) was developed by the Hazards & Vulnerability Research Institute at the University of South Carolina.[6]

A. Just Transition and Climate Justice[7]

"Just Transition" is a conceptual framework first developed by the trade union movement in relation to creating protections and opportunities for workers affected by a societal shift to a low-carbon and climate resilient economy. The concept has broadened to become more proactive by adding a vision of healthy, thriving, and connected local economies that will meet the needs of workers and communities in the transition to achieving the vision of sustainability. "Climate Justice" is a term used to focus on incorporation of economic and social justice as a foundation of climate change adaptation. Activists organize the "frontline communities" (low-income and communities of color particularly vulnerable to adverse impacts) around environmental justice issues "at the intersection of race, poverty and pollution" with a focus on ensuring that a transition to clean energy also includes cleaning up pollution and providing green jobs.

A. The Equitable and Just National Climate Platform www.ajustclimate.org

On July 18, 2019, a large coalition of environmental and environmental justice organizations issued the Equitable and Just National Climate Platform.[8] The platform lays out an agenda and vision for the future:

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[3] Tishman Environment and Design Center, "Local Policies for Environmental Justice: A National Scan," (New York: New School, February 2019) p. 8; https://tishmancenter.org/local-land-use-policies-for-environmental-justice-in-collaboration-with-nrdc/

[4] https://www.epa.gov/environmentaljustice/learn-about-environmental-justice

[5] https://www.epa.gov/ejscreen/what-ejscreen

[6] /artsandsciences.sc.edu/geog/hvri/hvri-resources

[7] This discussion draws on "'Just Transition'—Just what Is it? An analysis of Language, Strategies, and Projects," Labor Network for Sustainability and Strategic Practice Grassroots Policy Project, https://www.labor4sustainability.org/uncategorized/just-transition-just-what-is-it/

[8] https://ajustclimate.org/#platform

- No community left behind
- A healthy climate and air quality
- Reduction in cumulative impacts
- An inclusive, just, and pollution-free energy economy
- Access to affordable energy
- A healthy transportation and goods movement system
- Safe, healthy communities and infrastructure
- Economic diversity and community wealth building
- Anti-displacement, relocation, and the right to return
- Water access and affordability
- Self-determination, land access, and redevelopment
- Funding and research
- U.S. responsibility for climate action and international cooperation

B. NAACP Environmental & Climate Justice Program (ECJP)

The ECJP published a toolkit for local communities to organize and participate in climate change planning: *Our Communities, Our Power: Advancing Resistance and Resilience in Climate Change Adaptation Action Toolkit* (Baltimore: NAACP, 2019).[9] The toolkit provides a detailed roadmap, from creating a committee and running a meeting, building a constituency, communications, and legislative advocacy to policy making in 13 topic areas:

- Democracy and governance
- Economic justice
- Energy systems
- Emergency management
- Food systems
- Gender and LGBTQ responsive climate resilience
- Housing
- Land use planning and management
- Restorative criminal justice
- Sea level rise and coastal resilience
- Transportation systems
- Waste management
- Water resource management

C. Using the Equity Lens in Providence, Boston, and Cleveland

1. Just Providence

After adopting a sustainability plan in 2014, Providence developed a separate but linked equity lens project and framework: "Equity in Sustainability: A collaborative initiative by the City of Providence and frontline communities of color of Providence to bring a racial equity lens to the City's sustainability agenda." The year-long planning process (2016-2017) was a joint initiative of the Environmental Justice League of Rhode Island, Groundwork Rhode Island, and the City of Providence Office of Sustainability and supported by a $100,000 grant from the Rhode Island Foundation and Partners for Places. The process was undertaken by a newly established Racial and Environmental Justice Committee made up of

[9] https://live-naacp-site.pantheonsite.io/wp-content/uploads/2019/04/Our-Communities-Our-Power-TOOLKIT-FINAL.pdf

representatives of communities of color. The plan's recommendations were adopted by the City's Office of Sustainability in 2017. The process included racial equity trainings and developed 12 priority areas:

- Clean streets
- Industrial hazards
- Youth programs
- Diverse, local jobs
- Affordable housing and gentrification
- Race and representation
- Government accountability and service
- Policing practices
- Community safety
- Expanded public transit
- Mental health resources
- Education

This plan was influenced by the Just Transition model of equity in sustainability transitions and adopted a set of principles and values based on the Just Transition model. "A racially equitable and just Providence…"

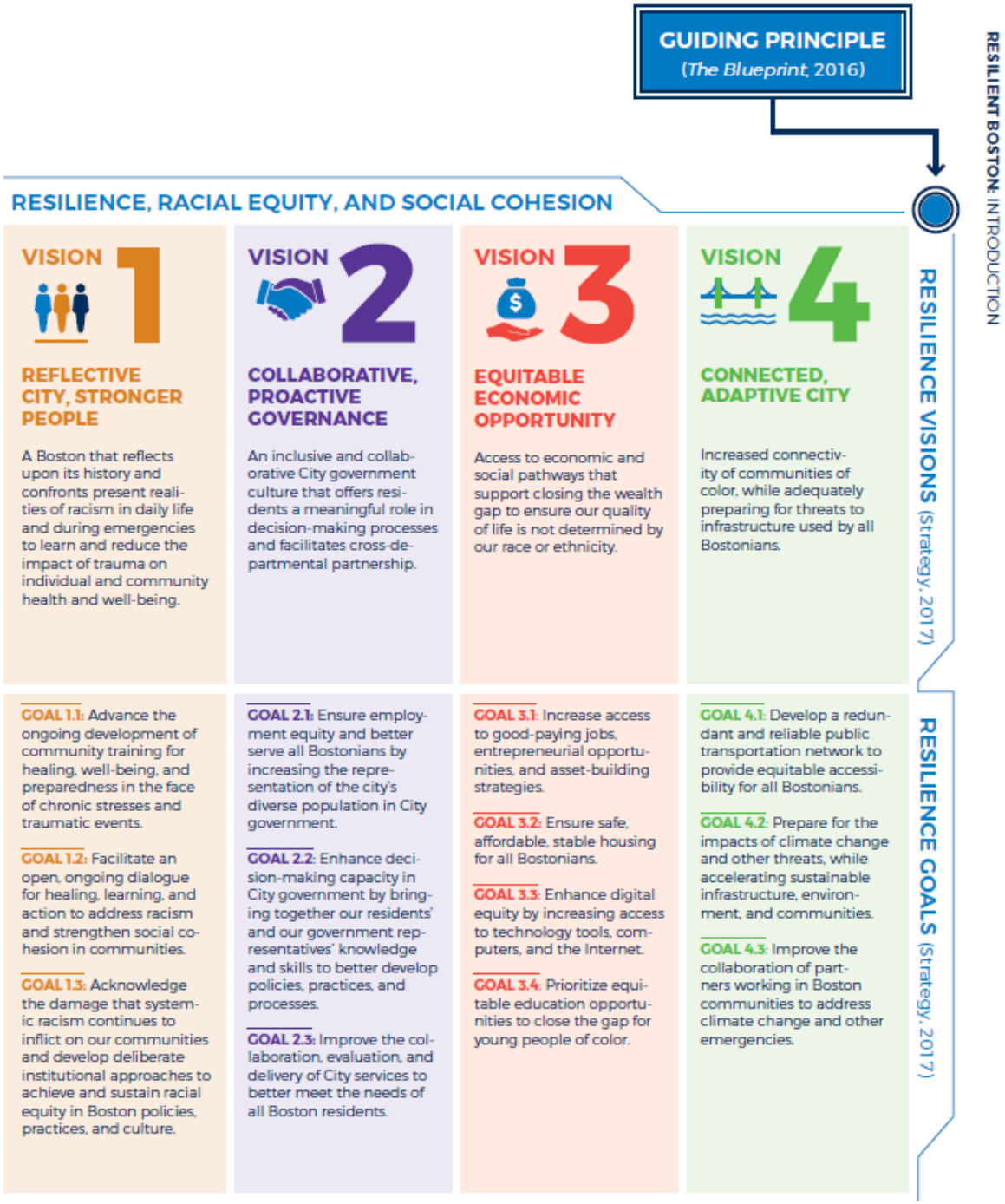
- …moves us toward el Buen Vivir ["living well without living better at the expense of others"]
- …support safe spaces for frontline communities of color
- …knows people are sacred and respects their cultures and traditions
- …upholds self-determination.
- …co-creates and co-leads governance…to ensure equitable access to resources, information and power.
- …values education for our children and youth…as a fundamental right.
- …practices local, regional, national and international solidarity
- …must create meaningful work
- …requires building a sustainable economy now [move towards zero waste, clean and efficient public transport, clean community energy, regional food and water systems, efficient/affordable/durable housing, ecosystem restoration and stewardship]
- ...respects community rights to land, water, and food sovereignty
- …works to end the extractive economy

Providence is currently developing a Climate Justice Plan with the Racial and Environmental Justice Committee that will be guided by the Just Providence framework. [10]

2. Resilient Boston

Boston's resilience plan, supported by the Rockefeller Foundation-funded 100 Resilient Cities program is a companion plan to the city's climate change plan, "Climate-Ready Boston." It focuses on equity issues within the context of resilience, such as economic inequality, climate change and environmental stresses, community trauma, health inequities, aging and inequitable transportation infrastructure, and systemic racism. The plan has four visions: 1) Reflective City, Stronger People; 2) Collaborative, Proactive Governance; 3) Equitable Economic Opportunity; and 4) Connected, Adaptive City. [11]

[10] http://www.providenceri.gov/sustainability/climate-justice-action-plan-providence/
[11] www.boston.gov/sites/default/files/document-file-07-2017/resilient_boston.pdf



3. Cleveland Racial Justice Toolkit

The neighborhood crowd-funding organization ioby (In Our Backyards, Inc.), worked closely with residents and the City on incorporating equity into Cleveland's sustainability and climate action planning. They created a Racial Justice Toolkit (www.ioby.org/justice), which includes videos, examples from other communities, and a publication: "A Racial Justice Guide: Lessons from Cleveland leaders who are breaking barriers, building bridges, and healing communities." The guide describes four models

of localized racial justice projects led by citizens that were supported by fundraising on the ioby neighborhood crowd funding platform:

- Model 1: Make Art Talk Race
  Creation of a mural in a location that separates downtown from a neighborhood that is predominantly African-American and includes dense public housing
- Model 2: Design for Justice
  A one-day charrette-style "Design as Protest" event organized by an architect to identify ways to improve the built environment for local communities, including identifying priority projects.
- Model 3: A Space for Healing
  Renovation of a vacant neighborhood property for local center for holistic health treatments, artist in residence, and community learning space.
- Model 4: Community Media Project
  A five part documentary series on race, racism and multiculturalism.

Other projects mentioned in the publication include community gardens and farms, a youth-led food justice coalition, advocacy group for a bike and pedestrian path, cooperatively-owned solar streetlights in a disinvested neighborhood.

V. TRIPLE BOTTOM LINE COST-BENEFIT ANALYSIS AND SUSTAINABILITY

Sustainable practices and projects are sometimes assumed to be more expensive than traditional, status quo approaches, often because traditional economic models do not capture the full value of the benefits of sustainable growth. These can include "transformative technological advances, preservation of essential natural capital, and the full health benefits of cleaner air and a safer climate, including the containment of pandemic diseases."[12] The 2018 report, *The New Climate Economy*, which has a global focus, has five thematic categories: energy, cities (focused on systems that support livable density), food and land use, water, and industry. In communities like Worcester, much of the infrastructure is nearing (or already beyond) its life span. New investment is renewing buildings, downtown, and neighborhoods in the city. The planning and design for retrofits and new growth is happening now. "We are on the cusp of a new economic era: one where growth is driven by the interaction between rapid technological innovation, sustainable infrastructure investment, and increased resource productivity. This is the only growth story of the 21st century. It will result in efficient, livable cities; low-carbon, smart and resilient infrastructure; and the restoration of degraded lands while protecting valuable forests. We can have growth that is strong, sustainable, balanced, and inclusive."[13]

Triple bottom line cost-benefit analysis (TBL-CBA), incorporating life-cycle cost analysis (LCCA) has been developed to capture the full benefits of sustainable projects and investments.

- "Triple bottom line" is a shorthand phrase for measuring performance across three domains: profit, people and planet.
- "Cost-benefit analysis" is a systematic way of evaluating and comparing potential decisions, policies, or projects to compare benefits with savings.

[12] Global Commission on the Economy and Climate, *2018 New Climate Economy Report*, p. 8,
[13] Ibid.

- "Life-cycle cost analysis" is used to evaluate the most cost-effective alternative that includes costs of all up-front and future investment, operations, maintenance, rehabilitation and replacement, and the residual value of assets at the end of the life cycle.

This type of analysis provides financial results and monetary values for social and environmental impacts that traditionally have been seen as externalities or qualitative benefits, such as improved water quality and restored habitat. A key consideration in TBL-CBA is which factors will be included in the analysis.

TBL-CBA is increasingly used by both the public and private sector, including for federally funded transportation and Army Corps of Engineers projects, state building projects, and municipal building and utility agencies. The LEED and Envision rating systems endorse use of TBL-CBA.

VI. RECENT MUNICIPAL SUSTAINABILITY PLANS

A. BGreen 2020: A Sustainability Plan for Bridgeport, Connecticut (2012)

The BGreen plan was jointly sponsored by the City of Bridgeport and the Bridgeport Regional Business Council. The Executive Summary highlights the economic benefit of going green for Bridgeport, a city with an estimated 2019 population of 147,000 that is challenged by its industrial legacy, pollution from regional transportation and utility systems, high 23 percent poverty rate, and vulnerability to sea level rise. (Worcester's poverty rate in 2017 was estimated at 21.8 percent).

