# Electric Vehicle Infrastructure Planning & Technical Assistance

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District Local Technical Assistance program

**Prepared for**
MAPC Municipalities

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# Acknowledgements

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This report was produced by the Metropolitan Area Planning Council. Professional technical assistance and project coordination was provided by Megan Aki, Clean Energy Analyst II. Additional project support was provided by Cammy Peterson, Director of Clean Energy; Alison Felix, Senior Transportation Planner; Lily Perkins-High, Analytical Services Manager; Alyssa Kogan, Regional Planning Data Analyst; Avery Lavalley, GIS and Planning Intern; and Mark Fine, Director of Municipal Collaboration. Project oversight was provided by Rebecca Davis, Deputy Director.

Special thanks to staff and volunteers from the cities and towns who made this project possible, including Stephanie Bilotti and Catherine Barrett with the City of Beverly.

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# Executive Summary

The purpose of the Electric Vehicle Infrastructure Planning and Technical Assistance 2019 DLTA project was to develop, test, and establish a replicable community-wide electric vehicle charging station siting analysis. The 2019 DLTA funds supported MAPC in developing this methodology, engaging municipal staff and community members in the City of Beverly on the placement of electric vehicle charging stations, and piloting the siting analysis in Beverly to inform future investments in electric vehicle charging stations. The 2019 DLTA project also supported MAPC's continued provision of technical assistance to cities and towns to facilitate access to funding and programs that support their transition to clean vehicles. The 2019 DLTA project was supplemented by MAPC's Planning for MetroFuture Technical Assistance (PMTA) funding, which will also support the continuation of this project in spring 2020.

This project responded to needs identified throughout the course of MAPC's 2017 and 2018 clean vehicle technologies programs. In the process of supporting municipalities with the procurement of electric vehicle charging stations in 2018, MAPC identified a gap in existing resources to support municipalities in strategic planning for ideal placement of charging stations. In tandem to this, MAPC also worked with the Cadmus Group to develop a preliminary analytical framework for equitable siting of electric vehicle charging stations across the region. With these two needs in mind, MAPC sought to establish a replicable methodology for communities to strategically and equitably plan for the installation of electric vehicle charging stations on publicly owned and privately owned sites.

MAPC worked with the City of Beverly to develop and pilot a method for selecting suitable sites for public access, high speed, or car share charging stations across the community. As a result of the pilot, MAPC identified specific actions to improve the analytical framework and replicate the study with additional communities.

In addition to the community-based site suitability analysis, MAPC leveraged the 2019 DLTA funds to expand available clean vehicle technologies on a statewide contract, convene Regional EV Strategy calls for MAPC cities and towns, and establish new partnerships for collaboration on future projects to support municipalities.

# Electric Vehicle Infrastructure Planning

The project team sought to develop an original methodology for community-based site suitability analysis to inform the strategic placement of charging stations in the MAPC region. A community-based site suitability analysis is a method for finding the most suitable parcels for locating charging stations given a series of indicators. Indicators can be adjusted and changed based on the community and its priorities. For this analysis, the research goals were to understand:

1. What methods and models are municipalities and public agencies using to locate electric vehicle charging stations?
2. What are the indicators and factors can be used to determine the siting of charging stations?
3. What equity considerations should municipalities consider in developing electric vehicle infrastructure?

The development of an original methodology for community-based site suitability analysis relied on a literature review to inform the development of suitability criteria, indicators, and infrastructure scenarios. Following the literature review and preliminary method development, the project team collected and cleaned the necessary datasets to prepare them for use in the GIS-based CommunityViz® software application. From there, the project team refined and piloted the methodology in the City of Beverly.

## Literature Review and Method Development

The literature review served the purpose of providing a deeper understanding of the existing analytical approaches available to build on and identifying gaps where existing methods fail to meet the primary goals and values of the project team.

The project team identified two primary ways to approach strategic planning for electric vehicle ("EV") charging infrastructure. One uses existing trends and demographic data to determine likely trends in adoption of EVs in the study area and makes siting recommendations based on meeting the projected demand. This EV adoption-based approach was the most used method across the EV readiness and infrastructure planning studies examined during the literature review. The other approach assumes a theory of change of, "if you build it, they will come," which applies behavioral findings that the presence of EV charging stations may impact a driver's likelihood to make the switch to an EV.

From the start of the project, the project team set out to develop an approach to strategic planning for EV infrastructure that would promote equitable access as the community transitions to zero emission vehicles. What we observed in analyses that focus on EV adoption trends is a strong relationship with high-income, highly educated populations in the study areas. As such, the project team made the foundational decision to design a method that does not take into consideration adoption trends and focus solely on criteria and indicators that relate to the conditions of the site and potential utilization if a station were installed.

Upon review of infrastructure planning approaches taken by other counties, regional planning agencies, and states, the project team developed the criteria of Screen Parcels, Existing Conditions, Adoption/Opportunity, and Equity to support with relevant indicators in the analysis. See **Appendix C** for details on how each of these criteria are defined and their supporting indicators.

The other defining structure of the analysis are the three selected charging station scenarios, which were informed both by the literature review and project team technical expertise on EV charging infrastructure.

> **Public Access**: This scenario is defined as sites most suitable to support publicly accessible Level II charging stations. This includes assumptions that support dwell time (i.e., time spend parked/charging) at the location for two to four hours and high utilization.
>
> **High Speed**: This scenario is defined as sites most suitable to support publicly accessible DC Fast Charging (DCFC) stations. This includes assumptions that support much shorter dwell times of 30 minutes to an hour. This scenario is focused on enable users that may be making longer distance trips in an EV.
>
> **Car Share**: This scenario is defined as sites most suitable to support Level II charging stations dedicated to an EV car share program. This includes many of the same assumptions as the Public Access scenario, but with an emphasis on sites located near multi-unit residential buildings and meet the methodology's equity criteria.

The project team also explored the possibility of including an on-street charging scenario but determined that inclusion of this scenario was not feasible with available data and budget for the pilot project in Beverly.

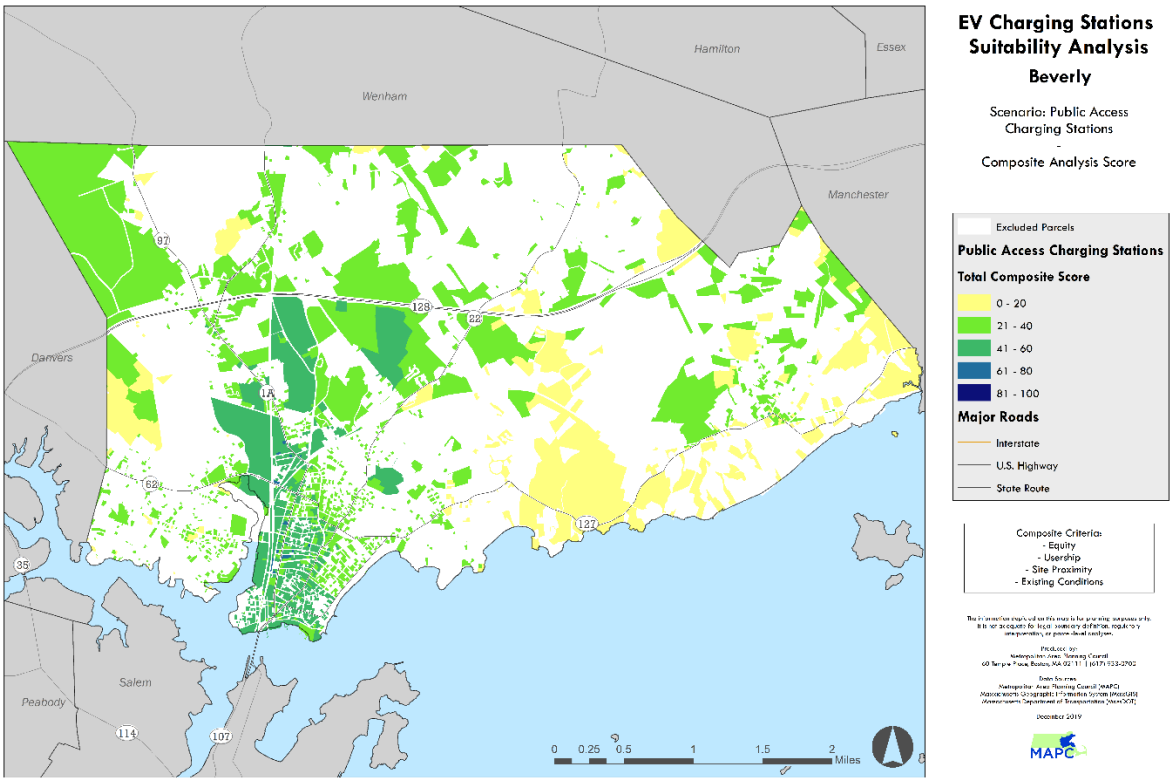
## Data Collection and Analysis

The project team carried out an iterative process to identify available datasets to support the proposed indicators. First, the project team downloaded all the publicly available datasets that matched to the identified indicators, seeking out spatial data layers where they were available. The data was then clipped to the study region for the pilot (Beverly). Any tabular data was joined to be applied in the analysis as a spatial data layer.

The project team used CommunityViz® to apply the methodology developed for this pilot project. CommunityViz® includes a "Suitability Wizard" that facilitates suitability analyses for planners and analysts by creating weighted suitability measures for features based on proximity, overlap, and specified numeric factors. The ability to create spatial data attributes that are formula-driven and dynamically updated as underlying data or criteria change allows planners to use spatial data for suitability analysis.

Once indicators and criteria have been established, the first step is to clip the data layers to the study area and upload them to the analysis via the Suitability Wizard. From there, each indicator

is assigned a formula that reflects its relationship with the site purpose (e.g., a parcel closer to a road will receive a higher score). After all indicators have been uploaded and the analysis is run, there are multiple options to adjust for different results. For this analysis, MAPC created three scenarios for each charging station use case and adjusted the weighting on each indicator to reflect relative prioritization.




*A composite map of suitable sites for the Public Access scenario in Beverly*

See **Appendix C** for a complete description of each indicator applied in the analysis and the associated data source, treatment, and weighting scheme across each scenario.

