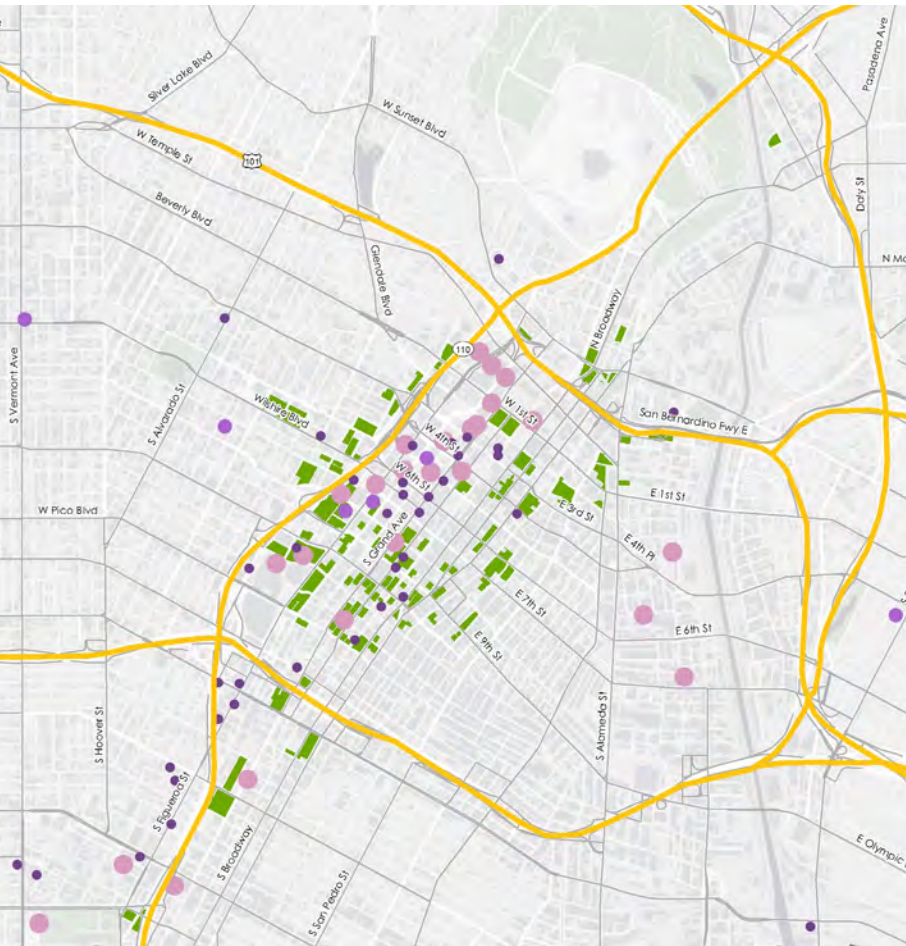


Southern California Plug-in Electric Vehicle Readiness Atlas: 2017 Update



UCLA Luskin School of Public Affairs

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**Southern California
Plug-in Electric Vehicle Readiness Atlas: 2017 Update**

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About this Document

This document was prepared for the Southern California Association of Governments (SCAG) by the UCLA Luskin Center for Innovation. SCAG is coordinating a multi-stakeholder group of government agencies, utilities, and university researchers to prepare multi-faceted and interdisciplinary regional PEV readiness plans. Among other purposes, these plans will help illuminate and guide strategic infrastructure investment, PEV-related economic development, and supportive policy design in Southern California.

The document also serves as an update to the 2013 Southern California Plug-in Electric Vehicle Readiness Atlas. The PEV market has changed considerably since the release of the 2013 report, so policymakers and planners are now encouraged to refer to this version of the PEV Atlas.

Disclaimer

This work was prepared for the Southern California Association of Governments (SCAG) as part of Agreement M-004-16 and sponsored by the California Energy Commission (CEC). The contents of this report reflect the views of the author, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of SCAG, CEC, the State of California, or their employees. This report does not constitute a standard, specification or regulation. The CEC, the State of California, their employees, contractors, and subcontractors make no warranty, express or implied, and assume no legal liability for the information in this document; nor does any party represent that the use of this information will not infringe upon privately owned rights.

Acknowledgements

We thank the Southern California Association of Governments and the California Energy Commission for support of this project. In particular, we thank Marco Anderson of the Southern California Association of Governments for his guidance and assistance.

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PREFACE

Plug-in electric vehicles (PEVs) may provide a range of important benefits. For drivers, PEVs are a way to save money on fuel, avoid trips to the gasoline station, contribute to energy independence, and improve local air quality. For utilities, PEVs represent a new source of demand for power even as they support efficient use of energy produced during overnight hours. For state and regional air-quality regulators, PEVs help reduce criteria air pollutants and greenhouse gas (GHG) emissions.

To fully realize the benefits of PEVs, planners must coordinate and facilitate the growth of two complementary markets: one for PEVs and another for the electric charging opportunities that these vehicles need to refuel. This Atlas describes how many PEVs are in a given neighborhood and how their spatial concentrations vary over the course of a day as their drivers travel to workplaces and retail destinations. This Atlas also projects PEVs growth over the next 10 years within neighborhoods and municipalities in each of the 15 councils of government (COGs) within the Southern California Association of Governments region.

This Atlas also maps potential charging infrastructure opportunities to support and complement growth in the PEV market. It identifies the locations and sizes of workplaces, multi-unit residences and retail establishments that could potentially host PEV charging. Lastly, the Atlas includes maps of other resources that support PEV charging, such as existing publicly-accessible charging stations and stand-alone parking facilities.

This spatial information enables planners to know where PEVs are currently and where growth is likely to occur. This will help them prioritize the municipal planning reforms such as those described in the Southern California PEV Readiness Plan. It describes where latent PEV demand is constrained because of the challenges of installing charging opportunities in multiunit residences. It also describes the locations of workplaces and retail establishments that are in neighborhoods with a higher density of PEVs during the day and evening. With this information, planners can take the next steps to provide the targeted technical assistance to these sites as described in the Southern California PEV Readiness Plan.

The methods section of this Atlas provides detailed information on data sources and analyses used to generate each map. This Atlas features the following **maps** of the neighborhoods and municipalities within each COG in the SCAG region:

1. **PEV registration density as of 2016.** Knowing how many PEVs are registered in a given area will indicate the location of current and near-future demand for residential charging. By extension, this information can help planners and utilities anticipate locations that will carry additional nighttime electrical load.
2. **PEV morning travel to work, providing spatial daytime PEV density at or near workplaces.** Understanding where PEVs are concentrated during morning peak hours (6 to 9 a.m.) can help planners and utilities identify neighborhoods where there will be demand for daytime charging.
3. **Workplaces identified by numbers of employees.** Planners can target the largest employers for workplace charging initiatives, as they presumably host the largest numbers of parking spaces on-site and can potentially serve the highest numbers of employees.
4. **Workplaces overlaid with morning peak PEV density.** Planners and utilities can use these maps to assess the potential utilization of workplace charging by comparing the spatial distribution of employers and weekday morning peak travel destinations for PEVs.
5. **Publicly accessible charging locations, identified by power level and number of stations per location.** Planners can use these maps to compare the location of existing publicly accessible charge stations with the locations of employment centers, retail centers and PEV daytime destinations, also mapped at the COG level in the Atlas. The maps can also be used to identify where there are gaps in meeting demand for charging. For MUDs that do not have parking, publicly accessible sites will become important charging options. The maps identify the number of charging units/cords available at each location along with the level of service (Level 1, Level 2, etc., or “Unknown” where charging is available but the quantity

of connectors and their level of service could not be immediately determined). The maps are based on a snapshot of publically accessible charging stations as of May 23, 2017.

6. **Multi-unit dwellings (MUDs) by number of units and density.**

City planners can use these maps to identify specific buildings and/or MUD owners that could potentially host charging on-site. Planners can use the maps to compare spatial distributions of MUD density with employment and commercial density, publicly accessible charging stations, and stand-alone parking areas to assess the potential for these other PEV sites to serve the charging needs of MUD residents. Mapping the precise location of MUDs and knowing the density of units on a site will be of particular use in utility planning. Utilities can use such maps to anticipate where upgrades may be needed for transformers and distribution stations to accommodate PEV charging at MUDs.

7. **Retail destinations, from strip development to regional centers.**

Many plug-in electric vehicle (PHEV) drivers find it valuable to charge when visiting retail destinations in order to maximize electric miles driven. After locating general categories of retail charging opportunities on the map, planners can turn to Chapter 8 of the Southern California PEV Readiness Plan for more detailed descriptions of how long cars are typically parked at specific types of retail destinations.

8. **Retail destinations overlaid with PEV mid-day travel, providing spatial retail PEV density at or near retail centers.**

Planners and utilities can use these maps to assess potential for retail charging by comparing the spatial distribution of retail centers and mid-day travel destinations (9 a.m. to 3 p.m.) for PEVs.

9. **Stand-alone parking facilities.** Publicly accessible parking facilities can fill a gap in PEV charging, particularly in older urban cores where retail stores and even some workplaces and multi-unit dwellings do not have dedicated parking. Park and ride lots in particular may substitute for Level 1 workplace charging if workers leave their PEVs parked all day. Parking lots and structures larger than 2.5 acres that

are not attached to other land uses are mapped at the COG level.

The Atlas provides this suite of spatial tools for PEV readiness planning for the following COGs:

- Arroyo Verdugo Subregion
- City of Los Angeles
- Coachella Valley Association of Governments
- Gateway Cities Council of Governments
- Imperial County Transportation Commission
- Las Virgenes Malibu Council of Governments
- North Los Angeles County
- Orange County Council of Governments
- San Bernardino Associated Governments
- San Fernando Valley Council of Governments
- San Gabriel Valley Council of Governments
- South Bay Cities Council of Governments
- Ventura County Council of Governments
- Western Riverside Council of Governments
- Westside Cities Council of Governments

METHODS

This section describes the methods, assumptions and data sources used to create the maps and charts presented in this study. They are presented in the order in which they appear.

PEV growth

In this study, we define a PEV as any fully electric vehicle (including low-speed neighborhood electric vehicles and electrified trucks) or a plug-in hybrid electric vehicle (PHEV). See **Table A.1** for a summary of the PHEV models counted in this analysis. The scope only includes PEVs registered as new in the Southern California Association of Governments region between December 2010 and September 2016 inclusive. PEV registrations were supplied at the 2010 Census tract level by IHS

Automotive (formerly R.L. Polk & Co).

It is important to note that the San Fernando Valley Council of Governments (SFVCOG) is an overlay of portions of the City of Los Angeles, the Arroyo Verdugo Subregion, and North Los Angeles County. There is no unique area within SFVCOG that is not included in another COG.

Once the 2010–2016 PEV counts were obtained, a reasonable growth rate was needed to predict how PEVs would grow through the end of 2025. We experimented with a number of different models of monthly and cumulative growth. Ultimately, a quadratic model of monthly cumulative growth appeared to fit the data best. We estimated the following model for months between December 2010 and September 2016:

Table A.1 PEVs Included in the Analysis

Make	Model	Type
Audi	A3	PHEV
Azure	Transit Connect	BEV
BMW	330e	PHEV
BMW	I3	BEV
BMW	X5	PHEV
Cadillac	ELR	PHEV
Chevrolet	Spark	BEV
Chevrolet	Volt	PHEV
Fiat	500	BEV
Fisker	karma	BEV
Ford	Focus	BEV
Ford	Fusion	PHEV
Ford	C-max	PHEV
GEM	N/A	NEV
Honda	Accord	PHEV
Honda	FCX	FCEV
Honda	Fit	BEV
Hyundai	Sonata	PHEV

Make	Model	Type
Kia	Soul	BEV
Mclaren	P1	PHEV
Mercedes-Benz	B-Class	BEV
Mercedes-Benz	S550	PHEV
Mitsubishi	Miev	BEV
Nissan	Leaf	BEV
Porsche	918	PHEV
Porsche	Cayenne	PHEV
Porsche	Panamera	PHEV
Smart Car	Fortwo	BEV
Tesla	Model S	BEV
Tesla	Model X	BEV
Tesla	Roadster	BEV
Toyota	Mirai	FCEV
Toyota	Prius	PHEV
Toyota	Rav4 EV	BEV
Volkswagen	Golf	BEV
Volvo	XC89	PHEV

$$Cumul_m = \alpha + \beta month_m + \gamma month_m^2 + \epsilon_m$$

where $Cumul_m$ is the cumulative PEV sales in a given month, $month_m$ is the number of months elapsed since December 2010, $month_m^2$ is the number of months elapsed since 2010 squared and ϵ_m is a mean-zero error term. Using the coefficient estimated from this regression, we predicted cumulative PEV sales for all months until the end of 2025. At some point the PEV market will reach saturation, so this quadratic growth model represents PEV registrations in the early stages of technology adoption. We believe that 2025 is early enough in the PEV lifecycle that market saturation will be unlikely.

However, a potential limiting factor on the actual growth of PEVs is the high percentage of Southern California residents who live in multi-unit dwellings (MUDs). Unless steps are taken to facilitate charging in MUDs, PEV ownership may not grow as projected.

PEV registrations

The PEV registration maps show the number of PEVs registered between December 2010 and September 2016 in the COGs by Tier 1 travel analysis zone (TAZ). TAZs closely follow 2000 Census tract boundaries and are used by SCAG to estimate travel within and between neighborhoods. There are 4,109 Tier 1 TAZs in the SCAG region. The map colors move from lighter in areas with no or few PEVs registered to darker in areas with more PEVs registered. PEV registration data was supplied at the 2010 Census tract level by IHS Automotive (formerly R.L. Polk & Co), and was harmonized with TAZ boundaries.

PEV morning peak destinations

We used the outputs from SCAG's 2012 Regional Model to determine the arrival locations and densities of PEVs during peak morning hours.¹ Using surveys of household travel behavior, SCAG's travel demand model estimates the number of trips from home to work, school, and other destinations by time of day. The morning peak period represents weekday trips that occur between 6 and 9 a.m. (i.e., commutes to work). The model does not distinguish commuting patterns by vehicle type, so

¹ Southern California Association of Governments. 2016. "SCAG Regional Travel Demand Model and 2012 Model Validation." Accessed October 2017 from http://www.scag.ca.gov/Documents/SCAG_RTDM_2012ModelValidation.pdf

we assumed that the commuting patterns of PEVs are the same as those of conventional vehicles, and applied the proportion of PEVs registered in the origin TAZ to the commute patterns that characterize that TAZ. The data on PEV registrations comes from automotive data vendor IHS Automotive, which provided the number of PEVs registered as new within each 2010 Census tract from December 2010 through September 2016. It is important to note that these morning peak destination TAZs receive vehicles from outside the COG.

Workplaces by number of employees

The maps of employment density were prepared using commercially available Infogroup data from 2015 on employer size (i.e., number of employees) and location. This data is compiled from public documents that disclose employment size, as well as through a website and phone verification process. Each circle on the map represents one workplace. The circles move from small to large and from yellow to red as the number of employees per workplace increases.

PEV morning peak destinations and workplaces

This is an overlay of the previous two maps. The maps show both where PEVs driving to work are likely to be during daytime hours and where there are many employers and potentially high demand for workplace charging depending upon how charging is priced.

Publicly accessible charging stations

Data on publicly assessable charging stations was obtained from the online database maintained by PlugShare (www.plugshare.com), which contains information posted by users that charge at these locations. "Publicly accessible" refers to stations that are owned by either the government or private businesses but that are available for use by the general public. The precise number of connectors or charging units that are operational at any given time and location are subject to maintenance and upgrade schedules. The distribution of publicly accessible charging stations presented in this report reflect a snapshot of the PlugShare database as of May 23, 2017.

Multi-unit residential land uses

This data is obtained from SCAG's 2012 Existing Land Use Dataset, which

includes information on the concentration of all residential units other than single-family in the SCAG region. The land use data was originally developed by Aerial Information Systems Inc. as a Modified Anderson Land Use Classification for the 2008 SCAG land use dataset. The 2012 dataset is based on this 2008 dataset and is updated using 2008-2012 new construction data and inputs from local jurisdictions in the SCAG region.² The designations were determined by using aerial photography to estimate the land use at the parcel level. Each residential parcel in the dataset is assigned a code that best describes the composition of residential unit types. The factors that contribute to a parcel’s residential designation are the height of the buildings, the square footage, and the concentration of multi-unit dwellings per parcel.³ See **Table A.2** for a summary of the multi-unit dwellings designations in the 2012 SCAG Existing Land Use Dataset.

Commercial (retail) destinations

This map data is obtained from SCAG’s 2012 Existing Land Use Dataset, which includes information on the concentration of retail centers in the SCAG region. The land use data was originally developed by Aerial Information Systems Inc. as a Modified Anderson Land Use Classification for the 2008 SCAG land use dataset. The 2012 dataset is based on the 2008 dataset and is updated using 2008–2012 new construction data and inputs from local jurisdictions in the SCAG region.⁴ The designations were determined by using aerial photography to estimate the land use at the parcel level.

The commercial (retail) destination maps contain retail and small business locations (such as beauty salons and small offices) within each COG in the region. They highlight five types of retail centers that are likely to attract many of the nonwork-related vehicular trips. These five categories are summarized in **Table A.3**.

2 Southern California Association of Governments Open Data. 2015. “Land Use Los Angeles.” Accessed October 2017 from: http://gisdata-scag.opendata.arcgis.com/datasets/0c432b1bca21426e83e40a358414fe7c_0

3 Southern California Association of Governments. 2002. Southern California 1990 Aerial Land Use Study: Land Use Code Descriptions and Key Signatures, Level III/IV

4 Southern California Association of Governments Open Data. 2015. “Land Use Los Angeles.” Accessed October 2017 from: http://gisdata-scag.opendata.arcgis.com/datasets/0c432b1bca21426e83e40a358414fe7c_0

Table A.2 Multi-Unit Dwellings Designations in the 2012 SCAG Existing Land Use Dataset

Code	Description	Density
1120	Multi-Family (General)	Uncategorized
1121	Mixed Multi-Family Residential	Mix of different density types
1122	Duplexes, Triplexes, and 2- or 3-Unit Condominiums and Townhouses	3 units or fewer
1123	Low-Rise Apartments, Condominiums, and Townhouses	4+ units; 10 to 18 units per acre; and 1-2 stories
1124	Medium-Rise Apartments and Condominiums	4+ units ; more than 18 units per acre; and 3-4 stories
1125	High-Rise Apartments and Condominiums	4+ units; more than 18 units per acre; and 5 stories or greater

Table A.3 Commercial (Retail) Designations in the 2012 SCAG Existing Land Use Dataset

Code	Description	Key Attribute
1220	Commercial (Other)	Retail stores and other/ unknown commercial development
1221	Regional Shopping Center	Department store with surrounding parking
1222	Retail Centers (Non-Strip With Contiguous Interconnected Off-Street Parking)	Magnet store with in-front parking
1223	Modern Strip Development	Small businesses with parking on-street and on one side
1224	Older Strip Development	Small businesses with on-street parking

Land use Code 1220, Commercial (Other), is the general code used for retail stores and commercial development when the specific subland use is not discernable.

Land use Code 1221, Regional Shopping Center, contains large retail centers with at least one major department store and a range of other smaller retail establishments. These shopping centers are generally enclosed malls with parking surrounding the one- to three-story building. This also includes factory outlet malls.

Land use Code 1222, Retail Centers, comprises at least one large magnet store, a large off-street parking lot, and additional detached commercial stores, including small retail stores, gas stations, and restaurants. All structures are generally one story tall. Retail Centers are often located conveniently off major highways or highly trafficked surface streets.

Land use Code 1223, Modern Strip Malls, designates parcels that contain retail stores, restaurants, service shops, and offices, and are often located along major traffic corridors. Parking is available on-street as well as off-street either in front, on the side, or behind the structures. Included in this category are gas stations, auto repair shops, convenience stores, liquor stores, small bank branch offices, clothing stores, restaurants, furniture stores, discount stores, novelty stores, car dealerships or auto centers, drug stores, small corner markets, auctions, and smaller malls which do not contain a large magnet store.

Finally, land use Code 1224, Older Strip Development, contains parcels of land with little or no off-street parking. This category is commonly found in older city and town business corridors. Units are small retail establishments, restaurants, and offices with storefronts without setback, adjacent to the sidewalk. Units are often attached to the neighboring unit creating an uninterrupted streetscape. Units with commercial space on the first floor and residential units on upper floors can be considered Older Strip Development.⁵

5 Southern California Association of Governments. 2002. Southern California 1990 Aerial Land Use Study: Land Use Code Descriptions and Key Signatures, Level III/IV

PEV mid-day destinations and commercial (retail) destinations

We used the outputs from SCAG's 2012 Regional Model to determine the arrival locations and densities of PEVs during mid-day hours.⁶ Using surveys of household travel behavior, SCAG's travel demand model estimates the number of trips from home to work, school, and other destinations by time of day. The mid-day period represents weekday trips that occur between 9 a.m. and 3 p.m. (i.e., trips to run errands). The model does not distinguish commuting patterns by vehicle type, so we assumed that the commuting patterns of PEVs are the same as those of conventional vehicles, and applied the proportion of PEVs registered in the origin TAZ to the commute patterns that characterize that TAZ. The data on PEV registrations comes from automotive data vendor IHS Automotive, which provided the number of PEVs registered as new within each 2010 Census tract from December 2010 through September 2016. It is important to note that these mid-day destination TAZs receive vehicles from outside the COG.

We then overlaid mid-day destination information from the travel demand model with the previous map to illustrate the relationship between retail centers and mid-day trips.

Stand-alone parking facilities

This map data is obtained from SCAG's 2012 Existing Land Use Dataset, which includes information on the concentration of retail centers in the SCAG region. The land use data was originally developed by Aerial Information Systems Inc. as a Modified Anderson Land Use Classification for the 2008 SCAG land use dataset. The 2012 dataset is based on the 2008 dataset and is updated using 2008–2012 new construction data and inputs from local jurisdictions in the SCAG region.⁷ The designations were determined by using aerial photography to estimate the land use at the parcel level.

The stand-alone parking facilities mapped at the COG level in the

6 Southern California Association of Governments. 2016. "SCAG Regional Travel Demand Model and 2012 Model Validation." Accessed October 2017 from http://www.scag.ca.gov/Documents/SCAG_RTDM_2012ModelValidation.pdf

7 Southern California Association of Governments Open Data. 2015. "Land Use Los Angeles." Accessed October 2017 from: http://gisdata-scag.opendata.arcgis.com/datasets/0c432b1bca21426e83e40a358414fe7c_0

Southern California PEV Atlas represent parking lots and structures greater than 2.5 acres that are not attached to other land uses. They highlight three types of stand-alone parking classified by SCAG:⁸

Table A.4 PEVs Included in the Analysis

Description	Key Attribute
Attended Pay Public Parking Facilities	Stand-alone public parking areas and parking structures that have an attendant-cashier present
Non-Attended Public Parking Facilities	Free or metered public parking areas where no attendant-cashier is present
Park and Ride Lots	Cal Trans park and ride lots provided for commuter ridesharing, buspooling, vanpooling, and carpooling

The “Attended Pay Public Parking Facilities” classification does not distinguish between privately owned commercial parking facilities available for public use and municipal or other parking facilities owned by the public sector that are available for public use.

⁸ Southern California Association of Governments. 2002. Southern California 1990 Aerial Land Use Study: Land Use Code Descriptions and Key Signatures, Level III/IV

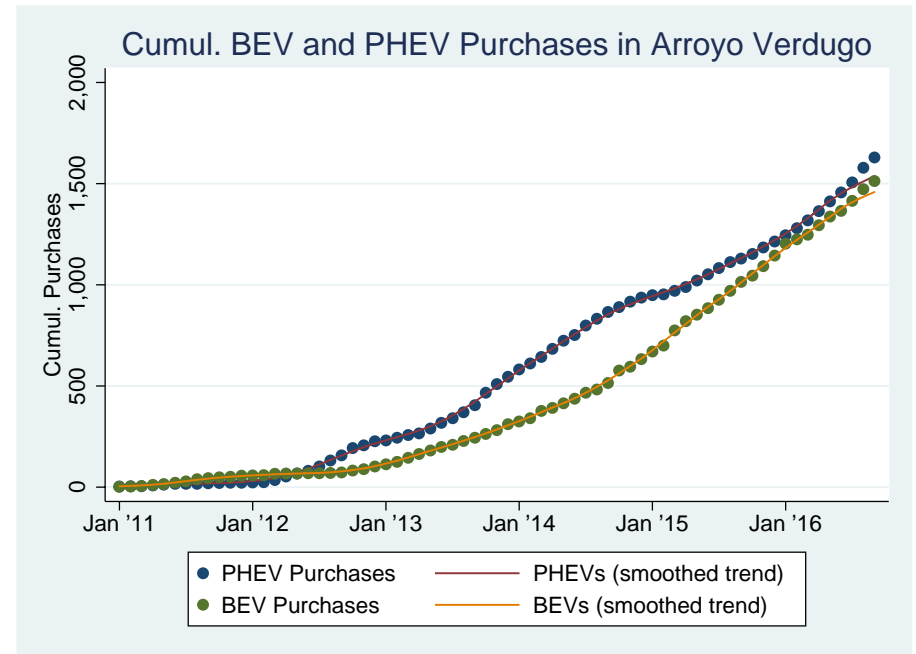
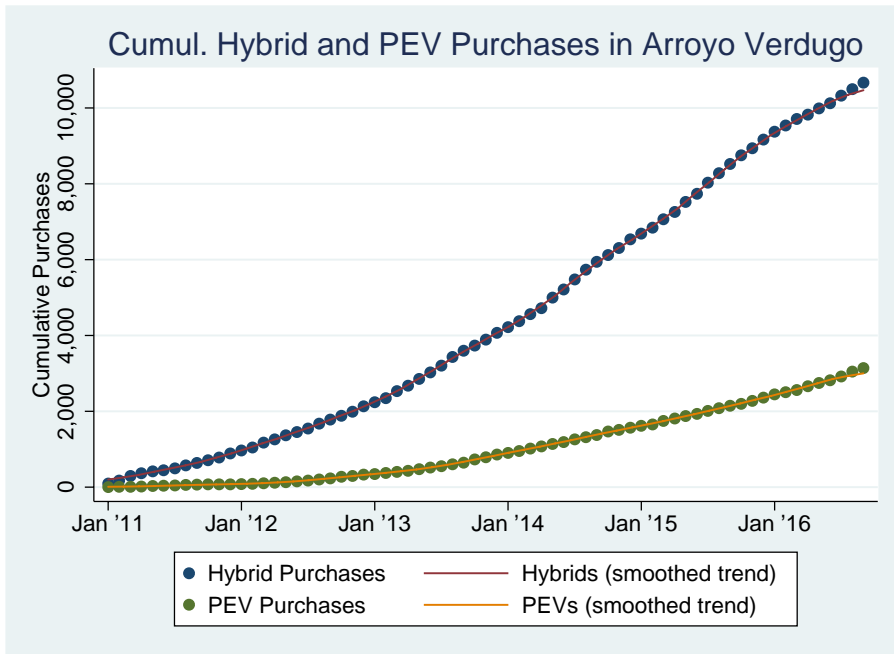
PEV GROWTH SUMMARY

PEV Growth by Council of Government (COG)

COG	Through 2016	Through 2020	Through 2025
Arroyo Verdugo Subregion	3,431	9,606	21,688
City of Los Angeles	29,071	80,760	181,541
Coachella Valley Association of Governments	1,427	3,904	8,713
Gateway Cities Council of Governments	6,568	17,453	38,251
Imperial County Transportation Commission	61	163	360
Las Virgenes Malibu Council of Governments	2,230	5,966	13,131
North Los Angeles County	15,526	43,178	97,053
Orange County Council of Governments	30,749	82,732	182,670
San Bernardino Associated Governments	5,451	14,779	32,763
San Fernando Valley Council of Governments	17,607	49,442	111,711
San Gabriel Valley Council of Governments	11,694	32,744	73,884
South Bay Cities Council of Governments	7,833	19,927	42,610
Ventura County Council of Governments	5,155	13,664	29,946
Western Riverside Council of Governments	5,516	14,879	32,892
Westside Cities Council of Governments	4,668	12,614	27,940
Total*	117,685	319,627	709,556

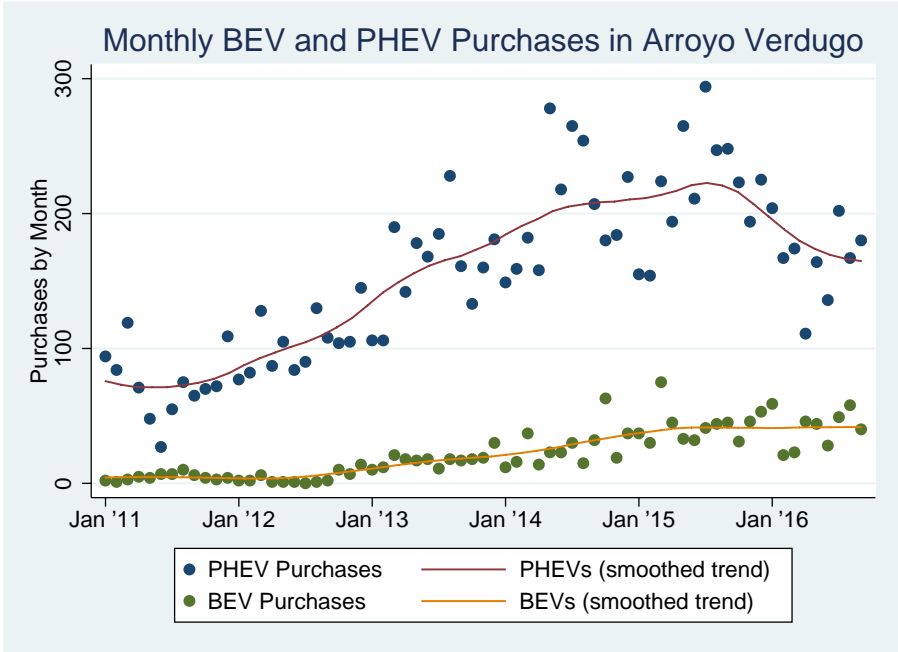
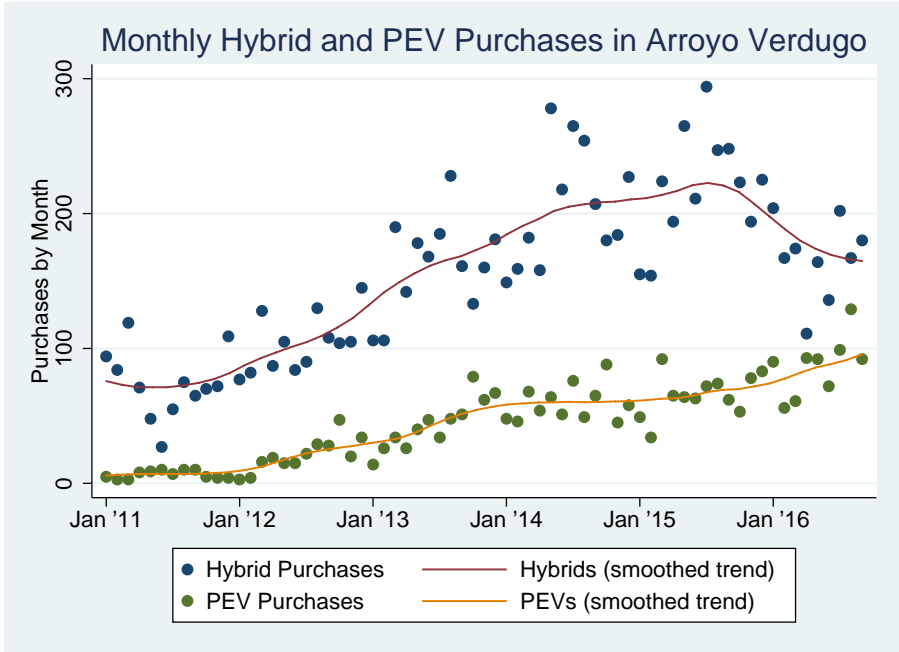
*The rows do not add up to the totals due to overlapping boundaries among some COG regions.