The sustainability plan is explicitly focused on green initiatives as an economic and environmental justice strategy: "Environmental action will provide the economic foundation to grow the city's jobs, tax base, and opportunity while lowering household bills for energy, water, and property taxes." (p. 3) A unique aspect of Bridgeport's sustainability plan is its early use of TBL within a municipal scale plan. Though not as rigorous as the TBL-CBA process discussed above, proposed strategies and initiatives were reviewed through a triple bottom line accounting framework "to assess their overall community impact." (p. 17)

Key strategies of the plan include:

- "An Energy Improvement District in Bridgeport will implement renewable electricity generation projects and develop programs to retrofit municipal buildings, businesses and homes, that reduce the city's greenhouse gas emissions from buildings, lower household and commercial utility bills, and shrink property tax bills by making city operations more energy efficient.
- A focus on transit and complete streets will lower greenhouse gas emissions from transportation and lower households' transportation costs by limiting the need for automobiles.
- A Green Collar Institute will consolidate resources to help businesses improve their bottom line through efficiency, help individuals develop the skills they need to find jobs in the new economy, assist the city in attracting and growing green businesses locally through a Green Business Incubator and a Green Business Cluster, and drive the creation of a green marketplace through purchasing policies.
- Zoning and Geographic Information Systems that encourage green redevelopment will reclaim the city's vacant and contaminated land for taxpaying buildings that will provide local jobs and affordable housing opportunities, and will shrink property tax bills by reducing the burden on existing households to support municipal services.
- Increased recycling and composting will significantly reduce the cost of disposal, create local jobs, save money in the city budget, thereby reducing taxes, and move us away from an industrial process that emphasizes disposable goods.

- A Conservation Commission will implement a parks plan that will bring open space, greenery, and the waterfront within reach of every city resident, and add neighborhood amenities like pocket parks, community gardens and other quality of life measures. And it will also champion the stormwater management issues that take into account the fragile nature of our community.
- A youth Conservation Corps, going door-to-door, will provide information to residents and businesses to help them save money, be stewards of the environment, and help improve the quality of life in our community." (p.14)

Thematic strategy categories

- Green Energy & Buildings
- Greenfields [vacant properties] & Green Wheels [transportation]
- Green Spaces
- Water Resources
- Municipal Solid Waste, Materials Use & Recycling
- Green Businesses, Jobs and Purchasing
- Green Marketing, Education and Outreach

B. The 2019 Baltimore Sustainability Plan

While Baltimore is larger than Worcester (estimated 2018 population of 602,495), it is a city still in transition from its industrial past, has a very diverse population, and a high 22% poverty rate. The city's development patterns include a dense urban core, areas of commercial and residential revitalization, and middle-class single-family neighborhoods similar to older suburban areas on the edges of the city.

The 2019 plan updates the 2009 Sustainability Plan and was developed by the City's Commission on Sustainability and Office of Sustainability. The update was developed over several years, with an extensive community engagement process including recruitment of citizen "Sustainability Ambassadors" who received equity training and conducted interviews with neighbors, friends, and family. Upon adoption, the plan became part of the City's comprehensive plan. The Commission's role is to oversee implementation of the plan through an annual review and report, an annual public open house, and a periodic update at least every three years on strategies, benchmarks, and metrics. In terms of process, the Commission states its commitments to transparency, collaboration, and accountability.

As a member of the USA Sustainable Cities Initiative (USA-SCI), Baltimore is one of three US cities to pilot implementation of United Nations Sustainable Development 2030 goals adopted by the UN in 2015. These goals, function as Baltimore's sustainability vision.

Like many recent plan updates, the 2019 plan explicitly incorporates an "equity lens," expanding on the original focus on core environmental issues to include the social and economic aspects of sustainability and racial equity. The Baltimore plan describes the use of an equity lens in the plan as a way to focus "on the experiences that have been historically harmful to some of our residents," that "broadens the scope of voices represented in the plan, inclusive not only of race but also gender, age, neighborhood, and employment status….The equity lens was used in framing issues and in crafting strategies, actions, and measures of success….Most importantly, it broadened the meaning of sustainability—for a vision that is meaningful for ALL residents in the city." (page 9

The plan framework is organized under five categories that originated in the STAR system (version 1). It also integrates related plans on open space, food, water and recovery, climate action, disaster preparedness, and urban agriculture.

C. L.A.'s Green New Deal Sustainable City pLAn 2019.

The tagline for the 2019 Los Angeles sustainability plan is: "Environment – Economy – Equity." This plan is the first four-year update of the 2015 Sustainable City pLAn. The four key principles of the plan are:

- "A commitment to the Paris Climate Agreement and to act urgently with a scientifically-driven strategy for achieving a zero carbon grid, zero carbon transportation, zero carbon buildings, zero waste, and zero wasted water.
- A responsibility to deliver environmental justice and equity through an inclusive economy, producing results at the community level, guided by communities themselves.
- A duty to ensure that every Angeleno has the ability to join the green economy, creating pipelines to good paying, green jobs and a just transition in a changing work environment.
- A resolve to demonstrate the art of the possible and lead the way, walking the walk and using the City's resources - our people and our budget - to drive change." (page 8)

The plan is intended to guide a "transition to an equitable and abundant economy powered by 100% renewable energy….[to support] the creation of hundreds of thousands of good, green jobs in all of our communities by:

- Building the country's largest, cleanest, and most reliable urban electrical grid to power the next generation of green transportation and clean buildings….
- Educating and training Angelenos to participate in the new green economy….
- Enacting sustainable policies that prioritize economic opportunity. We will mandate and incentivize the transition to a zero carbon city in a way that prioritizes the needs and opportunities of disadvantaged communities, ensuring that the new green economy fulfills the promise of a more just and equitable economy."

Topic areas:

- Environmental Justice
- Renewable Energy
- Local Water
- Clean & Healthy Buildings
- Housing & Development
- Mobility & Public Transit
- Zero Emission Vehicles
- Industrial Emissions & Air Quality Monitoring
- Waster & Resource Recovery
- Food Systems
- Urban Ecosystems & Resilience
- Prosperity & Green Jobs
- Lead by Example

Source: Baltimore 2019 Sustainability Plan, p.1.

What's New

- Globally-recognized adherence to a strict carbon budget that is consistent with the Paris Climate Agreement
- Adoption of a quantitative greenhouse gas (GHG) reduction pathway that charts a course to carbon neutrality
- Integration of equity initiatives across chapters, identified by the symbol E
- Third-party review of GHG reduction pathways and potential benefits of different initiatives to Angelenos
- Quantification of projected health outcomes from air quality improvements and job growth from investments resulting from pLAn commitments
- A Renewable Energy chapter to incorporate 2015 pLAn Local Solar and Climate Leadership commitments
- Expansion of Energy Efficient Buildings to Clean and Healthy Buildings capturing energy efficiency as well as new targets for net zero carbon buildings
- Deeper treatment of Air Quality via a new Industrial Emissions and Air Quality Monitoring chapter, as well as initiatives in Mobility & Public Transit and Zero Emission Vehicles
- First-ever commitments to address oil and gas operations in the city
- Dedicated Food Systems chapter incorporating community priorities
- Urban Ecosystems is expanded to Urban Ecosystems & Resilience to incorporate 2015 pLAn climate resilience goals on urban heat
- Inclusion and promotion of the leadership of our community partners in achieving our shared goals
- Incorporation of homelessness initiatives in recognition of link to sustainability
- Emphasis of link between L.A.'s sustainability targets and the United Nations Sustainable Development Goals

Accelerating our Targets

L.A.'s Green New Deal accelerates the following targets:

- Supply 55% renewable energy by 2025; 80% by 2036; and 100% by 2045
- Source 70% of our water locally by 2035, and capture 150,000 acre ft/yr (AFY) of stormwater by 2035
- Reduce building energy use per sq.ft. for all types of buildings 22% by 2025; 34% by 2035; and 44% by 2050
- Reduce Vehicle Miles Traveled per capita by at least 13% by 2025, 39% by 2035, and 45% by 2050
- Ensure 57% of new housing units are built within 1,500 feet of transit by 2025; and 75% by 2035
- Increase the percentage of zero emission vehicles in the city to 25% by 2025; 80% by 2035; and 100% by 2050
- Create 300,000 green jobs by 2035; and 400,000 by 2050
- Convert all city fleet vehicles to zero emission where technically feasible by 2028
- Reduce municipal GHG emissions 55% by 2025 and 65% by 2035 from 2008 baseline levels, reaching carbon neutral by 2045

D. Sustainable Providence (2014)

Providence, with a diverse population estimated at 179,219 is often viewed as a city comparable to Worcester. It is another former industrial city with a high 26.9% poverty rate, but it has a larger metropolitan area than Worcester. The city's Sustainable Providence Plan from 2014 is supported by a broader SustainPVD program and the separate sustainable equity framework, "Just Providence," adopted in 2017 and described earlier. The thematic focus areas of the plan are:

- Waste
- Food
- Transportation
- Water
- Energy
- Land Use and Development Plan

The City's Office of Sustainability includes a web portal with a dashboard showing progress toward plan goals, as well as additional pages focusing on energy initiatives, climate change, equity, and actions that individuals can take. (http://www.providenceri.gov/sustainability/)

Office of Sustainability

The Office of Sustainability works to provide a better quality of life for all residents while maintaining nature's ability to function over time by minimizing waste, preventing pollution, promoting efficiency and developing local resources to revitalize the local economy. This office is also tasked with reducing energy consumption in city-owned facilities, to cost-effectively lower utility operating costs, and to ensure occupant comfort and safety in city facilities.

Take Action | Sustainability Dashboard | Equity

RePowerPVD | Climate Justice PVD | Newsletter

E. Cleveland Climate Action Plan 2018 Update: Building Thriving and Resilient Neighborhoods for All

Cleveland, with an estimated 2018 population of 390,000, has a very high poverty rate of 34.5 percent, with almost half of its children living in poverty. Its 2018 Climate Action Plan updates a 2013 plan. Cleveland began a sustainability program in 2009 and in 2019 it is celebrating ten years of sustainability work and 50 years since the city's Cuyahoga River caught fire in 1969—an event that attracted national attention to the need to fight pollution. The Mayor's Office of Sustainability manages planning and implementation. Funders for the 2018 update included the Funders' Network for Smart Growth, Livable Communities-Partners for Places grant; George Gund Foundation; Cleveland Foundation. In addition to the climate action plan update, sustainability activities, and a progress dashboard that can be found on the program website (www.sustainablecleveland.org), the City has a "Sustainable Cleveland Municipal Action Plan" (2013) for municipal operations.

Cleveland has been a STAR certified community since 2014 and it is a member of the Global Covenant of Mayors for Climate and Energy (www.globalcovenantofmayors.org), an organization of over 9,000 cities and local governments across 132 countries and 6 continents, representing 800 million people committed to creating climate change resilient and low-emissions communities. As part of this coalition, Cleveland tracks and publishes progress in emissions reduction through the Carbon Disclosure Project (CDP), a nonprofit that provides a global system of environmental impact measurement and disclosure for cities, states, regions, companies, and investors. (www.cdp.net)

Like the Bridgeport plan, the Sustainable Cleveland initiative is focused on sustainable economic development and highlights how business and government can work together to bring green jobs to the city. The plan includes an appendix with a Green Jobs/Workforce Development Analysis. (p. 10) It also has a strong equity focus:

> "Equity serves as the main thread that ties this plan together. One of the advantages of organizing around climate action is that strategies to reduce GHGs and adapt to climate change create many other quality of life benefits. For example, investing in cleaner transportation options also improves air quality and creates safer, more walkable streets, thereby increasing the health and well-being of residents. Prioritizing actions within communities of color and low-income neighborhoods will have a greater impact because they have traditionally been impacted disproportionately by pollution sources and development patterns that both contribute to climate change." (p. 9)

ioby (In Our Backyard, Inc.)
This nonprofit helps city residents improve their communities through a crowd funding platform for neighborhood projects. They have offices in Cleveland, Detroit, Memphis, New York and Pittsburgh but work with communities around the country. They provide coaching on fundraising and have helped over 2,000 projects and trained over 20,000 leaders. The median donation for projects is $35 and donors' gifts a tax deductible.
In addition to the Racial Justice Guide discussed earlier, ioby has guides on a variety of topics such as traffic calming, green infrastructure, fund raising for local projects, winter community projects, etc. www.ioby.org/resources/freeguides

Cleveland Climate Action Fund (CCAF)
Founded in 2008, the Cleveland Climate Action Fund (formerly known as the Cleveland Carbon Fund) was the first community-based, open-access carbon reduction fund in the United States. It funds local projects that reduce emissions while increasing resilience and contributing to the local economy, social well-being, and environmental stewardship. In ten years, over $100,000 has funded local projects. The Fund is part of the Cleveland Foundation, making donations tax-deductible. (www.clevelandclimateaction.org)

Cleveland encourages citizen-initiated and citizen-led projects and works with ioby (In Our Backyards, Inc.), a nonprofit crowd-funding platform, and the Cleveland Climate Action Fund, a nonprofit that funds local carbon mitigation projects.