# City of Beverly Pilot Analysis

The preliminary spatial analysis completed by Cadmus Group for MAPC highlighted several communities in the North Share area of the MAPC region as having greater need for equitable access to zero emission mobility options. Driven by this, the project team focused outreach for the pilot in the North Shore. The City of Beverly was the first community to share an interest in strategic planning for EV charging stations.

The project team engaged with staff from the Mayor's office and constituent services and received input and feedback from the City throughout the project.

## Community Engagement

The project included engagement activities to better understand the communities' priorities in placing charging stations. The engagement activities were an opportunity to understand any inherent biases in the indicators chosen for the analysis. The engagement aimed to reveal resident attitudes towards EV charging stations and community priorities.

To maximize the budget allocated to engagement, the project team developed an online survey that could be used to engage residents at events and through the City's email listservs. The survey asked respondents to identify three locations (in Beverly) on a map where they would like to have an EV charging station installed and why they selected those locations (i.e., was it close to work, home, commercial area, downtown, or travel routes). The survey also engaged respondents with questions about barriers to owning an EV and interest in an EV car share program.

*Photo: Engagement station at Beverly's EV and Sustainability Fair*

The project team also participated in **Beverly's EV and Sustainability Fair**, hosted by a local volunteer-led group, Green Beverly, and the City of Beverly. At the fair, the project team collected input from attendees on where they would like to see EV charging stations in their community. This was done both via a white board, a poster-size map of Beverly, and the online survey.


*Photo: Green Beverly volunteers addressing attendees about EV programs*

In total, 29 responses were collected through the online survey. While not a robust enough amount of responses to provide a statistically significant data layer for the analysis, the results did provide some informative anecdotes about resident attitudes toward electric vehicles and charging stations. Some of the findings included:

- Nearly half of the respondents owned an EV, and ten were considering purchasing an EV.
- The cost of purchasing an EV was the most common barrier to purchasing identified.
- Nearly half of the respondents indicate that they would consider using an EV car share program it was made available.
- Of the specific locations recommended by respondents, the motivations included being close to a commercial area, downtown, travel routes, and home. Close to home was the most selected motivation.

See **Appendix A** for the project one pager used to disseminate information about the project in the City of Beverly.

## Analysis Results

The composite maps produced for each scenario (public access, high speed, and car sharing) displayed variation in sites with the highest suitability score. Prioritization of sites located near Beverly's main business district / downtown area held consistent across each scenario. The project team produced lists of the highest scored sites for each scenario. The top sites were broken down

by ownership type to make the recommendations from the analysis more actionable. For public access and car sharing, the top sites list includes ten commercial/institutional, ten multiunit residential, and ten municipally owned sites. For high speed, the top sites list includes 15 commercial/institutional sites. Across all three of the scenarios, those sites with commercial/institutional ownership yielded the highest suitability scores.

The next step with the analysis will be to ground truth the top sites lists for each scenario with City staff, as some of the sites may turn out to not be suitable for local reasons not captured by the data sets used in the analysis. The project team will also be developing policy recommendations to support the City with implementation of the recommendations that result from this analysis.

See **Appendix B** for images of all the maps delivered to the City of Beverly as a part of the suitability analysis.

# Clean Vehicle Technical Assistance

This 2019 DLTA project also provide supplemental support to MAPC's work to provide technical assistance to cities and towns to facilitate access to funding and programs that support their transition to clean vehicles. In 2019, this included expanding available clean vehicle technologies on statewide contract, launching a regional effort to engage in collaborative conversations on EV strategy, and fostering new partnerships to develop new funding and programmatic opportunities for municipalities in 2020 and beyond.

## Expansion of Statewide Contract

Through this 2019 DLTA project, MAPC continued to provide technical assistance to cities and towns on the procurement of new clean vehicle technologies by supporting the expansion of available vendors and products on the statewide contract, VEH102. MAPC continued in its role on the Strategic Sourcing Team with the Department of Energy Resources and Operational Services Division to reopen the contract in 2019.

In June 2019, the Strategic Sourcing Team reopened the statewide contract VEH102 to new vendors and current vendors that wished to bid in a new category of the contract. Throughout the summer and fall of 2019, MAPC actively worked with OSD and DOER to evaluate the bid responses.

One of the primary changes to the Request for Responses was to expand the list of eligible technologies in category one of the contract (electric vehicle supply equipment, hardware, software, and ancillary services). The contract was amended to explicitly include: electric vehicle supply equipment ("EVSE") paired with clean energy generation and/or storage, EVSE Vehicle to X software and services, EVSE demand management software and services, EVSE fleet charging management software and services, portable EV Charger or Fast EV Charger with or without solar.

The reopening of the contract resulted in the addition of 12 new vendors to the statewide contract offering a variety of EV charging supply equipment and services and anti-idling equipment. These new technologies are now available to public entities across the state, and country, as a result of this coordination and support provided by MAPC.

## Regional EV Strategy

Over the summer of 2019, the Metropolitan Mayors Coalition's Climate Preparedness Task Force expressed an interest in deeper regional coordination and knowledge sharing on topics related to planning for EVs and support increased adoption across their communities. In response to this request, MAPC designed and launched a series of Regional EV Strategy Calls to provide a space to generate creative multi-community solutions to the opportunities and challenges posed by increasing adoption of EVs across the MAPC region.

These calls have since been expanded to include communities from the North Shore Region, and MAPC continues to include additional communities in the MAPC region who express an interest in learning more about regional EV topics.

The bi-monthly conference calls provide an opportunity for communities to share EV-related updates with one another and a forum for short, informative presentations from a community or expert that relates to that months focus topic. The kick-off call in October focused on on-street charging challenges and solutions and the December call focused on EV school bus opportunities. Future calls will highlight the community-based site suitability analysis, statewide planning for EV infrastructure, and electricity rate design for EVs.

While the Regional EV strategy calls are just getting started, the discussions that have taken place with the participating communities have already generated new ideas for potential multi-community collaboration of supporting vehicle electrification.

## New Partnerships

MAPC's work supporting communities on accessing clean vehicle related funding and programs has also led to the development of new partnerships that represent viable opportunities for future work.

During the past year, MAPC has developed a collaborative relationship with staff at the National Regional Energy Laboratory, Massachusetts Institute of Technology, the Volpe National Transportation Systems Center, and the Center for Sustainable Energy. All of these organizations have been working together to develop a project concept to support new pathways in the Greater Boston area to energy efficient, shared, and electric mobility. These preliminary conversations and emerging relationships lay a strong foundation for the development of applicant teams to future grant opportunities related to clean vehicle technologies.

Additionally, MAPC has been exploring the hosting one or more EV Charging Station Ambassadors to connect municipalities in the MAPC region, and beyond, with opportunities to fund the installation of EV charging stations on public and private sites through partnerships with their electric utility service providers. This position would assist cities and towns with participation in electric utility make-ready programs, or similar incentive structures, and identification of suitable sites for EV charging stations. This opportunity was advertised to all electric utilities servicing communities in the MAPC region. MAPC is currently in conversations with National Grid about the potential of hosting such a position in 2020 to support cities and towns in the MAPC region and neighboring communities.

# Appendix A: Beverly Site Suitability Analysis Project One Pager

# Charging Up Electric Vehicles in the City of Beverly

*2019 District Local Technical Assistance project with MAPC*

## About

During the fall of 2019, the **Metropolitan Area Planning Council (MAPC)** will be providing technical support to the City of Beverly in developing a strategy to inform the placement of electric vehicle charging stations. The strategy seeks to prioritize locations that are the most useful to people who live, work, and play in the City, and will be informed by a community-wide **Site Suitability Analysis** performed by MAPC.

*Flip this page over to learn more about what that is!*

## Context

The **City of Beverly** has been a Green Community since 2010, and has reduced municipal energy consumption by over **16 percent**. Most recently, the City has begun to install and plan for the availability of electric vehicle charging stations. The City has installed charging stations at the Middle School and has plans to install stations at the High School.

## Engage

**Tell us where you'd like to charge an electric vehicle!** We are looking for input from all drivers – whether you currently drive an electric vehicle or not.

**mapc.ma/BeverlyEVCharging**

This survey will remain open until **October 4, 2019.** Responses to this survey will be kept anonymous.

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# What is a site suitability analysis?

A site suitability analysis is a method for prioritizing sites for a specific purpose based on a set of spatial criteria you define. The criteria can be positive or negative with different weighting to reflect the relative importance of each criteria/indicator. Mapping is used to determine how the indicators interact and overlay with each other within a space.

**Excluded Parcels** + **Indicator 1** + **Indicator 2** = **Suitable Parcels**

## Example: Housing Production Plan Site Suitability Analysis

**Excluded Parcels** + **WalkScore** + **Transit Options** = **Suitable Parcels**

# Learn More

*The Metropolitan Area Planning Council (MAPC) is the regional planning agency serving the people who live and work in the 101 cities and towns of Metropolitan Boston.*