ARROYO VERDUGO SUBREGION Cumulative PEV Growth

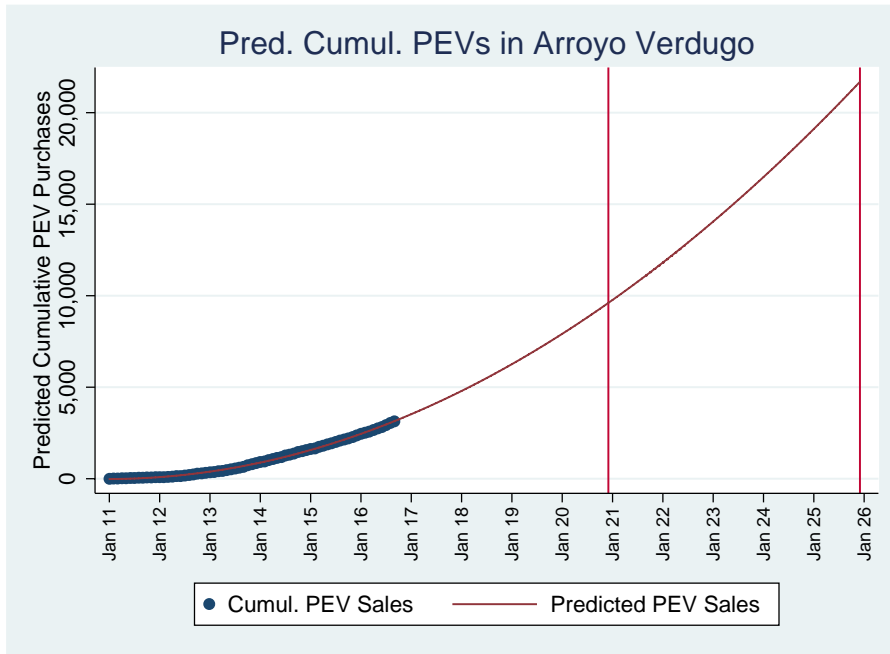


ARROYO VERDUGO SUBREGION

Monthly PEV Growth

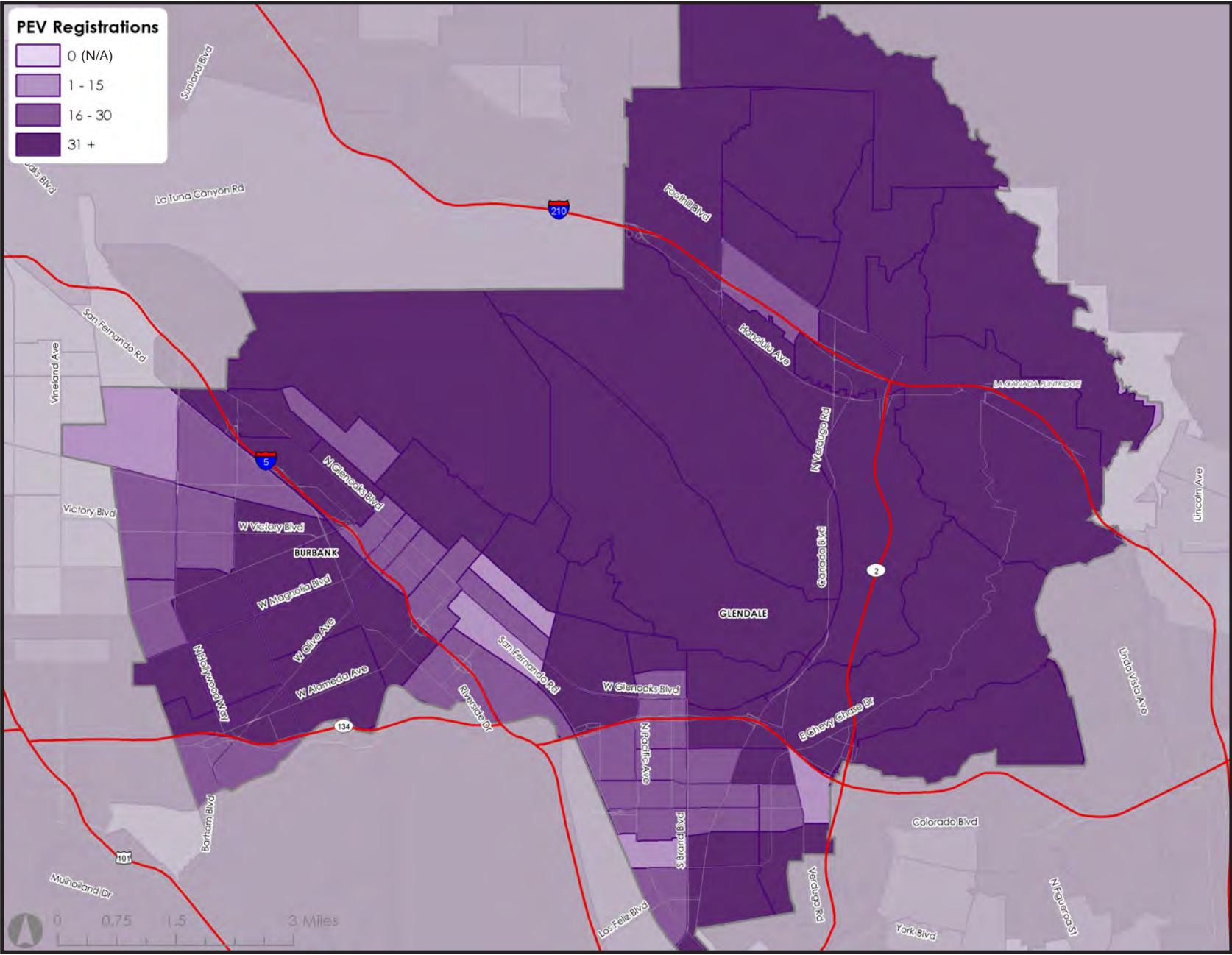


ARROYO VERDUGO SUBREGION Projected PEV Growth

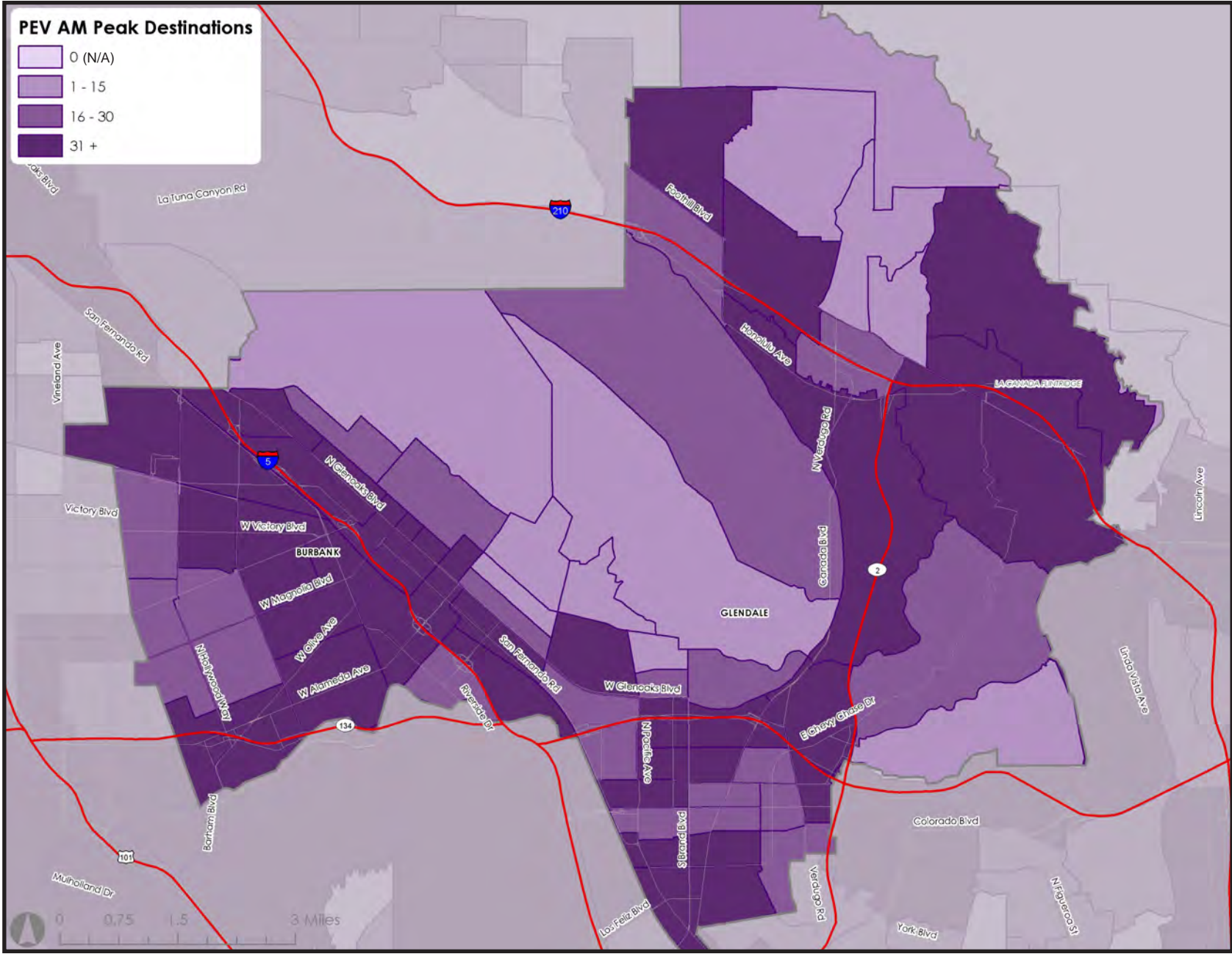


Year	Cumulative PEV Registrations
2016	3,431
2017	4,684
2018	6,131
2019	7,772
2020	9,606
2021	11,635
2022	13,857
2023	16,274
2024	18,884
2025	21,688

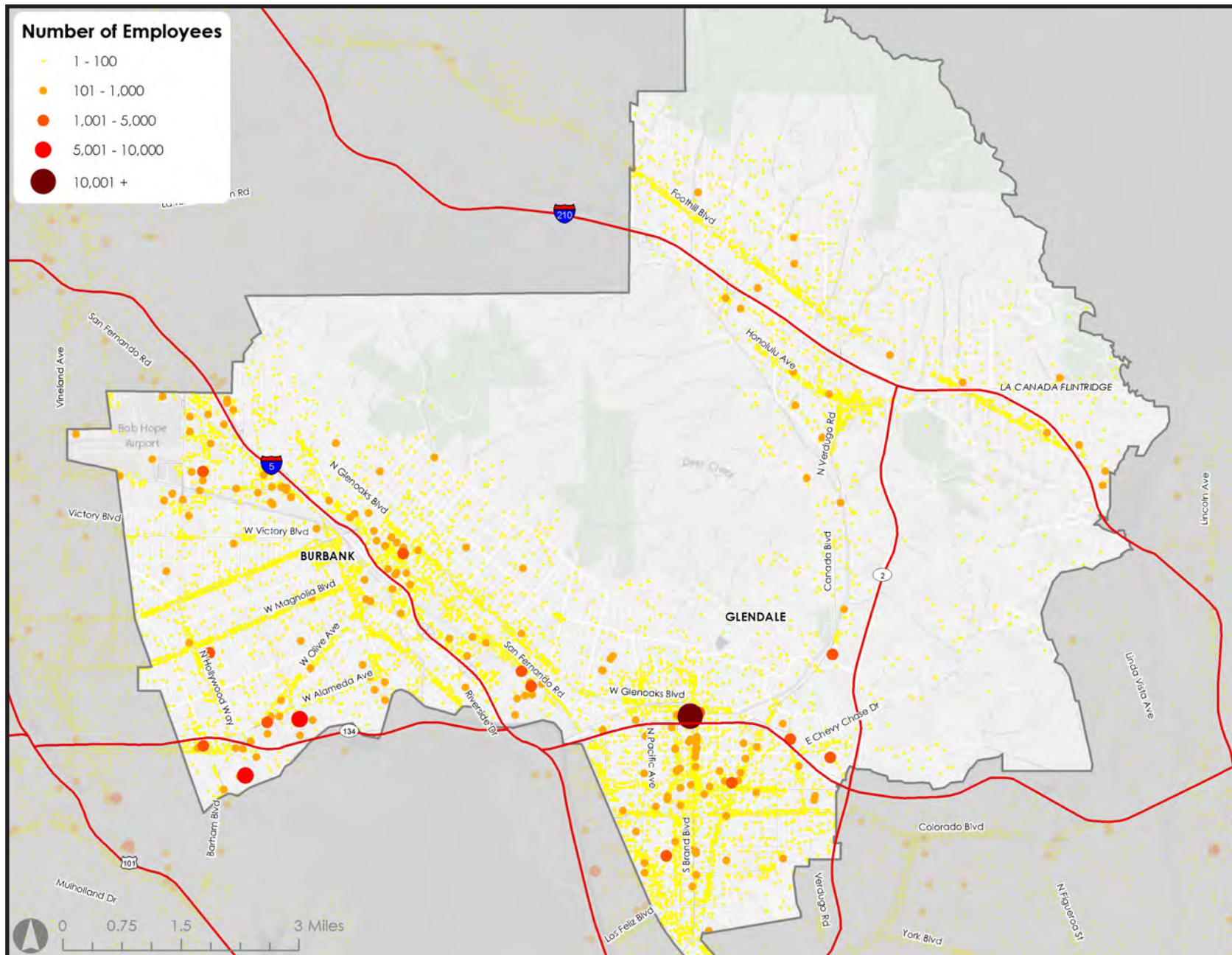
ARROYO VERDUGO SUBREGION PEV Registrations



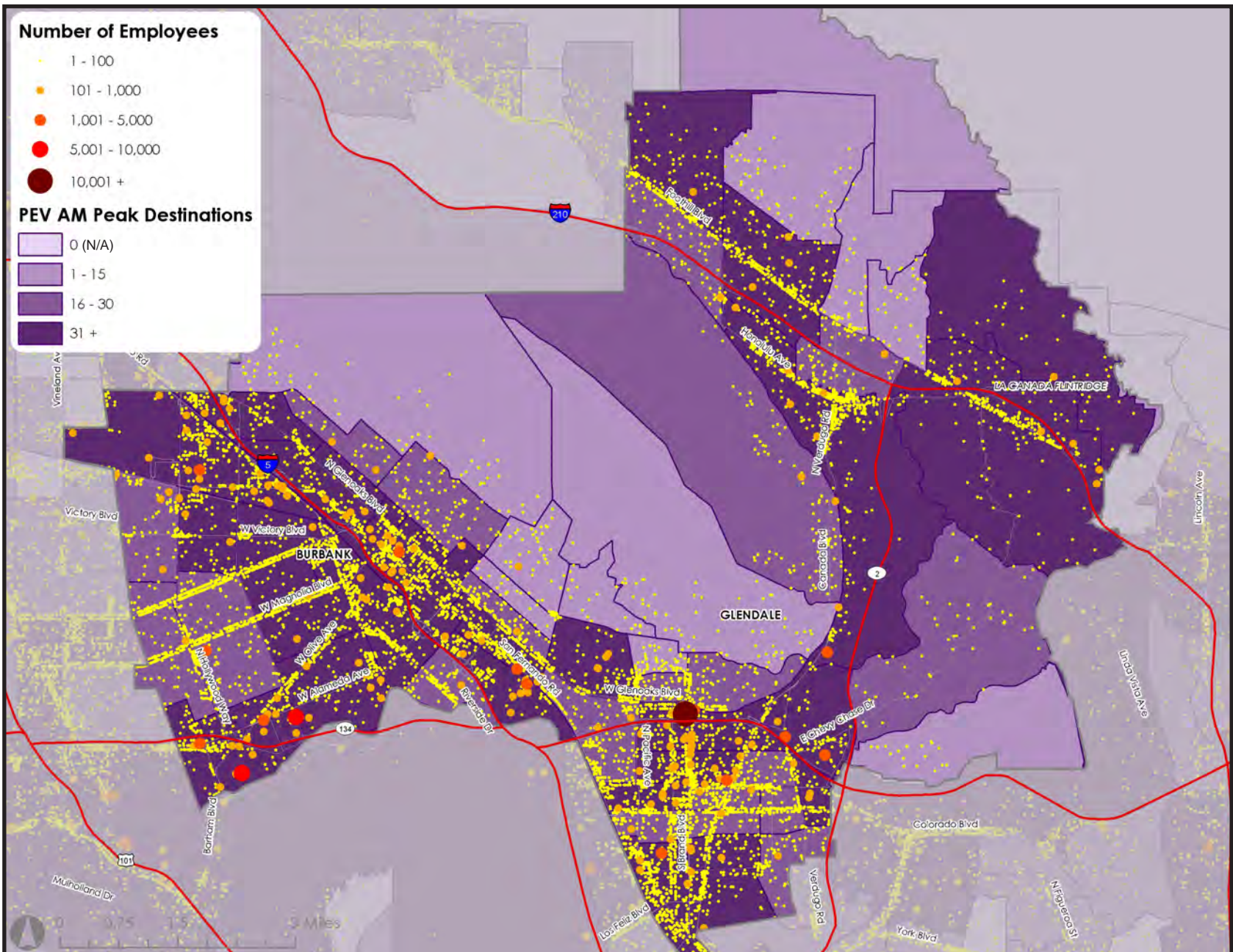
ARROYO VERDUGO SUBREGION PEV Peak Morning Destinations



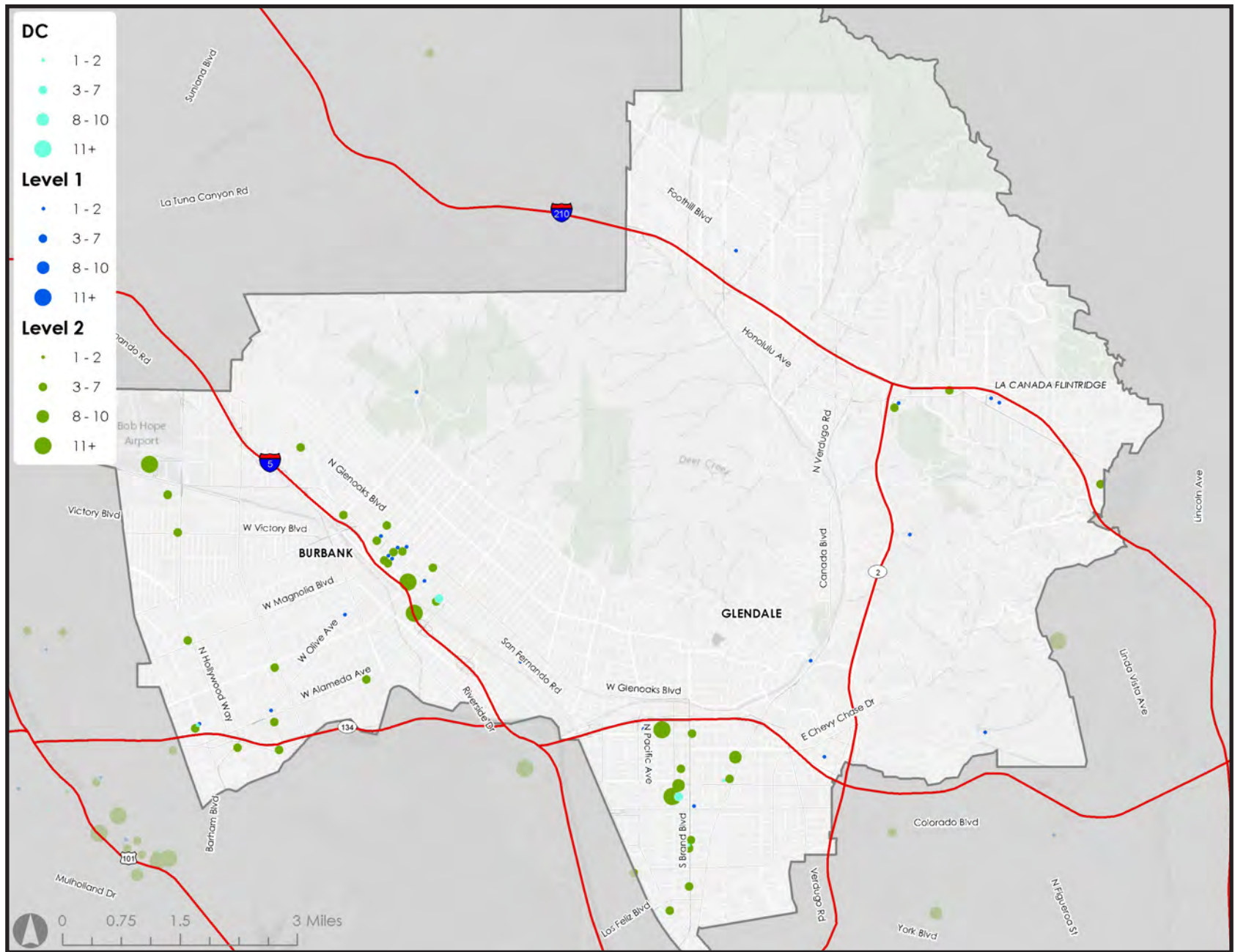
ARROYO VERDUGO SUBREGION Workplaces by Number of Employees



ARROYO VERDUGO SUBREGION PEV Peak Morning Destinations and Workplaces

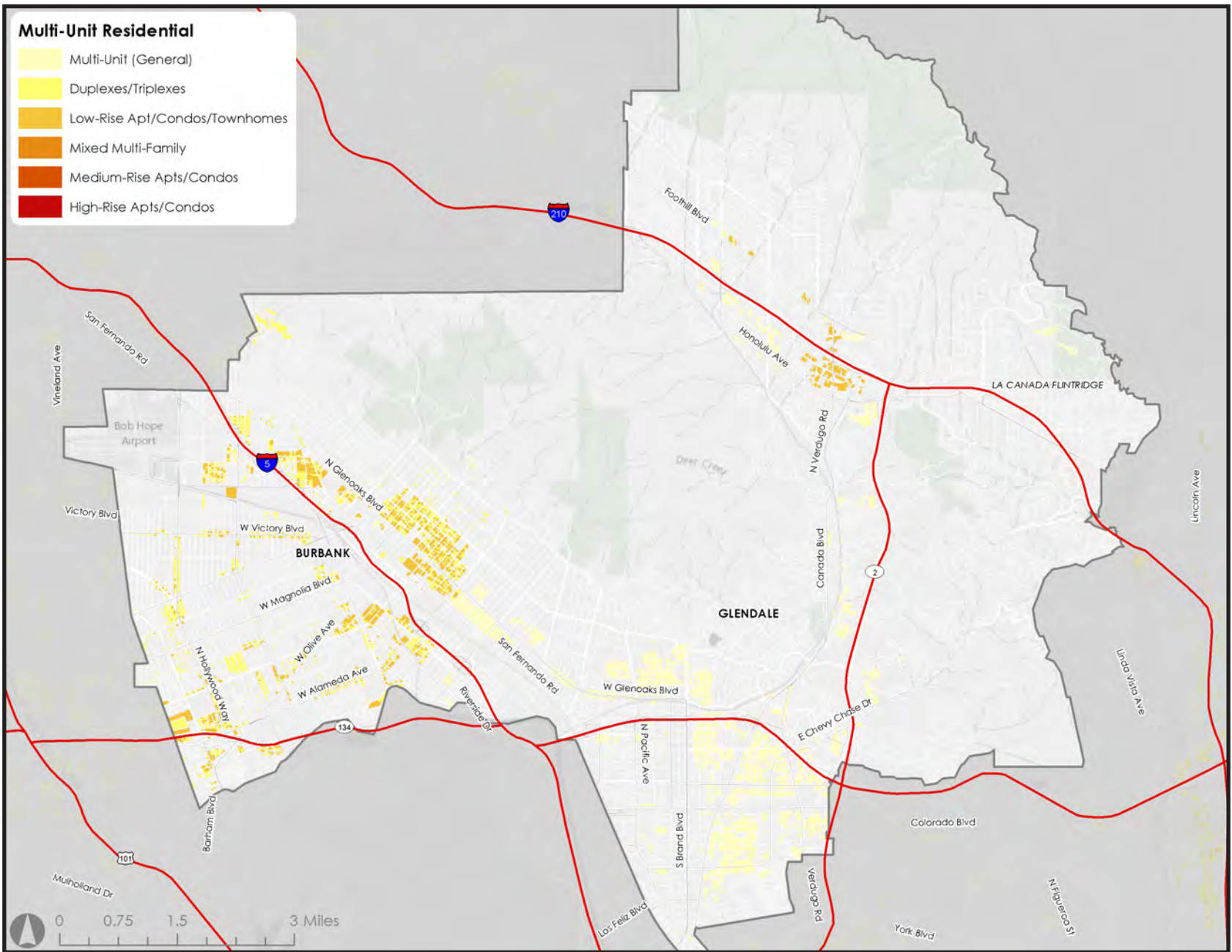


ARROYO VERDUGO SUBREGION Publicly Accessible Charging Stations

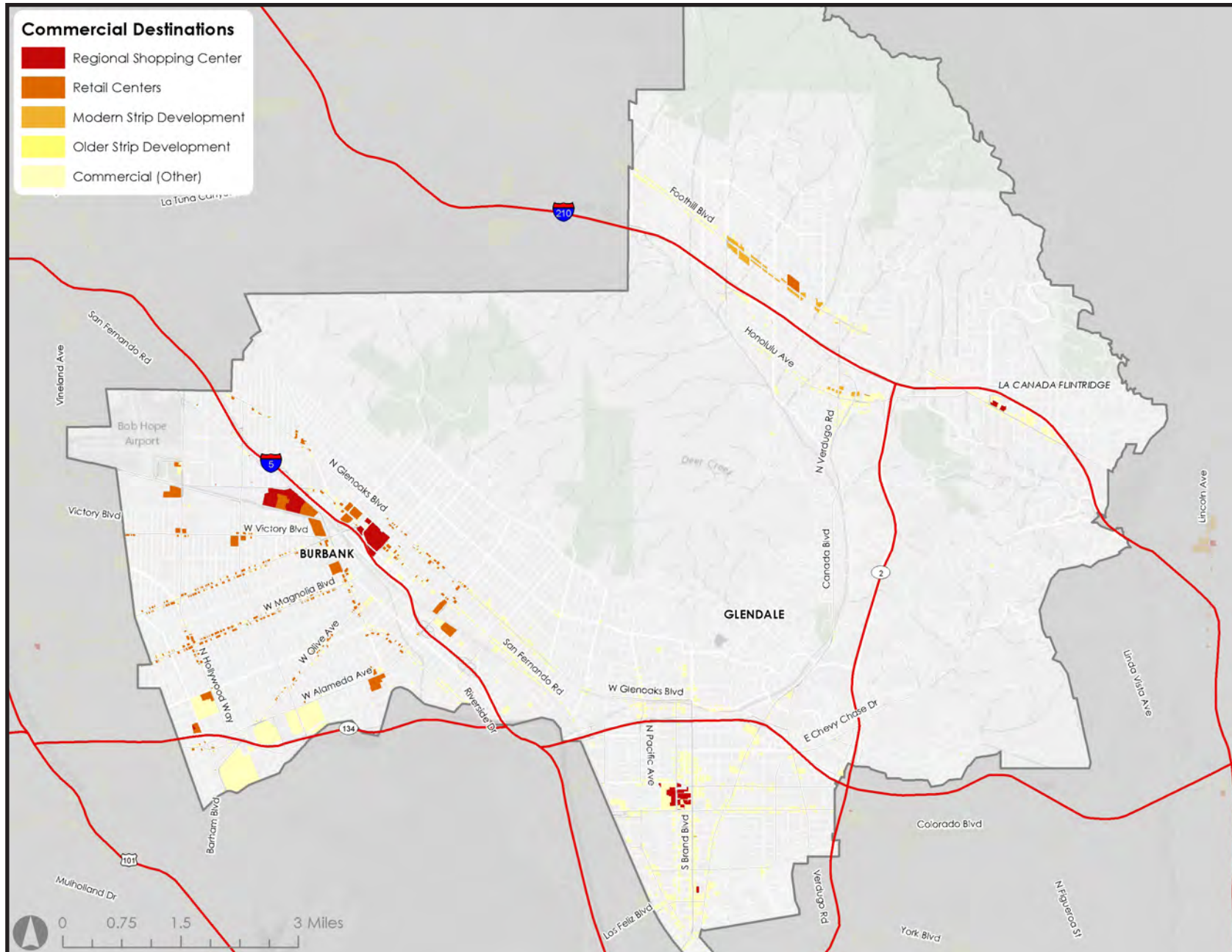


ARROYO VERDUGO SUBREGION

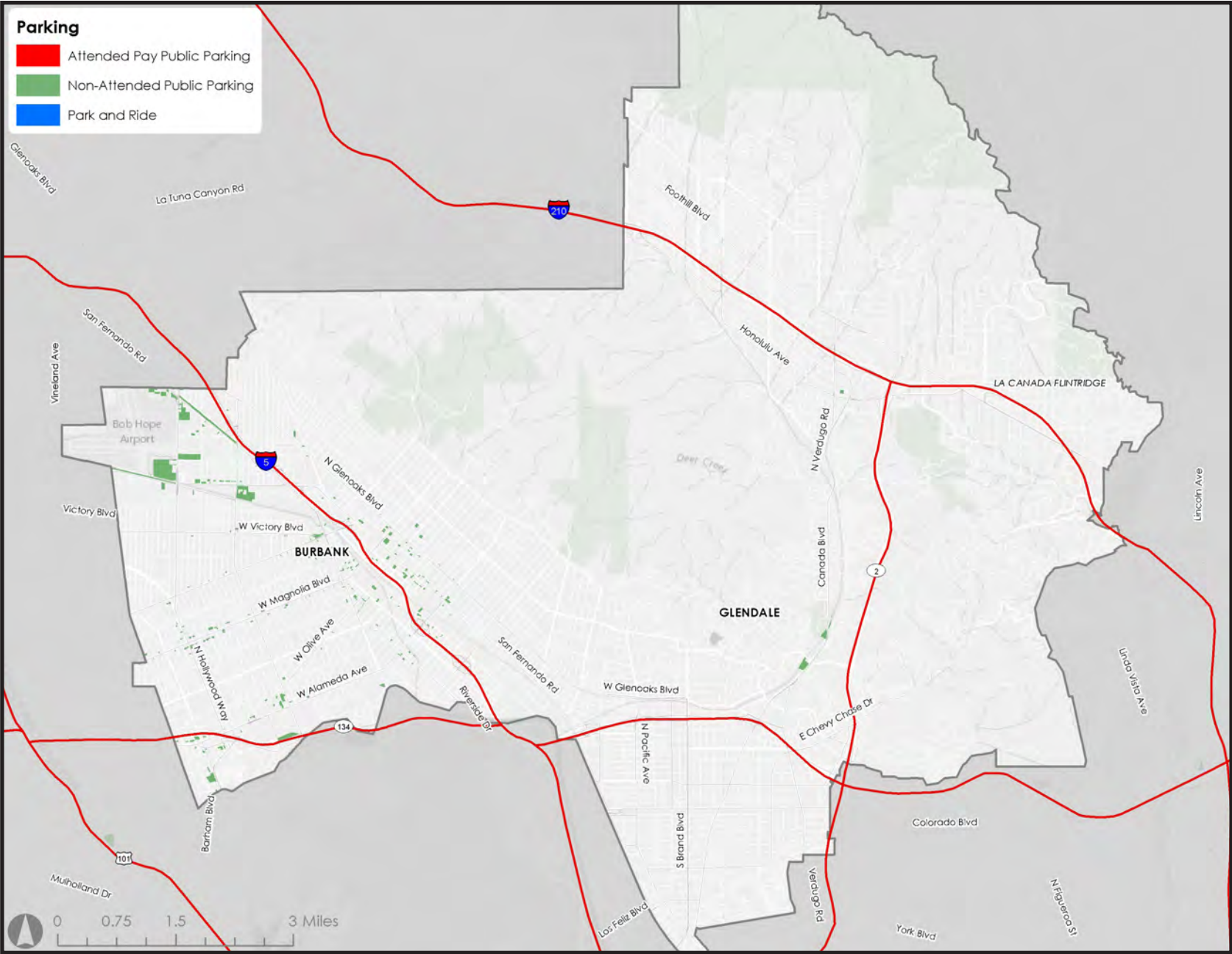
Multi-Unit Residential Land Uses



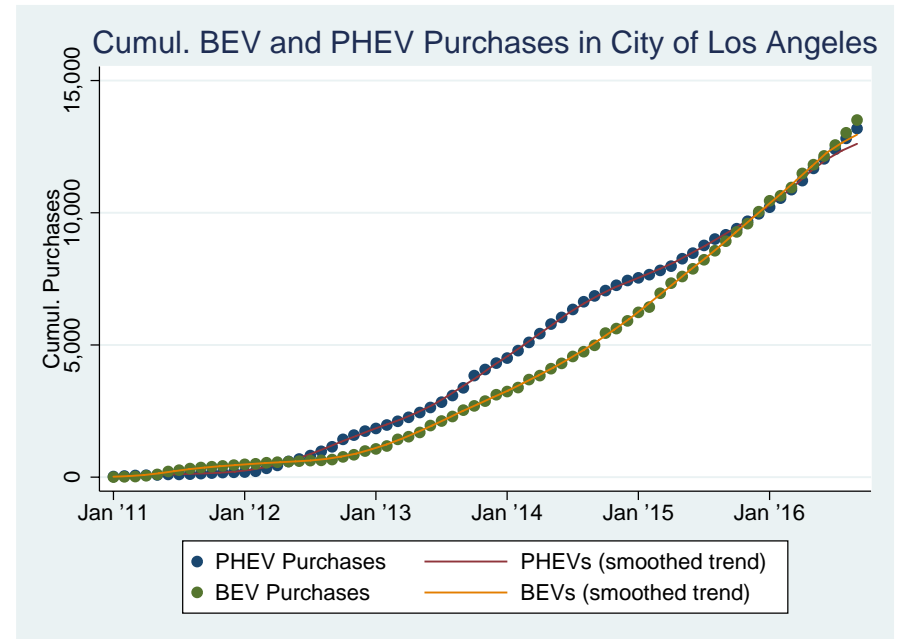
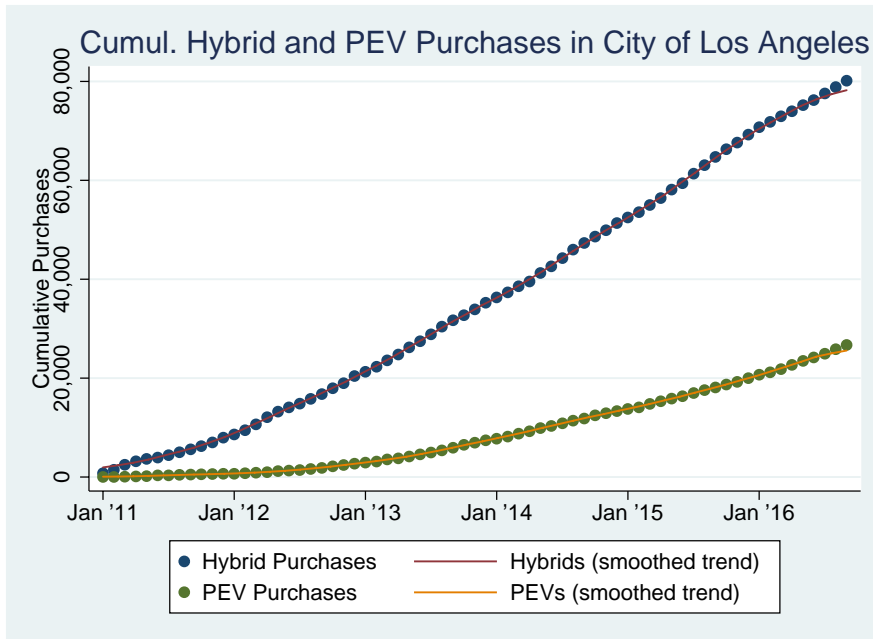
ARROYO VERDUGO SUBREGION Commercial (Retail) Destinations