The 2019 Climate Action Plan update has five thematic focus areas (shown on this page) and a category of "cross-cutting priorities." These are priorities that relate to all the focus areas:

- Social & Racial Equity
- Good Jobs, Green Jobs
- Climate Resilience
- Business Leadership

The Sustainable Cleveland Municipal Action Plan (SC-MAP) contains goals and actions for municipal operations in the categories of:

- Design, Construction and Maintenance
- Energy
- Transportation
- Water
- Materials Management and Purchasing

The SC-MAP also includes an estimated cost-benefit analysis which focuses on estimated savings to the city and emission reductions, but does not included a broader triple bottom line or life cycle analysis.

D. Worcester Green Projects Inventory (2020)

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
ENERGY						
Energy Efficiency and Renewable Energy	Energy Task Force	Greenhouse Gas Emissions Inventory	Community-wide greenhouse gas inventory.	2004	**Y**	http://www.worcesterenergy.org/uploads/47/27/472786b8f49ef214aecd6bb94bf4d7dd/cap-final-report_2007.pdf
Energy Efficiency and Renewable Energy	Energy Task Force	Climate Action Plan	Greenhouse gas emissions reduction plan.	2006-2007.		http://www.worcesterenergy.org/uploads/47/27/472786b8f49ef214aecd6bb94bf4d7dd/cap-final-
Energy Efficiency and Renewable Energy	City Energy and Asset Management Division	Creation of EAM	Creation of the Energy and Asset Management Division	2013		
Energy Efficiency and Renewable Energy	City Energy and Asset Management Division	Small Business Sustainability Pilot	25 detailed small business energy assessments with partners and federal funding. Six months after delivery of these assessment reports, only a small percentage of projects had actually been implemented. Lack of capital and time to invest in energy efficiency were cited as two of the principle barriers to project implementation.	2012		Small Business Energy/Sustainability Assessment Pilot Project Final Report, GDS for City of Worcester
Energy Efficiency and Renewable Energy	City Energy and Asset Management Division	Municipal Energy Efficiency and Renewable Energy Program	Multi-year, multi-million dollar energy efficiency and renewable energy project for municipal facilities. This endeavor was a significant step toward modernizing municipal facilities and achieving long term energy and cost savings, $100+million in investments and $164 million in savings and other benefits expected.	Established 2007		Mass Energy Insight data: www.massenergyinsight.net
	City Energy and Asset Management Division	Energy Savings Performance Contract	Agreement with Honeywell International to be the City's Energy Services Company (ESCO); energy audit followed by implementation of energy conservation and renewable energy projects. Implemented $26.6 million energy savings performance contract with energy conservation and renewable energy measures for 92 municipal facilities, 2011-2015.	2009 and renewal		
Energy Efficiency and Renewable Energy	City Energy and Asset Management Division	Purchase of Renewable Energy Certificates.	Purchase of renewable energy certificates to reduce the carbon footprint of municipal operations.	2009 and ongoing (renewal)		
Energy Efficiency and Renewable Energy	City Council adoption	Stretch Code	City of Worcester adoption 2010. In 2009, Massachusetts became the first state to adopt an above-code appendix to the "base" building energy code- the "Stretch Code" (780 CMR Appendix 115.AA). The Stretch Code, which emphasizes energy performance, as opposed to prescriptive requirements, is designed to result in cost-effective construction that is more energy efficient than that built to the "base" energy code.	Adopted 2010; Effective 2011		
Recognitions/Designations/Awards	City Energy and Asset Management Division	Green Community Designation	Worcester was designated a Green Community by the Massachusetts DOER's Green Communities Program in 2010 and has been reporting every year on its designation and commitments annual ever since. The commitment has been to reduce municipal energy use by 20% from the baseline, to purchase energy efficient vehicles, and more. Received Green Community grants in 2010, 2016, 2019.	2010 onward		
Recognitions/Designations/Awards	City Energy and Asset Management Division	EPA Green Power Partnership	The City joined the EPA Green Power Partnership and was designated a Green Power Partner because of its commitment to purchase electricity above the program's minimum 20% requirement	2012		
Energy Efficiency and Renewable Energy	City Energy and Asset Management Division	Residential Rebate Pilot	Financial incentives to homeowners to encourage energy efficiency improvements: 167 projects including 207 dwelling units for 1-4 family homes.	2014		

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Renewable Energy	City Energy and Asset Management Division	Municipal Solar Farm	City of Worcester constructed the then-largest municipal solar array in New England (8.1 MW-DC and 28,600 solar panels) on 25 acres atop the capped Greenwood Street landfill. Anticipated 6-year payback on the investment. Array's life expectancy is 30+ years	Completed in 2017.	Solar electricity is measured by PowerDash Inc. and is reported in order to claim Solar Renewable Energy Certificates.	Green Community Designation Annual Report
Energy Efficiency	City Energy and Asset Management Division	Municipal Street Lights Retrofit to LEDs	13,419 municipal street light converted to LEDs, with expected savings of ~$910,000 and over 6,000,000 kW a year in electricity – a reduction of 60%.	Completed in 2017	Software is used to measure electrical consumption of every street light.	Green Community Designation Annual Report. Measurement and Verification Report (part of Energy Savings Performance Contract).
Renewable Energy Projects' Support / Cost Savings	City Energy and Asset Management Division	Municipal Net Metering Contract	Executed Three Net Metering Contracts with Nexamp subsidiaries, which will save the City nearly $ 710,000 per year in electricity costs. This also supported a solar farm construction in the state of Massachusetts.	Completed in 2014 and 2016		
Renewable Energy / Cost Savings	City Energy and Asset Management Division	Community Choice Electricity Aggregation Program	On June 20, 2017, the City Council authorized the commencement of Worcester Community Choice Aggregation with the goals of cost stability, modest reductions in electrical costs, providing an option for green electricity for customers, and providing modest additional funding for municipal sustainability staff and programs.	Effective 2020	Y	Program reports
Education / Communication	City Energy and Asset Management Division	WorcesterEnergy website	www.WorcesterEnergy.org website to communicate City efforts related to energy efficiency, conservation and sustainability.	ongoing		
Energy Efficiency	Division of Planning and Regulatory Services	Worcester Energy - Pilot Rebate Program	$631,364 (74% of a total $852K state Green Communities Grant was expended in rebates of up to $5,000 per dwelling unit for homeowners of 1-4 unit properties who wanted to undertake energy efficiency and renewable energy improvements to their properties; a higher incentive formula was applied to income-eligible applicants.	2012-2014	Y	Program report: 207 dwelling units (167 buildings) participated in the program
Energy Efficiency	DPW&P - Reservoir Division	Facility lighting retrofit	Retrofit high efficiency LED lighting in water pumping stations and facilities			Facility Operations
Renewable Energy	DPW&P - Water Filtration Plant	Rooftop Solar Array	Install 60 kw rooftop array at the filtration plant.	2011	Y	Facility Operations
Renewable Energy	DPW&P - Water Filtration Plant	Ground Solar Array	Install 60 kw ground solar array on the grounds of the Filtration Plant property.	2013	Y	Metering/Billing
Energy Efficiency	DPW&P - Water Filtration Plant	LED Lighting Upgrade	Upgrade interior and exterior lighting to LED to increase efficiency and reduce electricity costs.	2017-2020 (ongoing)		
Energy Efficiency	DPW&P - Water Filtration Plant	Filter Air Scour System Upgrade	Upgrade the plant's filter air scour system to a more efficient system resulting in reduced air scour run times and reduced energy costs.	2014-2016	Y	Facility Operations
Energy Efficiency/ reduced waste water	DPW&P - Water Filtration Plant	Filter Media Adjustment	Through increasing the size of the filter media (anthracite) from 1.1 mm to 1.5 mm the plant was able to reduce waste water and electricity costs through increasing filter run times.	2010-2016	Y	Facility Operations
Energy Efficiency	DPW&P - Water Filtration Plant	Pump Upgrade	Upgrade domestic water pumps with variable drive pumps to increase efficiency and reduce electrical costs.	2019		Facility Operations

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Energy Efficiency	DPW&P - Water Filtration Plant	Ozone System Upgrade Project	Replace the existing inefficient first generation ozone generators producing 2% ozone with new high efficiency plate style generators that produce 15%+ ozone. Estimated annual savings of 1,766,00 kw of electricity translating to a savings of $162,600.00 annually.	2018-2019		Facility Operations
Energy Efficiency	DPW&P-Parks	LED Lighting Upgrade	Lighting throughout city park properties and facilities have been or will be converted to LED as an efficiency measure.	ongoing		Facility Operations
Regulation	Division of Planning and Regulatory Services	Wind Energy Ordinance	Large Wind Energy Conversion Facilities Ordinance allows wind energy turbines by special permit; amended 2010 to allow small scale turbines	2007; amended 2010		
GREEN AND BLUE SPACES - NATURAL SYSTEMS						
Open Space and Recreation	Division of Planning & Regulatory Services and DPW-Parks	Open Space and Recreation Plan	City Office of Planning and Community Development updates the Open Space and Recreation Plan every 7years.	latest update expected 2021	Y	OSRP update will include data on implementation of previous goals and other relevant data.
Open Space and Recreation	City	Perkins Farm acquisition - conservation land swap	Established major precedent setting conservation land swap resulting in 10:1 net gain of conservation land at Perkins Farm.	1990s		
Open Space and Recreation	City and nonprofit groups	Perkins Farm management plan	Completed passive recreation management plan at Perkins Farm which will serve as model for management plans for other city conservation areas. This was a team effort between City of Worcester and several conservation groups - Lake Quinsigamond Watershed Association, Lake Quinsigamond Commission, Grafton Hill Neighborhood Association, Mass Audubon.	1990s		
Open Space and Recreation	City and nonprofit groups	Walking trails and bike paths	With major involvement from the Regional Environmental Council as well as several other conservation groups, the City launched trail and bike path initiatives.	1990s		
Open Space and Recreation	DPW&P - Engineering	Crow Hill Project (45 Clarendon St) - acquisition and remediation.	A 15-acre open space parcel; remediation of 4.5 acres with engineered soil cap; use for passive recreation.	2018-2019	Y	DEP Compliance Reporting
Open Space and Recreation	DPW&P - Reservoir Division	Bald Eagle Monitoring/Banding	Monitor nesting pair of Bald Eagles at Pine Hill Reservoir and collaborate with Massachusetts Fish and Wildlife in their annual chick banding program for a long term population study.	ongoing		
Open Space and Recreation	DPW&P - Reservoir Division	Black Bear Population Study	Collaborate with Massachusetts Fish and Wildlife on a long-term black bear population study on reservoir lands including radio collar tracking, trapping and tagging.	ongoing		
Open Space and Recreation	DPW&P - Reservoir Division	Loon Monitoring/Banding	Monitor nesting pair of Loons at Pine Hill Reservoir and collaborate with Massachusetts Fish and Wildlife on banding and annual deployment of loon raft.	ongoing		
Open Space and Recreation	DPW&P - Reservoir Division	Grassland Habitat	Manage approximately 80 acres of grassland habitat including enhancements to promote pollinators.	ongoing		
Open Space and Recreation	DPW&P - Reservoir Division	Song Bird Population Study	Collaborate with the State Ornithologist on their long-term population study on Reservoir Division lands.	ongoing		
Open Space and Recreation	DPW - Reservoir Division	Osprey Platform	Construction of Osprey platform on Quinapoxet Reservoir in collaboration with Massachusetts Fish and Wildlife.	2015		
Open Space and Recreation	DPW&P - Reservoir Division/Worcester Public Schools	Wood Duck Box Project	Construct and install Wood Duck boxes in beneficial habitat areas in collaboration with Mass Fish and Wildlife and the Worcester Technical High School Carpentry and Environmental programs.	2016		