**www.mapc.org/our-work/expertise/data-services/**
**www.mapc.org/our-work/expertise/clean-energy/**

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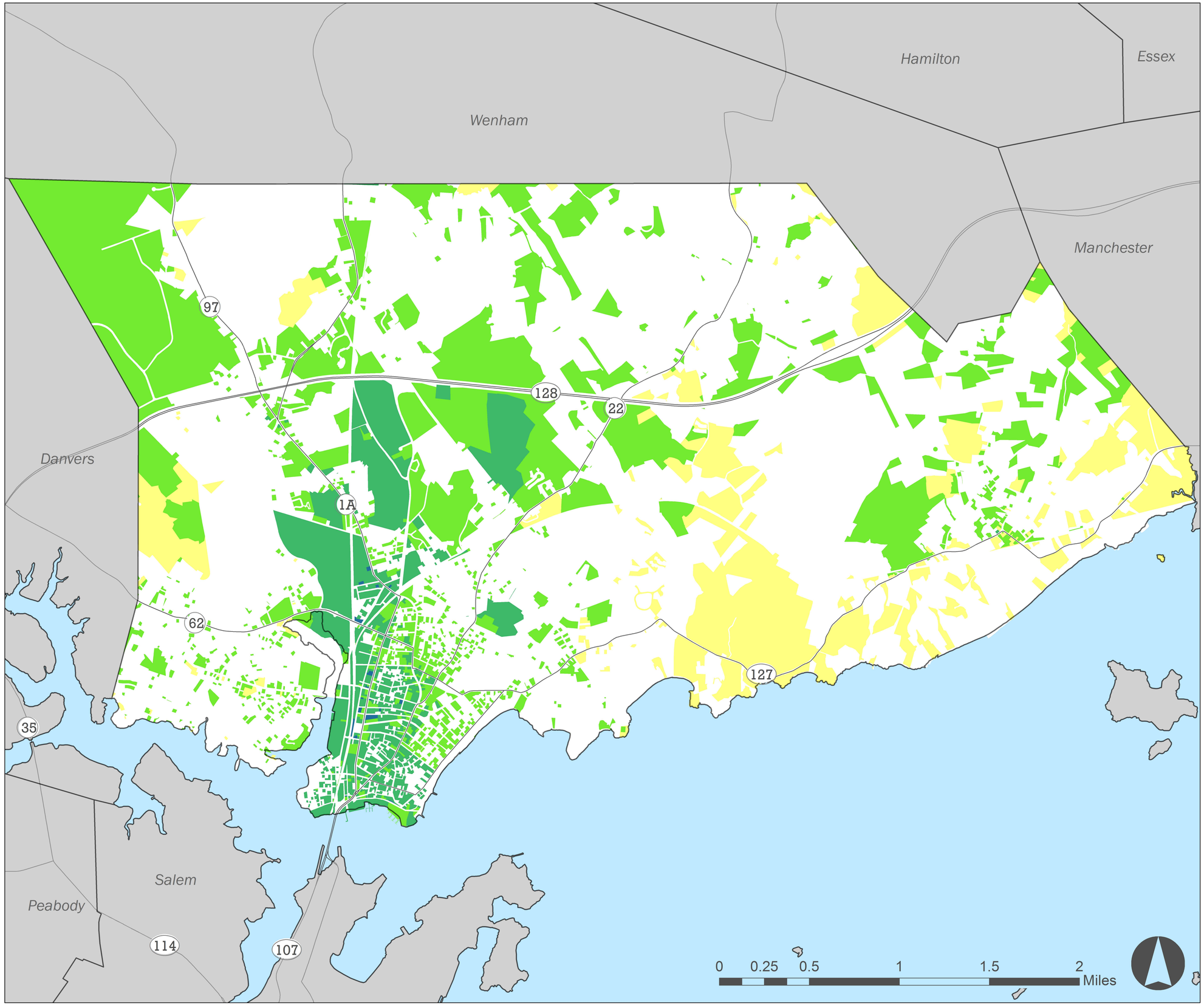
# Appendix B: Beverly EV Charging Station Site Suitability Maps

# EV Charging Stations Suitability Analysis

## Beverly

Scenario: Public Access Charging Stations
-
Composite Analysis Score




Excluded Parcels

**Public Access Charging Stations**

**Total Composite Score**

- 0 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100

**Major Roads**

- Interstate
- U.S. Highway
- State Route

Composite Criteria:
- Equity
- Usership
- Site Proximity
- Existing Conditions



Produced by:
Metropolitan Area Planning Council
60 Temple Place, Boston, MA 02111 | (617) 933-0700

Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Massachusetts Department of Transportation (MassDOT)

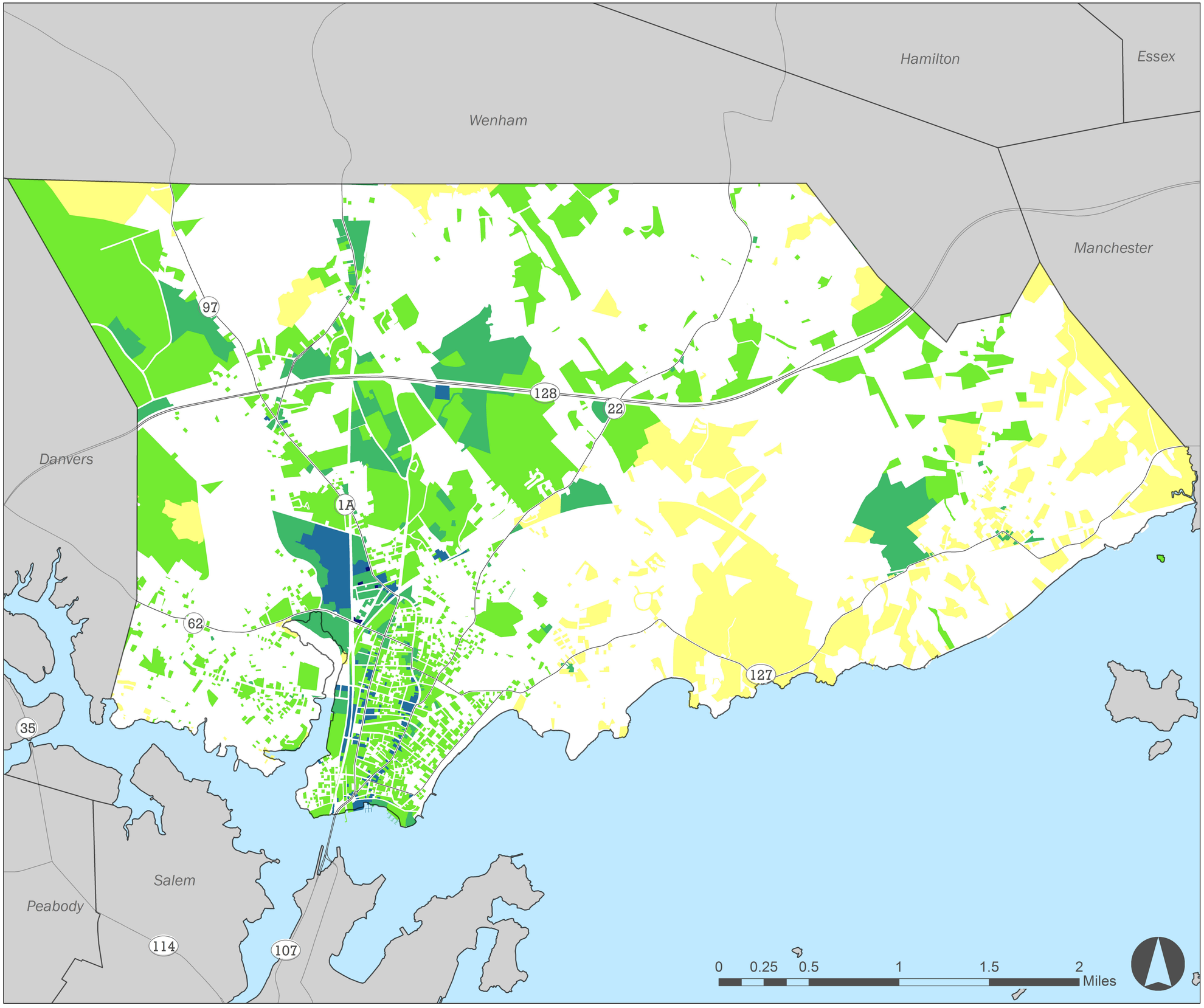
December 2019

MAPC

# EV Charging Stations Suitability Analysis

## Beverly

Scenario: High Speed Charging Stations
-
Composite Analysis Score




Excluded Parcels

**High Speed Charging Stations**

**Total Composite Score**

- 0 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100

**Major Roads**

- Interstate
- U.S. Highway
- State Route

Composite Criteria:
- Equity
- Usership
- Site Proximity
- Existing Conditions

The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.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Data Sources:
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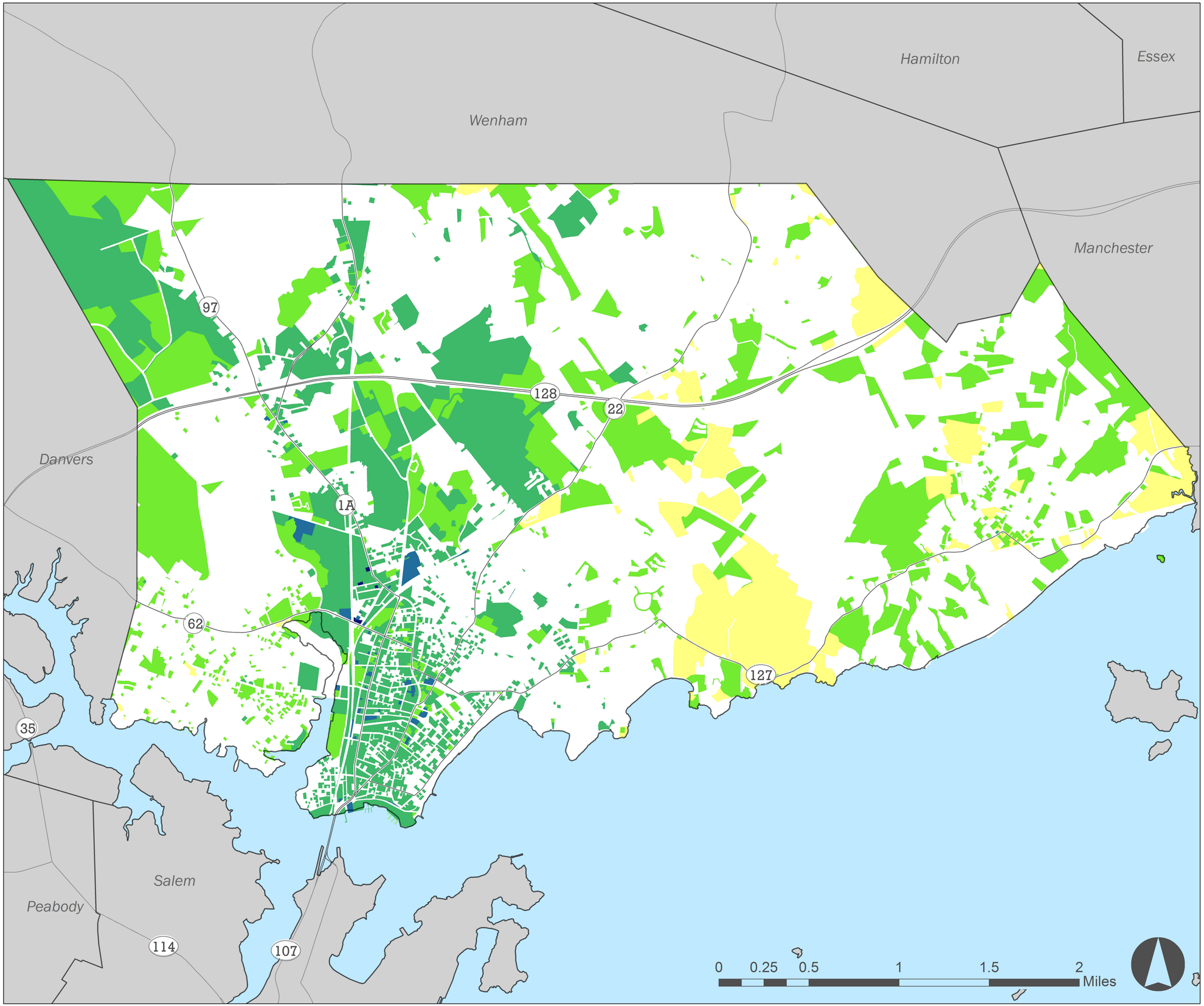
# EV Charging Stations Suitability Analysis