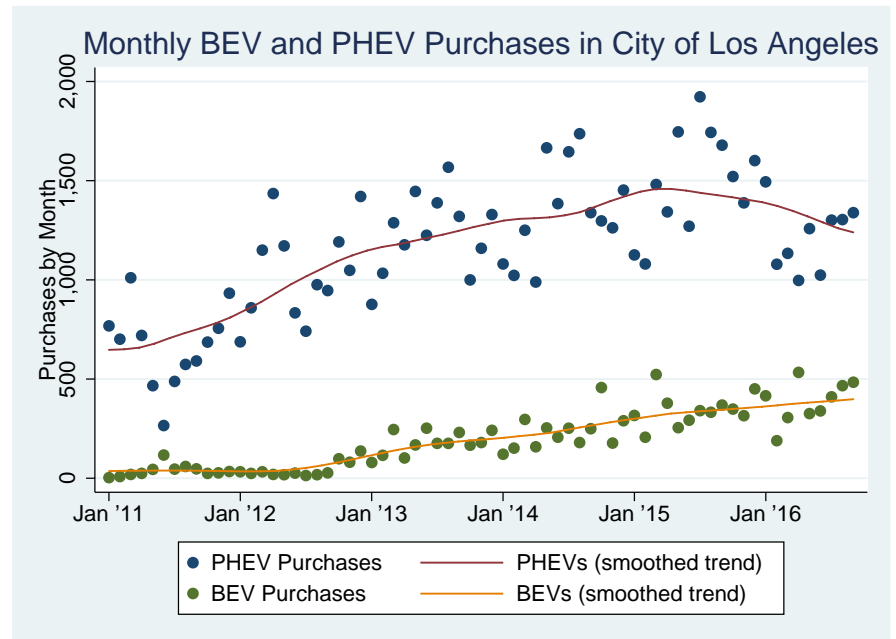
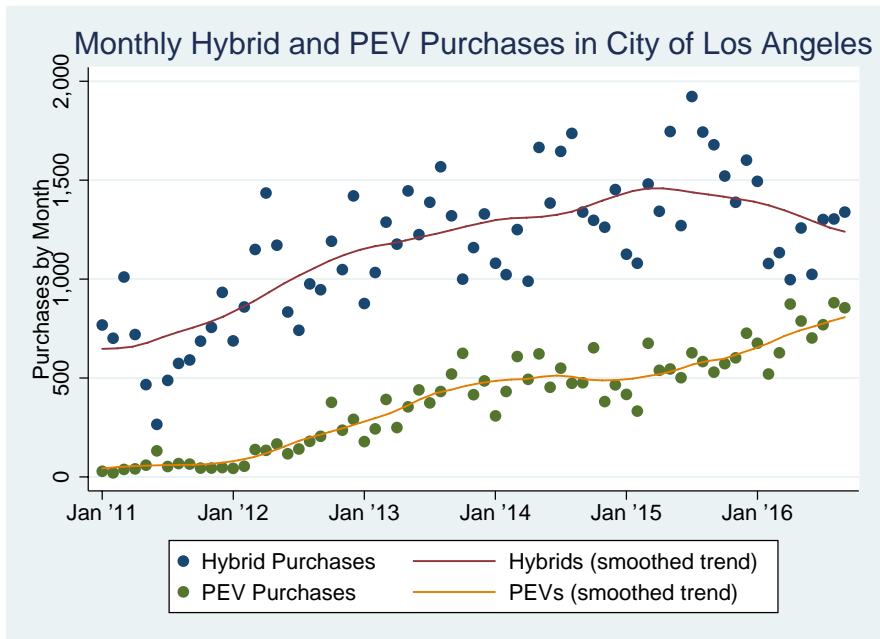
ARROYO VERDUGO SUBREGION Stand-alone Parking Facilities



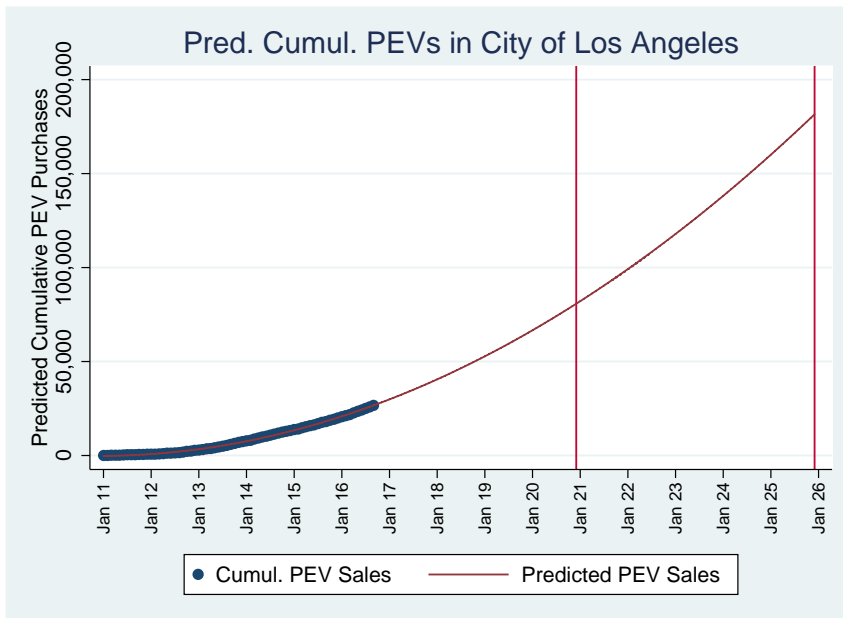
CITY OF LOS ANGELES Cumulative PEV Growth



CITY OF LOS ANGELES Monthly PEV Growth

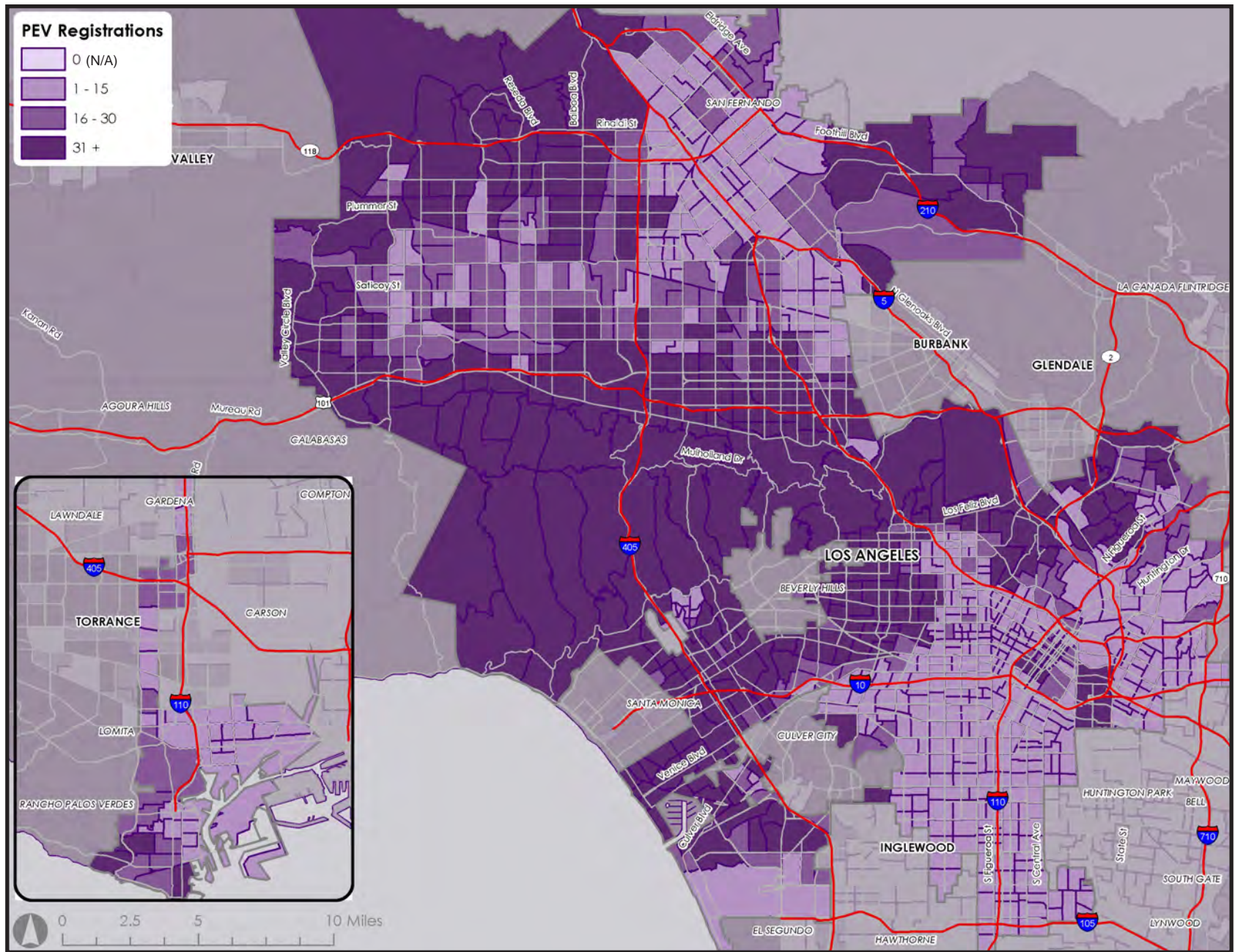


CITY OF LOS ANGELES Projected PEV Growth

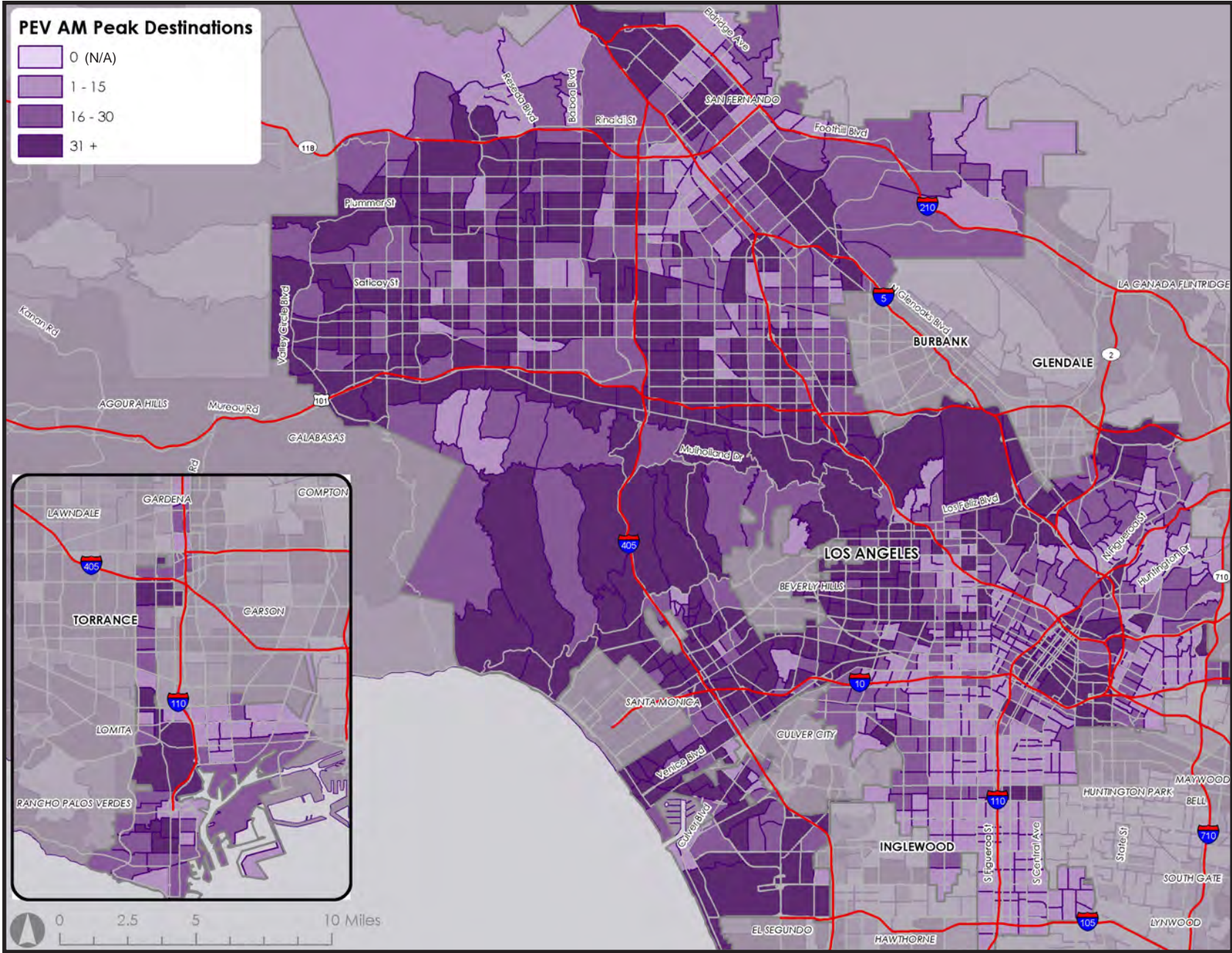


Year	Cumulative Predicted Sales
2016	29,071
2017	39,582
2018	51,701
2019	65,427
2020	80,760
2021	97,701
2022	116,250
2023	136,406
2024	158,170
2025	181,541

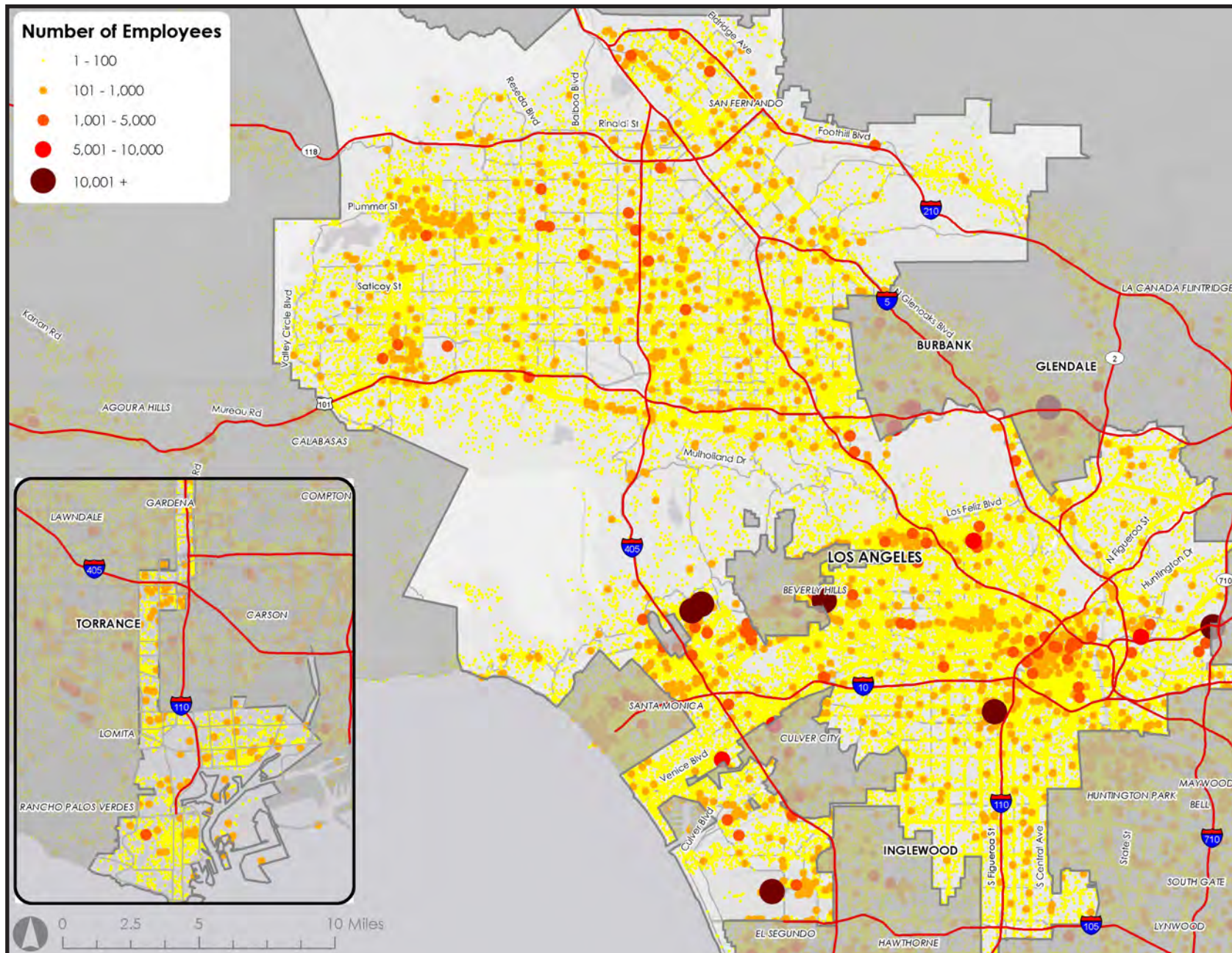
CITY OF LOS ANGELES PEV Registrations



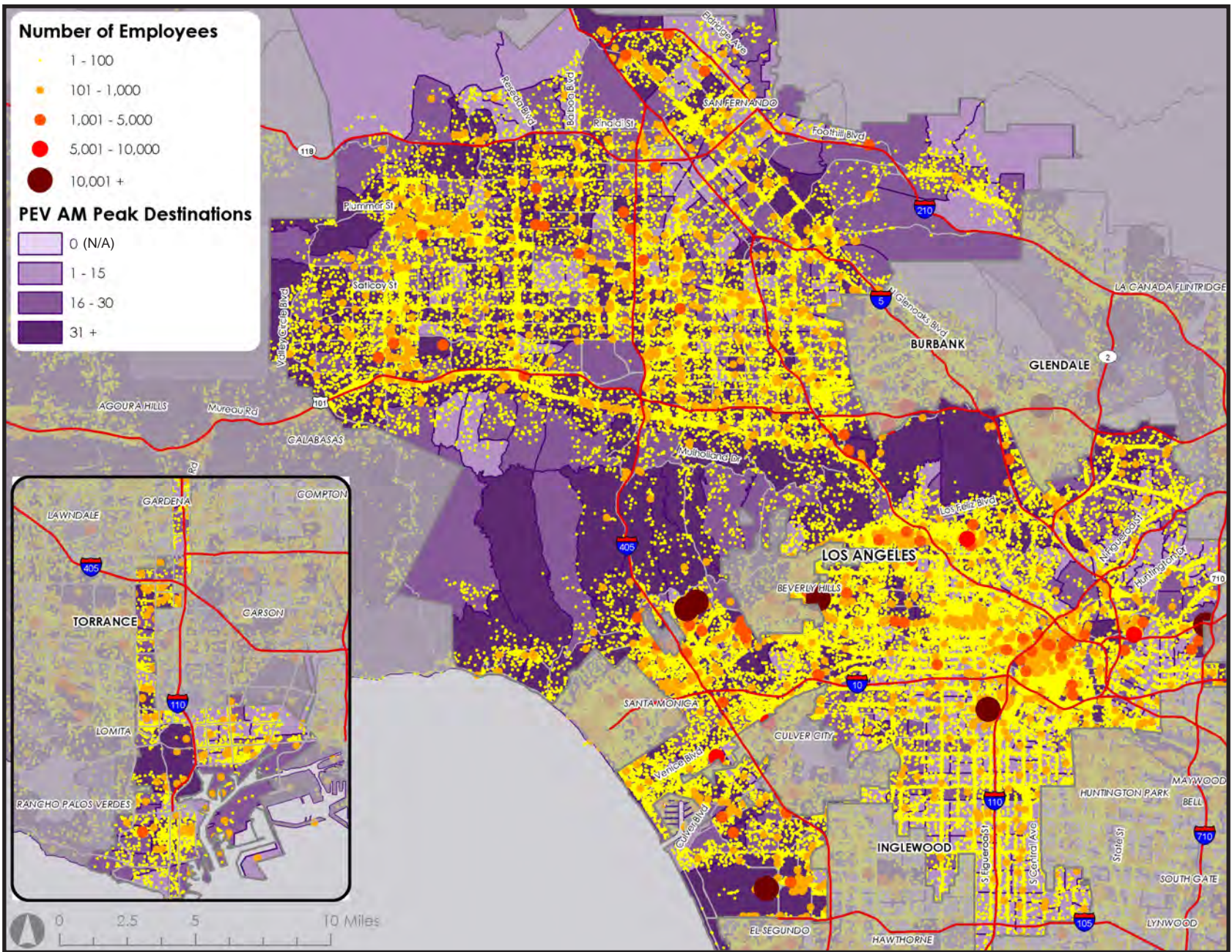
CITY OF LOS ANGELES PEV Peak Morning Destinations



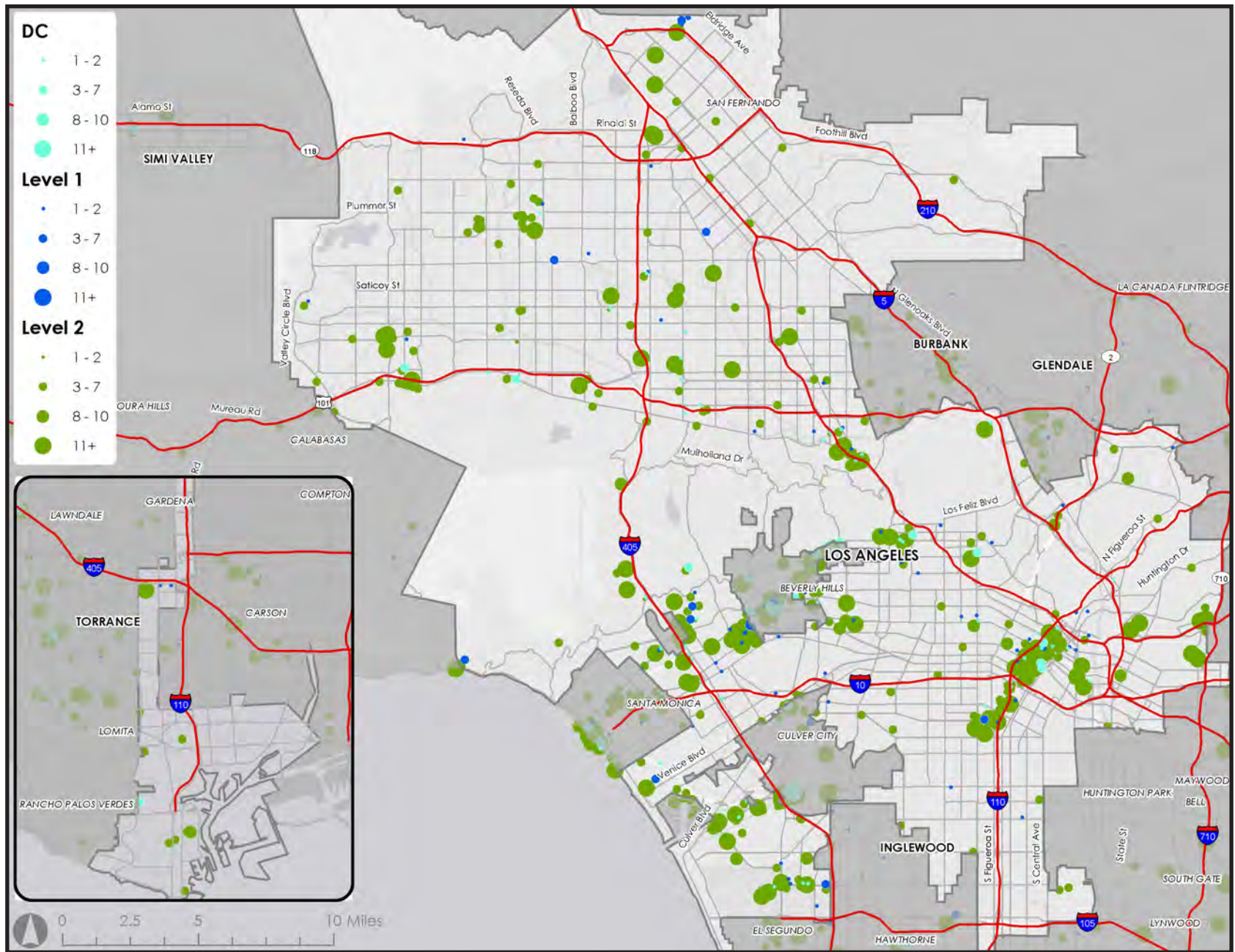
CITY OF LOS ANGELES Workplaces by Number of Employees



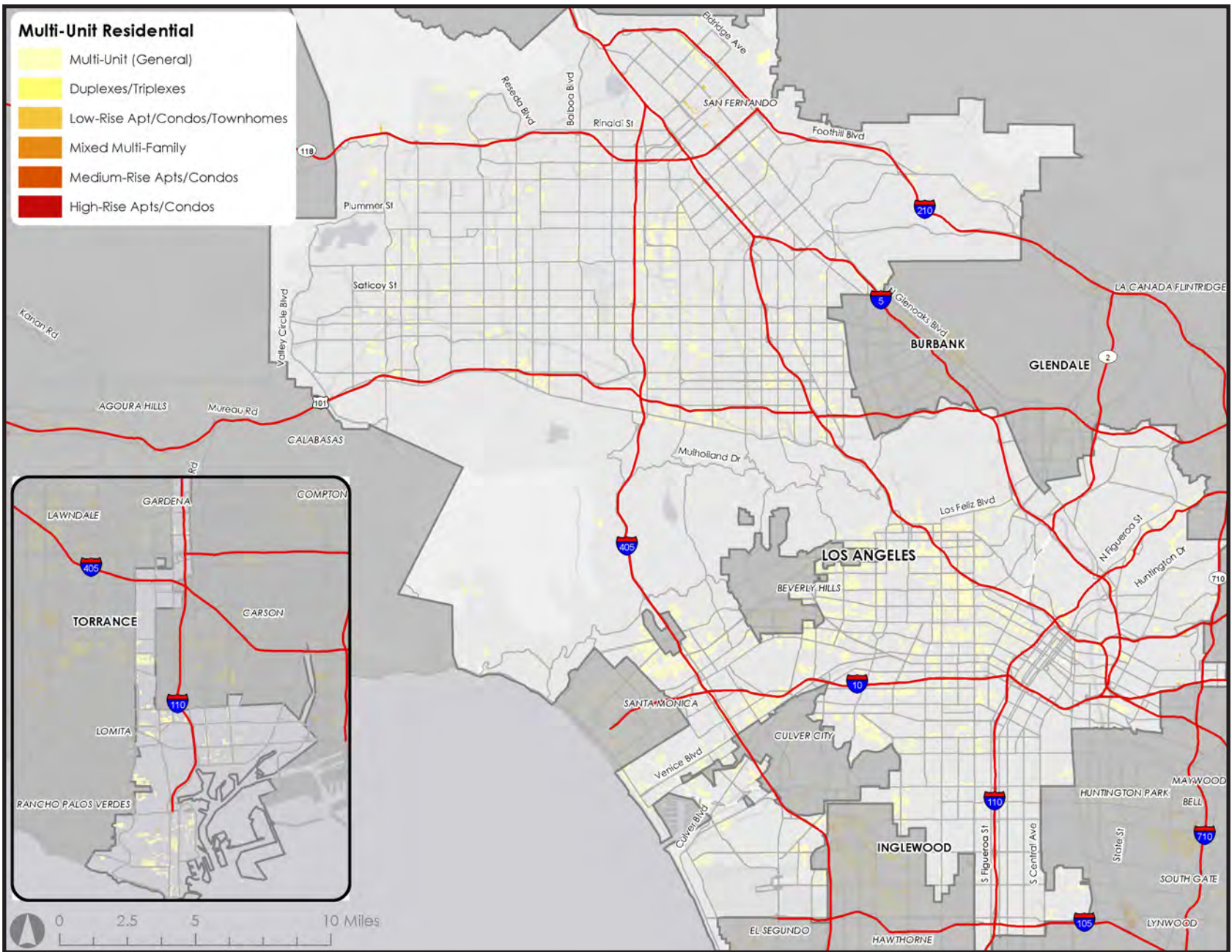
CITY OF LOS ANGELES PEV Peak Morning Destinations and Workplaces



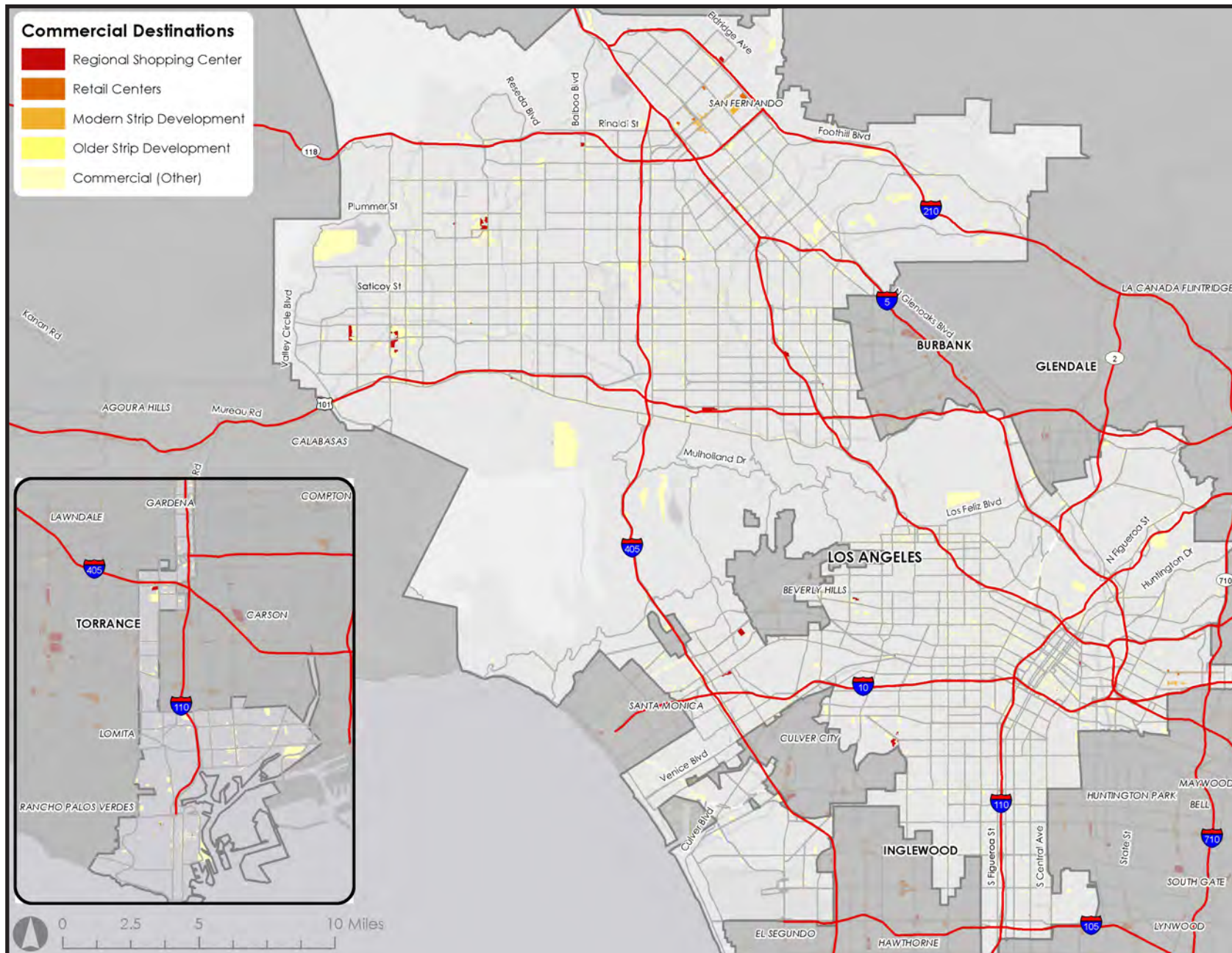
CITY OF LOS ANGELES Publicly Accessible Charging Stations