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Open Space and Recreation	DPW&P - Lakes and Ponds	Aquatic Invasive Plant Monitoring and Management Program	Created and implemented custom weed management programs that use a variety of methods, including lake drawdown, mechanical harvesting, and herbicide treatments to reduce the detrimental effects that invasive aquatic plants have on local ecology and recreational use of surface waters.	Since 2016	Yes, # of acres treated	Annual Lakes and Ponds Reports
Open Space and Recreation	DPW&P - Lakes and Ponds	Cyanobacteria Bloom Prevention and Mitigation Program	Preventive treatment and response application of algaecides in lakes with increased likelihoods of cyanobacteria blooms to increase public safety and detriment to ecosystems. Applications determined by the results from the cyanobacteria and water quality monitoring programs.	Since 2017	Yes, treatments performed	Annual Lakes and Ponds Reports
Open Space and Recreation	DPW&P - Reservoir Division/Worcester Public Schools	Kestrel Box Project	Construct and install Kestrel boxes in beneficial habitat areas in collaboration with Mass Fish and Wildlife and the Worcester Technical High School Carpentry and Environmental programs.	2017		
Open Space and Recreation	DPW&P/ED	Park Improvements	Blackstone Gateway Park & Institute Park (boardwalks/pedestrian bridges)			
Open Space and Recreation	DPW-Parks	Mowing Practices	Altered mowing practices in City parks to increase the acreage of natural habitat and decrease treatment.	Ongoing		
Open Space and Recreation	DPW-Parks	Urban Forestry	Through the forestry division of the parks department there are approximately 150-250 trees planted each year throughout the city.	Ongoing		
Open Space and Recreation	DPW-Parks	Invasive plant control	Various locations within park land are treated regularly to remove and control the spread of invasive plant species.	Ongoing		
Open Space and Recreation	DPW-Parks	Land Management Program	The department manages 1,400 acres of city parkland consisting of recreation areas, fields and forest throughout the city.	Ongoing		
Open Space and Recreation	DPW&P - Reservoir Division	Land Management & Forestry Program	Active management of approximately 8,000 acres of land within the drinking water reservoir system watersheds in a holistic approach to maintain and improve drinking water quality. Management includes a comprehensive forest management program, management of invasive species, and habitat management providing subsequent positive impacts to wildlife habitat and biodiversity. Proper management provides a healthy ecosystem to maximize the filtration capacity of the forests and reduce pollutants, organics, and nutrient loading into the reservoirs.	ongoing	Y	Department reporting and files
Open Space and Recreation	DPW&P - Reservoir Division	Water Quality Land Acquisition Program	Acquire land within the drinking water reservoirs watersheds for watershed protection purposes. This program has protected 1,240 acres of land since 2005.	2005 and ongoing	Y	Department reporting and files
Urban Forestry	DPW-Parks	Worcester Tree Initiative	The Worcester Tree Initiative (WTI) was established as a partnership of the City, the state Department of Conservation and Recreation, the US Department of Agriculture and nonprofit organizations to respond to the Asian Long-Horned Beetle (ALB) infestation (discovered 2008) and loss of trees in northern neighborhoods in Worcester and in adjacent towns. Since 2009, approximately 30,000 trees have been planted, focusing in the area affected by the ALB infestation, replacing the Norway maple monoculture with more diversity of species. Currently, the WTI is a partnership of the Department of Public Works and Parks and Tower Hill Botanical Garden, which continues tree planting in the city. WTI now includes a forestry program for young adults to maintain newly planted trees and is expanding its activities to plant more trees in the urban core of Worcester.	2009 and ongoing	Y	WTI reporting
Urban Forestry - Regulations	DPW-Parks	Protection of Public Shade Tress	Ordinance requiring all public tree planting, maintenance and removal of public shade trees to be approved by tree warden.	2008 and ongoing		

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Urban Forestry	DPW-Parks	Private Property Tree Adoption	When streets and sidewalks are too narrow for street tree planting, the City will provide trees for planting on private property adjacent to the sidewalk and teach the owners how to maintain them. After three years, the tree belongs to the private property owner.	ongoing		
Urban Forestry	DPW-Parks	Tree Donation Program	The City accepts donations of trees for public spaces. At a cost of about $500 the City will buy and plant the tree with a donation plaque. Typically, 5 or 6 trees are donated annually.	ongoing		
Urban Forestry	DPW-Parks	Right Tree, Right Place Program	The City selects trees that fit their intended purpose taking into account the growing space in the proposed location.	ongoing		
Regulations	Division of Planning and Regulatory Services	Regulatory protections	Wetlands Protection Ordinance	1990 and amended, 2007, 2016, 2019		
BUILDINGS: ENERGY-EFFICIENT AND RENEWABLE ENERGY						
Energy Efficiency and Renewable Energy	City Energy and Asset Management Division	School renewable energy	Solar installations on 14 schools.	2011 - 2016		Mass Energy Insight data
Energy Efficiency and Renewable Energy	City Energy and Asset Management Division	School white roof projects	Solar installations on 6 schools accompanied by white roof coating to reduce maintenance costs, improve solar productivity, and reduce cooling loads for facilities.	2015-2016		Mass Energy Insight data
Energy Efficiency and Renewable Energy	City Energy and Asset Management Division	Energy Audit	Energy audit of municipal facilities.	2009-2011		Mass Energy Insight data
Energy Efficiency	City Energy and Asset Management Division	Lighting Retrofits to LED	4 municipal parking garages; most city buildings; municipal parking lots and parks	Completed in 2017		Mass Energy Insight data
Energy Efficiency	City Energy and Asset Management Division	Claremont/Woodland Academy School Lighting Retrofit Project	Replacement of approximately 2,300 interior CFL lights with high-efficiency intelligent LED (light-emitting diode) lights, saving up to 40% in electricity costs.	Completed in September 2018		Mass Energy Insight data
Energy Efficiency	DPW&P - Engineering	New Building Construction or Major Renovation	Nelson Place Elementary School: first LEED for Schools v. 4 Certified in Mass; certified at Silver level. Mass Dept of Energy staff suggested that, based on energy modeling of the design, it would be the most efficient public building built to date (2017) in Massachusetts in MA.	Completed in September 2017		Mass Energy Insight data; Mass Department of Energy.
Energy Efficiency	City Energy and Asset Management Division		Promotion of residential energy audits and conservation projects through Mass Save.			Mass Save
Energy Efficiency	City Energy and Asset Management Division		Advocacy for stricter energy code standards.			
Energy Efficiency	City Energy and Asset Management Division		Doherty High School design modified to make the 420,000 sf building "not just carbon neutral but carbon negative"	Design 2020-2021; construction completion expected 2024		
SUSTAINABLE TRANSPORTATION CHOICES						
Transportation Planning	Division of Planning and Regulatory Services	Complete Streets	Policy to encourage appropriate design and use of public streets for all users; Policy in place, Transportation advisory group created to assist in implementation.	Ongoing		
Transportation Planning	Division of Planning and Regulatory Services	Complete Streets	Transportation Advisory Committee established 2019.	Ongoing		

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Transportation Planning	Division of Planning and Regulatory Services	Integration of Transportation into Planning Department	Senior Transportation Planner position opened in early 2019;			
Alternative Transpiration	City	Bike Share	Dockless bike sharing program, 2017-2018. The City is seeking a new provider.			
Electric Vehicles	City Energy and Asset Management Division	Electric Vehicle Charging	Public and semi-public EV charging stations in Worcester include City Hall, Union Station and Major Taylor Boulevard parking garages. The City is pursuing installation of additional EV chargers on four municipal properties with incentives from National Grid.	Ongoing	Y - # of current chargers installed plus # planned/ dates of expected installation	City reporting
WATER MANAGEMENT						
Planning	DPW&P	Integrated Water Resources Management Plan	Comprehensive plan to identify and prioritize investments in the water, wastewater and stormwater infrastructure for the next 50 years. Specific goals are: Protect public health and safety; Safeguard recreational waters; Improve drainage and reduce flooding; Maintain affordable water and sewer rates; Enhance wastewater treatment.	2018-2019		
Water Quality/ Stormwater	DPW&P	Stormwater Management Plan	Activities include cleaning of the City's 18,000 catch basins at least once every two years to reduce pollution; Outfall Screening Program, every three years for E. coli screening; Street Sweeping Program; Catch Basin Stenciling Program; Illicit Sewer Connection Program; Culvert and Brook Inlet Inspection and Maintenance Program; Dog Waste Program; and Fertilizer Use Reduction at Green Hill Golf Course. Stormwater management activities are included in the sewer enterprise annual maintenance budget and typically account for 60% of that budget.	updated 2015		Annual Stormwater Report
Water Conservation/Resiliency	DPW&P- Reservoir Division	Transfer Main Rehabilitation	Rehabilitation of the 1930s 36" steel Quinapoxet Reservoir transfer main to reduce water loss and provide a more resilient and reliable system.	2020		
Water Supply Protection	DPW&P- Reservoir Division	Kendall Reservoir Risk Mitigation Project	Install drainage infrastructure and underground containment units to protect the quality of the City drinking water supply through removal of TSS and providing containment for a potential release of hazardous materials.	2018-2019		
Water Supply Protection	DPW&P- Reservoir Division	Emergency Spill Response Program	Outfitted an emergency spill response trailer and implemented a spill response program including annual training to respond to and prevent environmental impacts to the drinking water supply	ongoing		
Water Supply Protection/Flood Management/ Resiliency	DPW&P- Reservoir Division/Engineering Division	Dam Management Program	The program provides inspection, maintenance, and repair of City controlled dams throughout the City and the reservoir system.	ongoing		
Water Quality/Stormwater	DPW&P - Sewer Operations	Catch Basin Maintenance Program	Clean the 18,000 City catch basins at a minimum of once every two years to reduce total suspended solids, nutrient loading and trash from entering surface water bodies.	ongoing	Y	Annual Stormwater Report
Water Quality/Stormwater	DPW&P - Sewer Operations	Bell Pond Beach Improvement Project - Green Infrastructure (GI)	Install permeable concrete and other drainage features to reduce erosion and sedimentation to Bell Pond.	2012		
Water Quality/Stormwater	DPW&P - Sewer Operations	Outfall Screening Program	Wet weather and dry weather screening of the outfalls in the city are conducted on a three year rotating basis for E-coli. This monitoring provides key information on the quality of water passing through the City stormwater system and greatly aids in tracking illicit sewer connections that ultimately impact surface waters in the city.	ongoing	Y	Annual Stormwater Report

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Water Quality Monitoring	DPW&P - Lakes and Ponds with volunteers	Worcester Cyanobacteria Monitoring Collaborative Citizen Science Group	Local volunteer-led sampling and analysis of water from 8 Worcester lakes for cyanobacteria and other planktonic life. Volunteers are trained in sample collection and microscopy, and learn how to identify aquatic organisms and their significance in the ecosystem. Data helps to make predictions about algae blooms and ecosystem functioning on a local scale, and contributes to a larger EPA study to examine temporal and spatial dynamics of cyanobacteria.	Since 2017	Yes, # of volunteers trained, lakes assessed, and observations of cyanobacteria made.	inaturalist.org CyanoScope Project, Worcester Cyanobacteria Monitoring Program Monthly Reports; Annual State of the Lakes Reports
Water Quality Monitoring	DPW&P - Lakes and Ponds	Cyanobacteria Density Monitoring	Professional contracted collection and enumeration of cyanobacteria in recreational waters suspected to be at risk for cyanobacteria blooms for use in determining management strategies.	Since 2017	Yes, # of samples collected	no, unless there is an exceedance
Water Quality Monitoring	DPW&P - Lakes and Ponds	Lakes and Ponds Water Quality Monitoring Program	Collection and analysis of major water quality indicators in lakes and their tributaries and outlets, twice monthly at four recreational water bodies.	Since 2017	Yes	Annual State of the Lakes Reports
Water Quality/Stormwater	DPW&P - Sewer Operations	Northeast Cutoff Rain Garden Project (GI)	Install rain garden along Northeast Cutoff to treat approximately 5,000 SF of paved surface.	2016		
Water Quality/Stormwater	DPW&P - Sewer Operations	Clason Beach Project (GI)	Install permeable concrete pavers along the perimeter of the parking lot area to increase infiltration and reduce runoff. This project was initiated to reduce erosion and subsequent deposition of TSS and nutrients to Coes Reservoir.	2015		
Water Quality/Stormwater	DPW&P - Street Division	Leaf Collection Program	Approximately 54,000 cubic yards (10,000 tons) of leaves are collected through this program ultimately removing these nutrients and organics from entering the city stormwater system which would ultimately impact the surface waters in the city.	ongoing	Y	Annual Stormwater Report
Water Quality/ Stormwater	DPW&P - Street Division	Street Sweeping Program	Over the course of a year DPW&P sweeps 10,000 miles of curb collecting approximately 72,000 cubic yards of material preventing it from entering the drainage system and impacting surface waters of the city.	ongoing	Y	Annual Stormwater Report
Water Quality/Stormwater	Division of Planning and Regulatory Services	Wetlands Protection Ordinance & Regulations - Stormwater Protection Zone	Innovative regulations around stormwater management; requiring permitting by the Conservation Commission for construction activities located within 100' of surface system storm drain inlet (assuming meets certain slope and size thresholds).	Ongoing	N	
Floodplain Management	Division of Planning and Regulatory Services/ISD	FEMA Community Rating System	Participate in elective program committed to exceeding national minimum floodplain management standard. Provide education to real-estate brokers, residents, and professional about relevant flood plain information.	Ongoing	Y	# inquiries re: floodplain properties (data is incomplete)
Water Conservation/Resiliency	DPW&P - Water Operations	Leak Detection Program	The entire drinking water distribution system in the city is surveyed for leaks on an annual basis. Leak repair minimizes water waste/water loss and improves system performance.	Ongoing/Annually	Y	Department reporting and DEP regulatory reporting
Water Conservation	DPW&P - Water Operations	Water Conservation Program	Providing or promoting the use of low flow fixtures to residential customers with the goal of reducing baseline water consumption. In addition, free toilet leak detection kits are made available to residents.	Ongoing	Y	Department records
Water Conservation	DPW&P - Water Operations	Rain Barrel Program	Rain barrels are offered at a discount to residents through the manufacturer on an annual basis. Approximately 1,000 rain barrels have been purchased by residents through the program to date.	2007 ongoing annually	Y	Department records
Water Conservation/Resiliency	DPW&P - Water Operations	Water Main Rehabilitation Program	Systematic rehabilitation or replacement of water main throughout the distribution system. This effort reduces water loss and improves resiliency of the system.	ongoing	Y	Department reporting and records