## Beverly

Scenario: Car Sharing Charging Stations
-
Composite Analysis Score




Excluded Parcels

**Car Sharing Charging Stations**

**Total Composite Score**

- 0 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100

**Major Roads**

- Interstate
- U.S. Highway
- State Route

Composite Criteria:
- Equity
- Usership
- Site Proximity
- Existing Conditions



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December 2019

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# Appendix C: Beverly EV Charging Station Site Suitability Methodology Documentation

## Suitability Analysis Methodology

A suitability analysis is a method of evaluating the relative utility of sites for a specific purpose; in this case, the relative utility of parcels in Beverly to serve as sites for electric vehicle (EV) charging stations. A suitability analysis begins with the definition of criteria for preferred sites, which then are operationalized through a series of indicators. These indicators may be positive qualities, that improve the utility of a site, or negative qualities that restrict the utility of a site. In most cases, an indicator will make a site incrementally better or incrementally worse than another, however, in some circumstances, presence of or proximity to an indicator will lead to its elimination from the analysis. Mapping is used to relate indicators to each other and to sites. A suitability analysis results in scored sites, which enables their prioritization.


*Figure 1: Abstracted Suitability Analysis*

### Analytical Framework

To develop the criteria and indicators for the EV charging station suitability analysis, MAPC conducted a literature review and developed a logic model, which informed each other in an iterative process. The literature review served the purpose of providing a deeper understanding of the existing analytical approaches available to build on. It also helped our team identify the gaps where existing methods fail to meet the primary goals and values of the methodology the project team sought to develop. The literature review covered peer-reviewed sources, white papers, case studies, and publications from advocacy groups, and resulted in charging stations siting requirements, recommendations for implementation and ultimate adoption, and policy solutions.

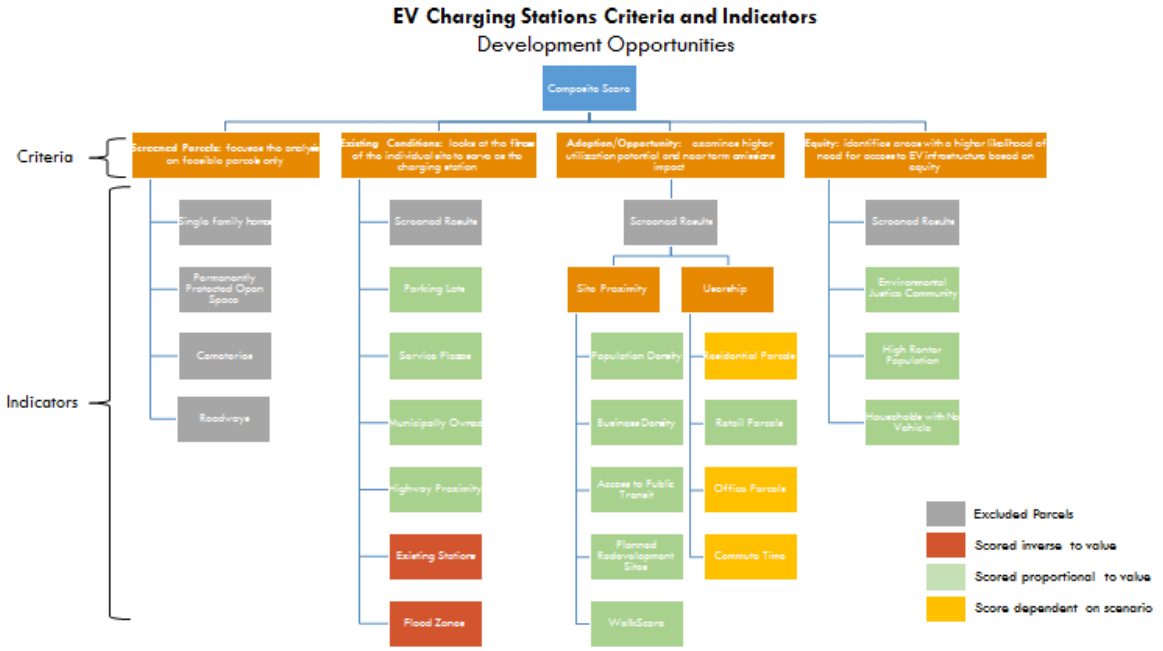
Through the literature review, the project team identified two primary ways to approach strategic planning for electric vehicle charging infrastructure. One uses existing trends and demographic data to project adoption of electric vehicles in the study area and then makes siting recommendations based on meeting those anticipated demands. This approach of leveraging data on EV adoption trends was the most used method across the EV readiness and infrastructure planning studies examined during the literature review. The other approach assumes a theory of change of "if you build it they will come," which applies behavioral findings that the presence of electric vehicle charging stations may impact a driver's likelihood to make the switch to an electric vehicle.

From the start of the project, the goal was to develop an approach to strategic planning for electric vehicle infrastructure that promoted equitable access as the community transitions to zero emission vehicles. What was observed in those analyses that focused on EV adoption trends was a strong relationship with high-income, highly-educated populations in the study areas. As such, the project team made the foundational decision to design a method that does not take into

consideration adoption trends and focused solely on criteria and indicators that relate to the conditions of the site and potential utilization if a station were installed.

From the results of the literature review, MAPC refined the indicators, producing a final comprehensive list of 22 indicators that would influence the site suitability for an EV charging station. These indicators were then grouped into four criteria that represent larger guiding principles for the analysis. The logic model below provides an overview of the data, which will be described in detail in Table A.

*Figure 2: EV Charging Stations Criteria and Indicators*




The literature review also clarified differences in EV charging station technology, which led MAPC to develop three possible use cases: public access charging, high speed charging, and car sharing charging. The assumptions of each use case are described in more detail below:

**Public Access Charging:** This scenario is defined as sites most suitable to support publicly accessible Level II charging stations. This includes assumptions that support dwell time (i.e., time spent parked/charging) at the location for two to four hours and high utilization.

**High Speed Charging:** This scenario is defined as sites most suitable to support publicly accessible DC Fast Charging (DCFC) stations. This includes assumptions that support much shorter dwell times of 30 minutes to an hour. This scenario is focused on enabling users that may be making longer distance trips in an electric vehicle. As a result, sites near high mobility infrastructure are prioritized, such as arterial roads and service stations.

**Car Sharing Charging:** This scenario is defined as sites most suitable to support Level II charging stations dedicated to an electric vehicle car share program. This includes many of the same assumptions as the Public Access scenario, but with an emphasis on sites located near

multi-unit residential buildings and that meet the methodology's equity criteria. These locations are specifically aimed at populations that may not have sufficient economical or geographic access to EVs and are consequently not traditionally the primary adopters of EVs.

The intention of multiple scenarios is to demonstrate variety and offer flexibility in how an EV charging station could be used.

## CommunityViz®

MAPC conducted its suitability analysis using CommunityViz®, an add-on for ESRI ArcGIS created by City Explained, Inc. that enables advanced planning applications. CommunityViz® includes a "Suitability Wizard" that structures suitability analyses for planners and analysts through a pre-established structure of indicators, assumptions, scenarios, and criteria. The ability to create spatial data attributes that are formula-driven and dynamically updated as underlying data or criteria change allows planners to use spatial data for suitability analysis. For example, CommunityViz® smoothly integrates distance from relevant features or the percent to which features overlap other features as analysis criteria without lengthy manual spatial analysis. The "scenarios" tool allowed sites to be compared from three scenarios described above. CommunityViz® Suitability Wizard also automatically normalized indicator values so they would take on a common range of values that are straightforward to compare across indicator categories.

## Criteria

***Criteria*** are the principles by which the sites are evaluated. Criteria are the response to the question: *What qualities will the preferred site for this use possess*? Criteria are established at the beginning of the suitability analysis and are derived from many sources, including academic literature and planning documents, as noted above. While most criteria are structured to evaluate sites across a spectrum of preferable to less preferable, some analyses will include criteria describing where the use should never be located, regardless of how many other positive characteristics are present. Sites possessing these qualities are referred to as ***screened***.

For this analysis, MAPC created the following criteria:

1. Screened Parcels: focuses the analysis on feasible parcels only. All indicators included under screened parcels present some barrier to installing EV charging stations at this site.
2. Existing Conditions: looks at the fitness of the individual site to serve as the charging station. All the indicators in this criterion focus on characteristics that are necessary for a charging station.
3. Adoption/Opportunity: examines higher utilization potential and near term emissions impact, relying on indicators that would imply greater EV adoption and utilization, and therefore success.
4. Equity: identifies areas with a higher likelihood of need for access to EV infrastructure based on equity. Because EV's tend to be adopted by high-income, well-educated populations, by adding indicators to the analysis which would redirect EVs to areas that tend to have lower access, MAPC hopes to introduce an equity lens.