CITY OF LOS ANGELES Multi-Unit Residential Land Uses

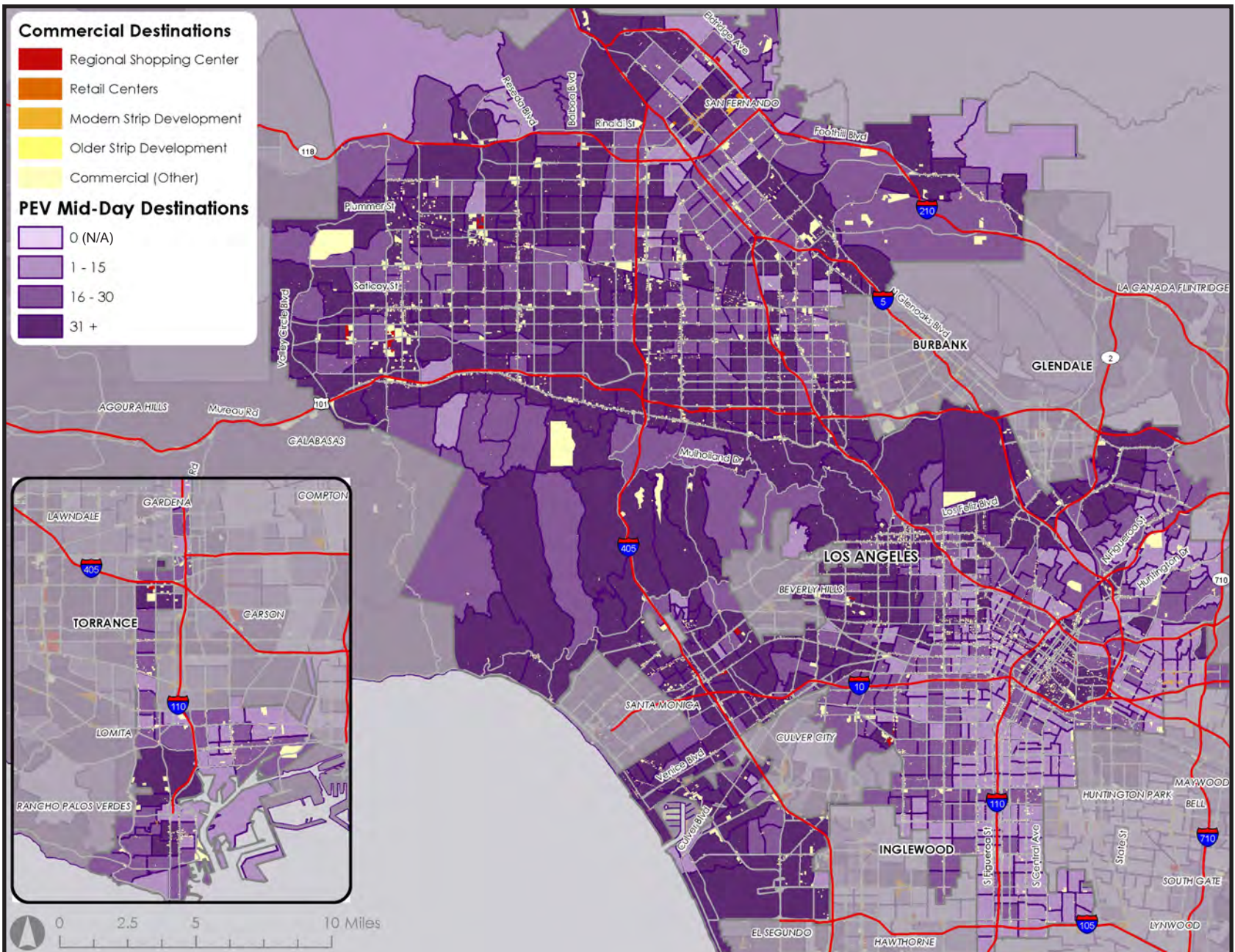


CITY OF LOS ANGELES Commercial (Retail) Destinations

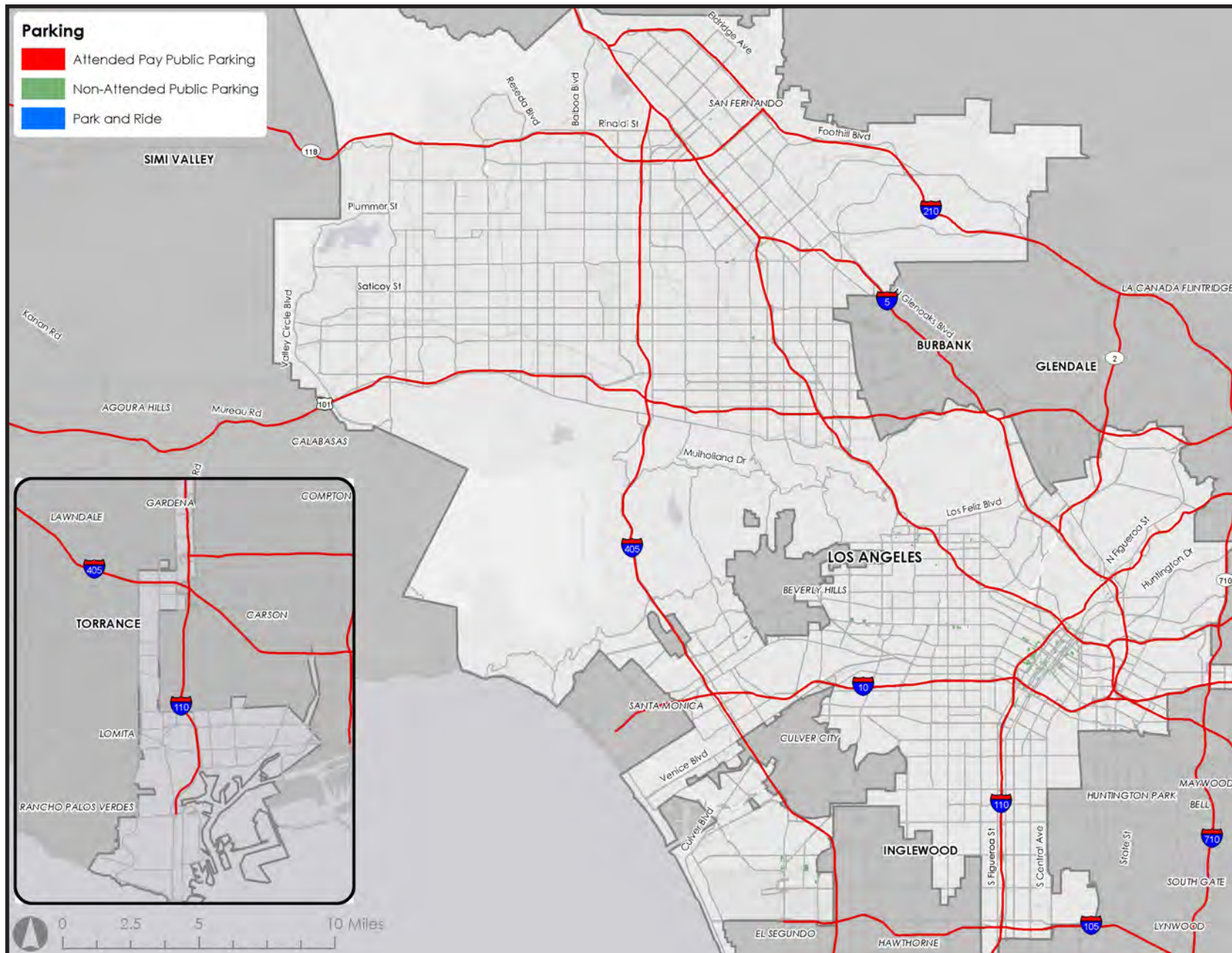


CITY OF LOS ANGELES

PEV Mid-Day Destinations and Commercial (Retail Locations)

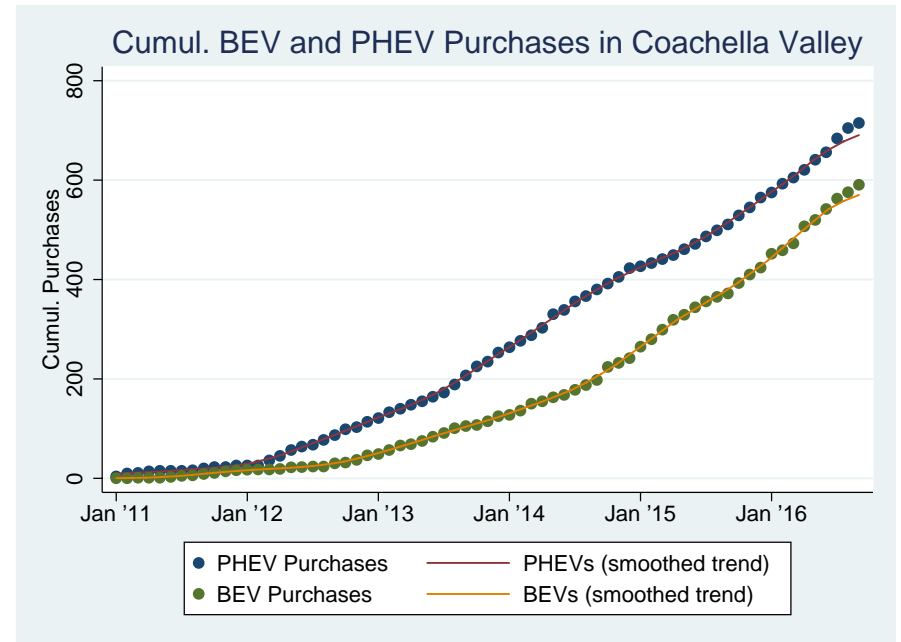
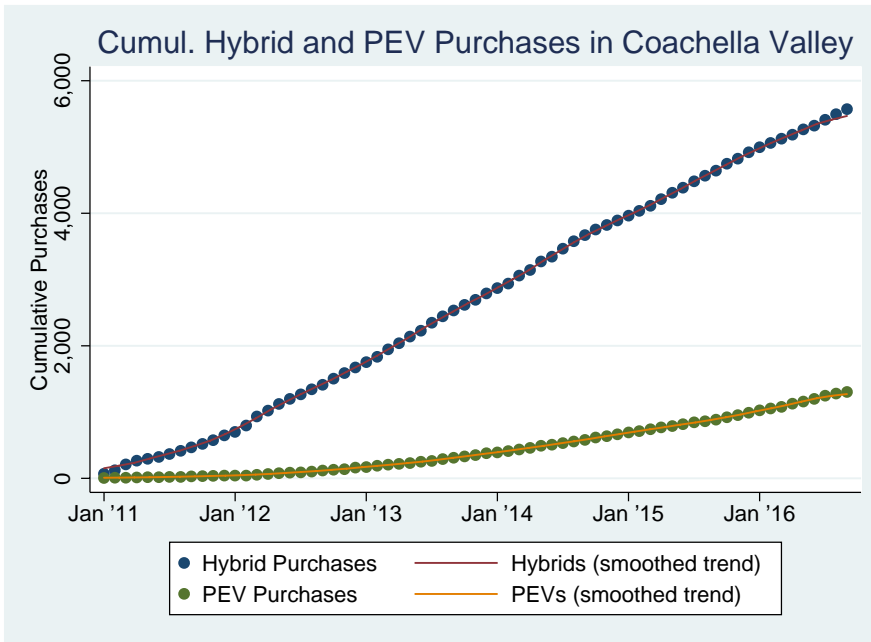


CITY OF LOS ANGELES Stand-alone Parking Facilities



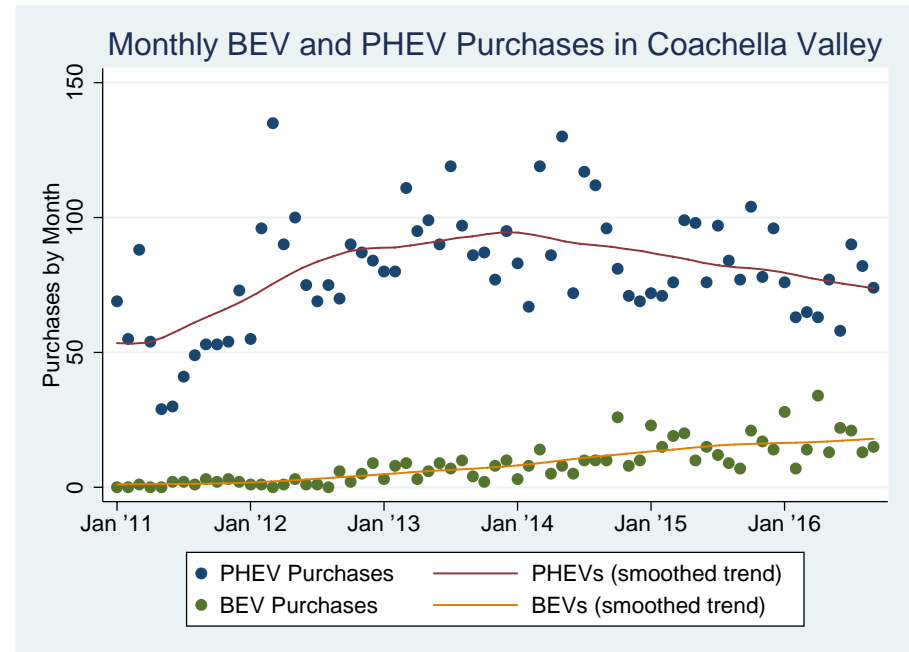
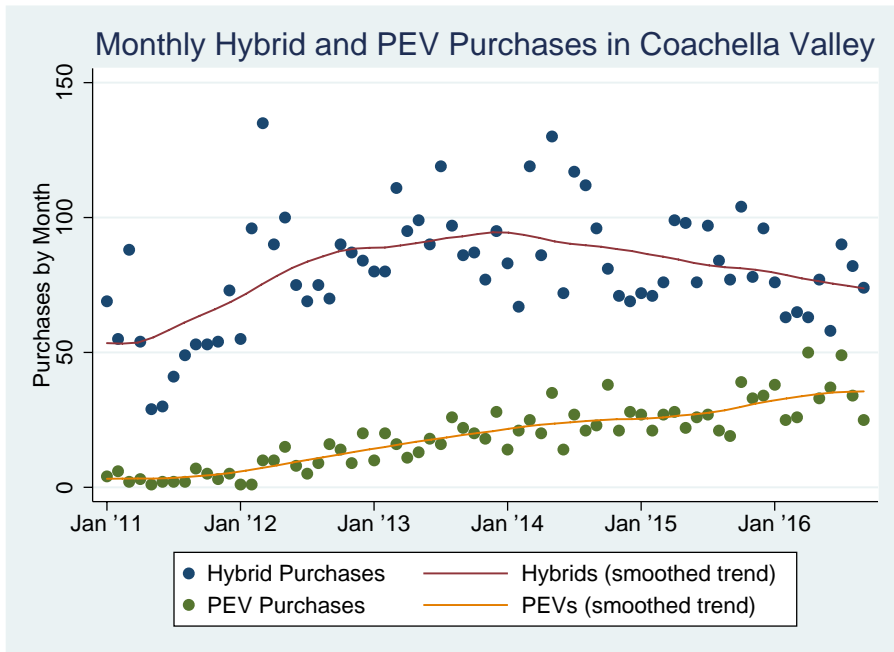
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

Cumulative PEV Growth



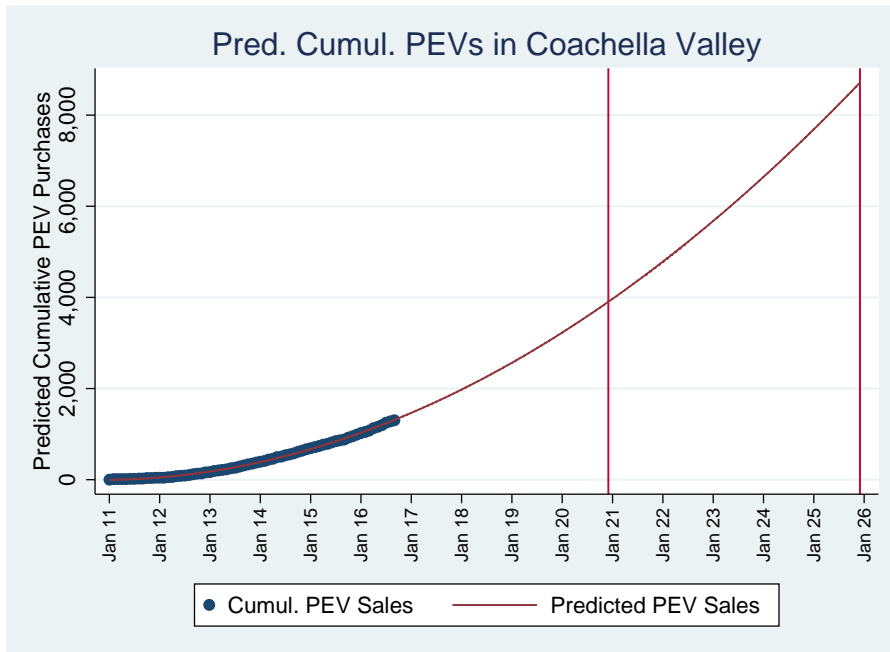
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

Monthly PEV Growth



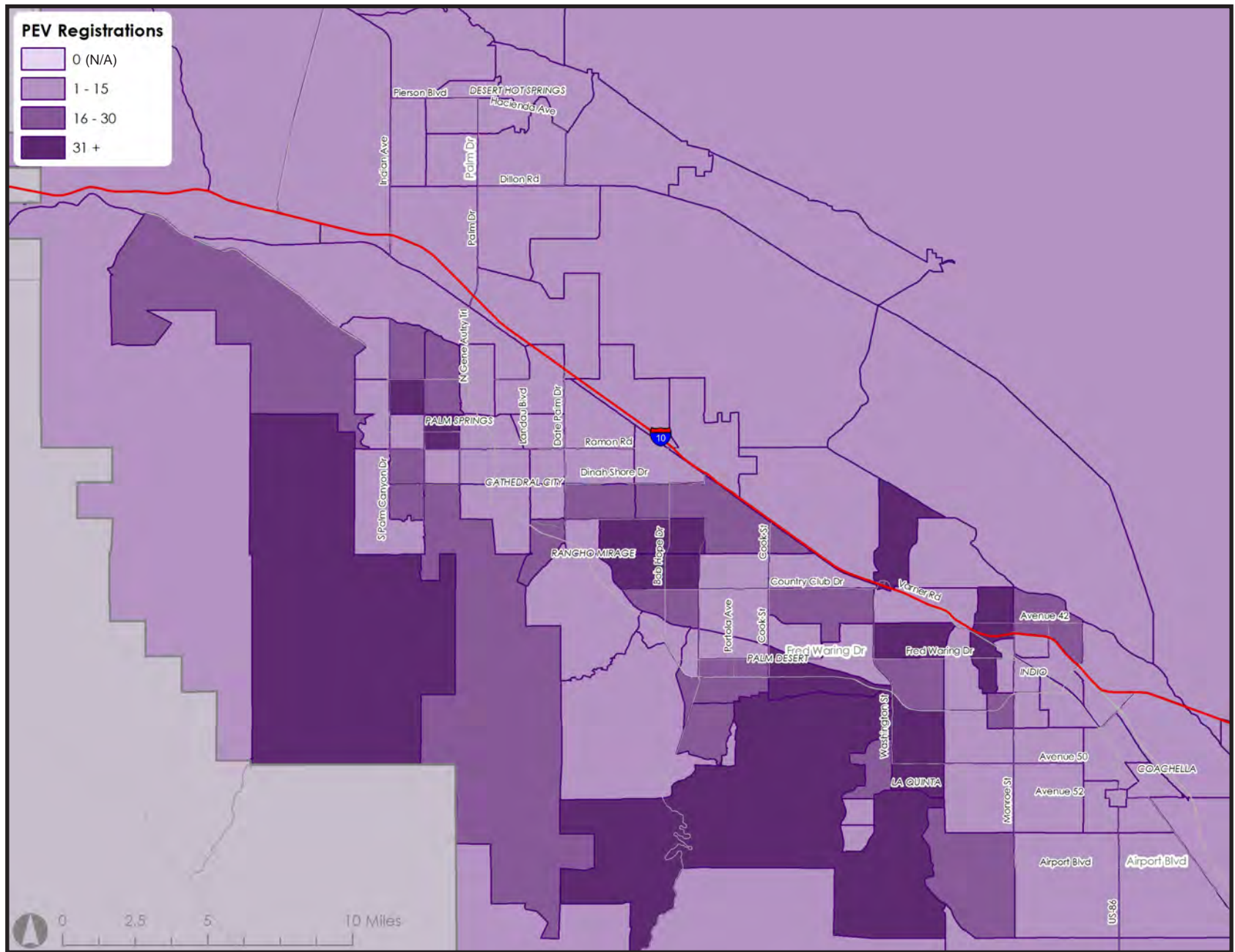
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

Projected PEV Growth



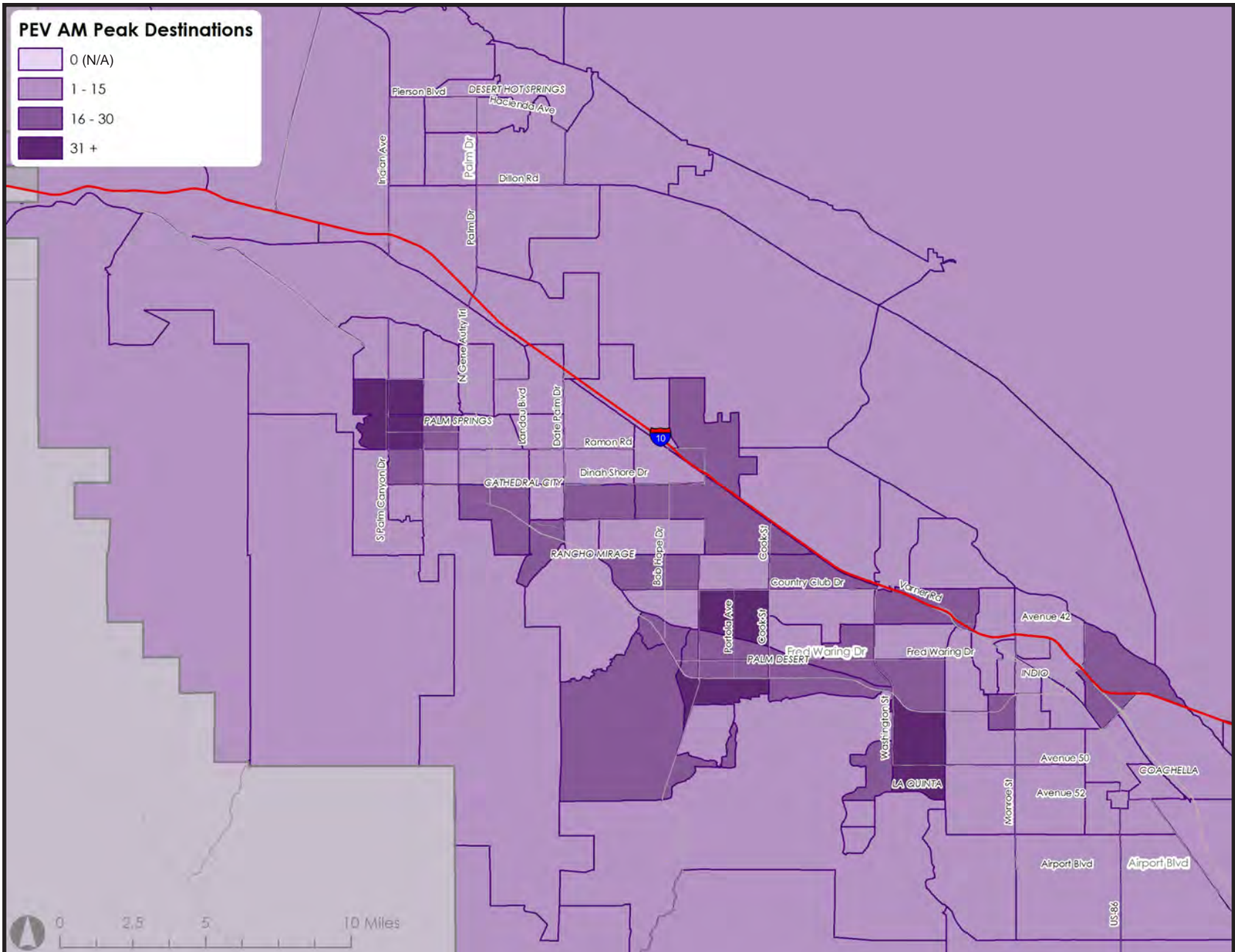
Year	Cumulative Predicted Sales
2016	1,427
2017	1,932
2018	2,513
2019	3,171
2020	3,904
2021	4,714
2022	5,599
2023	6,561
2024	7,599
2025	8,712

COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS PEV Registrations



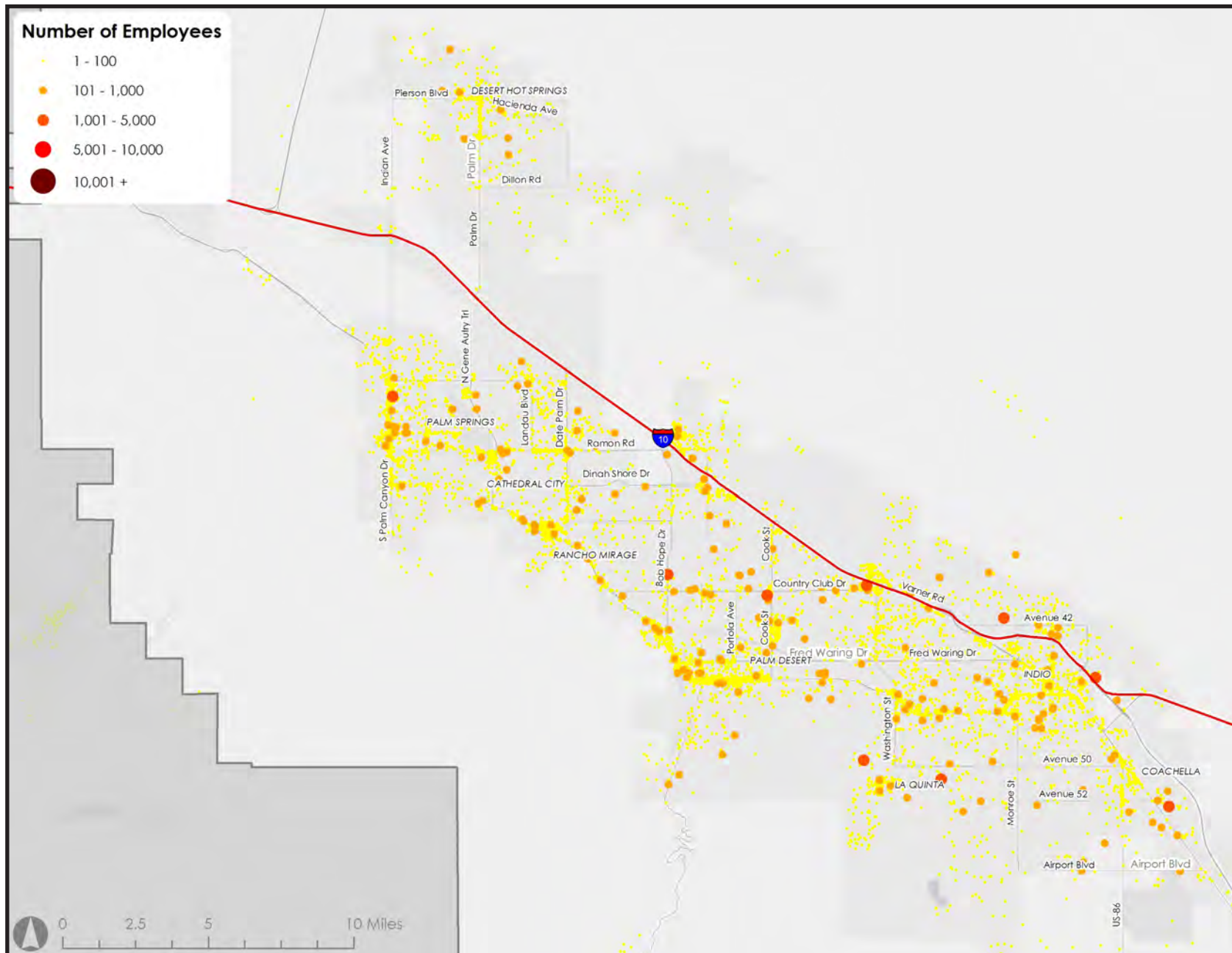
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

PEV Peak Morning Destinations



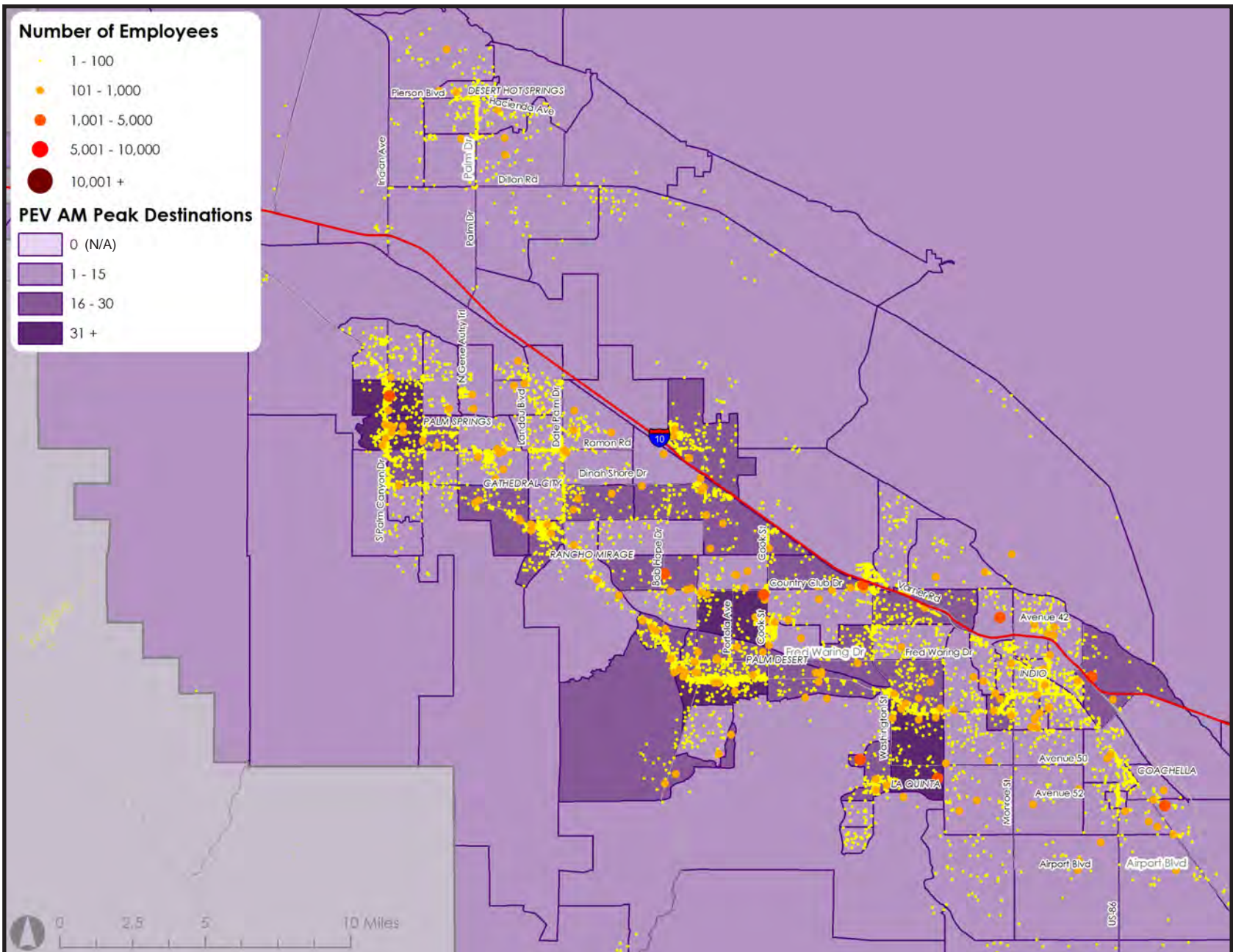
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

Workplaces by Number of Employees



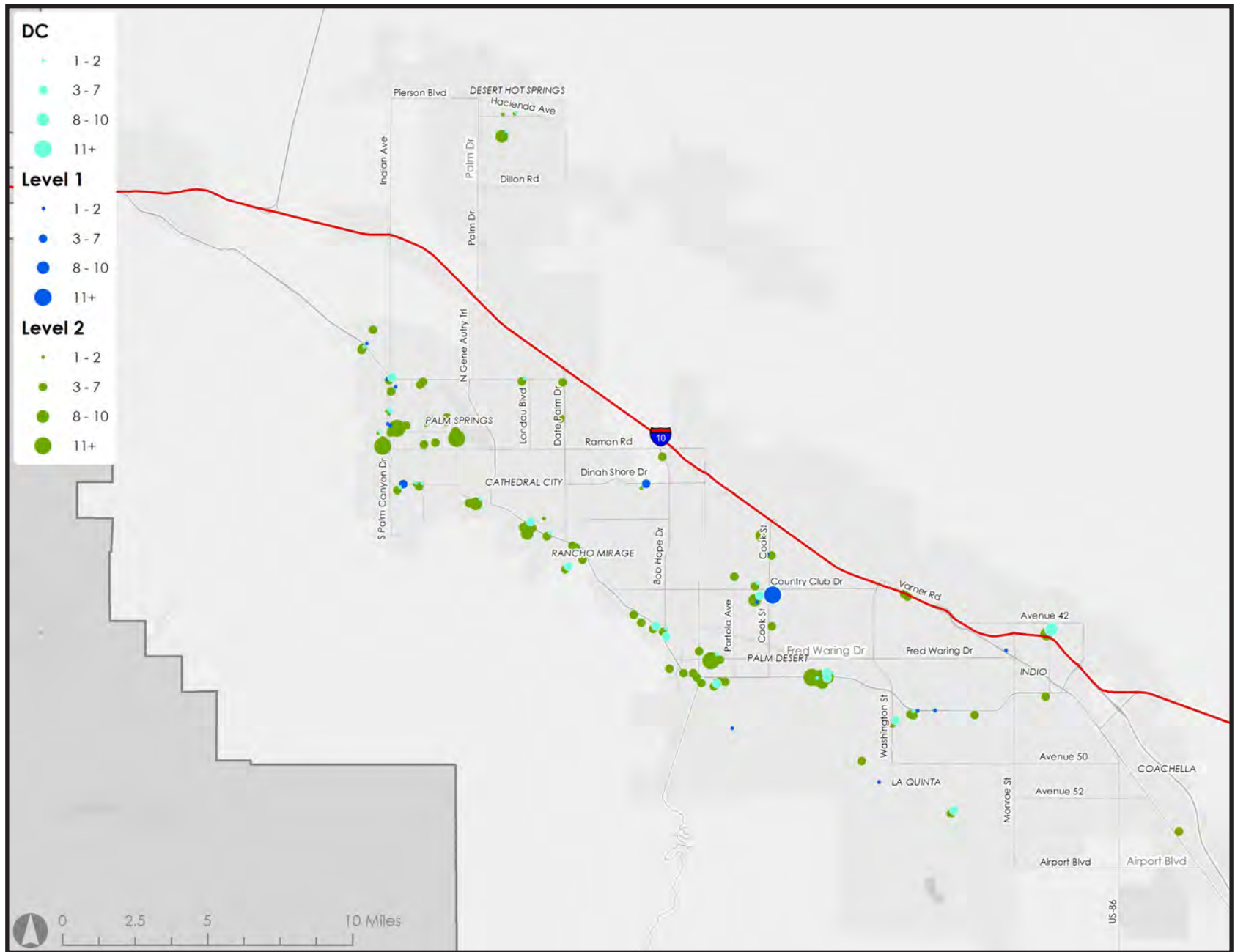
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