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Water Quality/Public Health	DPW&P - Water Operations	Distribution Sampling Program	Through both regulatory and non-regulatory distribution sampling the quality of the city drinking water supply can be monitored and maintained.	ongoing/weekly, monthly & annually	Y	Various regulatory reporting, Consumer Confidence Report, Department records
Water Quality/Public Health	DPW&P - Water Operations	Water Quality Investigation	Reports of potential water quality problems from either the public or staff are investigated and acted upon if warranted.	Ongoing	Y	Department records
Water Quality/Public Health	DPW&P - Water Operations/Sewer Operations/ Reservoir Division/Water Filtration Plant/lakes & Ponds/Environmental	Public Education Program	DPW&P has an extensive public education program covering drinking water, water conservation, wastewater, stormwater, recreational waters, land use, recycling & waste collection and many other related issues and services. Activities include classroom education throughout the Worcester Public School system and universities, tables at various events throughout the city, presentations to various groups, tours of facilities, social media posts, videos, programming on public access television and mailings.	ongoing		Department records
Water Quality	DPW&P - Sewer Operations	Tree Box Filters	A total of 26 tree box filters have been installed in various locations in the city. These filters remove total suspended solids (TSS) and phosphorus from stormwater prior to discharge to surface waters in the city.		Y	Annual Stormwater Report
Wastewater /Water Quality/ Cost Savings	DPW&P - Sewer Engineering/Operations	Inflow & Infiltration Reduction Program	Identification and reduction of the inflow and infiltration of groundwater and surface water into the sewage disposal system through system rehabilitation, lining, and other projects reclaims system capacity and operating efficiency to reduce system overflows that may have negative impacts to the environment. In addition, resolving I/I issues reduces overall treatment costs and improves treatment capacity at the treatment facility.	ongoing	Y	Various system reports and studies on file at DPW&P
Water Quality	DPW&P - Sewer Operations	Hydrodynamic Separators	A total of 33 hydrodynamic separators have been installed and are maintained the sewer operations. These units remove TSS from stormwater prior to discharge to surface waters in the city.		Y	Annual Stormwater Report
Water Quality	DPW&P - Sewer Operations	Bio-Filtration Units	Two FocalPoint biofiltration units have been installed at key locations in the Indian Lake watershed. These units filter TSS and nutrients (phosphorus) from stormwater prior to discharge to surface waters in the city.		Y	Annual Stormwater Report
Water Quality	DPW&P - Sewer Operations	Catch Basin Stenciling Program	Catch Basins in sensitive areas are stenciled to indicate no dumping as the discharge goes to surface water.	ongoing	Y	Annual Stormwater Report
Water Quality	DPW&P - Sewer Operations	Illicit Sewer Connection Program	Manholes and surface drain pipes are inspected to locate and eliminate illicit sanitary sewage connections from the surface storm drain system.	ongoing	Y	Annual Stormwater Report
Flooding/ Water Quality	DPW&P - Sewer Operations	Culvert & Brook Inlet Inspection & Maintenance Program	Continuously inspect and maintain 60 culverts and brook inlet locations throughout the city to remove debris and prevent flooding situations.	ongoing	Y	Annual Stormwater Report
Water Quality/Public Health	DPW&P - Sewer Operations	Dog Waste Program	The dog waste ordinance and education program was initiated to reduce dog waste from entering in the surface stormwater system. This reduces bacteria and nutrients being discharged to surface waters.	ongoing	Y	Annual Stormwater Report
Water Quality/Public Health	DPW&P - Green Hill Golf Course	Fertilizer Use Reduction	Green Hill Golf Course implemented a reduction in phosphorus containing fertilizer. A majority of fertilizer in use is zero phosphorus fertilizer which greatly reduces the phosphorus in runoff entering surface waters of the city.	ongoing	Y	Annual Stormwater Report
Water Quality	DPW&P - Sewer Operations/ Engineering	Policy prohibiting drainage in unpaved streets	The policy prohibits installation of catch basins in unpaved private streets. This prevents TSS from entering the storm drain system and ultimately being discharged to surface waters.	1993	Y	Annual Stormwater Report

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Water Quality	DPW&P - Engineering	Private Street Conversion Program	Through the Private Street Conversion process, private streets are made public and improved through installation of drainage and paving. This greatly reduces silt laden runoff to surface waters of the city.	ongoing	Y	Annual Stormwater Report
Water Quality	DPW&P - Sewer Operations	FOG (Fats, Oils, Grease) Program	Inspection of grease traps (primarily in restaurants and food service establishments) to ensure they are properly cleaned and maintained. Fats, oils and grease entering the sanitary sewer system is a leading cause of blockages and eventual sewer overflows that potentially impact surface waters and public health.	ongoing	Y	Annual Stormwater Report
Water Quality	DPW&P-Parks	Institute Park Improvements	Two Vortechnic water quality devices installed for the removal of TSS and floatables from stormwater entering Salisbury Pond	2008		
Water Quality	DPW&P-Parks	Institute Park Improvements	Three additional Vortechnic water quality devices to be installed throughout the park and sediment forebay at Salisbury pond to further improve water quality through the removal of TSS and floatables from stormwater.	2020		
Water Quality/ Conservation	DPW&P-Parks	Elm Park - Elm Park Pond Improvements	A new retaining wall was constructed along the shore of the pond to reduce existing erosion issues. A well was installed for providing water to the pond rather than using water from the city's water redistribution system.	2015-2016		
Water Quality	DPW&P-Parks	Shore Park Improvements	Stormwater improvements incorporated into the Shore Park improvement project significantly reduced erosion of the beach and surrounding park area.	2018		
Quality/Infiltration	DPW&P-Parks	Ty Cobb Park Improvements (GI)	Walkways were replaced/installed using porous asphalt to increase infiltration and reduce runoff.	2015		
Flooding	DPW&P-Parks	Beaver Brook daylighting (GI)	The park was redesigned and the Beaver Brook culvert was daylighted in the park to allow the brook to overflow and flood the playing fields to manage stormwater and reduce flooding in the surrounding area and downstream.	2007		
Water quality /Infiltration	DPW&P-Parks	Blackstone Gateway Park (GI)	Walkways within the park installed using porous asphalt to increase infiltration and reduce runoff and potential erosion issues.	2018		
Quality/Infiltration	DPW&P-Parks	Burncoat Street Playground (GI)	The playground surface installed consists of a porous material that allows infiltration of stormwater to reduce runoff and potential erosion issues.	2017		
Water Quality/Stormwater	DPW&P-Parks	Coes Knife Park Improvements (GI)	Multiple stormwater management best management practices were incorporated into the park design to manage stormwater runoff from surfaces. Designs increased infiltration and reduced stormwater runoff to reduce potential erosion issues and TSS from stormwater.	2016		
Water Quality/ Stormwater/ flooding	DPW-Parks	Crompton Park Improvements (GI)	Installation of porous asphalt, porous pavers and other stormwater improvements to promote infiltration and improve flood control. Future installation of porous rubber playground surface and porous walkways.	2016 - 2019		
Water Quality/ Stormwater	DPW-Parks	Farber Field	Installation of synthetic field and drainage system improvements to reduce runoff and potential erosion issues.	2020		
Water Quality/ Stormwater/ Habitat	DPW-Parks	Green Hill Park	Installed stormwater improvements at Vietnam Memorial location to reduce runoff and alleviate localized standing water issues. Constructed vernal pool.	2007		
Quality/Stormwater	DPW-Parks	Green Hill Park Pond Dam	Changed outfall location to direct overflow to Coal Mine Brook and remove flow from the combined sewer system.			
Water Quality/Stormwat	DPW-Parks	Holmes Field (GI)	Installation of pervious playground surfaces to promote infiltration and reduce runoff.	2018		
Water Quality/Stormwat	DPW-Parks	Mill Street Greenway (GI)	Design for Greenway along the Coes and Patch Reservoirs includes green infrastructure in the median.	?		
Water Quality/ Stormwater	DPW-Parks	Providence Street Playground	Installation of synthetic field and drainage system improvements to reduce runoff and potential erosion issues.	2016		

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Water Quality/ Stormwater	DPW-Parks	Rockwood Field Improvements	Install subsurface stormwater system to improve stormwater management and increase stormwater storage to reduce flooding potential.	2008		
Water Quality/ Surface Water	DPW-Parks	Parks Ponds	Ponds located at Elm Park, University Park and the Vietnam Memorial are treated for invasive species on a yearly basis.	Ongoing		
Water Conservation	DPW&P-Parks	Spray Parks & City Hall Fountain	The City spray parks and the fountain at City Hall operate on systems that recirculate water through filtration units to conserve drinking water.			
Water Quality		Route 20 Sewer Extension Project	The project provides a comprehensive solution to the sewerage needs of the area and eliminates the need to operate the Broadmeadow Brook and Grafton Street pump stations. T	2018-2020		http://www.worcesterma.gov/route-20-sewer-extension
Water Quality and Stormwater Management		Green Infrastructure	Green infrastructure projects at 17 locations as of 2020 (some listed above).			
Water Quality and Stormwater Management	EAM	Green Infrastructure	Rain garden as part of Senior Center renovation to mitigate stormwater pollution and flooding adjacent to the parking lot.	2020		
Drinking Water Filtration	DPW	Water Filtration Plant construction	Constructed state-of-the-art Water Filtration Plant.	1997		
Land Management	Division of Planning and Regulatory Services	Regulations	Wetlands Protection Ordinance; Aquifer Protection Overland Zone; Floodplain Overlay District; Water Resource Protection Overlay District.	1990; amended 2007, 2016, 2019		
Education and Awareness	Blackstone River Valley National Heritage Corridor	Expansion and reauthorization	Secured the official expansion and reauthorization of Blackstone River Valley National Heritage Corridor to include all of the City of Worcester and town of Leicester, therefore enhancing the city's and region's ability to attract tourism and focus attention on water quality issues of the Blackstone.	1990s (early)		
Education and Awareness	DPW	Waterway Signs	City DPW places signs identifying the City's many waterways.	1990s (early)		
Education and Awareness	DPW	Storm drain stenciling project	City DPW undertakes storm drain stenciling project working with school groups and individuals.	1990s (early)		
Regulations	Division of Planning and Regulatory Services	Local wetlands protection ordinance	Passage of local wetlands protection ordinance which regulates development within 100 feet from catch basins.	1990s (early)		
Regulations	Division of Planning and Regulatory Services	Aquifer Protection Overlay Zone	Passage of the Aquifer Protection Overlay Zone, which is expected to allow city water supply to expand by 20% due to new well fields now protected by overlay zoning.	1990s (early)		
WASTE						
Waste Disposal	DPW&P - Street Division	Residential Trash Collection Program	The Sanitation arm of the Street Division collects approximately 21,000 tons of household waste per year through the pay-as-you throw collection program.	1993-ongoing	Y	Department reporting & records
Recycling	DPW&P - Street Division	Waste Recycling Program	The recycling program, operated as part of the residential trash collection program, operates at a recycling rate of approximately 32% in 2019.	1993-ongoing	Y	Department reporting & records
Recycling	DPW	Single Stream Recycling	Implementation of single stream recycling.	2007 - schools; 2008 - residential curbside up to 6 units		
Recycling	DPW&P - Water Filtration Plant	Plastic Recycling Program	Instituted a plastic recycling program throughout the facility.	2018	Y	Department reporting & records
Waste Disposal	DPW&P - Street Division (Nuisance Inspection)	Illegal Dumping Removal and Investigation	Locations of illegal dumping throughout the city are cleaned, investigated and violations issued accordingly.	ongoing	Y	Department reporting & records

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Graffiti Removal	DPW&P - Street Division (Nuisance Inspection)	Graffiti Removal Program	Quick response program to remove graffiti around the city using environmentally friendly, soy based graffiti remover and a hot-water pressure washer system.	ongoing	Y	Department reporting & records
Waste cleanup and disposal	DPW&P - Street Division	Earth Day Cleanups	Annual event where cleanups are undertaken at approximately 80 locations around the city with approximately 1,000 volunteers. Approximately 70 to 80 tons of trash/waste is collected and disposed of during this annual event.	ongoing annual event	Y	Department reporting & records
Hazardous Waste	DPW&P - Street Division	Household Hazardous Waste Collection Day	Annual event where residents are encouraged to drop off hazardous materials generated or stored at their residences. This removes those materials that have the potential to be disposed of improperly or accidentally released to the environment.	ongoing annual event	Y	Annual Stormwater Report
Hazardous Waste	DPW	Lead Paint Program	Municipal Childhood Lead Poisoning Prevention and Healthy Housing programs distribute lead abatement funds, and offers a lead paint poisoning prevention assessment on request for households with children under six, including rental households.	ongoing		
Trash	DPW&P-Parks	Trash Collection Program	The department cleans up trash and empties trash receptacles within City parks on a daily basis.			
Trash	Ordinance	Plastic Bag Ban	Plastic bags banned in retail in 2019. Implementation 2020.	Ongoing		
Waste Disposal	DPW&P-Parks	Municipal Composting	Worcester has one of the largest municipal composting programs in the state. The compost is free to residents, used by City departments, and sold to commercial businesses. The City does a one-time annual fall leaf collection from streets and residents can bring yard waste to three collection sites.	Ongoing	Y	Composting report
School System Waste Disposal	Worcester Public Schools	Hazardous Waste	Environmental Management System, to manage environmental health and safety issues in the school system. These range from dealing with building material risks, in older buildings, to indoor environmental quality, integrated pest management, and waste. Policies emphasize source reduction and toxics use reduction. Developed guidance for academic and operations departments to change purchasing to increase the use of Environmentally Preferred Products (EPPs).	2010 - Ongoing		The most recent status report on the EMS system was published in November 2019, https://worcesterschools.org/wp-content/uploads/2019/11/EMS-Status-Report-November-2019.pdf
FOOD SYSTEMS						
Food	Worcester Public Schools	Farm to School Program	Offers free breakfast and lunch at school to all students. Menus include fresh fruits and vegetables, whole-grain breads, minimally processed foods and locally-sourced food whenever available.			
Urban Agriculture	City Council adoption	Tax Levy Parcels for Urban Agriculture	The Education & Agriculture Training (EAT) Center, a collaboration of the City of Worcester REC, Ascentria Care Alliance, and Worcester Common Ground uses suitable undeveloped tax levy parcels for urban agriculture that provides training and tools for refugees with an agricultural background in their countries of origin.			
Land Use Planning	Division of Planning and Regulatory Services	Urban Agriculture - Zoning Ordinance Amendment	Adoption of Section 16-Urban Agriculture for local food production/sales (excluding livestock).	2019		
POLLUTION PREVENTION						
Land Development	Economic Development	Brownfields Program	Brownfield Cleanup Revolving Loan Fund to assist property owners in remediating site contamination.	Ongoing	Y - amount loaned	
Water Quality	DPW - Lakes & Ponds; volunteers; university and EPA partners	Worcester Cyanobacteria Monitoring Collaborative	Citizen scientists collect samples contribute to a national study; water treatments to reduce levels of phosphorus – an indicator for cyanobacteria – in the lakes, including an alum-dosing station triggered by stormwater levels going into Indian Lake, which has the greatest propensity for cyanobacteria; and partnering with universities and the EPA.	Ongoing		