## Indicators

The degree to which a site meets the established criteria is evaluated through a corresponding set of spatial data sets, or ***indicators***. Indicators are the response to the question: *How will we know the site fulfills the established criteria*? Indicators may be physical characteristics of the site – such as

above a certain size or the presence of steep slopes – or other qualities – such as land value or presence within a historic district. Sites may also be evaluated to their distance to features – such as proximity to parks or transit – or general qualities of the surrounding area. Importantly, indicators may be positive qualities that are scored proportionately and increase the site's suitability score or negative qualities that are scored inversely and reduce the site's suitability score. They can also be scored along a gradient, or scored in binary terms, where a site does or does not possess a certain indicator or falls above or below a certain threshold. This indicators for this analysis can be seen in the logic model above but are also enumerated in greater detail in the chart below.

## Weighting

The relative importance of criteria and the indicators they comprise is established through ***weighting***. Equal weighting across all criteria and all indicators means every data set in the analysis is equally important; higher weights assigned to certain criteria or indicators means these parameters are more important to identifying preferred sites than others. This analysis utilized weighting as the method for differentiating among the three scenarios described above. While CommunityViz has the ability to weight indicators on a scale of 1-10, for simplicity, MAPC opted to weight the relevant indicators as either 0, 5, or 10, signifying that an indicator was irrelevant, semi-important or very important, respectively. See the table below for details on the weighting.

## Suitability Score

Once the indicators and weighting have been established, they are combined to create a score for each parcel. Then, to compute an aggregate suitability ranking for each site, criteria are assigned weights reflecting their importance relative to other criteria. For this analysis, MAPC assigned equal weighting for each of the criteria. The result is a score for each parcel on a range of 0 to 100, where scores closer to 100 signify more suitable sites.

## Results

Suitability analyses produce a set of well-informed spatial results, but are ultimately theoretical. Consequently, ground truthing is a key step in assessing the results. To facilitate this process and prioritize the most suitable sites, MAPC exported the top scored sites by scenario and by site ownership.

### Municipally Owned

These sites included all those with the owner field as "City of Beverly." The top 10 sites were pulled for Public Access Charging and Car Sharing Charging scenarios. Top sites were not pulled for the High Speed Charging scenario because the high installation and operating costs make it less feasible for a municipal property.

### Commercial/Institutional

These sites included those classified as "Commercial," "Commercial Vacant," "Federal, State or Municipal," "Institutional/Exempt" and "Institutional/Exempt Vacant." The top 10 sites were pulled for Public Access Charging and Car Sharing Charging scenarios, and the top 15 were pulled for the High Speed Charging scenario.

### Multiunit Residential

These sites included those with land use code 111 and 112. The top 10 sites were pulled for Public Access Charging and Car Sharing Charging scenarios. Top sites were not pulled for the High Speed Charging scenario because a residential area does not fit within the intended uses for a high speed charger.

## Recommendations and Limitations

Because the analysis has been an iterative process based on ongoing conversations and data refinement, MAPC concludes with recommendations for future suitability analyses for EV charging station sites.

1. Because the base geography for the analysis was parcels, many of the indicators translated into discrete variables (I.e., a certain land use code or not) by extension. The reality is, however, that a more continuous variable approach may be more conducive to real life circumstances. This approach also helps to avoid edge effects. For example, a site may be suitable for an EV charging station if it is next to a retail parcel rather than exactly on it. Thereby, MAPC recommends using a kernel density approach to shift some of the discrete variables into a more continuous landscape, specifically population density, business density, and retail land use.

2. Another key consideration for future analyses is how indicators interact with each other. In other words, when two factors are correlated, the result is extra emphasis on the idea they both convey. Alternatively, if two indicators behave inversely, it is possible that they may be mutually exclusive and negate each other if not merged into one indicator. For example, two different kinds of land uses may cancel each other out since a parcel can only be assigned one land use code.

**Table A: EV Charging Station Site Suitability Indicators and Weighting**

| Indicators | | | Applicable Scenarios | | |
|---|---|---|---|---|---|
| **Screened Parcels: focuses the analysis on feasible parcels only** | **Data Source** | **Treatment** | Public Access Charging | High Speed Charging | Car Sharing Charging |
| Single family homes | Assessor's data | To be eliminated from analysis | N/A | N/A | N/A |
| Permanently protected open space | MassGIS | To be eliminated from analysis | N/A | N/A | N/A |
| ROW and RAIL and WATER | Assessor's data | To be eliminated from analysis | N/A | N/A | N/A |
| Cemeteries | Assessor's data | To be eliminated from analysis | N/A | N/A | N/A |
| **Existing Conditions: looks at the fitness of the individual site to serve as the charging station** | | | Public Access Charging | High Speed Charging | Car Sharing Charging |
| Availability of parking spaces/garages | Assessor's data | Parcels with land use code for commercial parking lots receive higher scores | 10 | 10 | 10 |
| Service Plazas | MassDOT | Parcels containing a Service Plaza receive higher scores | 5 | 10 | 0 |
| Municipally owned sites | Assessor's data | Parcels owned by Town of Beverly receive higher scores | 10 | 0 | 10 |
| Highway proximity | MassDOT | Parcels closer to highways receive higher scores | 5 | 10 | 0 |
| Flood Zones | FEMA / DCR | Parcels located in flood zones receive lower scores | 5 | 5 | 5 |
| Proximity to charging stations | Alternative Fuel Data Center, US Dept of Energy | Parcels farther from existing charging stations receive higher scores | 5 | 5 | 0 |
| **Adoption/Opportunity: examines higher utilization potential and near term emissions impact** | | | Public Access Charging | High Speed Charging | Car Sharing Charging |
| **Site Proximity** | | | | | |
| Population density | ACS 2013-2017 | Parcels near to areas of high population density receive higher scores | 10 | 10 | 10 |
| Business density | ACS 2013-2017 | Parcels near to areas of high business density receive higher scores | 10 | 10 | 10 |
| Transit station proximity | MassDOT; CTPS | Parcels near to transit stations (bus stops and commuter rail) receive higher scores | 10 | 0 | 10 |
| Planned redevelopment sites | MassBuilds | Parcels near to redevelopment sites receive higher scores | 10 | 10 | 10 |

| | | | | | |
|---|---|---|---|---|---|
| Walkscore | WalkScore | Parcels associated with higher walk scores receive higher scores | 10 | 0 | 10 |
| **Usership** | | | | | |
| Dwell time - residential | Assessor's data | Parcels with a residential land use receive higher scores | 5 | 0 | 10 |
| Dwell time - retail use | Assessor's data | Parcels with a retail land use receive higher scores | 10 | 10 | 10 |
| Dwell time - office use | Assessor's data | Parcels with an office land use receive higher scores | 10 | 0 | 0 |
| Commute time | ACS 2013-2017 | Parcels associated with a higher percentage of workers who drive to work with 60 min or more commute receive higher scores | 10 | 0 | 5 |
| **Equity: identifies areas with a higher likelihood of need for access to EV infrastructure based on equity** | | | Public Access Charging | High Speed Charging | Car Sharing Charging |
| Environmental justice communities | MassGIS | Parcels in EJ communities receive higher scores | 10 | 10 | 10 |
| High % renter populations | ACS 2013-2017 | Parcels associated with a higher percent of renter occupied households receive higher scores | 10 | 5 | 10 |
| Households with no vehicle | ACS 2013-2017 | Parcels associated with a higher percentage of households with no vehicle receive higher scores | 0 | 0 | 10 |

# Appendix D: Regional EV Strategy Kick-Off Call Slides

# REGIONAL EV STRATEGY
# KICK-OFF CALL

*Wednesday, October 16, 2019*

MAPC
METROPOLITAN AREA PLANNING COUNCIL

# Today's Agenda

| | |
|---|---|
| 11:00 – 11:05 AM | **Settle-in / Introductions** \| Megan Aki (MAPC) |
| 11:05 – 11:15 AM | **Setting Goals for Regional EV Collaboration** \| Megan Aki (MAPC) |
| 11:15 – 11:30 AM | **Group Discussion #1** |
| 11:30 – 11:40 AM | **Strategy Spotlight: Cambridge Residential EV Charging Pilot** \| Bronwyn Cooke (Cambridge) |
| 11:40 – 11:55 AM | **Group Discussion #2** |
| 11:55 – 12:00 PM | **Wrap up** \| Megan Aki (MAPC) |