PEV Peak Morning Destinations and Workplaces



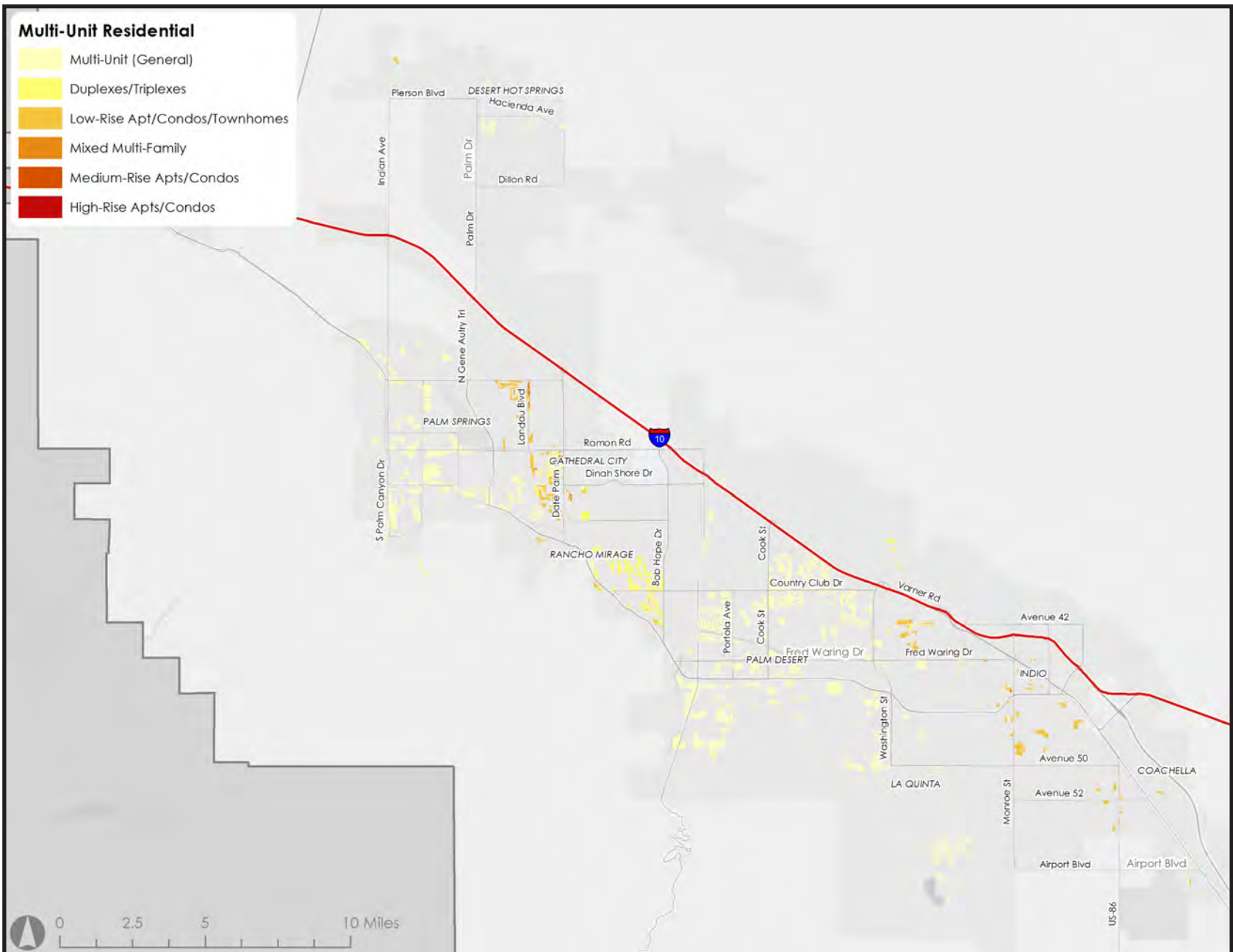
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

Publicly Accessible Charging Stations



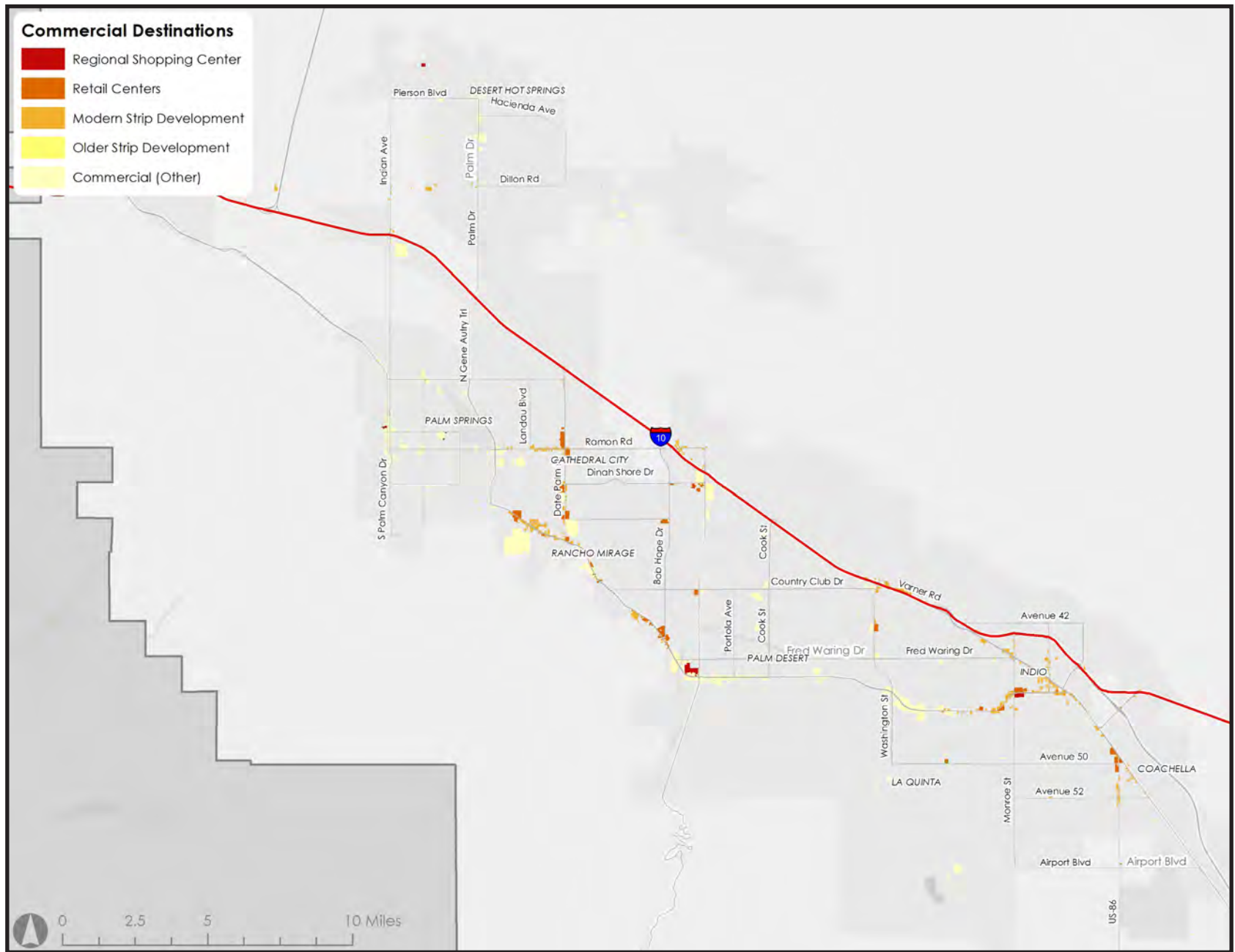
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

Multi-Unit Residential Land Uses



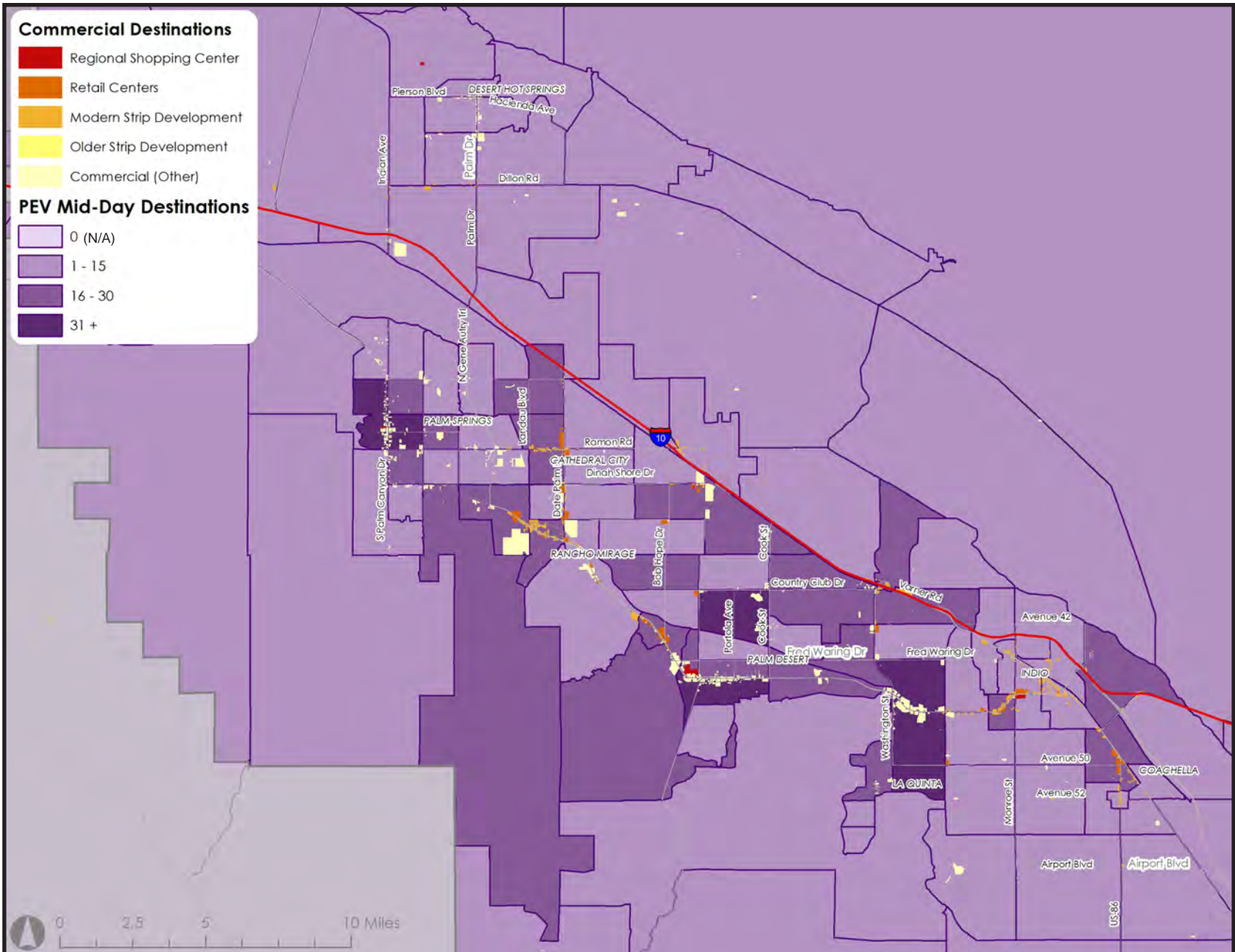
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

Commercial (Retail) Destinations



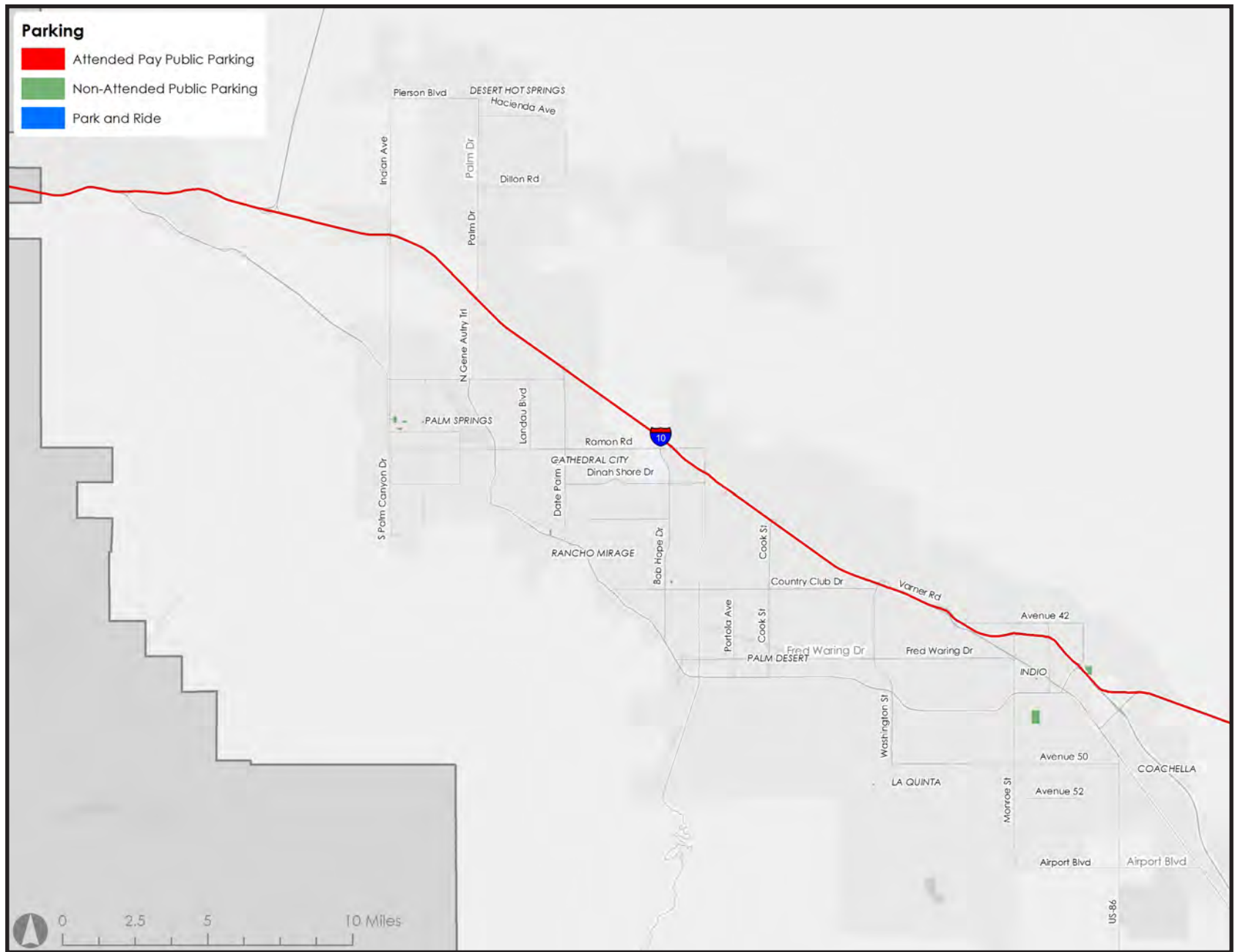
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

PEV Mid-Day Destinations and Commercial (Retail Locations)



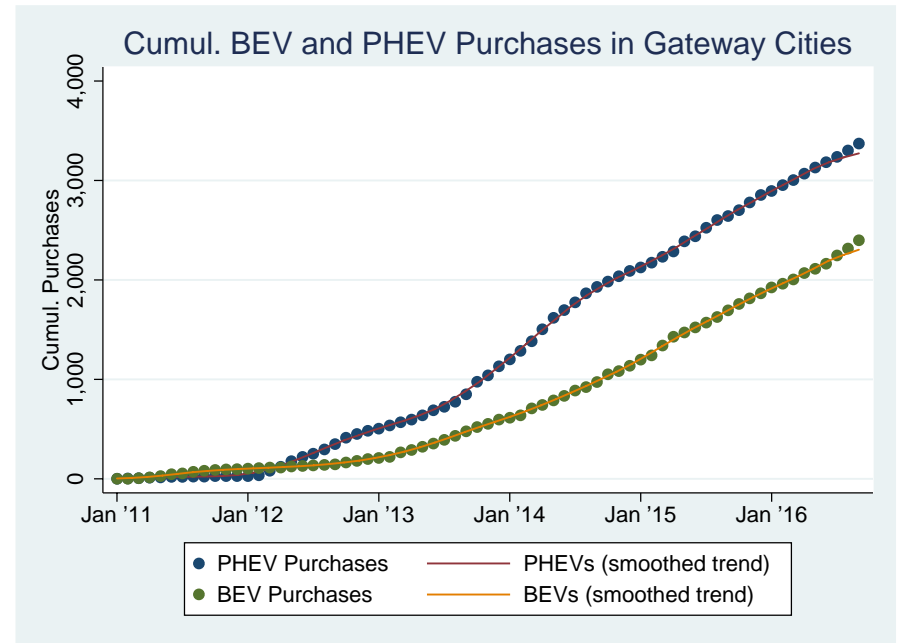
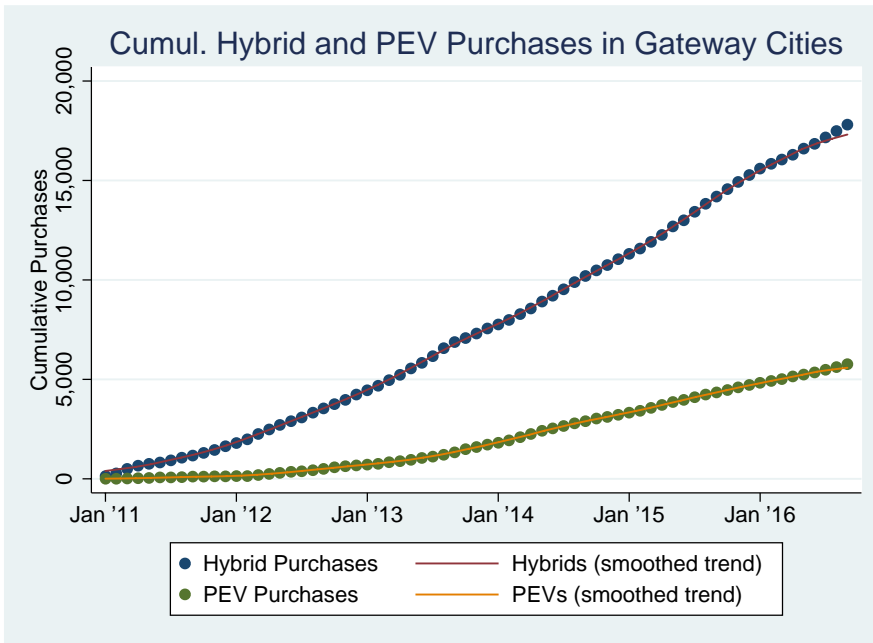
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS

Stand-alone Parking Facilities



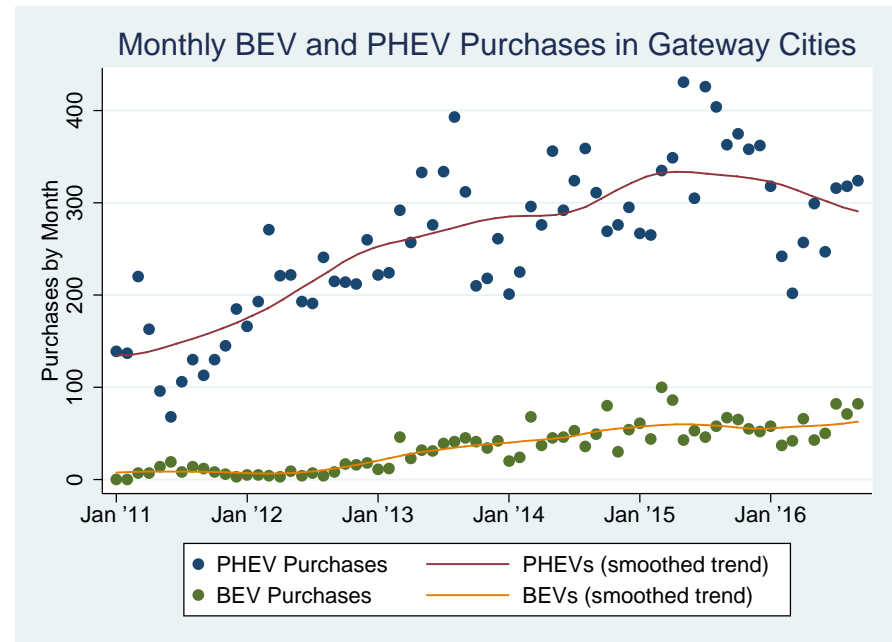
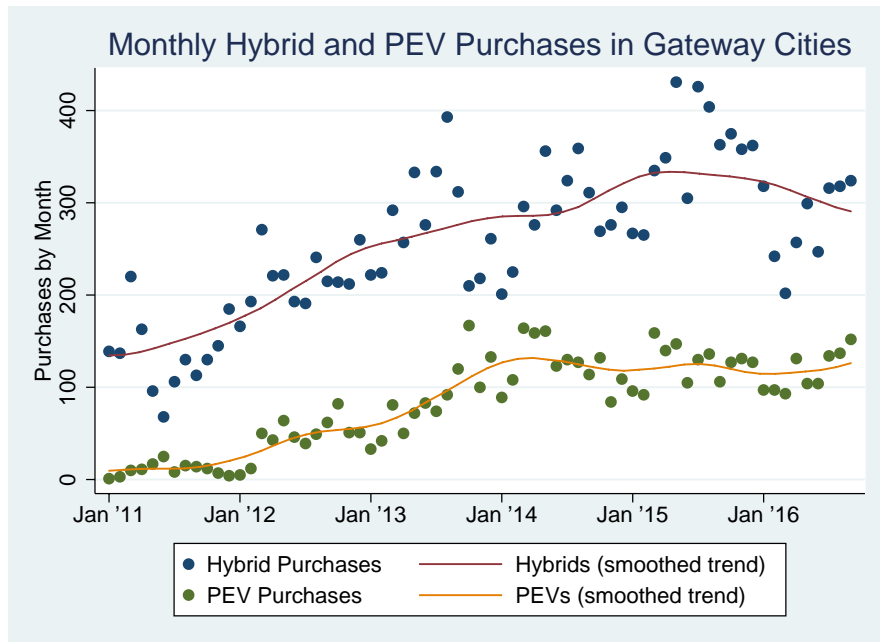
GATEWAY CITIES COUNCIL OF GOVERNMENTS

Cumulative PEV Growth



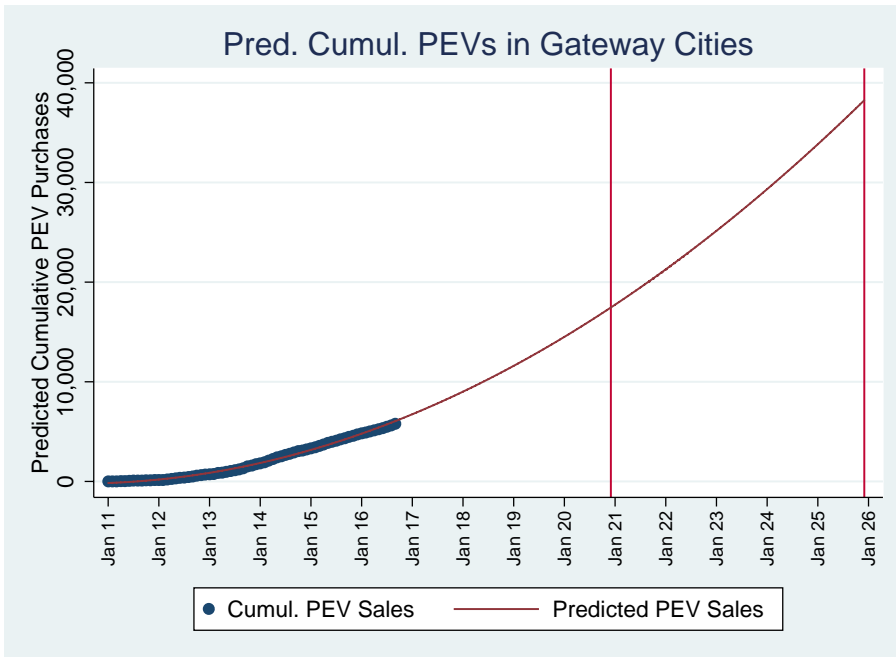
GATEWAY CITIES COUNCIL OF GOVERNMENTS

Monthly PEV Growth



GATEWAY CITIES COUNCIL OF GOVERNMENTS

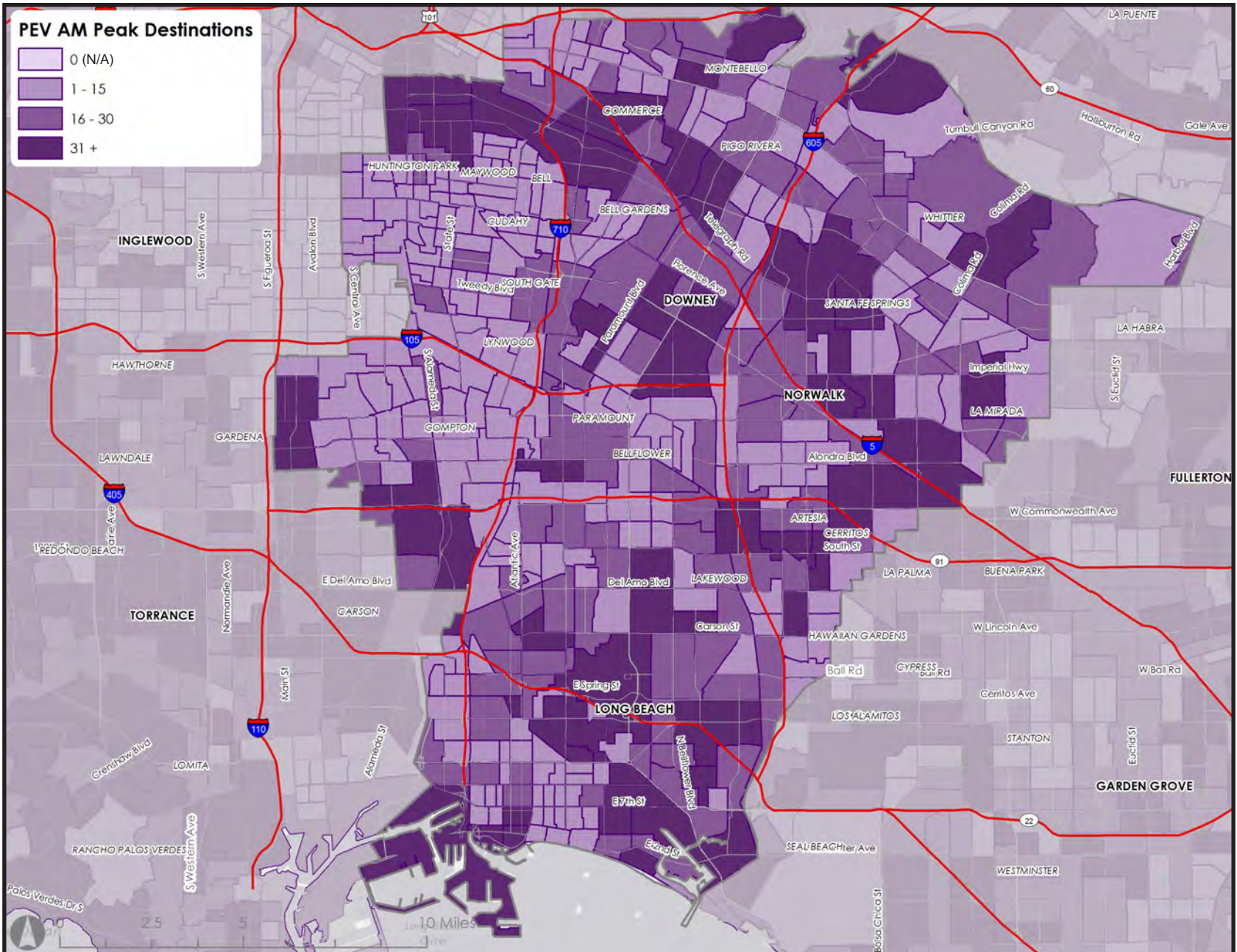
Projected PEV Growth



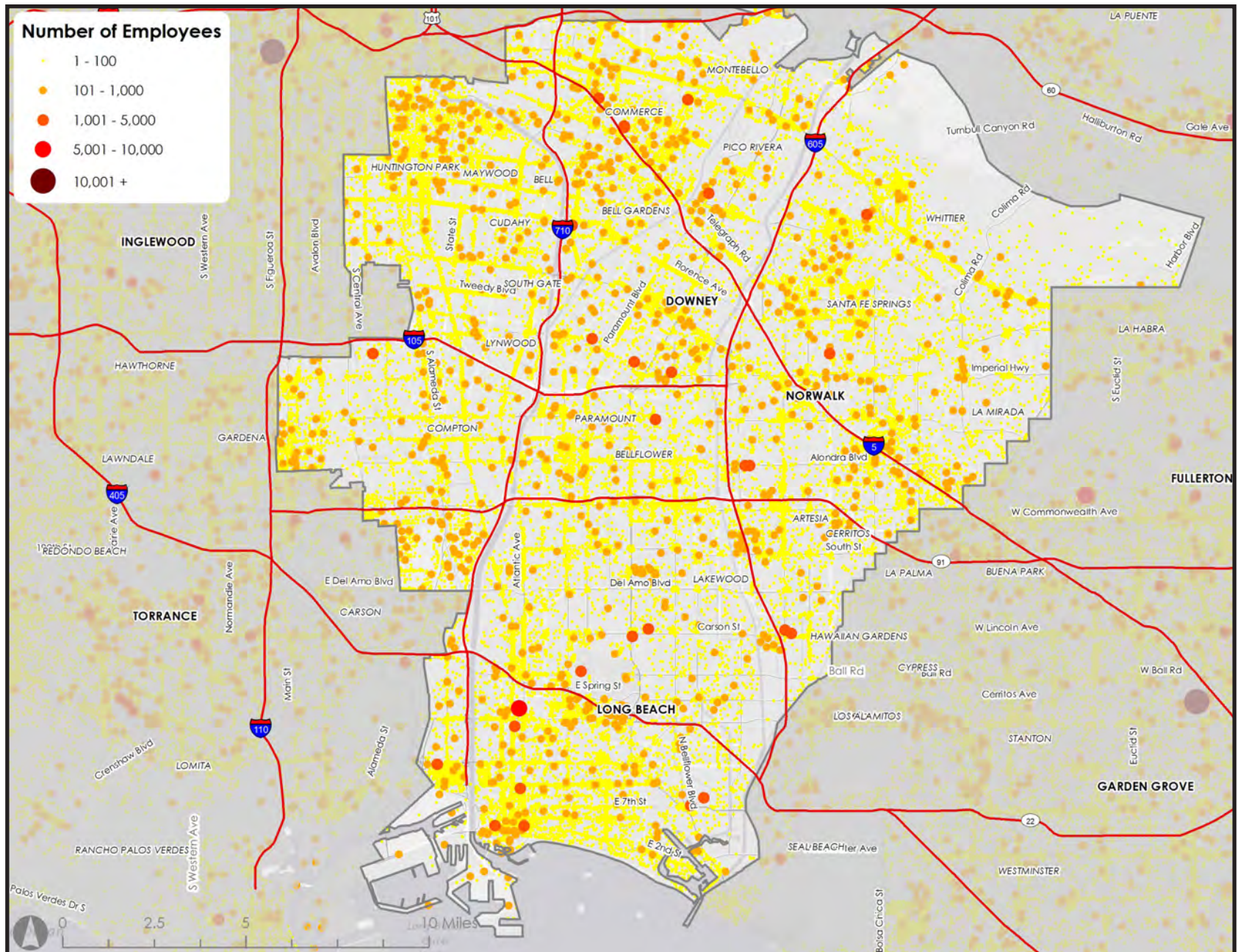
Year	Cumulative Predicted Sales
2016	6,568
2017	8,810
2018	11,371
2019	14,253
2020	17,453
2021	20,974
2022	24,813
2023	28,973
2024	33,452
2025	38,251