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Lead Abatement	City	Childhood Lead Poisoning Prevention and Healthy Housing Program	Worcester Lead Action Collaborative (2005-2014), city-nonprofit collaborative; City programs since 2015; community education and outreach, public policy initiatives, de-leading of hundreds of affordable housing units; lead paint poisoning prevention assessment provided on request.	Ongoing	Y - number of units deleaded	Program reports. Since 2007, receipt of $15 m in federal funds for direct lead abatement and analysis of health hazards in housing.
Environmental Purchasing Policy	City	Environmentally Preferable Purchasing Policy	Basic Environmentally Preferable Purchasing Policy identifies a preference for products with recycled materials and "environmentally preferable products."	Ongoing		
Environmental Management	Worcester Public Schools	Environmental Management System	Policies that emphasize source reduction and toxics use reduction; guidance for operations and academic departments to change their purchasing to increase the use of Environmentally Preferred Products. Resources include a study of indoor air pollution in schools. Ventilation improvements for schools were initiated in 2020.	Ongoing		
CLIMATE CHANGE RESILIENCE						
Climate Change Resilience	City Energy and Asset Management Division	Municipal Vulnerability Assessment	With a state grant of $100,000 Municipal Vulnerability Preparedness grant the City prepared a climate change vulnerability assessment, designed an action plan for preparedness activities, and conducted a number of targeted vulnerability assessments of critical sectors.	2018-June 2019		
Vulnerability and Risk	Emergency Management	Natural Hazard Mitigation Plan	Existing, regional, plan from 2012; update completed with CMRPC for a Worcester specific plan in 2018. Reviews hazards such as drought, flooding, extreme temperatures, sever snow/ice storms, etc.	2019	Y - Action Plan;	Various data sources collected
Water Quality and Quantity	DPW	Integrated Water Management Plan	Stormwater management, including green infrastructure; flood mitigation.	2019 and ongoing		
Water Quality and Quantity	DPW	Lakes & Ponds Program	Monitoring and actions provide information and options to deal with the impacts of climate change, such as warming water temperatures changing the aquatic environment.	ongoing		
Open Space	Division of Planning and Regulatory Services	Open Space and Recreation Plan	State requirement to include consideration of climate change impacts.	expected completion 2021		
Climate Change	Municipal Vulnerability Plan	New resilience standards	The MVP plan recommends incorporating LID standards and limitation of impervious surfaces (including parking lots) in Zoning and Wetlands Protection Ordinances; and creating Best Management Standards for land clearing and grading to avoid creating steep slopes and large retaining walls.			
SUSTAINABILITY, RESILIENCE, AND GREEN EDUCATION IN ALL POLICIES						
Land Use Planning & Transportation	Division of Planning and Regulatory Services	City Comprehensive Plan Update	Existing plan dates to 1987. The plan will identify existing data, reports and related findings, and will involve a robust community engagement element to gather information about community needs and desires. The Green Worcester Plan and other plans will be integrated into the Update.	Initiated in 2021		
Regulations	Division of Planning and Regulatory Services	Ordinance Amendments	Passage of New Worcester Zoning Ordinance which includes regulatory provisions for comprehensive site plan approval, aquifer protection overlay zoning (as mentioned), cluster zoning for open space provisions and designation of open space and park zones. Some amendments passed since then. After completion of the Comprehensive Plan Update, a review and	1990s (early); new review and update expected mid-2020s.		
Land Use - Stormwater	Division of Planning and Regulatory Services	Front Yard "Paving" - Zoning Ordinance Amendment	Land use regulations limit % of front yard areas that can be rendered impervious.			

GREEN PROJECT INVENTORY - MUNICIPAL PROJECTS						
Sub-Category	**City Department/ Division**	**Project/ Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N); describe if Y**	**Source of Reported Metrics, if applicable**
Land Use Planning & Open Space Protection	Division of Planning and Regulatory Services	Green Infrastructure/LID ordinance review	CMRPC & Mass Audubon provided a comprehensive review of subdivision rules/regulations, site plan review, zoning ordinance, and stormwater ordinance and provided recommendations to encourage Low Impact Development (LID) and nature-based solutions both within and between	Completed in 2017?		
Climate Change	Municipal Vulnerability Plan	New resilience standards	The MVP plan recommends incorporating LID standards and limitation of impervious surfaces (including parking lots) in Zoning and Wetlands Protection Ordinances and creating Best Management Standards for land clearing and grading to avoid creating steep slopes and large retaining walls.	2019		
Strategic Plan	Office of the City Manager	Strategic Plan for City Government	Includes Key Performance Indicators	2019		
Data driven decisions	Office of the City Manager	Office of Urban Innovation	Improve City data gathering and organization for KPIs and an open data system.	2019		
Health Information	City Health Department	Comprehensive Health Improvement Plan	Annual plan on city and regional health data and priorities.	Annual		
Parking	Division of Planning and Regulatory Services	Parking maximums	Included in the Commercial Corridor Overlay Districts to discourage excessive parking; with Planning Board discretion to modify parking			
Housing	Housing Department	Worcester Housing Now	Program to support 2-4 unit rehabilitation and affordability including promoting energy efficiency elements.			
MEPA certification	Economic Development	Polar Park MEPA certification and Community Benefits Agreement	Sustainability and resilience commitments for Polar Park and associated mixed-use development in the MEPA certification and in the Community Benefits Agreement.	2019		

GREEN PROJECT INVENTORY - NON-MUNICIPAL AND COMMUNITY PROJECTS						
Sub-Category	**Organization**	**Project /Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N)**	**Source of Reported Metrics, if applicable**
ENERGY						
Renewable Energy	Solar generation city-wide	State's Renewable Portfolio Standard	As of November 2019: 1,573 solar installations on residential, commercial, industrial, institutional, and municipal facilities with total generation capacity of 2,414,345.83 kW of electricity in the City of Worcester. (1.96 MW capacity of solar energy installed in the city (RPS Solar Carve-Out I) between 2010-2014; 20.3 MW capacity of solar energy installed in the city (Solar Carve Out II program) between 2014-2018.)	2010-2018		https://www.masscec.com/data-and-reports).
Renewable Energy	Holy Name High School	Large Wind Turbine	600 kW Vestas RRB - 262ft tall, producing 850 mWh/year. The installation has decreased long-term energy costs for the school and provides educational opportunities to students in the area.	2008		www.telegram.com/news/20180909/holy-name-central-catholic-in-worcester-flexes-green-energy-power
Energy conservation	National Grid	Smart Energy Solutions Pilot in Worcester	National Grid's pilot to study smart metering and how it can impact customer behavior in managing the grid impact during peak usage (as a precursor to grid modernization project that will result in more sustainable and intelligent energy usage).	2014-2018		https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/9179984
Energy education	National Grid, Clark University and partners.	Sustainability Hub	912 Main Street 2,220 sf space donated by Clark Univ. Exhibits, demonstrations, education on energy efficiency and renewable energy, including community meeting space and university student ambassadors.	2011 - present		
Renewable Energy	Worcester Crossing Plaza	Small Wind Turbine	18 Small-scale wind turbines on parking lot lights at Worcester Crossing Plaza - now removed.	2010-2015		https://www.telegram.com/article/20150322/NEWS/303229690
Energy conservation and Renewable energy	Higher education institutions	American College and University Presidents' Climate Commitment	Four higher education institutions in Worcester have signed a pledge to conserve energy, be more efficient, and utilize renewable energy to help reduce their GHG emissions. Signatories include: Clark University, Holy Cross, University of Massachusetts Medical School, Worcester State University	ongoing		Annual, public reporting at https://reporting.secondnature.org
Energy conservation and Renewable energy	Worcester Polytechnic Institute	GHG tracking	Greenhouse Gas Reduction Plan (2017)	2017		https://www.wpi.edu/sites/default/files/inline-image/Offices/Sustainability/GHG_Plan_WPI_Exec%20Summ%20Final2.pdf
Energy conservation and Renewable energy	Clark University	GHG tracking	Annual tracking of Greenhouse Gas emissions, and a commitment to be net-zero by 2030	2010 onward		www.clarku.edu/offices/campus-sustainability/sustainable-clark/energy-climate/; https://unhsimap.org/home (carbon and nitrogen-accounting platform to track campus-wide sustainability.
Energy conservation and Renewable energy	Assumption University	Multiple programs	EPA certification as a Green Power Partner in 2014; partnerships with an 18-acre solar photovoltaic farm in Spencer MA, which generates 1/3 of energy used by the collage; rooftop solar panels on the library; CHP cogeneration at the heating plant reducing emissions; building lighting retrofits			https://www.assumption.edu/student-experience/sustainability
Energy conservation and Renewable energy	Bancroft School	Solar installation	900 high-efficiency solar panels			
Energy conservation and renewable energy	Mass Audubon at Broad Meadow Brook	Green technology improvements	Energy audit for buildings and recommendations implemented; three photovoltaic arrays installed (total purchase of 24.91 kW); 100% green energy for all energy not produced on site; deep energy retrofit of a residence to become the Fargo Education Center; installation of water conservation measures.			https://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/broad-meadow-brook/about/green-features
Community Energy Cooperative	Renewable Energy Worcester (RENEW)	Renewable Energy projects for env. Justice communities	Initial priority for solar power to lower energy costs for faith communities and small nonprofits. One project completed as of 2020 (Mustard Seed Catholica Worker House). Working on solar project for Christian Community Church.	Formed 2016.		https://www.cooppower.coop/worcester
Energy conservation and electric vehicles	E4 the Future	Community Clean Energy Project	Goals: exploring promising new technologies and project models, expanding local clean energy generation, emphasizing energy efficiency, and clearing the obstacles to participation for our economically disadvantaged neighbors.	Ongoing		https://e4thefuture.org/
Energy Advocacy	Greater Worcester Chamber of Commerce	Electric Energy and Policy Group	Advocate on electrical energy and utility issues that affect regional businesses.	Formed 2020		https://www.worcesterchamber.org/policy-advocacy/policy-updates/

GREEN PROJECT INVENTORY - NON-MUNICIPAL AND COMMUNITY PROJECTS						
Sub-Category	**Organization**	**Project /Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N)**	**Source of Reported Metrics, if applicable**
Energy Efficiency	Dismas House and Commonwealth/ Worcester Green Low-Income Housing Coalition		Promotion of energy efficiency and renewable energy; assistance to housing nonprofits with energy upgrades, solar, insulation and heating	2014 and ongoing		
Energy Policy	Commonwealth of Massachusetts	Policy Plan	Massachusetts 2030 Decarbonization Roadmap	2020		https://www.mass.gov/info-details/ma-decarbonization-roadmap
Energy Policy	Commonwealth of Massachusetts	Statute	Signing of An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy (Senate Bill 9)	Jan-21		
GREEN AND BLUE SPACES - NATURAL SYSTEMS						
Urban Forestry	Tower Hill Botanic Garden with others	Worcester Tree Initiative (WTI)	Established as a partnership of the City, the state Department of Conservation and Recreation, the US Department of Agriculture and nonprofit organizations to respond to the Asian Long-Horned Beetle (ALB) infestation (discovered 2008) and loss of trees in northern neighborhoods in Worcester and in adjacent towns. Currently, the WTI is a partnership of the Department of Public Works and Parks and Tower Hill Botanical Garden, which continues tree planting in the city. WTI now includes a forestry program for young adults to maintain newly planted trees and is expanding its activities to plant more trees in the urban core of Worcester.	2009 and ongoing	About 30,000 trees planted;focus in the ALB-affected area; replace monoculture with more species diversity.	
Open Space Preservation	Multiple	Private open space conservation.	About 17% of the city's area (4,230 of the 24,685 acres) are designated open space. 31% of the open space is owned by City Parks Division and the rest by non-municipal entities.			
Trails and Connections	Park Spirit and City of Worcester	East-West Trail	14-mile, cross-city hiking experience, connecting 20 Green Spaces (13 parks, 5 Greater Worcester Land Trust properties, one Clark University Arboretum, and one cemetery) with city streets and throughways for a challenging trek through Worcester's hills.	Opened 2016	Y	parkspirit.org/the-east-west-trail
Parks	Friends Groups	Park Upkeep and Maintenance	Some parks have "Friends" groups that work with the city's Parks Division to support park maintenance and programs. Groups include Friend of Newton Hill at Elm Park; Friends of Institute Park; Friends of Worcester Dog Parks.			
Open space preservation & management	The Greater Worcester Land Trust	Open space preservation	Approximately 300 acres under protection and management.	1990s and ongoing		
Open space preservation & management	Mass Audubon at Broad Meadow Brook	Wildlife Sanctuary	Largest urban wildlife sanctuary in New England; over 400 acres cooperatively managed or owned by Mass Audubon; 5 miles of 15 trails, including a one-mile universally accessible sensory trail			https://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/broad-meadow-brook
Environmental Education and Awareness Building	Mass Audubon at Broad Meadow Brook	Nature education programs	Many programs for children, youth and adults including summer day camp and Field Naturalist Certificate Program.			https://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/broad-meadow-brook
Environmental Education and Awareness Building	Collaborations with WPS	Multiple	Worcester schools have benefitted from several new partnerships between environmental groups and local schools to provide environmental programs.			
Environmental Education and Awareness Building	REC, WPI, and others	Multiple	Worcester area colleges have had hundreds of students participate in environmental internships including many coordinated by the Regional Environmental Council over the past 13 years through the project center at Worcester Polytechnic Institute.			
Environmental Education and Awareness Building	Mass Audubon		Pollinator Garden Pilot			https://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/broad-meadow-brook