# BACKGROUND AND GOALS

*Setting goals for Regional EV Collaboration*

# Public Stations in the Metro Mayors Region

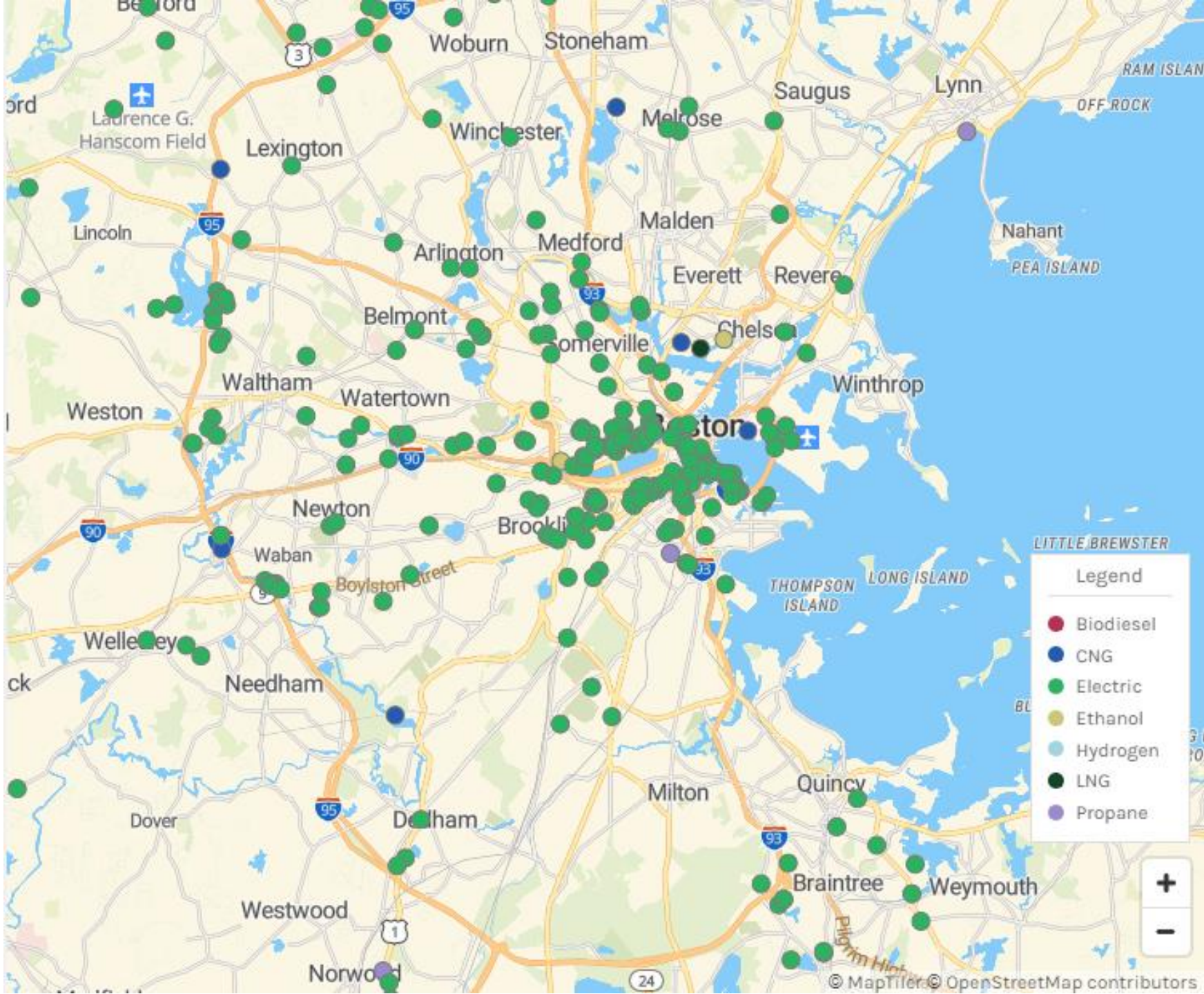



*Image source: US DOE Alternative Fuels Data Center*

# Public Stations in the Metro Mayors Region

| Municipality | Number of Level 1 Stations | Number of Level 2 Stations | Number of DCFC Stations |
|---|---|---|---|
| Arlington | 0 | 2 | 3 |
| Boston | 2 | 395 | 41 |
| Braintree | 0 | 18 | 17 |
| Brookline | 0 | 24 | 0 |
| Cambridge | 3 | 123 | 8 |
| Chelsea | 0 | 1 | 0 |
| Everett | 0 | 0 | 0 |
| Malden | 0 | 0 | 0 |
| Medford | 2 | 17 | 1 |
| Melrose | 1 | 5 | 0 |
| Newton | 1 | 25 | 0 |
| Quincy | 1 | 7 | 1 |
| Revere | 0 | 2 | 1 |
| Somerville | 0 | 14 | 0 |
| Winthrop | 0 | 0 | 0 |
| **TOTALS** | **10** | **633** | **72** |

*Data source: US DOE Alternative Fuels Data Center*

Outside of Boston, approximately **11%** are **municipally owned***

*This excludes stations located in the City of Boston because it is unclear in the data set which are municipally owned.

# Near-term Opportunities

- Volkswagen Environmental Mitigation Trust Funds (~$75 million in MA)
- Eversource and National Grid “make-ready” programs
- New providers on statewide contract VEH102 (*to be announced*)

# Feedback and Ideas Received to Date

## PROPOSED TOPICS

**Electric school buses**

**Charging station utilization data sharing**

**Dealer education**

**Private site host engagement**

**Strategic siting of EV charging stations**

**Renter/garage-orphan solutions**

## PROPOSED PRESENTERS

**MA DOER Clean Cities**

**Utility make-ready program managers**

# Proposed Goals for this Collaboration

**Purpose:** to provide a space to generate creative multi-community solutions to the opportunities and challenges posed by increasing adoption of EVs across the MAPC region.

**Proposed Approach:**

- Collection and circulation of brief EV-related updates from participating communities in advance of each call to support robust and relevant discussion on each call
- Short, informative presentations from a community or expert that relates to the topic focus of the call to fuel discussion
- Open discussion with guiding questions to support productive use of participants' time

**Participants:** Metro Mayors Climate Preparedness Taskforce members and relevant staff, other communities within the MAPC region that are actively interested in or working on EV initiatives

**Facilitator:** MAPC

# Proposed Schedule for FY20

**Wed, Dec 4th, 2019**
**11AM – 12PM**
*Topic Focus:* TBD

**Wed, Feb 19th, 2020**
**11AM – 12 PM**
*Topic Focus:*
Strategic/equitable planning for EV infrastructure and private site host outreach (*proposed*)

**Wed, Apr 15th, 2020**
**11AM – 12PM**
*Topic Focus:*
Opportunities for regional collaboration on EV School Buses (*proposed*)

**Wed, Jun 17th, 2020**
**11AM – 12PM**
*Topic Focus:* TBD

**What are other critical topics of interest?**

**How would you like to see MMC and other communities collaborate regionally?**


# Residential EV Charging Pilot
# City of Cambridge
# New Mobility Blueprint

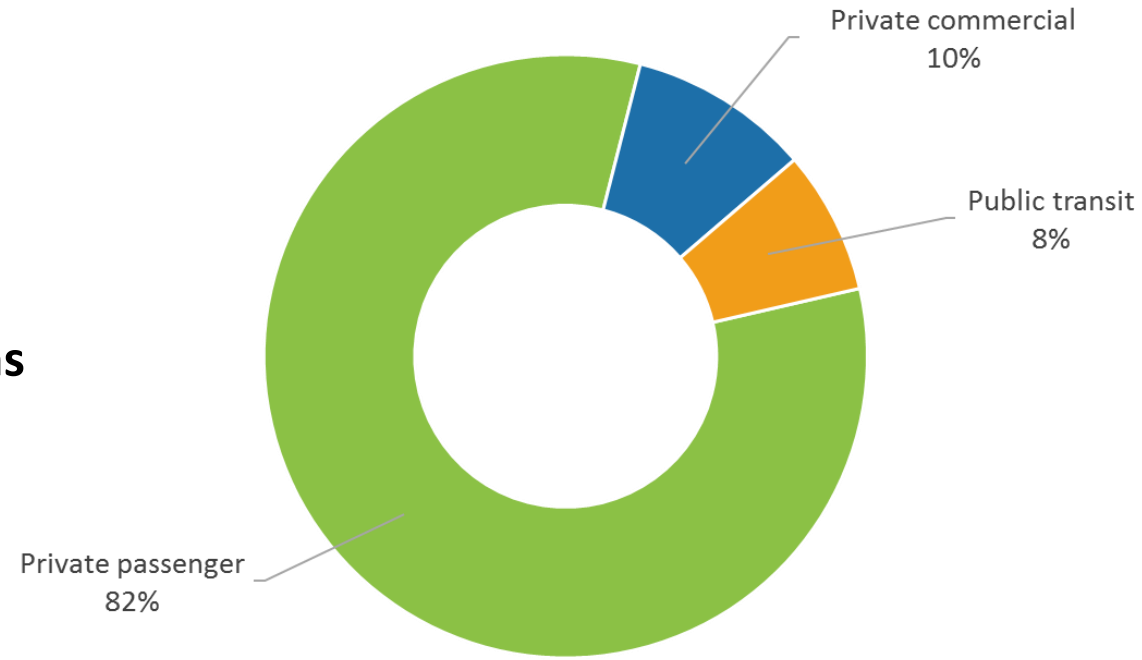
October 16, 2019

# Greenhouse Gas (GHG) Emissions

Transportation accounts for…

- 29% of U.S. emissions
- 43% of MA emissions
- 11% of Cambridge emissions*

- **82% of Cambridge transportation sector emissions are from private passenger vehicles**

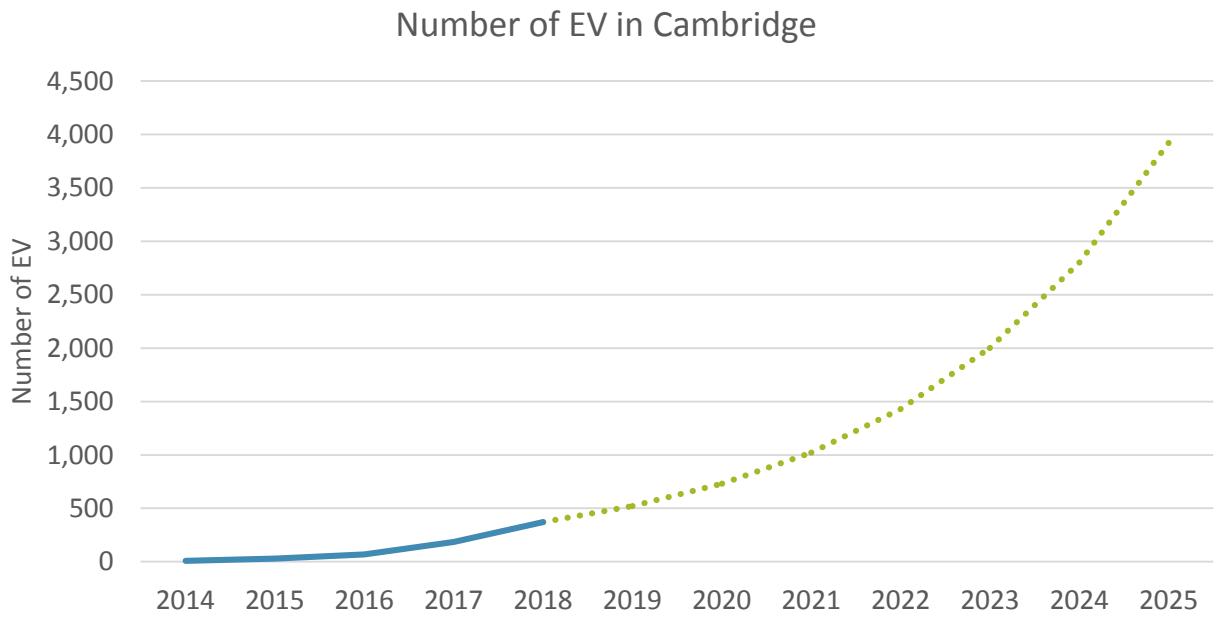



*Includes: vehicles registered in Cambridge, a portion of public transit emissions
Doesn't include: emissions generated from trips starting outside and ending in the City, emissions from trips made through the City.