GATEWAY CITIES COUNCIL OF GOVERNMENTS

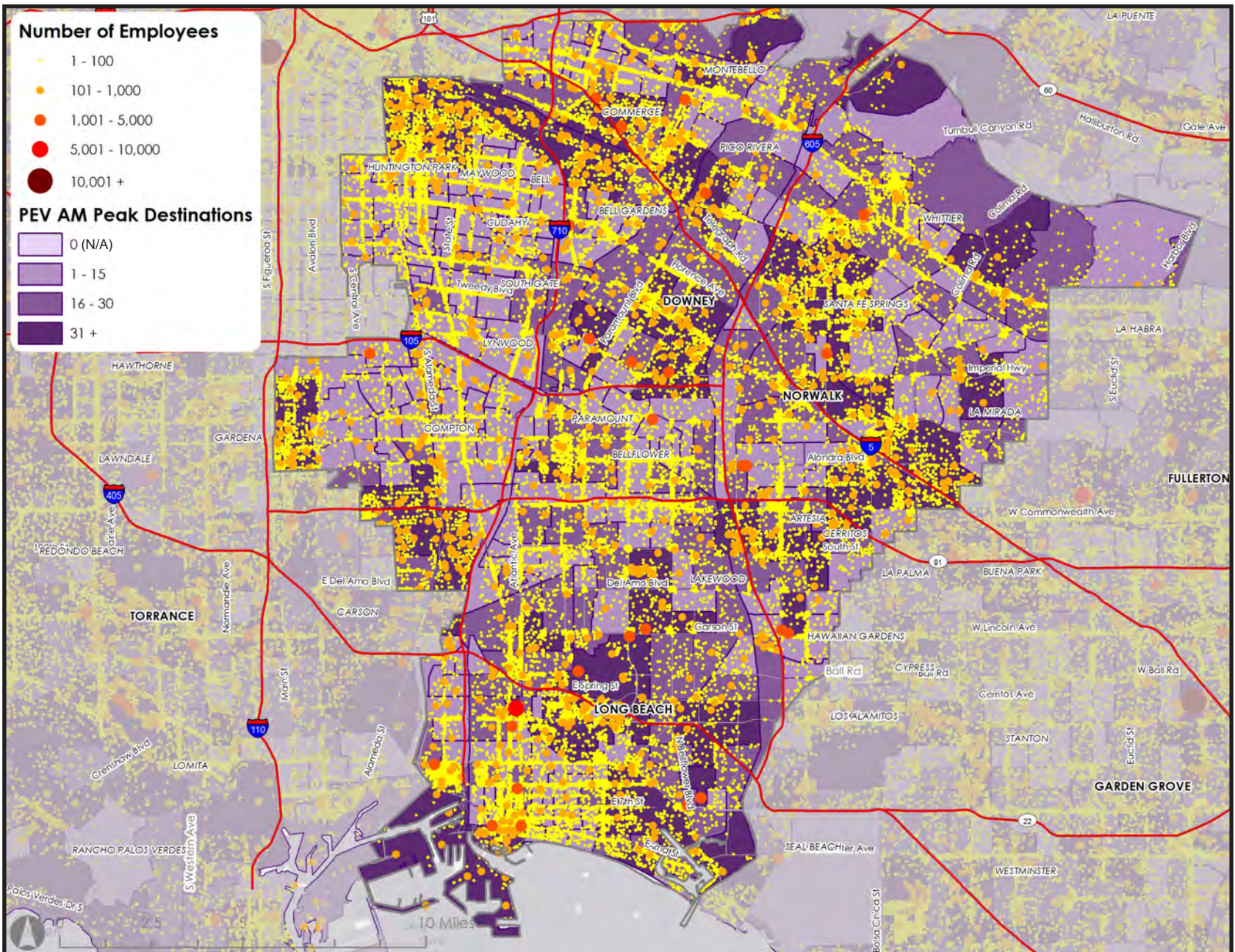
PEV Peak Morning Destinations



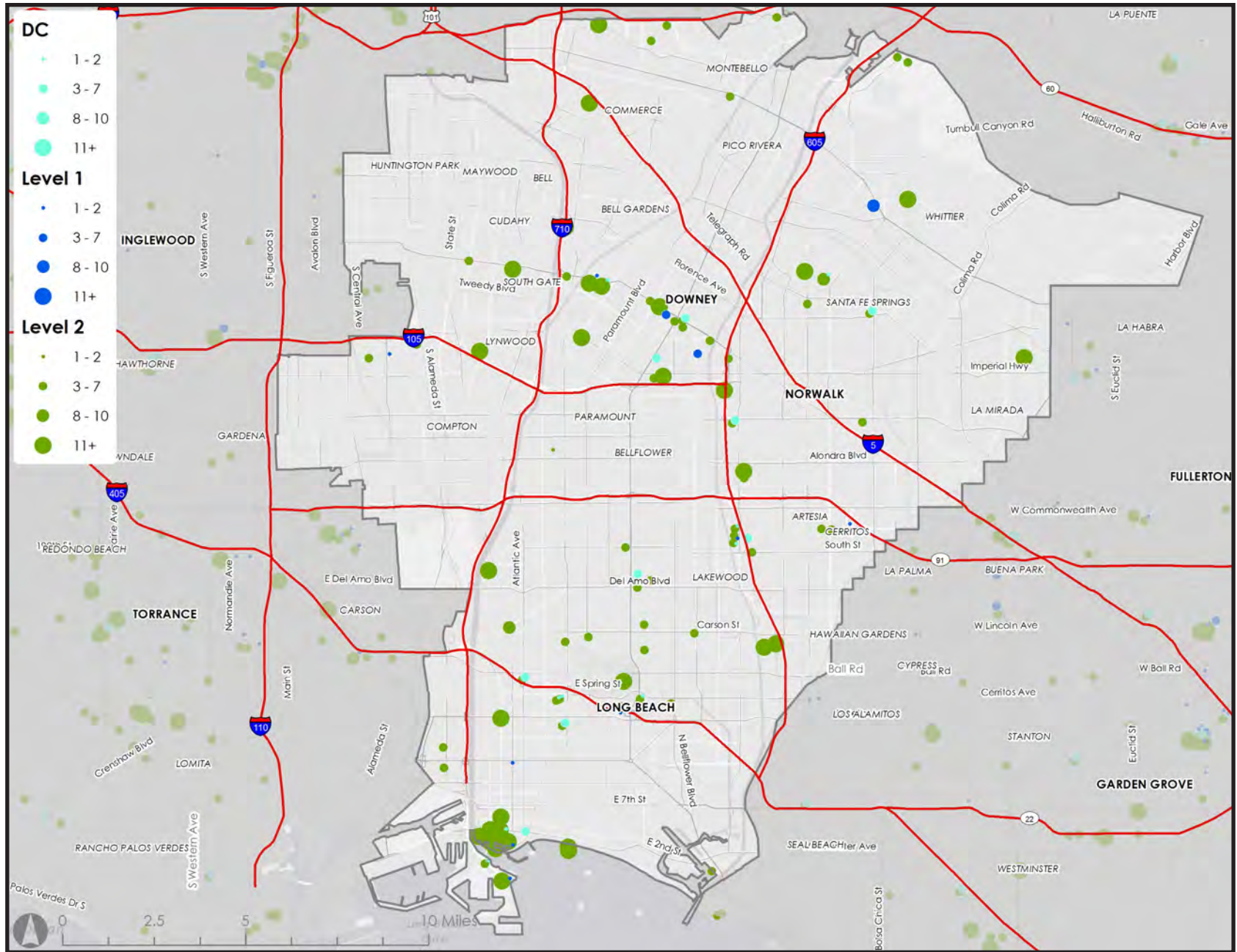
GATEWAY CITIES COUNCIL OF GOVERNMENTS Workplaces by Number of Employees



GATEWAY CITIES COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations and Workplaces

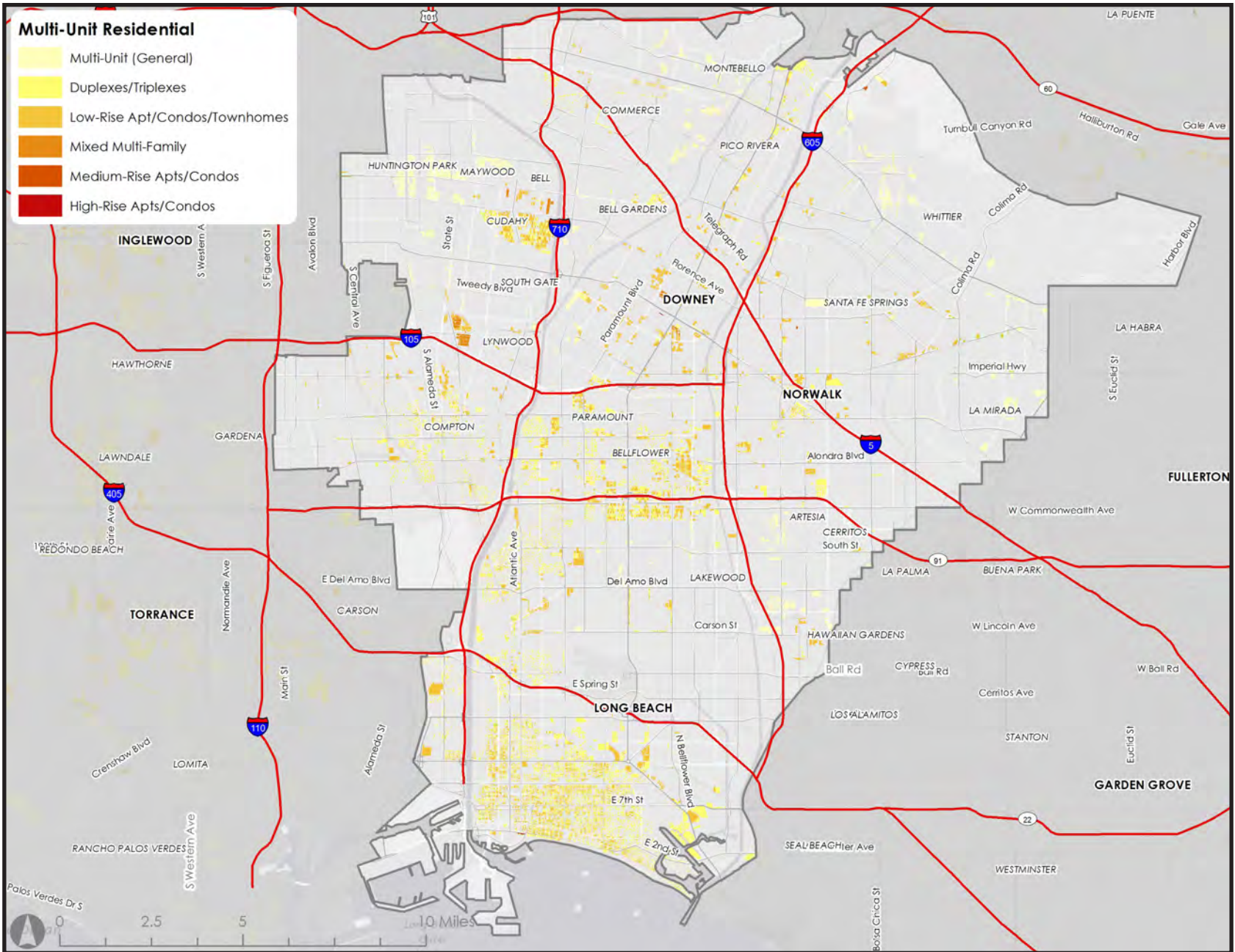


GATEWAY CITIES COUNCIL OF GOVERNMENTS Publicly Accessible Charging Stations



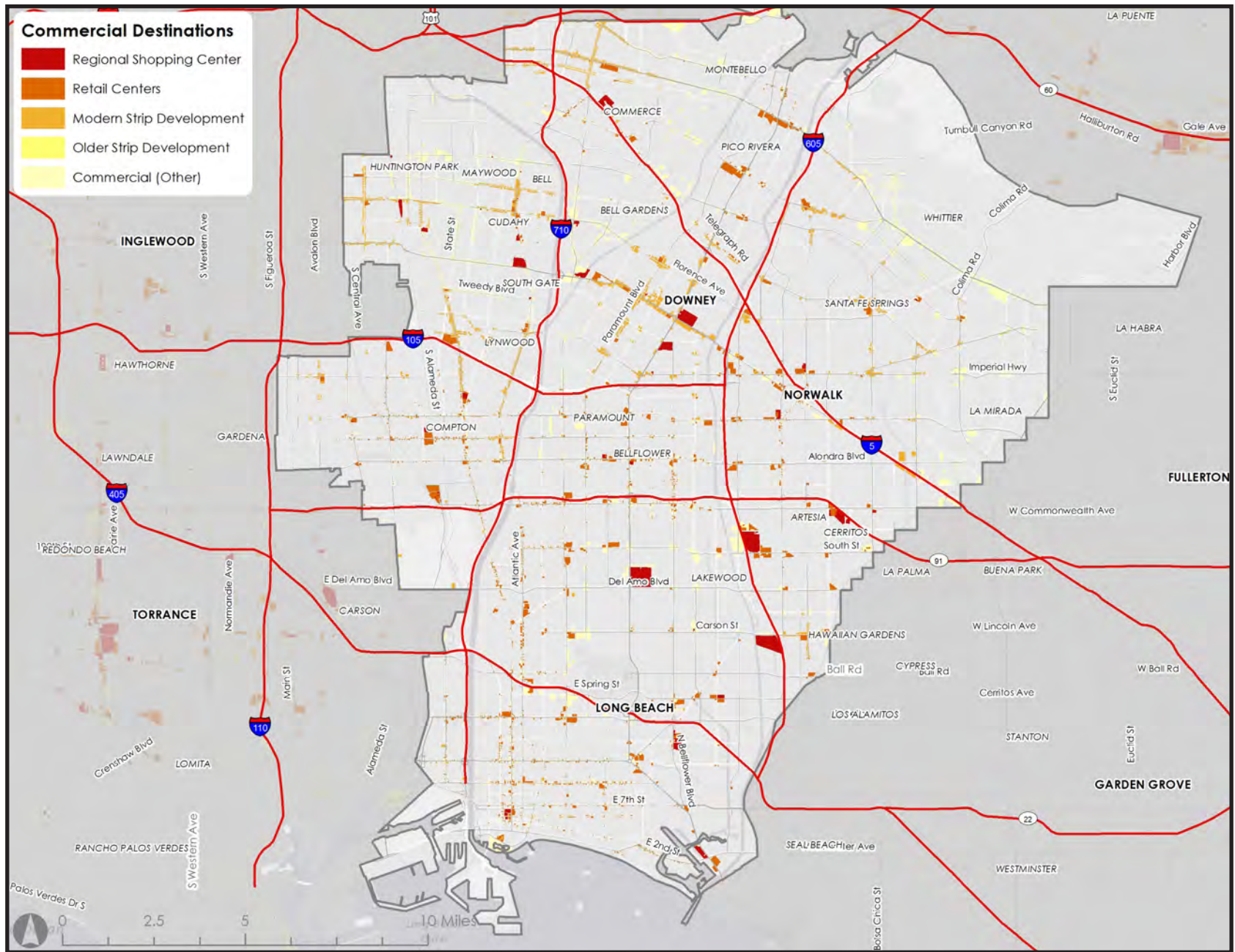
GATEWAY CITIES COUNCIL OF GOVERNMENTS

Multi-Unit Residential Land Uses



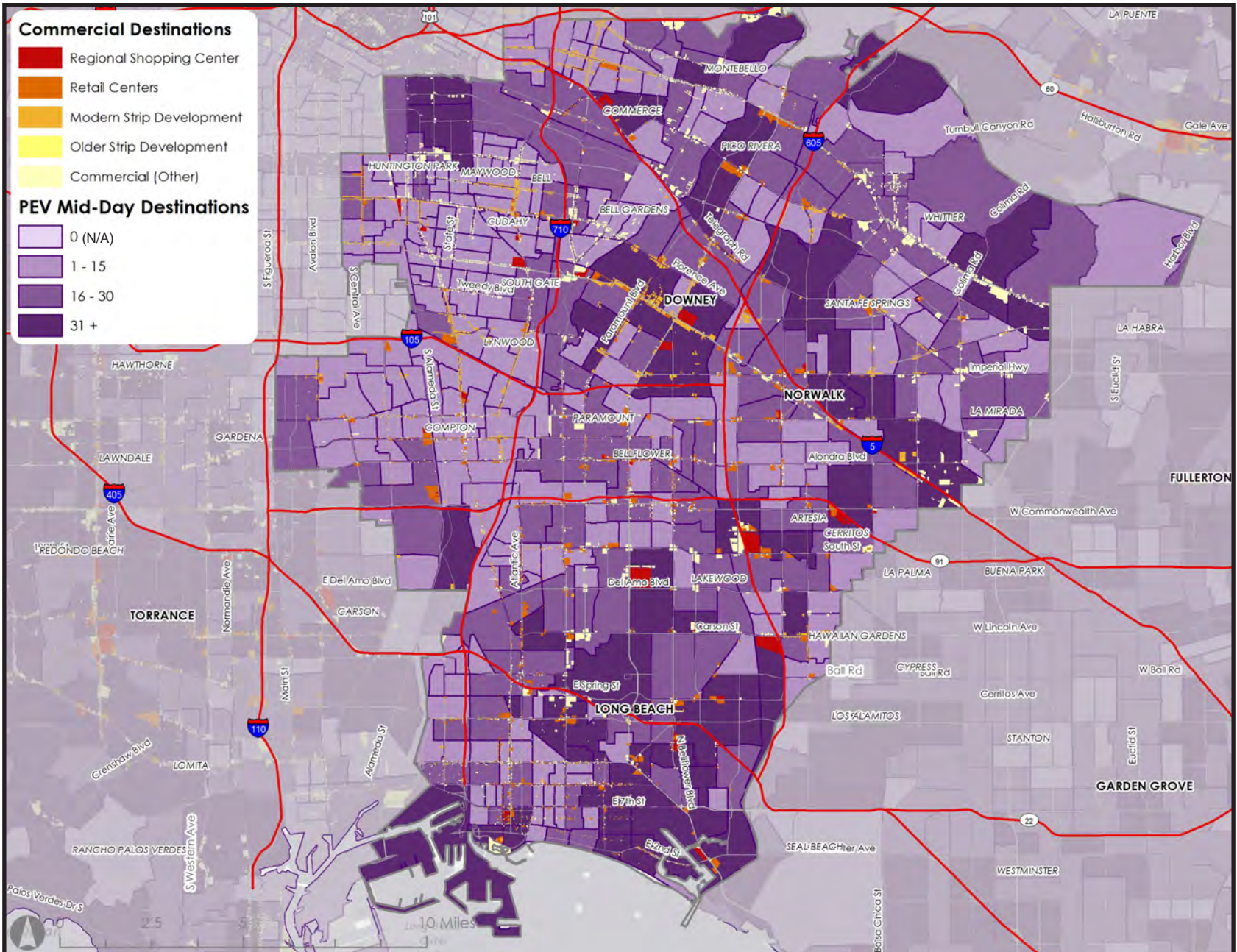
GATEWAY CITIES COUNCIL OF GOVERNMENTS

Commercial (Retail) Destinations



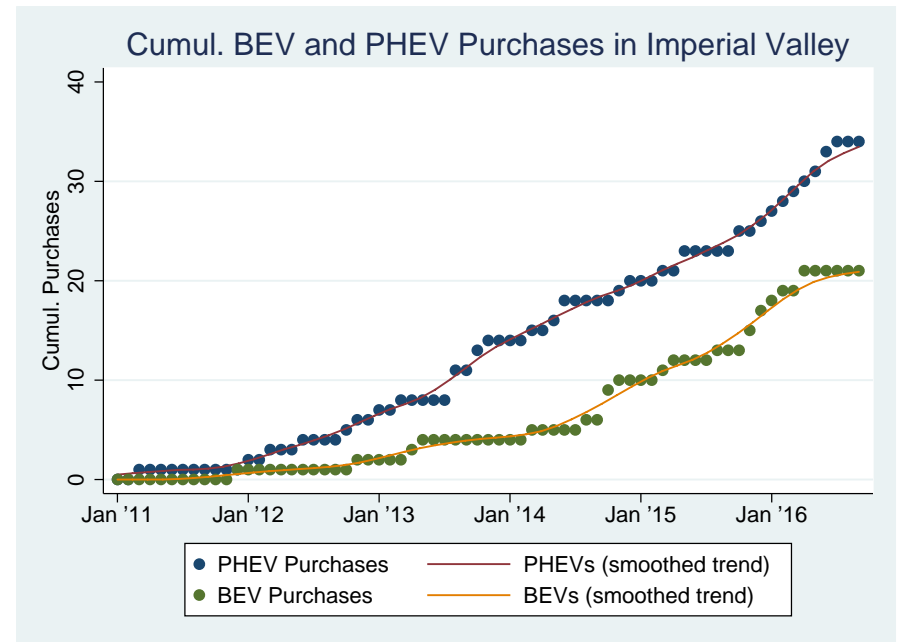
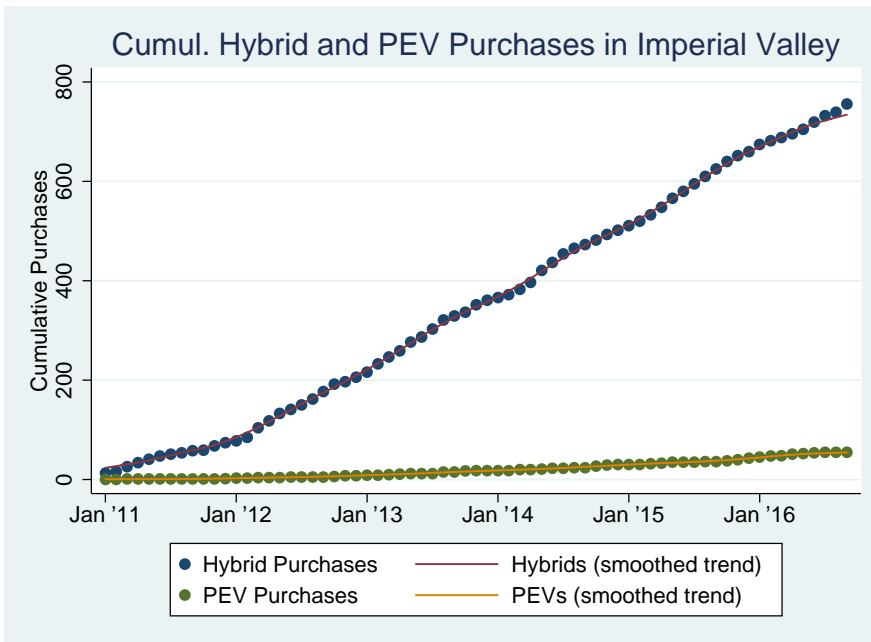
GATEWAY CITIES COUNCIL OF GOVERNMENTS

PEV Mid-Day Destinations and Commercial (Retail Locations)



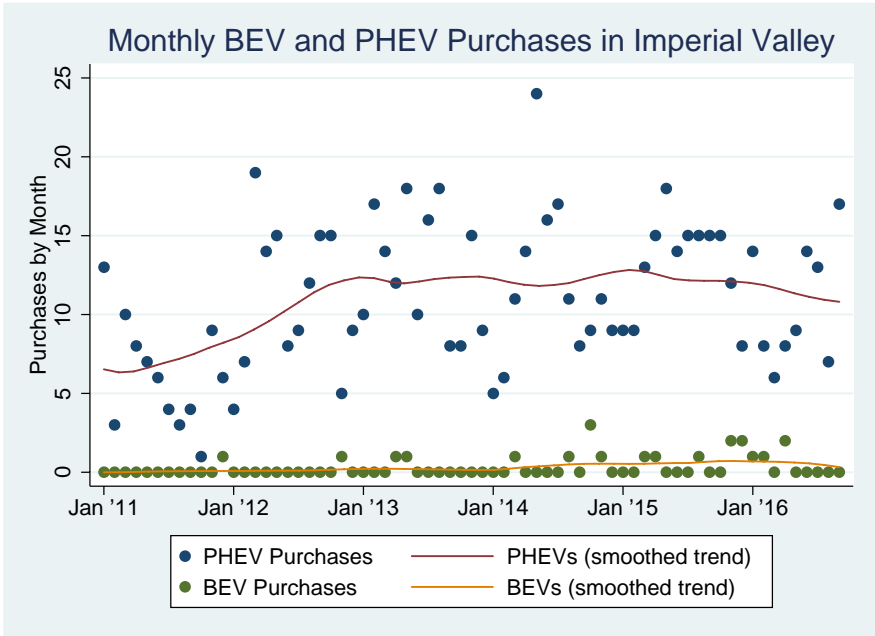
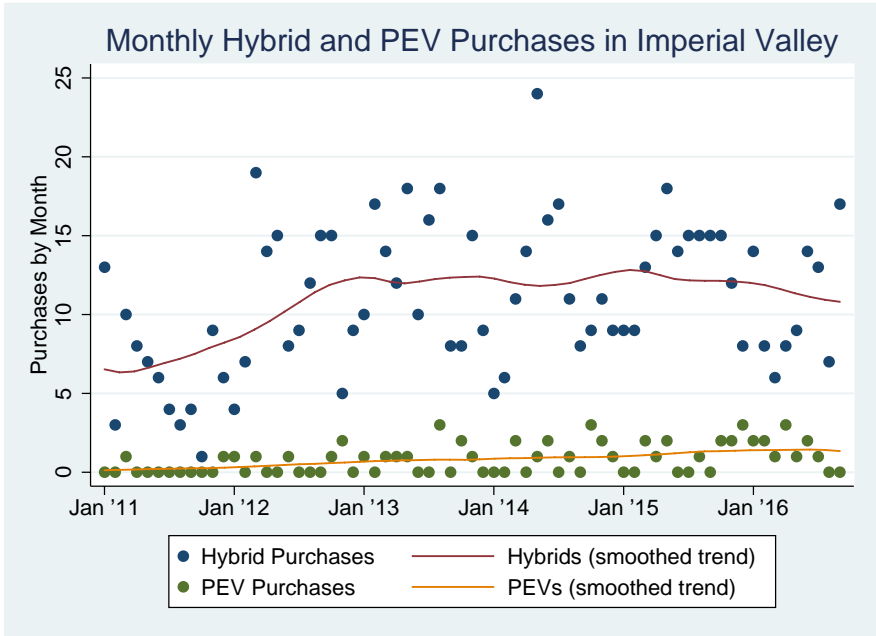
IMPERIAL COUNTY TRANSPORTATION COMMISSION

Cumulative PEV Growth



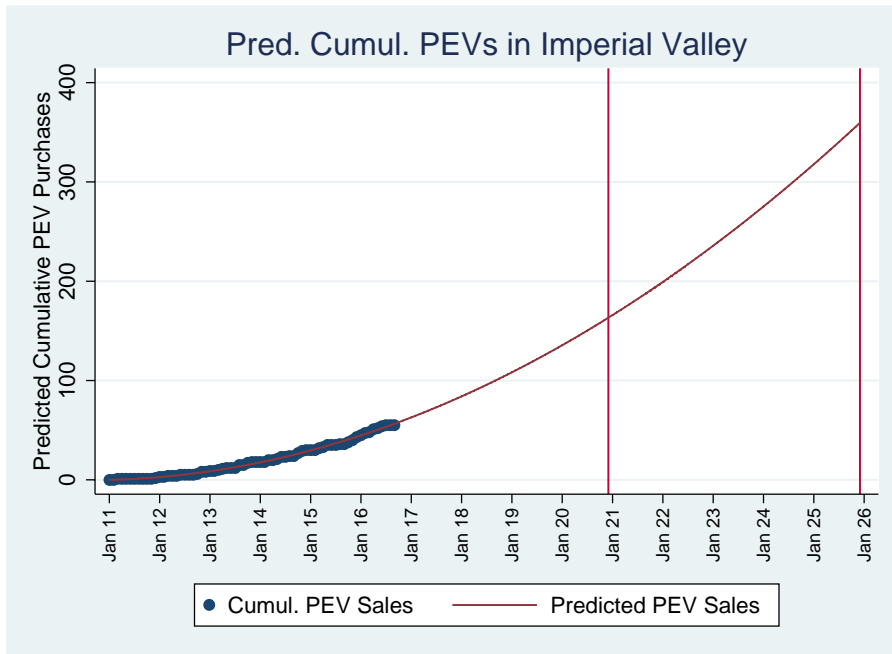
IMPERIAL COUNTY TRANSPORTATION COMMISSION

Monthly PEV Growth



IMPERIAL COUNTY TRANSPORTATION COMMISSION

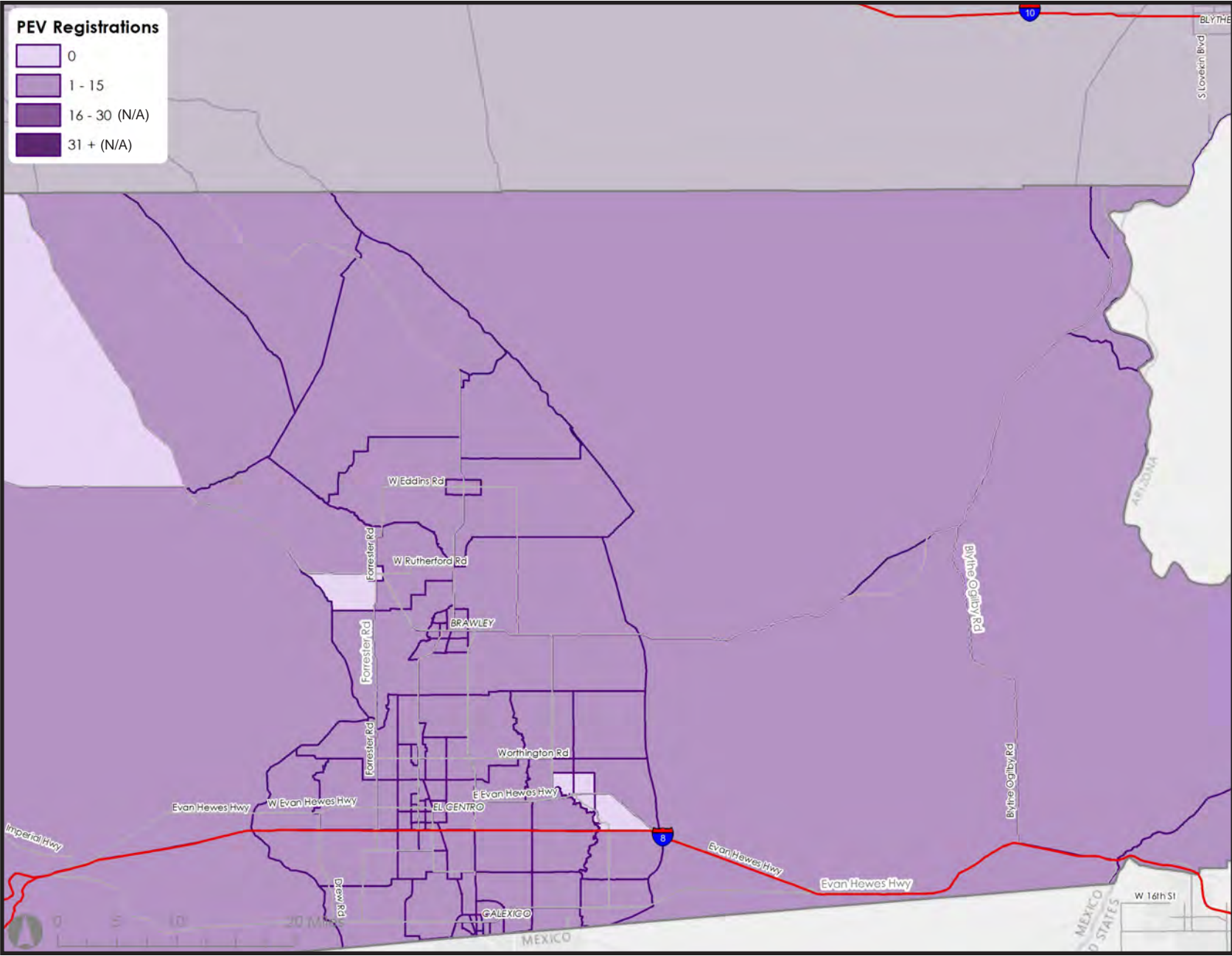
Projected PEV Growth



Year	Cumulative Predicted Sales
2016	61
2017	82
2018	106
2019	133
2020	163
2021	196
2022	233
2023	272
2024	314
2025	360