GREEN PROJECT INVENTORY - NON-MUNICIPAL AND COMMUNITY PROJECTS						
Sub-Category	**Organization**	**Project /Initiative**	**Brief Description of the Project/Initiative**	**Approximate timeline**	**Metrics (Y/N)**	**Source of Reported Metrics, if applicable**
Trails and Connections	Park Spirit and City of Worcester	East-West Trail	14-mile, cross-city hiking experience, connecting 20 Green Spaces (13 parks, 5 Greater Worcester Land Trust properties, one Clark University Arboretum, and one cemetery) with city streets and throughways for a challenging trek through Worcester's hills.	Opened 2016	Y	parkspirit.org/the-east-west-trail
Parks	Park Friends Groups	Park Upkeep and Maintenance	Some parks have "Friends" groups that work with the city's Parks Division to support park maintenance and programs. Groups include Friend of Newton Hill at Elm Park; Friends of Institute Park; Friends of Worcester Dog Parks.			
Open Space Preservation	Multiple		About 17% of the city's area (4,230 of the 24,685 acres) are designated open space. 31% of the open space is owned by City Parks Division.			
Environmental Education	The Blackstone Heritage Corridor Visitor Center at Worcester		The Blackstone Heritage Corridor Visitor Center at Worcester is the gateway to the Blackstone River Valley National Heritage Corridor, the Blackstone River Valley National Historical Park, and the City of Worcester. It provides visitors and residents with a connection to recreational, historical, cultural and geographic attractions throughout the region.			https://blackstoneheritagecorridor.org/exploring-the-blackstone-river-valley/visitor-centers/worcester-blackstone-visitor-center/
Environmental Education and Awareness Building	Worcester Public Schools	Multiple	Worcester schools have benefitted from several new partnerships between environmental groups and local schools to provide environmental programs.			
Environmental Education and Awareness Building	Institutions	Multiple programs	Worcester area colleges have had hundreds of students participate in environmental internships including many coordinated by the Regional Environmental Council over the past 13 years through the project center at Worcester Polytechnic Institute.			
BUILDINGS						
Institutions	Worcester Polytechnic Institute	LEED Buildings	Policy since 2007 to design all new buildings to meet LEED standards; 5 LEED certified buildings; building energy and lighting retrofit program.	2007 and ongoing		
Institutions	Clark University	LEED Buildings	Policy that new buildings over 5,000 sf will attain a minimum LEED Silver certification unless it costs more than 10% of the total life cycle cost of the building; all major renovations (over 50% of cost of total replacement) will meet a LEED Silver minimum and LEED criteria are applied to smaller renovation projects. University policies also require sustainable practices in site selection, materials, operations and maintenance	ongoing		Annual, public reporting at https://reporting.secondnature.org
Institutions	College of the Holy Cross	LEED Buildings	Policy to meet LEED silver standards in all new major construction and renovation; 2 LEED gold buildings; interior and exterior lighting replacement with energy efficient lighting and sensors	ongoing		Annual, public reporting at https://reporting.secondnature.org
Institutions	Worcester State University	LEED Buildings	4 LEED Gold buildings and solar panels on three buildings.			Annual, public reporting at https://reporting.secondnature.org; Also see http://das.solardesign.com/gcdash.php?site=WorcesterStateUniv
Institutions	Assumption University	LEED Buildings	One LEED gold building			
Institutions	Umass Medical	LEED Buildings	2 silver and one gold LEED buildings.			Annual, public reporting at https://reporting.secondnature.org
Institutions	Worcester Recovery Center and Hospital	LEED Buildings	One gold LEED building.			
Institutions	Worcester Academy	LEED Buildings	LEED silver building renovation			
Energy - conservation/ renewable	Worcester Polytechnic Institute	LEED Buildings	Since 2007, WPI requires new buildings to achieve LEED certification. As of 2019, 5 LEED-certified buildings have been constructed.	2007 onward		
Energy - conservation/ renewable	Clark University	Solar installation	Solar panels installed on Shaich Family Alumni and Student Engagement Center with goal of providing 50% of the building's power	2016 onward		https://www.clarku.edu/offices/campus-sustainability/
Energy - conservation/ renewable	Worcester State University	LEED Buildings	Worcester State has constructed 4 LEED-certified Gold buildings, and installed solar panels on the rooftops of 3 buildings on campus. Generate 140,000 kilowatt hours of electricity annually	Ongoing	Y - kW of generating capacity	https://www.worcester.edu/Sustainability-Initiatives/#Solar-Energy
Energy - conservation/ renewable	Assumption University	LEED Buildings	Constructed 1 LEED-certified Gold building.			https://www.assumption.edu/student-experience/sustainability

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Energy - conservation/ renewable	Clark University	LEED Buildings	New buildings over 5,000 sf will attain a minimum LEED Silver certification unless it costs more than 10% of the total life cycle cost of the building. Similarly, all major renovations (over 50% of cost of total replacement) will meet a LEED Silver minimum and LEED criteria are applied to smaller renovation projects. University policies also require sustainable practices in site selection, materials, operations and maintenance.	Ongoing		https://www.clarku.edu/offices/campus-sustainability/
Energy - conservation/ renewable	Worcester State University	LEED Buildings	Worcester State has constructed 4 LEED-certified Gold buildings, and installed solar panels on the rooftops of 3 buildings on campus. Generate 140,000 kilowatt hours of electricity annually	Ongoing	Y - kW of generating capacity	https://www.worcester.edu/Sustainability-Initiatives/#Solar-Energy
Energy - conservation/ renewable	One Mercantile Street		LEED silver office building	2013		
Private solar installations and energy retrofits	Multiple		As of November 2019: 1,573 solar installations on residential, commercial, industrial, institutional, and municipal facilities with total generation capacity of 2,414,345.83 kW of electricity in the City of Worcester. (1.96 MW capacity of solar energy installed in the city (RPS Solar Carve-Out I) between 2010-2014; 20.3 MW capacity of solar energy installed in the city (Solar Carve Out II program) between 2014-2018.)	2010-2019 and ongoing		https://www.masscec.com/data-and-reports).
Polar Park development projects	Multiple	MEPA Certificate and Community Benefits Agreement	Environmental commitments for Polar Park and associated mixed-use development include a variety of considerations and actions, such as reserving rooftop area for future solar systems; measures to reduce GHG emissions.	2021		
SUSTAINABLE TRANSPORTATION						
Transportation Planning	Central Massachusetts Metropolitan Planning Organization (CMMPO)	2040 Long-Range Transportation Plan	Plan document with 20-year horizon for the use and prioritization of federal transportation funds for Central Massachusetts, including pedestrian, bicycle, and transit, as well as roads.	every 20 years	Y	http://www.cmrpc.org/cmmpo
Transportation Planning	CMMPO	Regional Pedestrian & Regional Bicycle Plan	Recommendations focused on how to plan, integrate, and fund pedestrian facilities, working with regional and state agencies, and the plan includes maps of existing and planned facilities. The bicycle plan identified and mapped the potential for 100.24 miles of bicycle facilities in Worcester.	Complete 2018	Y	http://www.cmrpc.org/cmmpo
Public Transportation	WRTA	Bus Service	The WRTA serves over 1,200 bus stops and nearly 40 bus shelters, most of which are located in Worcester. There are 52 full-sized fixed route buses: 17 are diesel-electric hybrids, 29 are clean diesels, and six are all-electric vehicles.	Y	% coverage of transit routes, ridership #s	WRTA reports
Public Transportation	MBTA	Commuter Rail Service	Established rail link to Boston with several trains now running daily. Ongoing studies for increasing frequency and speed of service	Y	# or frequency of train service	MBTA reports
Alternative transportation	WalkBike Worcester	Advocacy focused on walking and bicycling in Worcester	Goals: To Improve non-motorized connections among neighborhoods, to public transit, and to destinations such as shops, parks, schools, and services; calm traffic, and improve safety; reduce environmental and climatic impact of transportation; encourage daily physical activity to combat obesity and other health problems; increase transportation option for populations with lower access to personal vehicles, including low-income individuals, the young, and college students			
Alternative transportation	WalkBoston and MassBike	Chandler Street Assessment	Walk and bike infrastructure assessment for Chandler Street	2016		https://walkboston.org/wp-content/uploads/2016/08/WalkBoston-BicycleandPedestrianInfrastructureAssessment-Worcester.pdf?8621dc&8621dc
Alternative transportation	Walk Boston	Neighborhood Walk Audit	Green Hill Neighborhood Walk Audit (2019)	2019		https://walkboston.org/wp-content/uploads/2019/11/WalkBoston-Worcester-Green-Hill-walk-audit-report-FINAL.pdf?8621dc&8621dc
Alternative transportation	Clark University	Cycles of Change	Bike Share program; Ride Share and Carpool finder; Zipcar membership			
Alternative transportation	WPI	Gompei's Gears	Free bike share program run by student Green Team at 4 location on campus with 18 bikes. Zipcar program.	2016 and ongoing		

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Alternative transportation	Holy Cross	Multiple	Use of battery operated cars, bikes and carts; bike rack installation; 4 zipcars			
Alternative transportation	Assumption University	Green Bikes program	Student bike share program			
Alternative transportation	Assumption University	Car programs	U-Car car-sharing platform including hybrid car; electric vehicles used by departments			
Electric Vehicles	Institutions and businesses	Electric Vehicle Charging	Local higher education institutions and businesses are installing electric vehicle charging stations on privately owned property, partly with incentives from National Grid. Locations include Quinsigamond Community College, Worcester Polytechnic Institute (6), Clark University (3), UMass medical school (8), Medical Center (2), the College of the Holy Cross (4), Worcester State University (2), and Broad Meadow Brook Conservation Center (2)	Y -	# of total privately-installed EV charging stations	
Electric Vehicles	E4 the Future	Good2Go Pilot	Project to create an affordable electric car-sharing program for Worcester.	2020 and ongoing		
Polar Park redevelopment	Multiple	MEPA Certificate and Community Benefits Agreement	Environmental commitments for Polar Park and associated mixed-use development include a variety of considerations and actions, such as reservation of up to 10 % of parking spaces with EV charging stations or EV-ready; Transportation Demand Management measures to minimize SOV trips; pedestrian and bicycle access improvements.	2021		
ONE WATER						
Local watershed management and advocacy	Watershed Associations	Establishment of active grassroots watershed associations	Establishment of several active grassroots watershed associations throughout the city: Coes Pond, Indian Lake, Lake Quinsigamond, Tatnuck Brook	1990s (early)		Links at http://www.worcesterma.gov/water-sewer/recreational-waters
Local watershed management and advocacy	Watershed Coalition	Formation of Blackstone Headwaters Coalition	City conservation and watershed groups team up to form the Blackstone Headwaters Coalition and group receives funding from the Greater Worcester Community Foundation	1990s (early)		
Local watershed management and advocacy	Blackstone Headwaters Coalition	Guide to Worcester as the Headwaters of the Blackstone	Designed and printed guide to Worcester as the Headwaters of the Blackstone - a team effort of Massachusetts Audubon and Worcester Historical Museum, funded by the Massachusetts Foundation for the Humanities	1990s (early)		
Local watershed management and advocacy	Blackstone River Coalition; Mass Audubon water testing lab	Water Quality Monitoring	Volunteers sample and test 30 sites in and around Worcester. About 90 volunteers cover 75 sites throughout the Blackstone River watershed from Worcester to Pawtucket. The testing lab is at Mass Audubon's Broad Meadow Brook Wildlife Refuge.			https://www.blackstoneheadwaterscoalition.org/water-monitoring.html
Local watershed management and advocacy	Coes and Parches Ponds Watershed Associations	Coes Dam rehabilitation	Secured state DEM funds to rehab Coes Dam which will ultimately become a historic park and conservation area.	2014		
Water Quality/ Stormwater	UMASS Amherst	Greening Worcester	Plan created by a team of UMass-Amherst graduate students in 2014, contains a variety of landscape and green infrastructure proposed designs for specific locations in the city.	2014		https://www.umass.edu/larp/project/greening-worcester-planning-and-designing-green-infrastructure-networks-habitat-recreation
Conservation/ Stormwater	Worcester Polytechnic Institute	Sports & Recreation Center	Underground cisterns to capture rainwater installed at the Sports and Recreation Center, capture rainwater that is later used to irrigate gardens around campus.			
Water Quality/ Stormwater	Worcester Polytechnic Institute	East Hall Green Roof	Green roof on East Hall reduces stormwater runoff and was the first green roof in the City of Worcester.			
Water Quality/ Stormwater	Worcester Polytechnic Institute	Massachusetts Water Resource Outreach Center	Study - Storm Water Runoff Reduction on the Worcester Polytechnic Institute Campus	2018		https://digital.wpi.edu/pdfviewer/rx913q48q
Polar Park redevelopment	Multiple	MEPA Certificate and Community Benefits Agreement	Environmental commitments for Polar Park and associated mixed-use development include a variety of considerations and actions, such as reduction in impervious area to reduce the urban heat island effect; stormwater management systems with increased capacity, use of rain gardens	2021		