# EV Growth

The State goal is to have 300,000 EVs on the road by 2025.

- Cambridge registered autos account for 1.3% of MA's registered autos in 2025.
- For Cambridge to contribute proportionally to the State goal, it should have ~4000 EV by 2025.




*Data Source: MA DOER EV Rebate Data*

# EV Barriers

Range Anxiety

- *99% of trips are under 70 miles, most EVs have 100+ miles of range*

Cost

- *Incentives bring EVs in line with average new vehicle MSRPs*
- *Used market is growing*

Technology Uncertainty

- *Lease options alleviate fear of being locked in*

**Access to EV Charging**

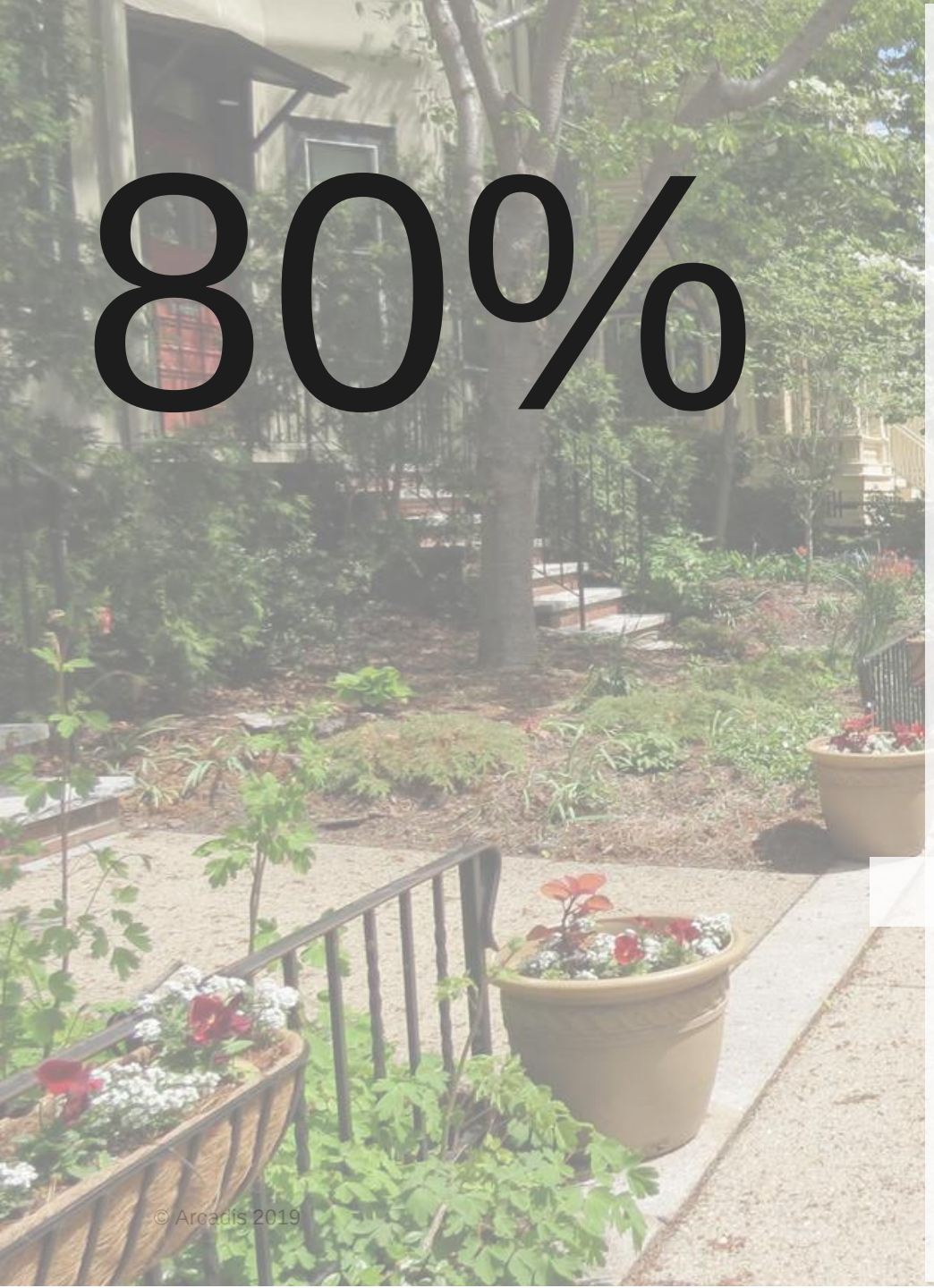
# 80%

**Of charging is expected to take place at home**

# 20%

**Public charging**

- **retail/commercial lots**
- **transportation corridors**
- **Workplace charging**
- **Level 2 and Level 3**



# 80%

## Of registered vehicles use on-street parking

Passenger vehicles registered in Cambridge ~41,000
Resident on-street parking stickers issued ~33,000

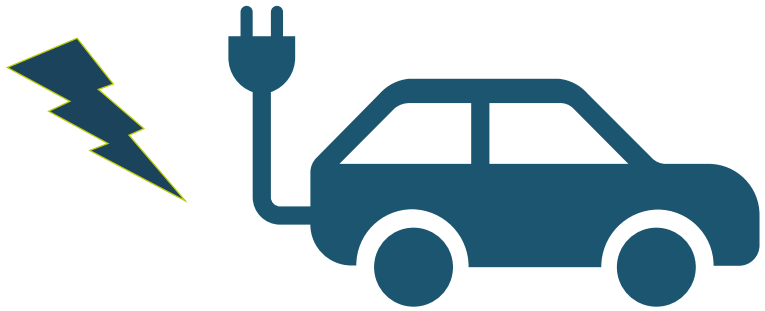
## Of housing units are in 3+ unit multifamily buildings

| | ALL UNITS | |
|---|---|---|
| Type of Housing[1] | Count | Percent of Total |
| Single Family | 3,780 | 7.2% |
| Two Family | 6,976 | 13.2% |
| Three Family | 6,216 | 11.8% |
| 4 to 6 Units | 5,019 | 9.5% |
| 7 to 25 Units | 6,259 | 11.8% |
| 26 to 50 Units | 3,995 | 7.6% |
| 51 to 100 Units | 5,659 | 10.7% |
| Over 100 Units | 14,918 | 28.2% |
| Total Units | 52,822 | 100% |

# Residential EV Charging Pilot Goal

The City of Cambridge aims to be carbon neutral by 2050, and emissions from vehicles registered in Cambridge equate to approximately 92% of Cambridge's transportation emissions. Transitioning these vehicles from gasoline to electric is an important strategy for reducing emissions.

However, a significant barrier to EV adoption in Cambridge is the lack of "at home" charging, which is expected to be the primary source of charging for EV owners. Recommendations to expand the EVSE network is needed to support EV adoption of in a way that's equitable across The City.



# Pilot Design Methodology

## 1. Determine EV Charging Use Case

### Use Case
- Cambridge resident
- Current car owner
- No access to EV charging (no driveway)
- Relies on car for commute and for personal travel

### Parking Type
*Private off-street*

*Parking lots*

*Workplace*

Curbside
*Pilot focus*

## 2. Select Two Neighborhoods

- Agassiz
- Area 2/MIT
- Cambridge Highlands
- Cambridgeport
- East Cambridge
- Mid-Cambridge
- Neighborhood 9
- North Cambridge
- Riverside
- Strawberry Hill
- The Port
- Wellington-Harrington
- West Cambridge

### Utility Score
- % residential lots with driveways
- # residents per driveway
- # permits per acre
- % households with 2+ cars

### Equity Score
- Household median income
- Affordable housing
- EJ community

Select two neighborhoods to move forward with EV Pilot

## 3. Evaluate EV Charging Design

### Constraints Based Analysis
- Clearances
- ADA
- Curb cuts/tress/street infrastructure etc.

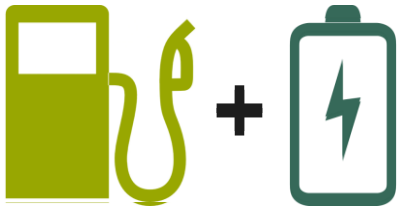
### Evaluate EVSE Solutions
- EVSE Configuration
- Hardware/software products
- Ownership/partnership models
- Parking policies, regulations
- Use fees

## 4. Implement Pilot

- Implement pilot
- M&E
- Determine next steps for - EVSE network expansion

# EV Charging Use Case

Battery Electric Vehicle



Plug-In Hybrid Vehicle

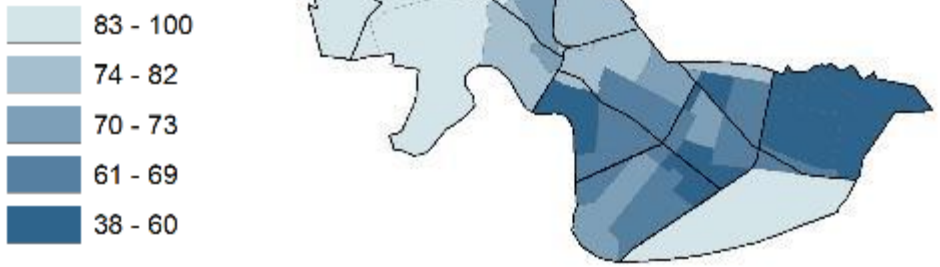
| Battery Electric Vehicle | | Plug-In Hybrid Vehicle |
|---|---|---|
| 118 miles | Average vehicle range* | 30 miles |
| 1.3 | Number of charges needed per week** | 5.0 |
| 23.6 | Level 1: Time for full charge | 6.0 |
| 5.9 | Level 2: Time for full charge | 1.5 |
| 1.0 | Level 3: Time for full charge | .3 |