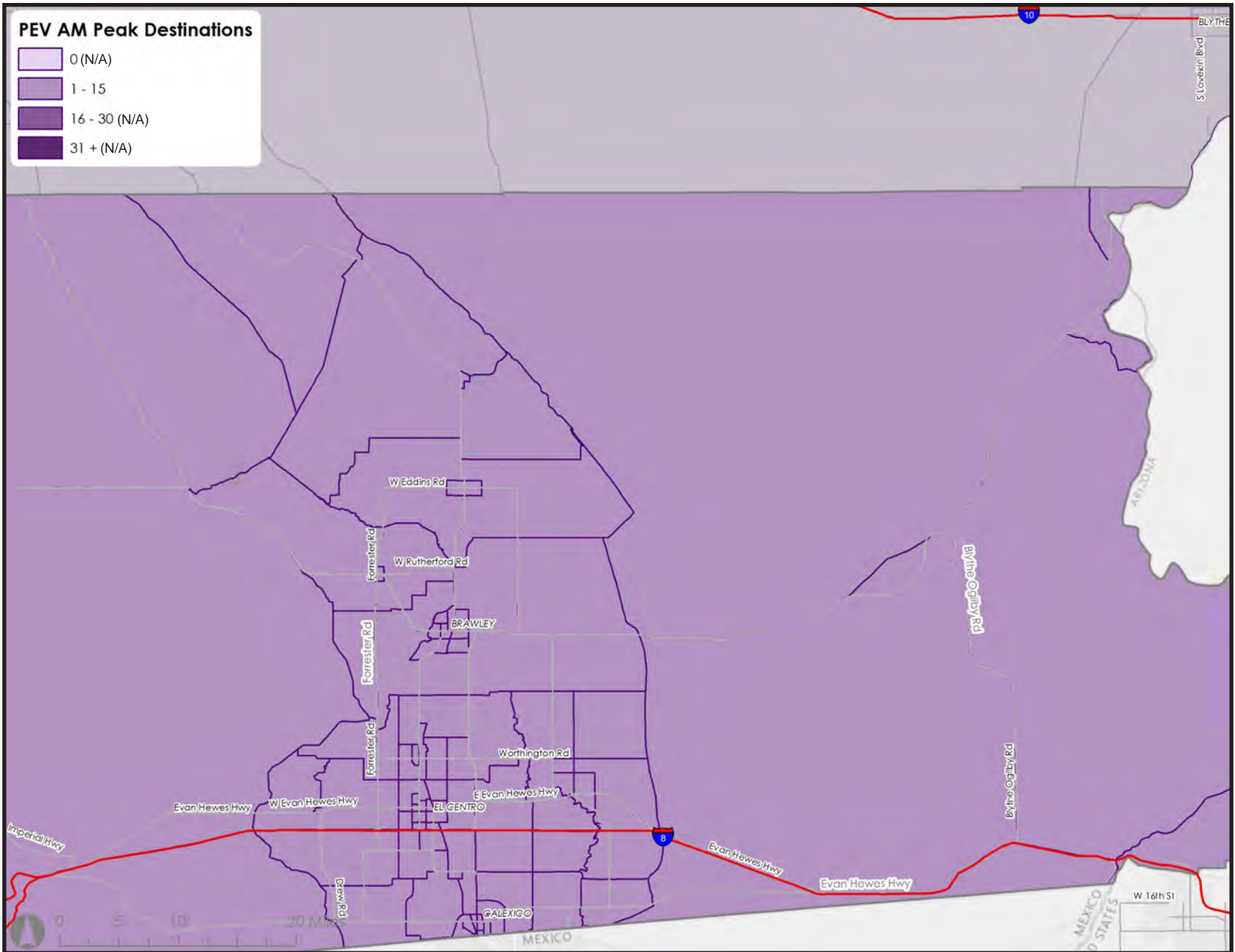
IMPERIAL COUNTY TRANSPORTATION COMMISSION

PEV Registrations

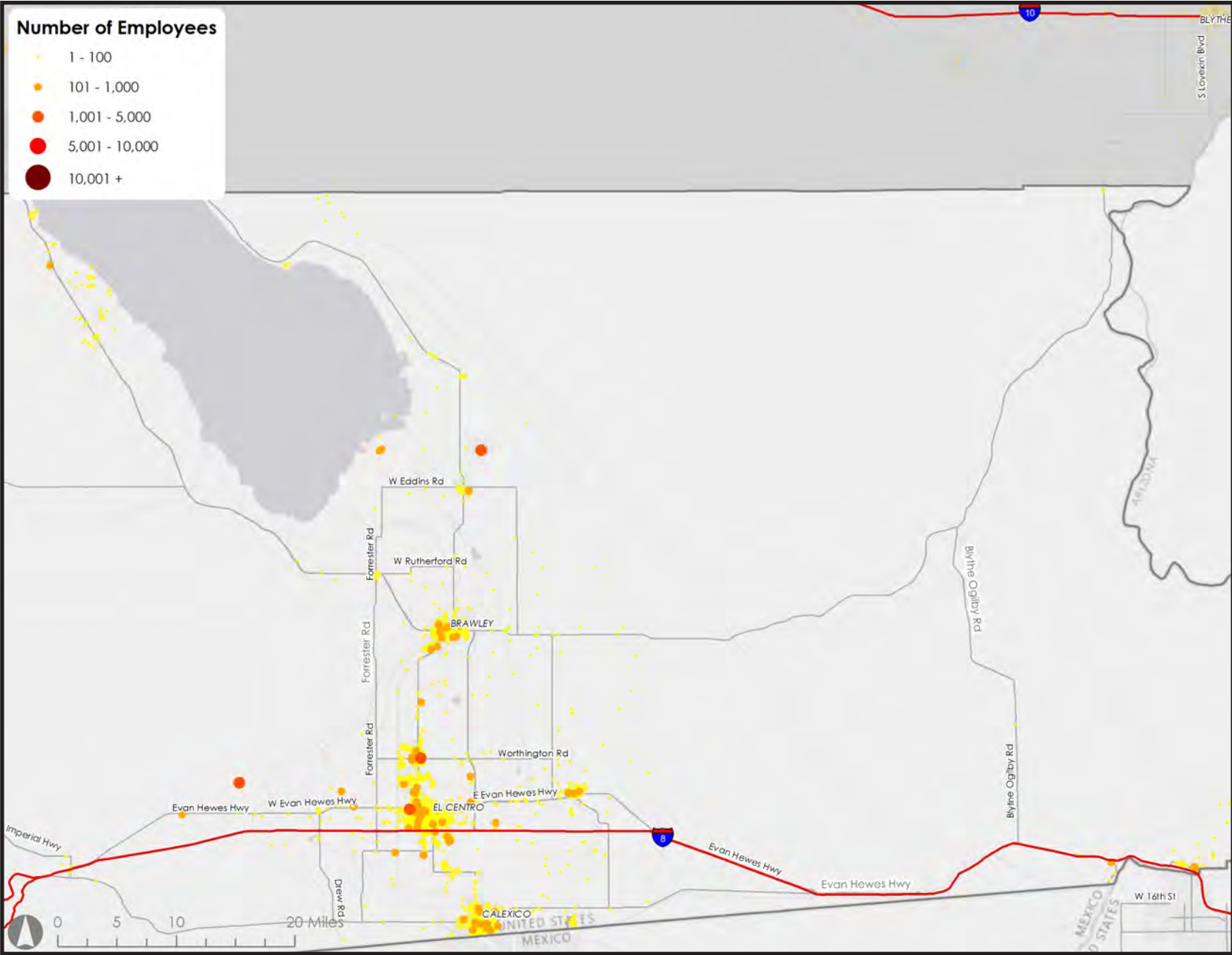


IMPERIAL COUNTY TRANSPORTATION COMMISSION

PEV Peak Morning Destinations

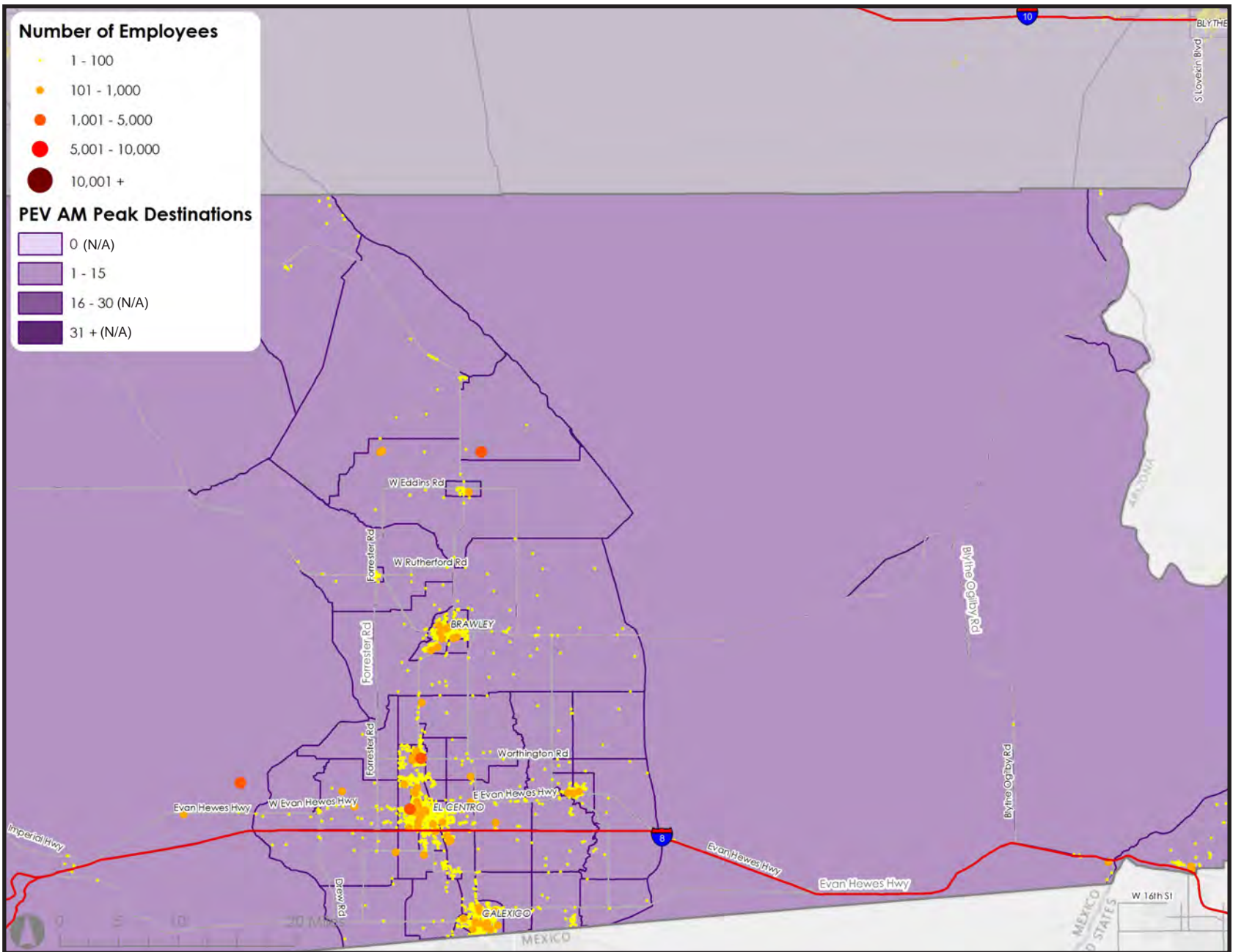


IMPERIAL COUNTY TRANSPORTATION COMMISSION Workplaces by Number of Employees

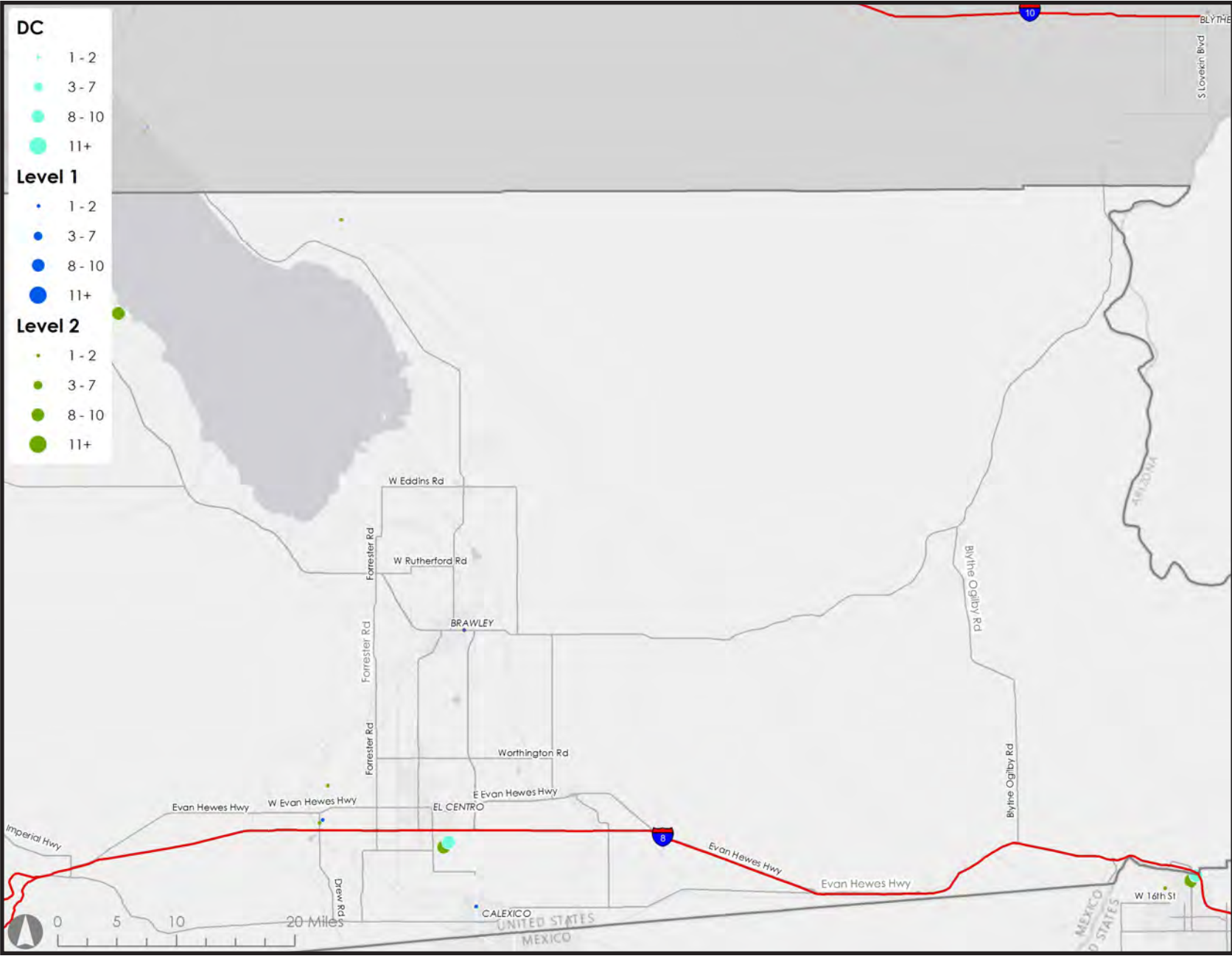


IMPERIAL COUNTY TRANSPORTATION COMMISSION

PEV Peak Morning Destinations and Workplaces

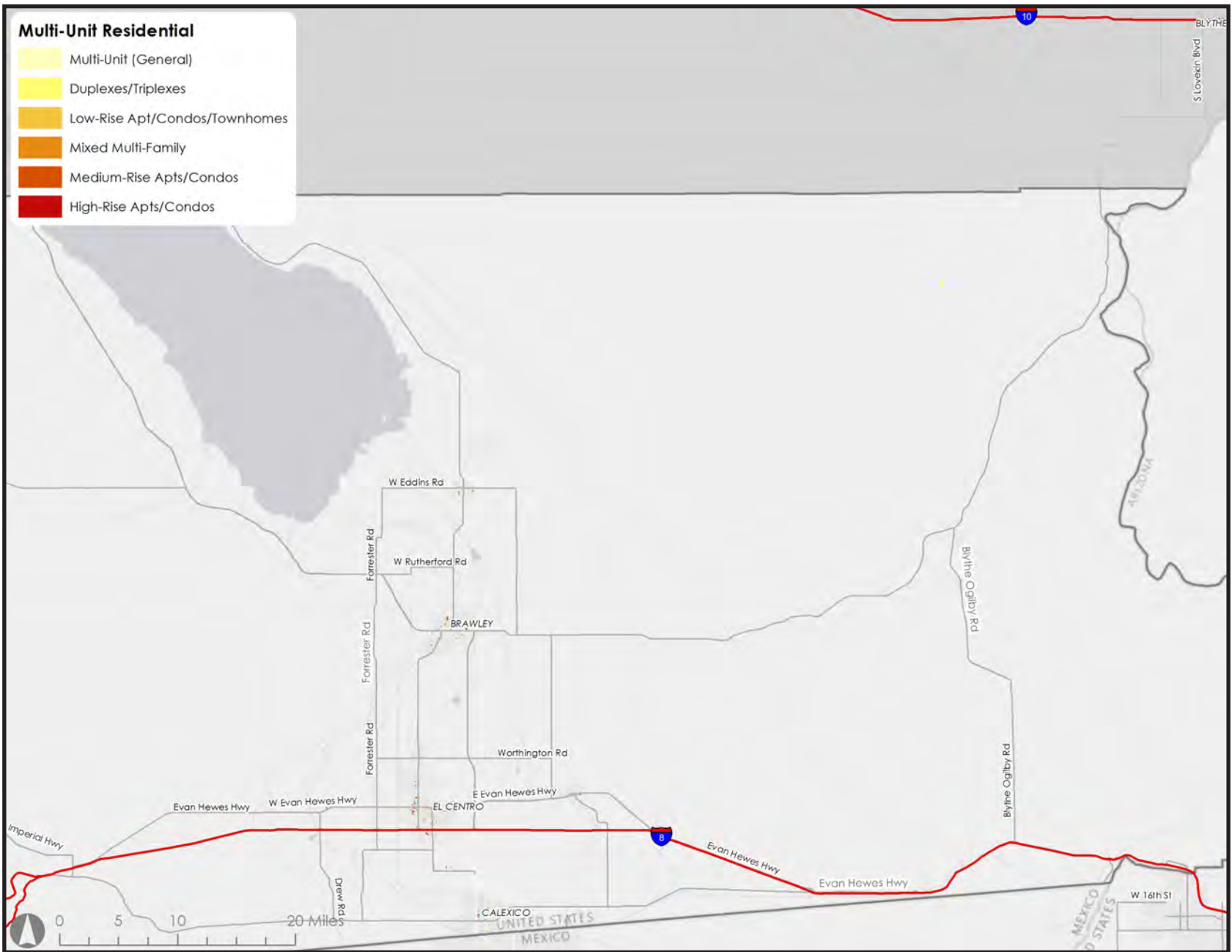


IMPERIAL COUNTY TRANSPORTATION COMMISSION Publicly Accessible Charging Stations



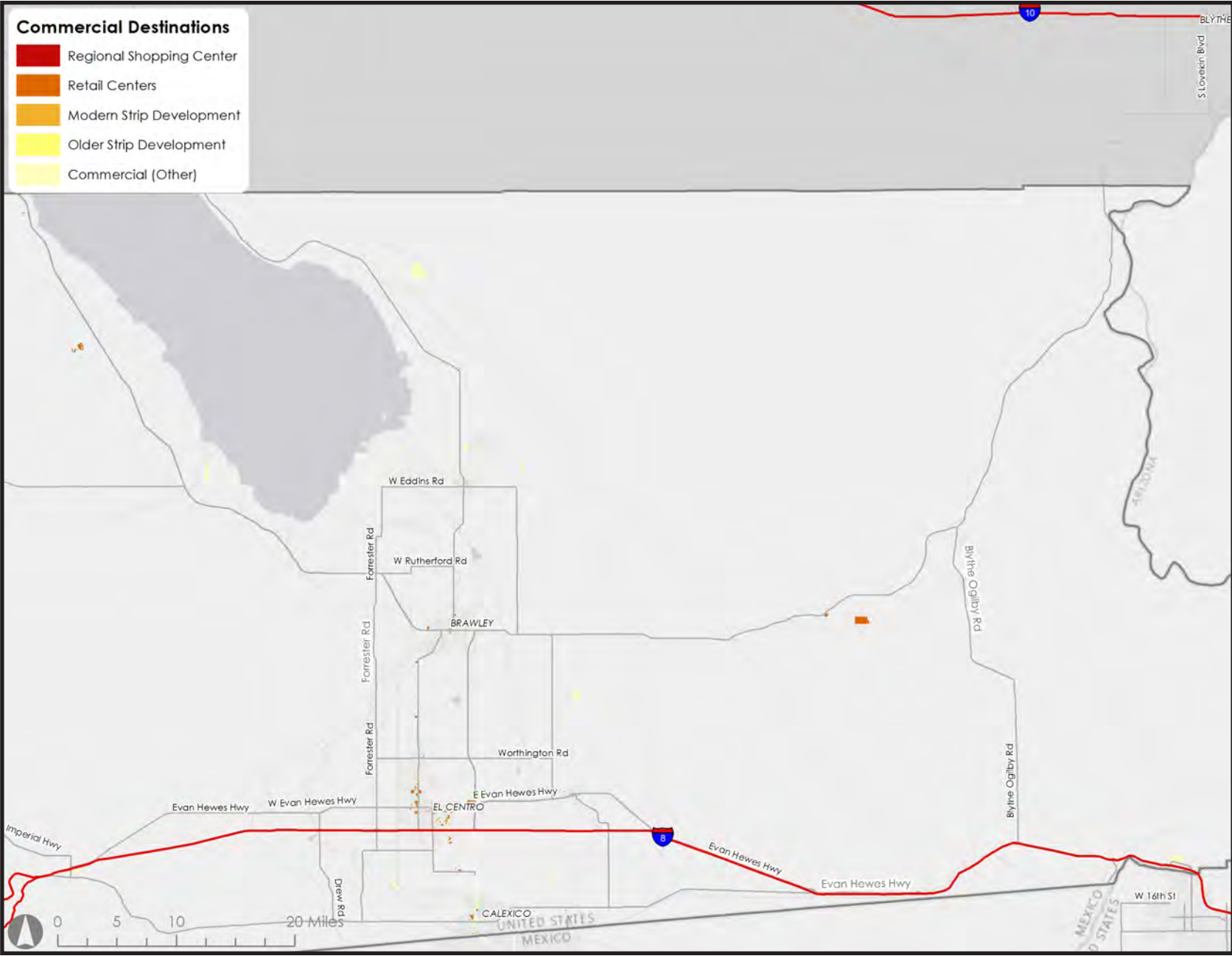
IMPERIAL COUNTY TRANSPORTATION COMMISSION

Multi-Unit Residential Land Uses

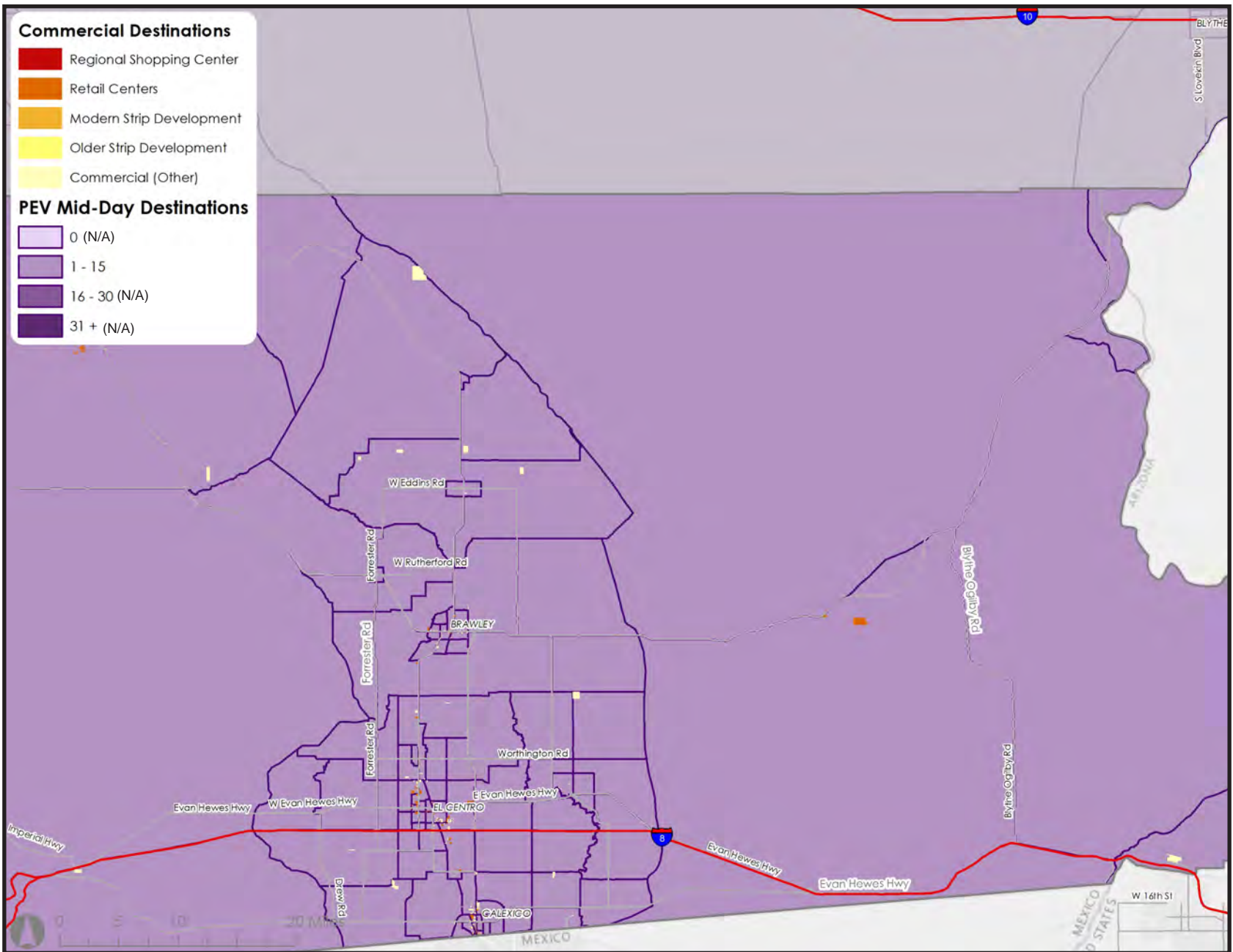


IMPERIAL COUNTY TRANSPORTATION COMMISSION

Commercial (Retail) Destinations

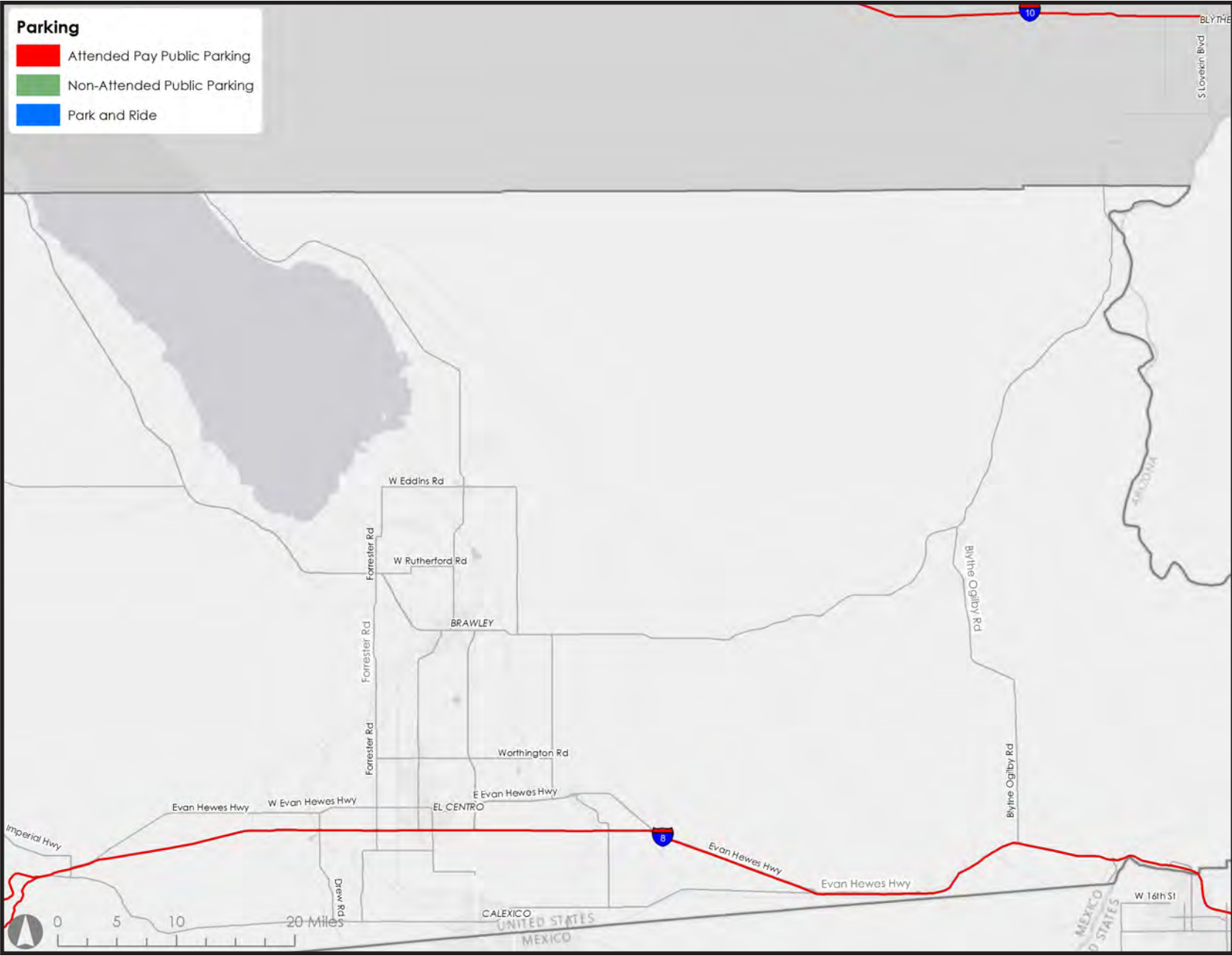


IMPERIAL COUNTY TRANSPORTATION COMMISSION PEV Mid-Day Destinations and Commercial (Retail Locations)



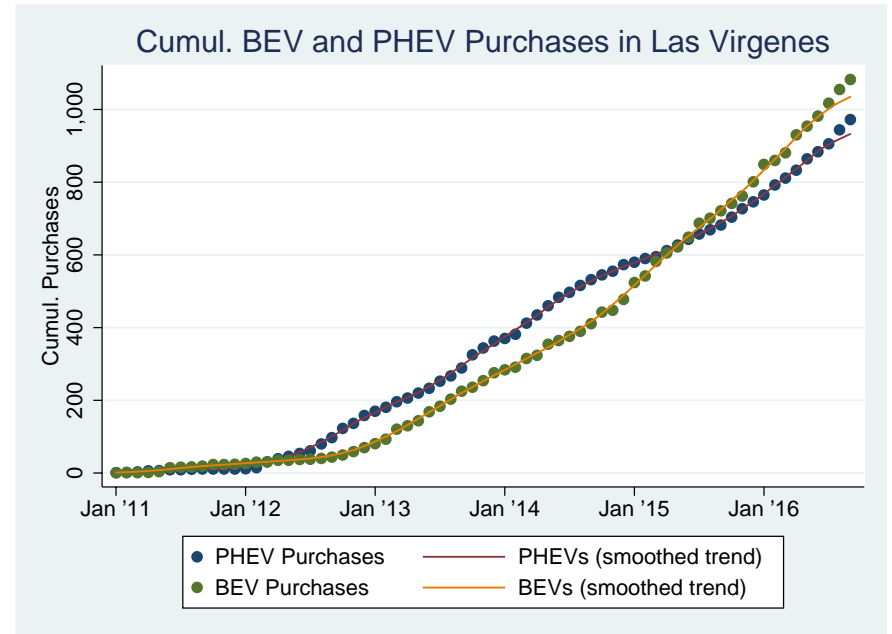
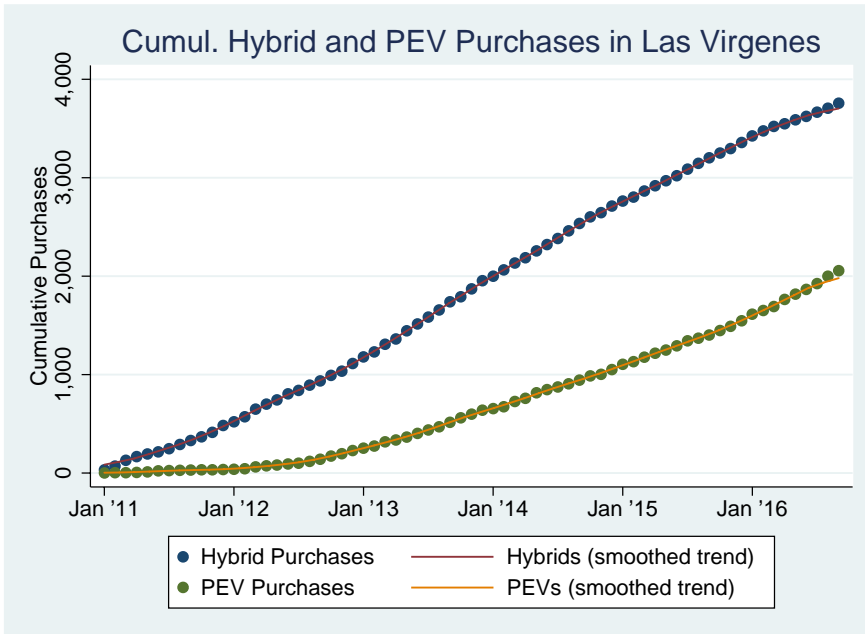
IMPERIAL COUNTY TRANSPORTATION COMMISSION

Stand-alone Parking Facilities



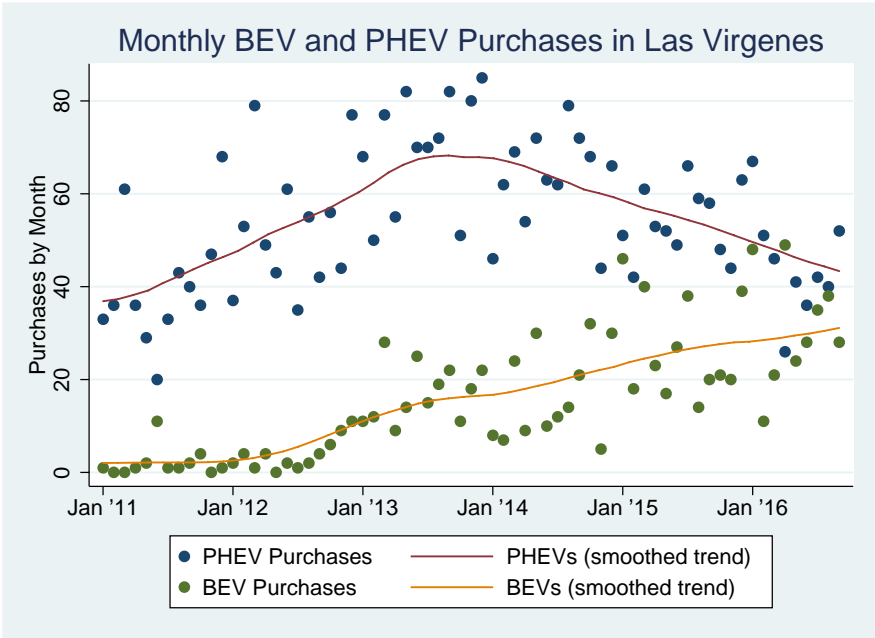
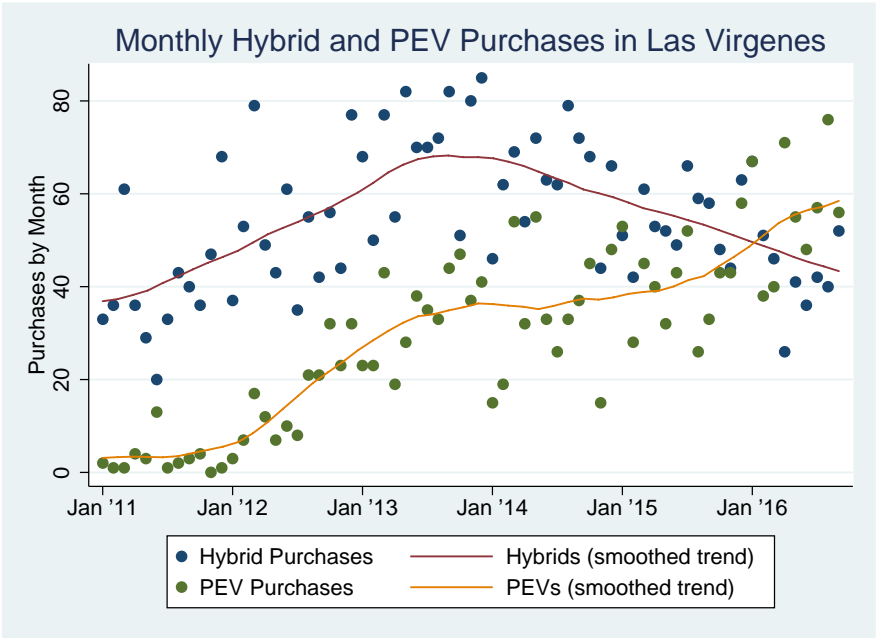
LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