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Environmental Education and Awareness Building	Mass Audubon	Green Infrastructure	Rain gardens at nature center and education center; rainwater collection			https://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/broad-meadow-brook/programs-classes-activities
Water Quality/ Stormwater	Blackstone Headwaters Coalition	Rain Gardens Program	Rain Gardens - constructed at Mass Audubon, Worcester Youth Center, Clark U Admissions, Midland Street School, Fisherville and Regatta Point State Park, Worcester DEW&P Northeast Cutoff.			https://www.blackstoneheadwaterscoalition.org/
Water Quality/ Stormwater	Clark University	Rain Garden	Rain garden installed in front of admissions department.			https://www.clarku.edu/offices/campus-sustainability/sustainable-clark/food-water-landscape/
Environmental Education and Awareness Building	Blackstone Headwaters Coalition	Environmental Modeling	The Enviroscape Model used in classrooms and at public events demonstrates the effect of land use on waterway quality.			
WASTE						
Food Waste	UMASS Medical Center	Composting and organic waste management	Collecting food scraps from the 7500 meals it prepares per day and sending them to the Tyde Brook Farm in Holden for composting. They have also been recycling cooking oil.			
Food Waste	Umass Memorial Hospital		Recycling of kitchen oils	2010 and ongoing		
Food Waste	Regional Environmental Council	Composting and organic waste management	REC composts waste from the Mobile Market at its YouthGROW farm where it has large-scale composters but prefers donating food if possible to groups such as Rachel's Table, Catholic Charities, the Mustard Seed, and Ss. Francis and Therese Catholic Worker			
Food Waste	Institutions	Food waste diversion	Clark University; WPI, Assumption University and other institutions have some food waste composting			
Food Waste	Holy Cross	Food waste diversion	Trayless service reduces food waste; elimination of all styrofoam;			
Food Waste	WPI	Reducing and diverting food waste	Reduction of kitchen food waste (Trim Trax program); send about 60 tons of food waster annual to a pig farm for animal feed; food donation to local shelters, Food Recovery Network: student volunteers pick up food form dining halls and transport it to Worcester shelters.			
Construction & Demolition Waste	Multiple		Regional nonprofits and businesses in the waste diversion sector include: Habitat for Humanity ReStore, Massachusetts Housing Alliance Donations Clearinghouse, Worcester County Food Bank.			
Recycling and Waste Diversion	Umass Medical	Surplus reuse	SWAP (Surplus With a Purpose) Shop to facilitate reuse by students, faculty and staff of surplus office supplies, small furniture, and lab equipment.			
Recycling and Waste Diversion	Clark University	Multiple programs	EPA Waste Wise Partner; electronics recycling; excess furniture and supplies donations			https://www.epa.gov/smm/wastewise; https://connect.re-trac.com/login?identifier=wastewise
Recycling and Waste Diversion	WPI	Multiple programs	Annual waste audit; book and food donations. Establishments of "waste stations" that consolidate trash, recycling, plate/tray, and food waste bins.			
Recycling and Waste Diversion	Assumption University	Recycling programs	Resident hall single-stream recycling; maintenance recycling of batteries, scrap metal, light bulbs, vehicle oil, cooking oil, refrigerants and food cans; electronic recycling and donation program; zero waste station for recycling of items such as CFL light bulbs, ink cartridges, and office supplies; book donation program; paper shredding and recycling program			
Composting	Assumption University	Green waste and food waste programs	Composting of yard waste and food waste			
Recycling	Worcester State	Recycling programs	Single stream recycling since 2006			
Recycling	Holy Cross	Multiple programs	Waste diversion in place since mid-90s; single stream recycling adopted 2012			
FOOD SYSTEMS						

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Urban Agriculture	Regional Environmental Council	Multiple programs	Network of 67 gardens including community gardens, school gardens, and urban farm sites production for the market. Over 500 volunteer gardeners participate, including 18 schools (involving 2000 students) and senior centers. It began in 1992 with one garden and one volunteer. The community gardens produce over 15,000 pounds of food annually for consumption by gardeners Urban Farms. Urban farms produce for sale in the market.	Food programs began 1992 - ongoing		REC reports
Farmers' Markets and local food	Regional Environmental Council		Seasonal, year-round, and mobile farmers' markets.			REC reports
Farmers' Markets and local food	Regional Environmental Council and Seven Hills Foundation		REC collaboration to provide indoor food production for the Stearns Tavern café.	2020 and ongoing		
Farmers' Markets and local food	Worcester Public Market		About 30 food vendors, mostly selling value-added products.	2020 and ongoing		
Farmers' Markets and local food	Clark University	The Local Root	Student-run, on-campus fresh and local food market, including subscription and on-campus delivery service.	2012-2018		
Farmers' Markets and local food	Holy Cross	Multiple programs	Dining Services purchase 20-25% of all products from local companies sponsors a weekly farmer's market in season;			
Farmers' Markets and local food	WPI	Campus farmers market	Twice a month, August - November market			
Farmers' Markets and local food	Clark University and Worcester State	Fresh greens	Fresh greens grown on campus for dining halls			
Farmers' Markets and local food	Freight Farms		Co-founded by a Clark University alumnus, Freight Farms provides hydroponic farms in shipping containers, predominantly to the institutional market. Worcester State University and Clark University use Freight Farms to produce fresh greens for their dining halls. The company says that its first model consumed less than five gallons of water and 125 kWh of electricity a day and a new model was announced in 2019.	Ongoing		
Farmers' Markets and local food	WooSox	WooSox Farms	Urban farm on the second deck of the third base concourse at Polar Park. Supported by Harvard Pilgrim and managed by REC with YouthGrow farmers.	2021 and ongoing		REC expected to provide metrics
Farmers' Markets and local food	GW Chamber and Health Foundation of Central Mass	Worcester Regional Food Hub	Supported by the Greater Worcester Chamber of Commerce and supported by the Health Foundation of Central Massachusetts, the food hub seeks to strengthen sustainable agriculture by supporting and enhancing the production-to-distribution chain for local producers and small acreage farmers	2015 and ongoing		
Farmers' Markets and local food	Worcester Food Policy Council		3 focus areas: Healthy Food for All --fresh, culturally appropriate, and affordable fruits, vegetables, and healthy meals for all neighborhoods; Growing Urban Agriculture –ensure that anyone can farm land and sell their products in the City; Building a Food Movement for All – farmers, nutritionists, activists, researchers.			
	WPI	Food Recovery Network		2015 and ongoing		
POLLUTION PREVENTION						
Water Quality	DPW - Lakes & Ponds; volunteers; university and EPA partners	Worcester Cyanobacteria Monitoring Collaborative	Citizen scientists collect samples contribute to a national study; water treatments to reduce levels of phosphorus – an indicator for cyanobacteria – in the lakes, including an alum-dosing station triggered by stormwater levels going into Indian Lake, which has the greatest propensity for cyanobacteria; and partnering with universities and the EPA.	Ongoing		

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	Mass Audubon	Water Quality Lab	Water-testing lab at Broad Meadow Brook Wildlife Sanctuary. Volunteers sample and test 30 sites in and around Worcester. About 90 volunteers cover 75 sites throughout the Blackstone River watershed from Worcester to Pawtucket.	Ongoing		
CLIMATE CHANGE RESILIENCE						
Advocacy	WPI	Students for a Just and Sustainable Future	Focus on climate change awareness and projects.			
Advocacy	Climate Action Circle	Coalition	Citywide climate coalition			
Advocacy	350 Central Mass	Campaigns	Local affiliate of 305.org and 350 Mass for a Better Future. Campaigns to eliminate use of fossil fuels and promote climate justice.			https://www.350centralmass.org/
Advocacy	Mothers Out Front Worcester	Clean Heat, Clean Air Campaign	2021 campaign to stop expansion of polluting energy infrastructure and enact systemic change to provide clean, safe, and affordable heat to homes and businesses. Advocate for passage of state legislation.			https://www.mothersoutfront.org/team/massachusetts/worcester/
Advocacy	Mass Audubon - Broad Meadow Brook	Climate Cafes	Discusstions created and facilitated by high school students and open to all community members.			
Advocacy	Sunrise Worcester	Campaigns	Local affiliate of the national youth-led climate justice organization. Promotes immediate action and enacting a Green New Deal.			
Advocacy	Educational institutions	Student clubs	Student groups focused on climate change can be found at Worcester Technical Public School; Quinsigamond Community College; College of the Holy Cross (Eco-Action); Assumption University (Green Hounds); Worcester State University; Clark University; Worcester Polytechnic Institute; Bancroft School; St Peters Central Catholic School			
Polar Park redevelopment	Multiple	MEPA Certificate and Community Benefits Agreement	Environmental commitments for Polar Park and associated mixed-use development include a variety of considerations and actions, such as design and systems to increase resilience to projected climate conditions, including drought, extreme heat and increased precipitation, such as "cool roofs," dought resistant plantings, operable windows.	2019-20		
SUSTAINABILITY, RESILIENCE, AND GREEN EDUCATION IN ALL POLICIES						
Institutional Sustainability	Assumption University	Multiple	Greenhounds student sustainability club promotes individual and community sustainable practices. CRS Social Justice Ambassadors led a Fair Trade initiative resulting in approval by Fair Trade Colleges and Universities as a Fair Trade College.			https://www.assumption.edu/student-experience/sustainability
Institutional Sustainability	Clark University	Multiple	Climate Action Plan and updates (2007-2015); Climate-Friendly Investing Policy; green building design policy; Green Purchasing policy; Building Heating policy; Universal Waste Policy			www.clarku.edu/offices/campus-sustainability/policies/
Institutional Sustainability	Holy Cross	Multiple	Eco-Action student environmental group; Student Government Association established an environmental liaison in every residence hall			https://www.holycross.edu/campus-life/sustainability/office-sustainability
Institutional Sustainability	Worcester State	Multiple	Climate Action Plan. Students with a common interest in sustainability live together in a specific residence hall and are required to take a sustainability seminar.	2012		https://www.worcester.edu/Sustainability-Initiatives/
Institutional Sustainability	WPI	Multiple	Sustainability Plan 2012 and 2020; establishment of an Office of Sustainability and Director of Sustainability (2014); Greenhouse Gas Reduction Plan (2017); Annual Sustainability Report; Green Revolving Fund; Green Purchasing Policy. Sustainability Project Competition for undergraduate and graduate students (2008 and ongoing). Green Team student group runs events to raise awareness and runs Gompei's Gears bike share. The Student Sustainability Leaders Roundtable meets with the Office of Sustainability once each term to discuss initiatives and coordinate activities. Eco-Reps are volunteers who work with the Office of Sustainability to promote sustainable practices among students on campus.			Receipt of AASHE STARS Gold rating for overall performance in operational, educational, research, and community aspects of sustainability, 2017. https://www.wpi.edu/offices/sustainability
Institutional Sustainability	WPI	Green Revolving Fund	The fund finances projects for increased efficiency or reduced consumption that will produce savings that are reinvested in the fund each year.	2017 and ongoing		
Sustainability education	WPI	Programs open to community	Symposia and competitions; e-waste drive; discounted LEED Green Associate Certification course			

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Institutional Sustainability	Umass Medical	Multiple programs	Recycling and reuse programs; EV charging; energy conservation			https://www.umassmed.edu/growinggreen/
Urban Forestry education	Tower Hill Botanic Garden	Worcester Tree Initiative programs	Arbor Day/Week events; Master Tree Stewards Training Program; Community Tree Stewards; Community Planting Events; Young Adult Foresters; Urban Tree Syumposium	2009 onward		www.treeworcester.org/
Environmental Education and Awareness Building	The Blackstone Heritage Corridor Visitor Center at Worcester	Collaboration	The Blackstone Heritage Corridor Visitor Center at Worcester serves as a gateway to the Blackstone River Valley National Heritage Corridor, the Blackstone River Valley National Historical Park, and the City of Worcester. It provides visitors and residents a connection to recreational, historical, cultural and geographic attractions throughout the region.			
Environmental Education and Awareness Building	REC and others	Earth Day	Regional Environmental Council in concert with the Worcester Parks Dept, the EcoTarium and many others has established a strong and growing annual Earth day celebration in the city with educational programs, children activities and clean - ups involving dozens of cooperating organizations.	ongoing		
Green Joba	Green Jobs Academy	Weatherization job training	Provides entry level skills training and continuing education for in-demand, living wage jobs with a career ladder in the weatherization industry.			http://greenjobsacademy.org/
Environmental Education and Awareness Building	Worcester Institute for Senior Education		Assumption University hosts this group. Courses on sustainability topics. Special InterestGroup (SIG) on environmental issues: "examines public policy and the technoloty of how energy is produced, used, and conserved, and how our approach to energy can and should change in the future."	ongoing		https://assumptionwise.org/