** From 2018 US EVs on the market, subtracting Tesla Model S and Model X

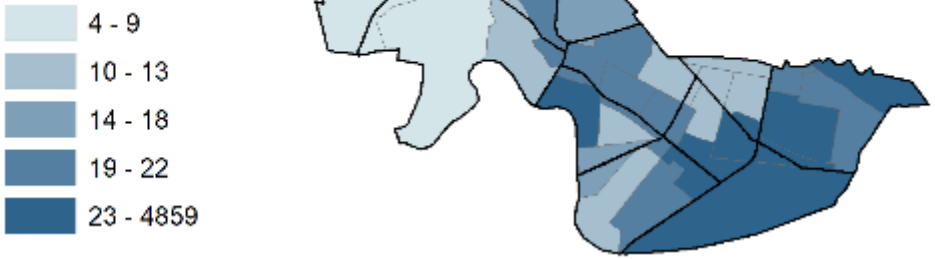
**21.5 miles per day is the average VMT; data provided by the City of Cambridge. There was no weekend VMT data available so the assumption was made that the average resident travels this amount on weekends for simplicity

# Neighborhood Selection – Utility Score

**Percent of residential lots with driveways**
Darker areas have lower percent of residential lots with driveways




**Number of residents per driveway**
Darker areas have more residents per driveway




**Number of parking permits per acre**
Darker areas have more parking permits per acre

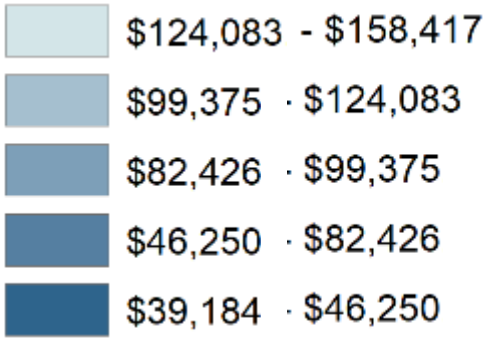

**Percent of households with 2+ vehicles**
Darker areas have a higher percentage of households with 2+ vehicles

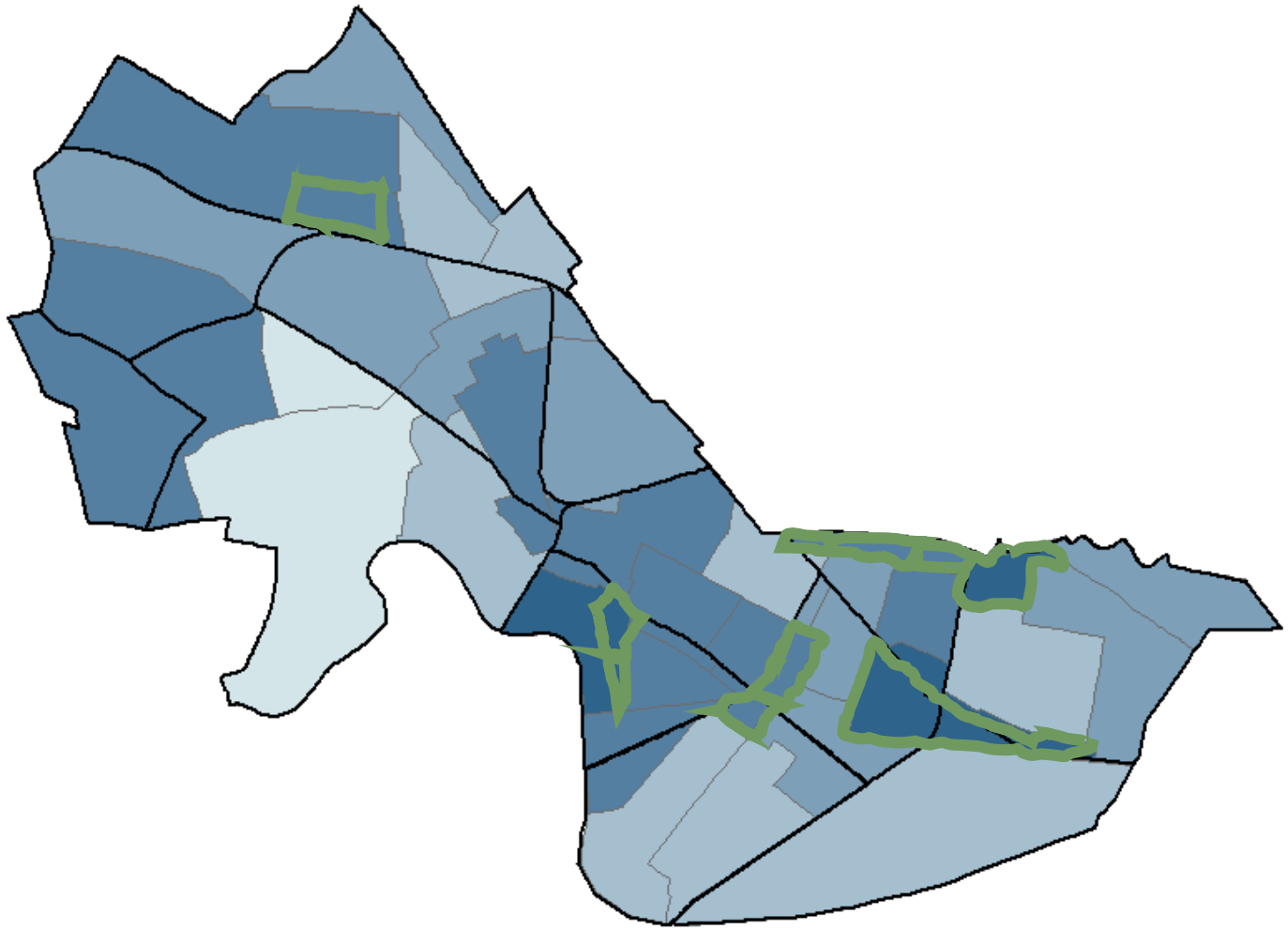



Data from 2010 Census and City of Cambridge GIS Database

# Equity Scoring - Household Income Distribution in Cambridge

- Darker areas have a lower household median income than lighter areas; affordable housing is also accounted for in siting selection.
- Green highlighted areas represent State of Massachusetts Environmental Justice Communities.



Data from 2010 Census and City of Cambridge GIS Database

# Neighborhood Selection Scoring Summary

*Below is the scoring matrix using raw cost effectiveness and equity scores. Weights can be applied to the scores based on importance. Higher score is more suitable for this pilot.*

| | Utility Score | Equity Score | Total Score |
|---|---|---|---|
| Agassiz | 1 | 2 | 3 |
| Area 2/MIT | 1 | 2 | 3 |
| Cambridge Highlands | 3 | 2 | 5 |
| Cambridgeport | 3 | 1 | 4 |
| East Cambridge | 3 | 3 | 6 |
| Mid-Cambridge | 3 | 3 | 6 |
| Neighborhood 9 | 2 | 2 | 4 |
| North Cambridge | 3 | 2 | 5 |
| Riverside | 2 | 3 | 5 |
| Strawberry Hill | 2 | 2 | 4 |
| The Port | 1 | 2 | 3 |
| Wellington-Harrington | 3 | 3 | 6 |
| West Cambridge | 1 | 1 | 2 |

# EV Charging Pilot Design

*When evaluating EVSE vendors, there will be many features to consider. To select a vendor, the primary considerations need to be determined for vendor requirements. Additional considerations should be evaluated but may not be requirements. Considerations may change depending on field conditions, and whether Level 1, Level 2, or Level 3 charging is used.*

## Primary Considerations

*Features to be evaluated, and included as specifications for pilot implementation*

- Charging speed/level
- Number of stations/ports
- Open vs. closed charging
  *Open charging allows EV charging stations and central management systems from different vendors to communicate with each other*
- Payment platforms
- Cable management
- Accessibility (ADA) and safety

## Additional Considerations

*Features to be evaluated more closely in pilot evaluation, and may become specifications for future network expansion*

- Warranty and maintenance
- Connection to power utility (demand pricing/V2G)
- Branding or advertising space
- Other ownership/partnership models

# Constraints Overview

*Below are the minimum clearances initially proposed for siting EVSE. In addition, installation priorities should be considered after meeting all minimum clearances. Depending on the vendor selected, the siting constraints may change.*

## Minimum Clearances

**5'** minimum clear path of travel (ADA) on sidewalk
**5'** from a building entrance
**5'** from a curb cut
**5'** minimum from sign and legal furniture
**5'-6'** minimum distance from underground utilities
**8'** preferred clear path of travel on sidewalk
**10'** from the trunk of a street tree or 5' from the edge of a tree pit
**10'** clearance from corner
**15'** from the open side of a T-stop entrance or bus stop
**15'** from fire hydrant
**18"** minimum setback from curb and siting in the amenity strip
**25'** clearance from the main entrance of a major building, school, or hospital

## Installation Priorities

- *Residential only parking spots*
- *Not metered parking spots*
- Proximity to an electric panel
- Cellular network availability
- ADA compliance
- Driver's side (left-hand) installations for safety on one-way roads
- Installations in the first legal parking space after the intersection
- Maximum station visibility for safety
- Opportunities to minimize visual clutter
- Away from low point/ponding areas
- 6" curb height

# So About Regional Strategy…

- What's the key barrier in your area?
- What's the barrier you have the most agency in addressing?
- How can cities' needs/goals be matched/aligned to better support regional strategy?
- How do we think about and frame equity for EV programs/policy?

# Wrap Up & Next Steps

**Call Feedback**

- What did you find useful?
- What could be improved for next time?

**Next call: December 4, 11AM-12PM**

**Megan Aki**
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617-933-0795