Cumulative PEV Growth



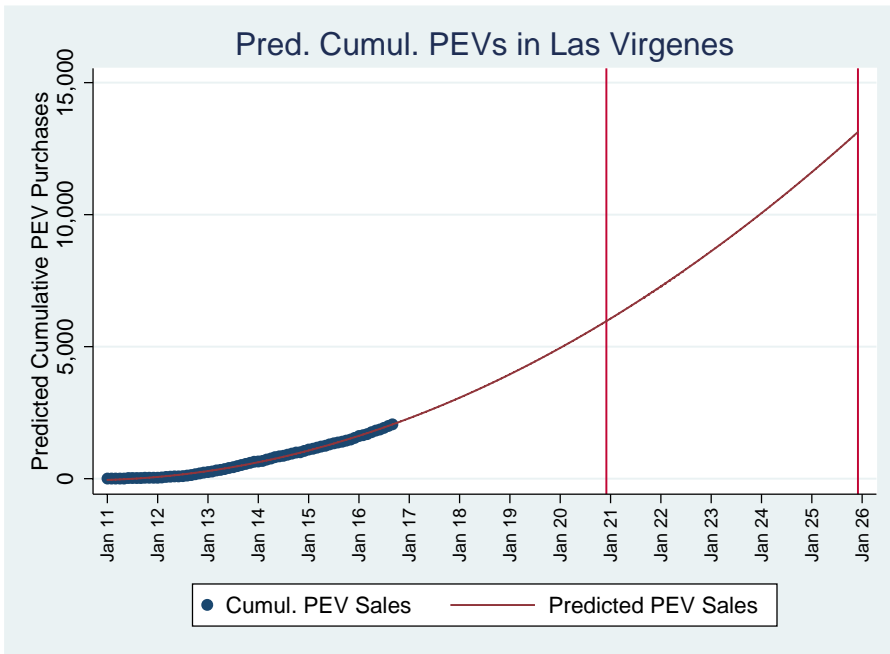
LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

Monthly PEV Growth



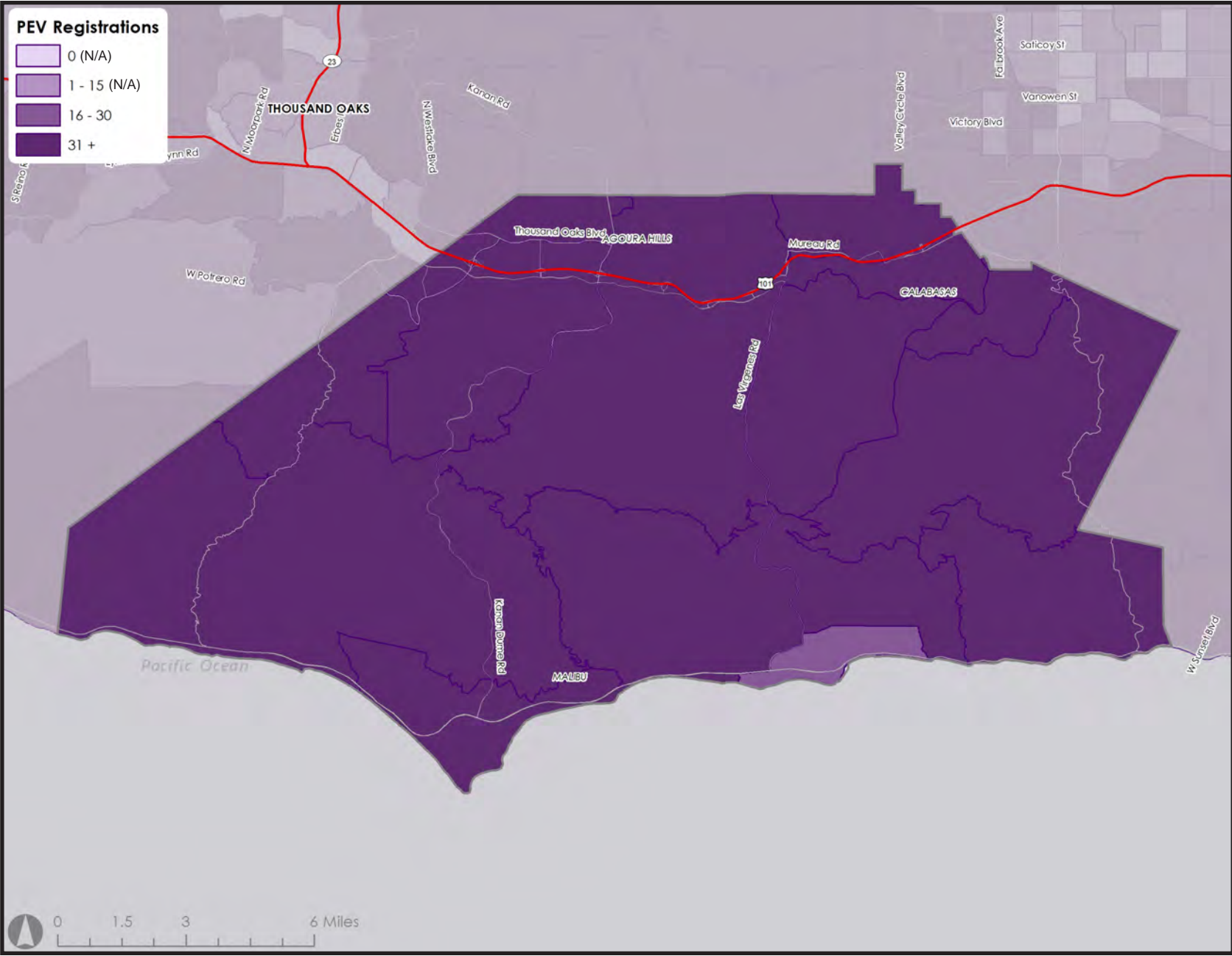
LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

Projected PEV Growth



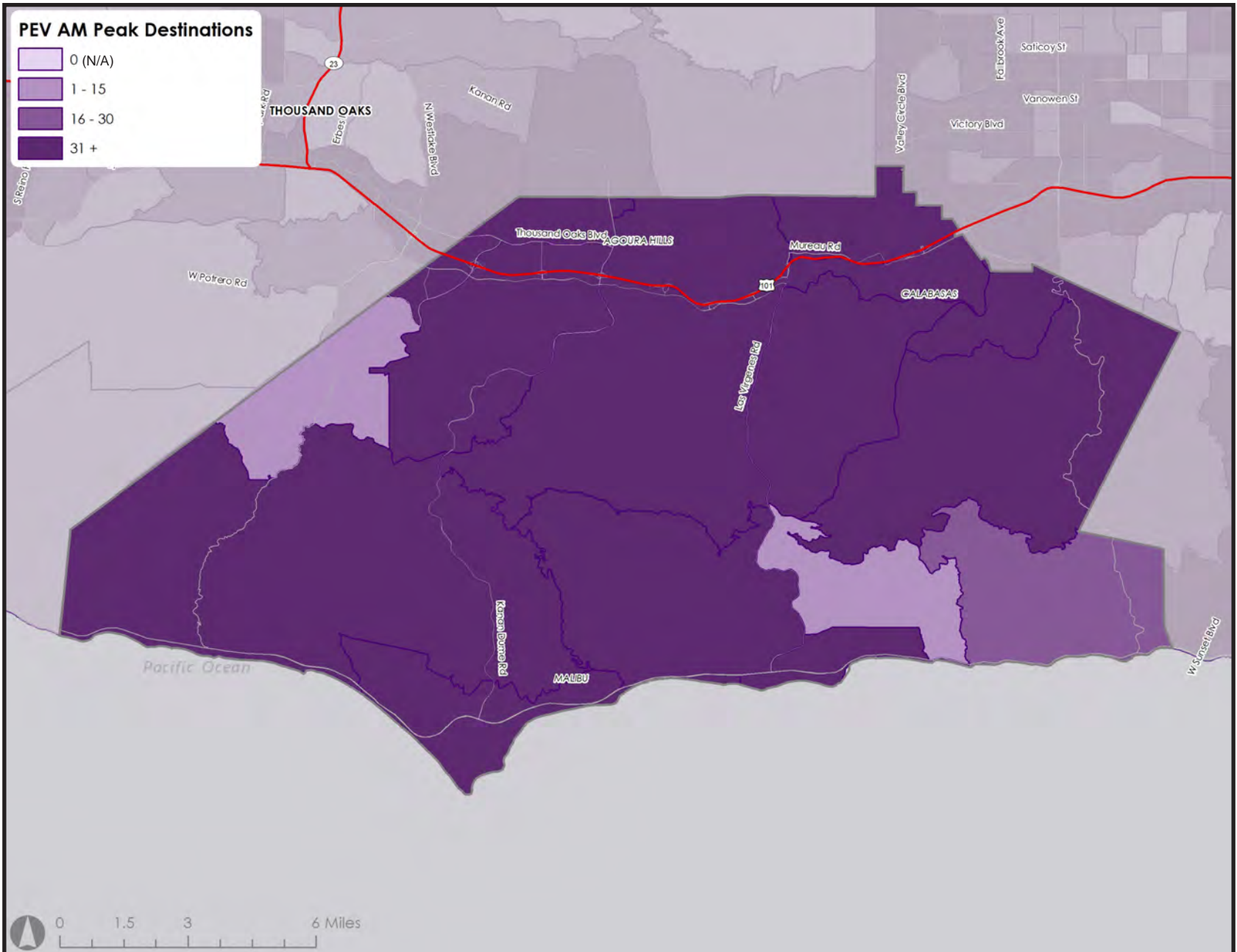
Year	Cumulative Predicted Sales
2016	2,230
2017	2,997
2018	3,876
2019	4,866
2020	5,966
2021	7,177
2022	8,500
2023	9,932
2024	11,476
2025	13,131

LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS PEV Registrations

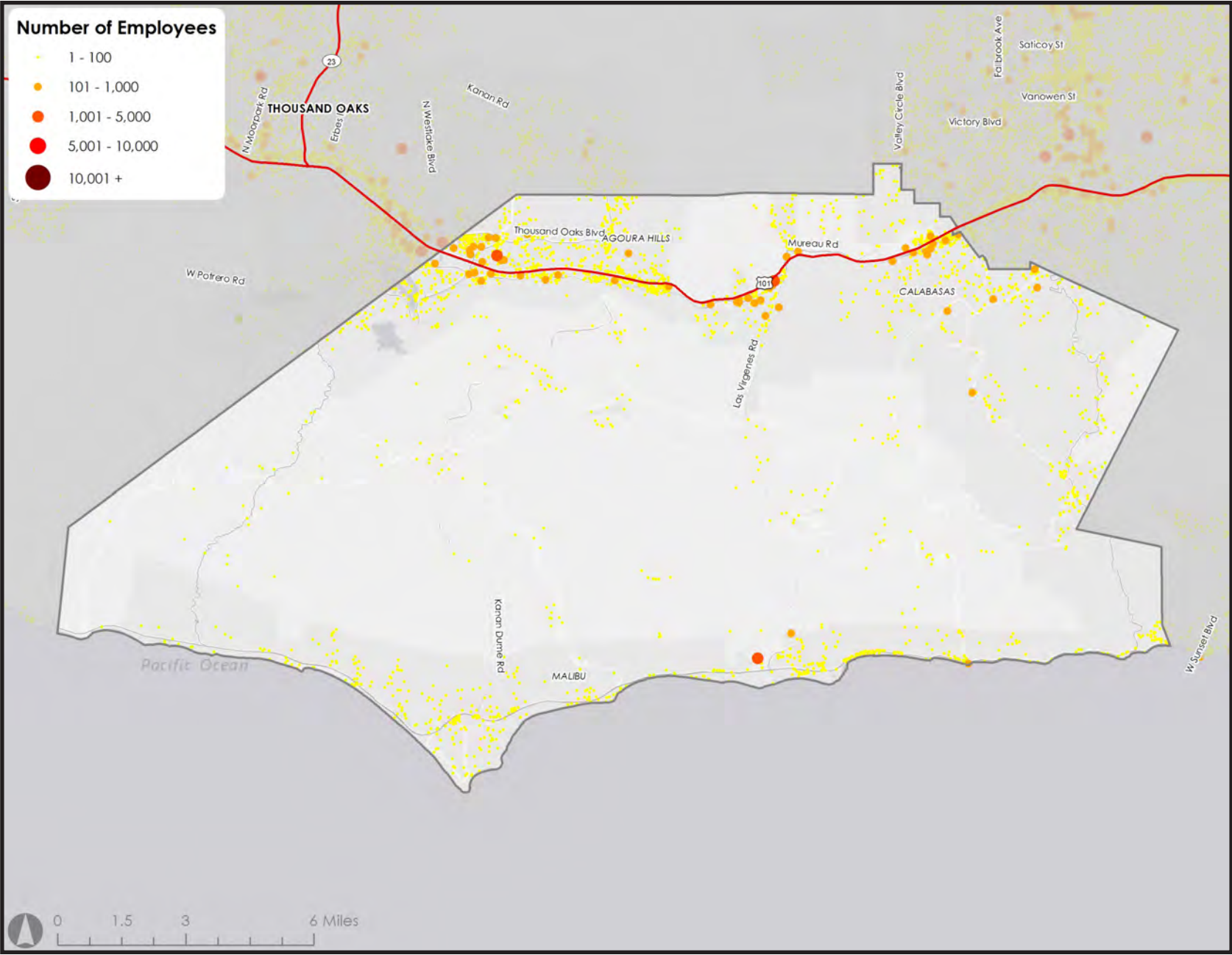


LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

PEV Peak Morning Destinations

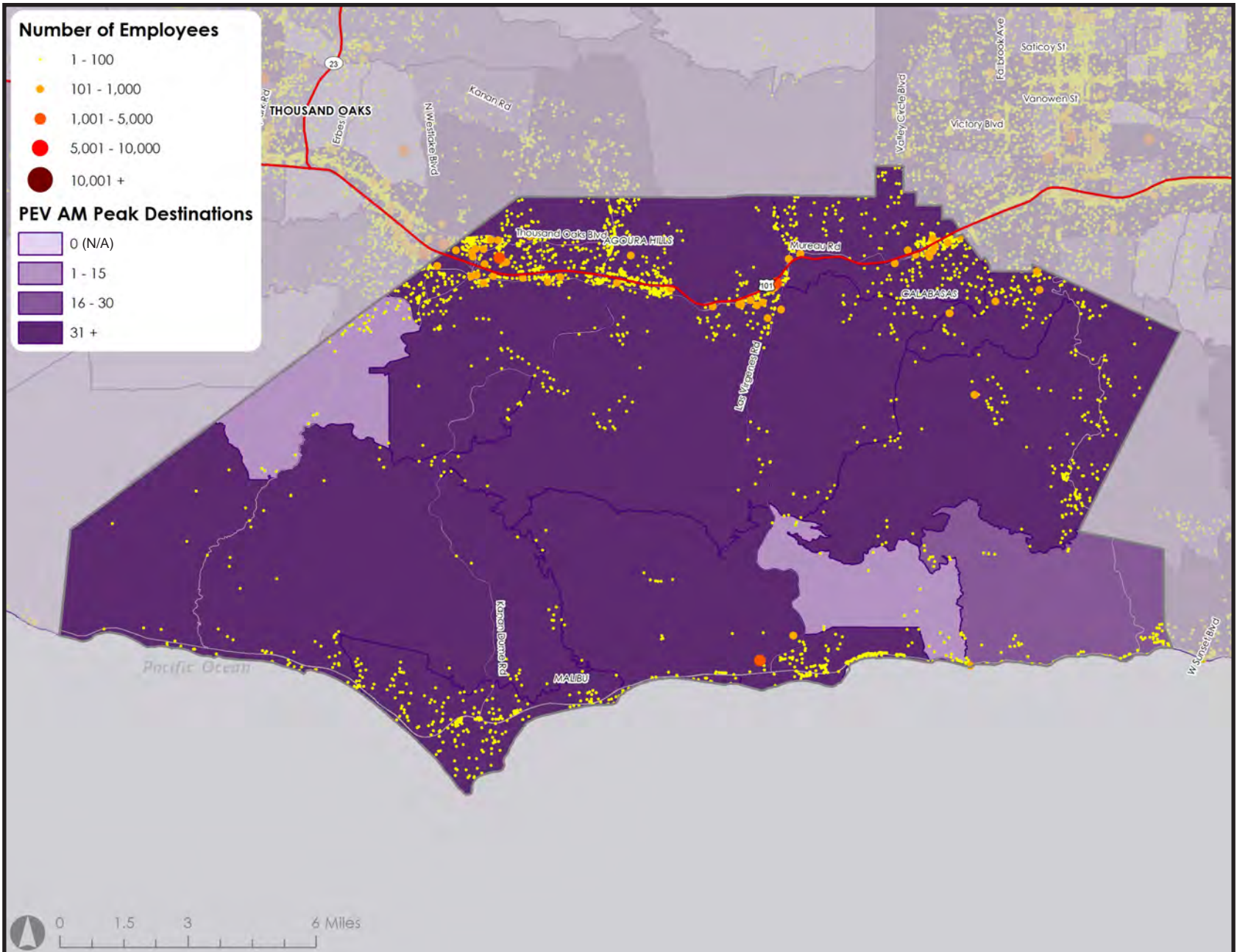


LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS Workplaces by Number of Employees



LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

PEV Peak Morning Destinations and Workplaces

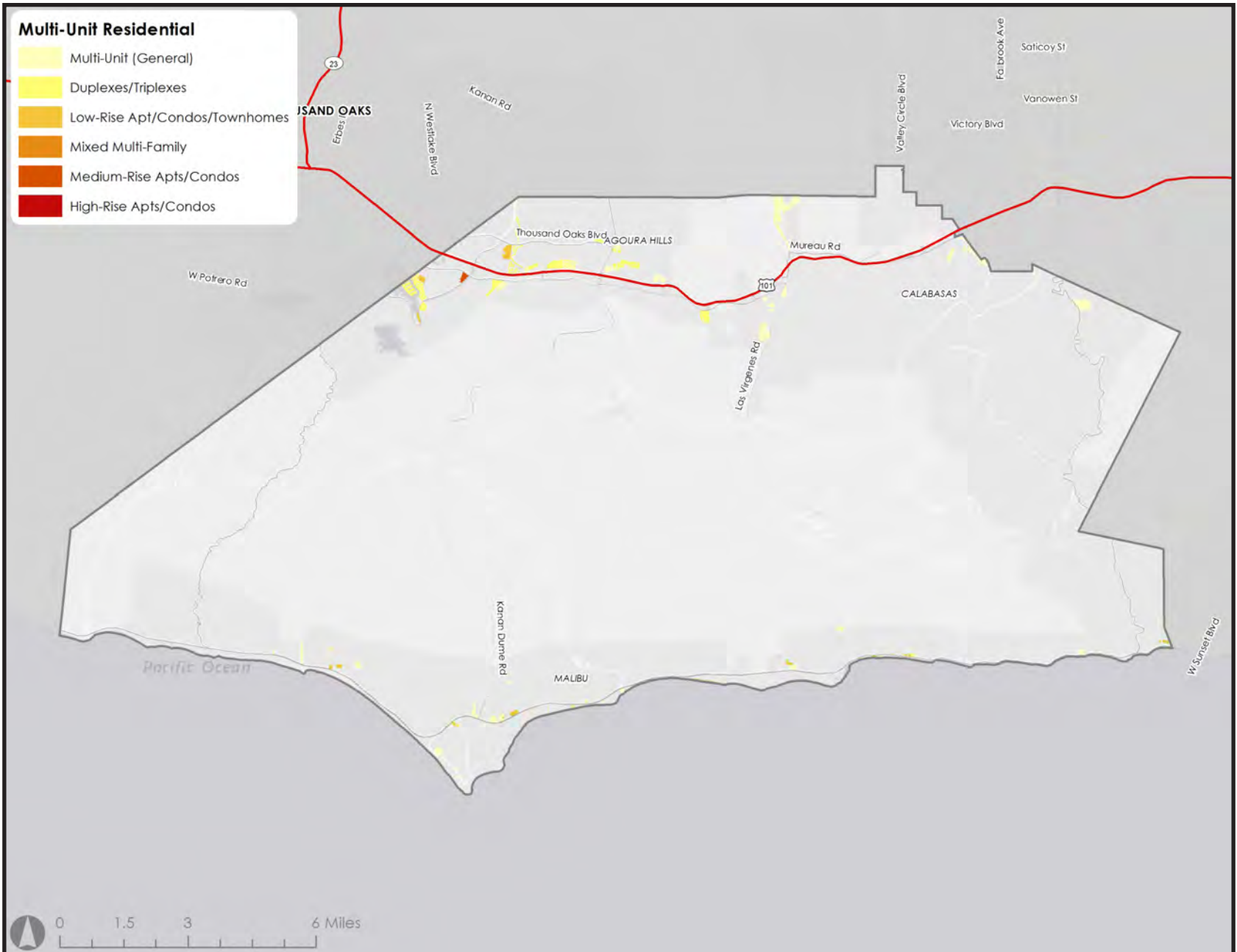


LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS Publicly Accessible Charging Stations



LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

Multi-Unit Residential Land Uses



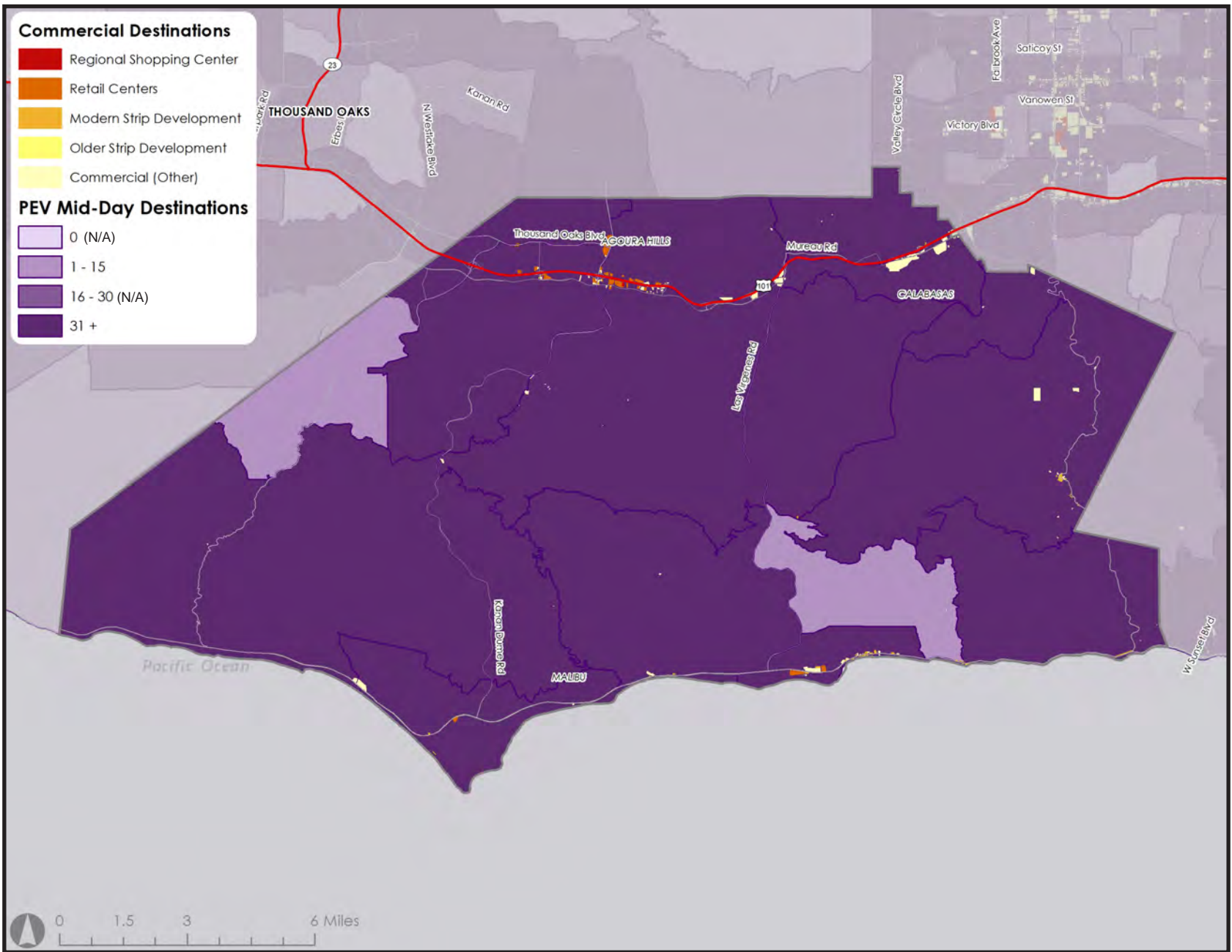
LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

Commercial (Retail) Destinations



LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

PEV Mid-Day Destinations and Commercial (Retail) Locations

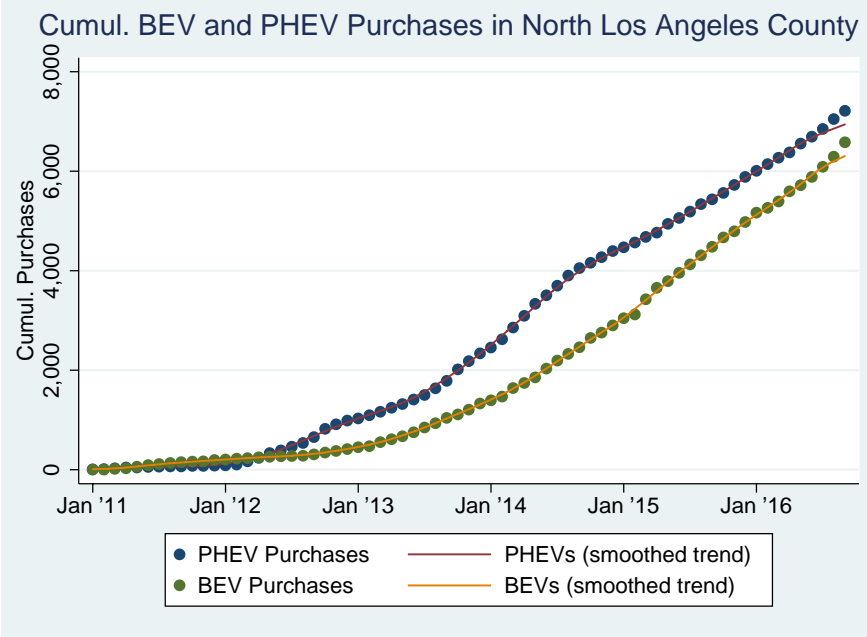
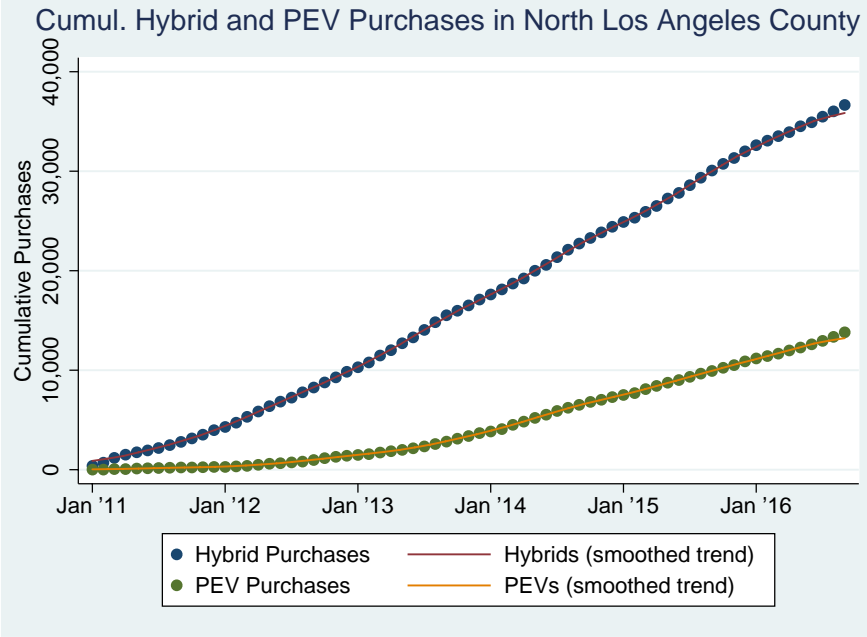


LAS VIRGENES MALIBU COUNCIL OF GOVERNMENTS

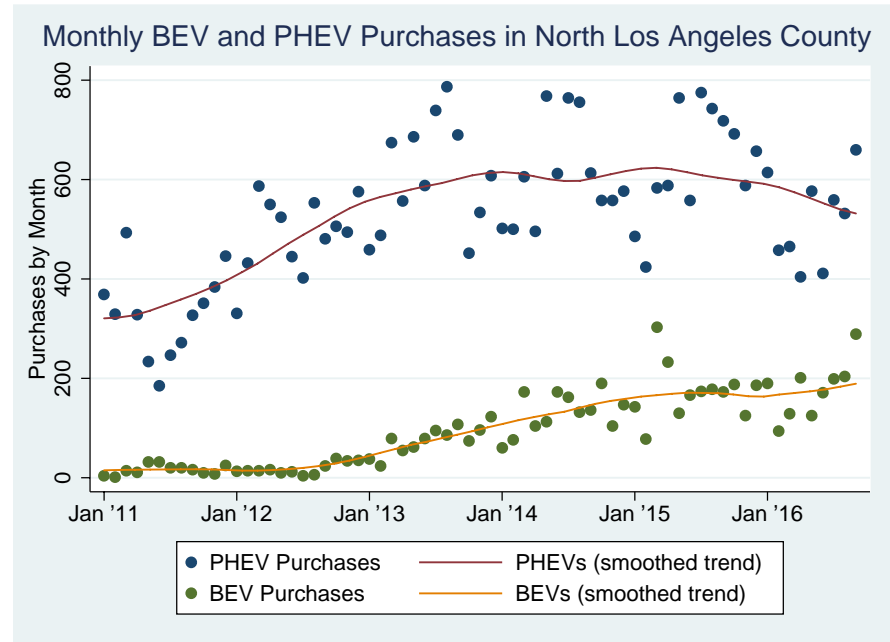
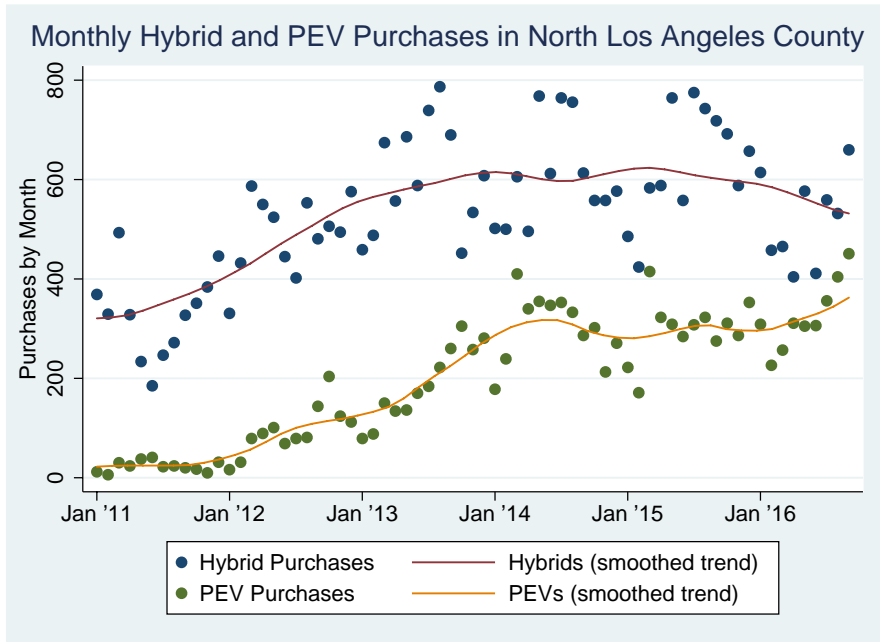
Stand-alone Parking Facilities



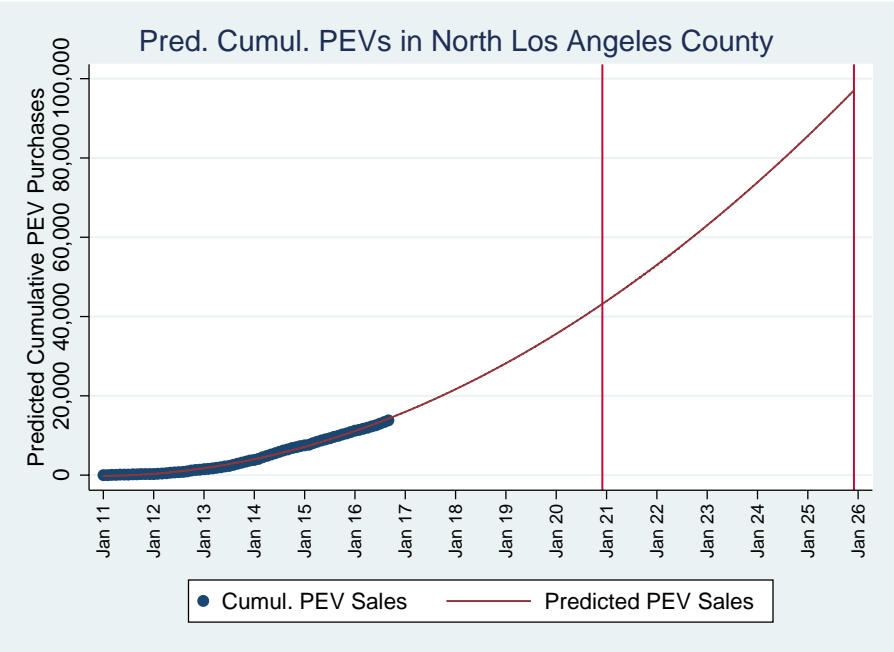
NORTH LOS ANGELES COUNTY Cumulative PEV Growth



NORTH LOS ANGELES COUNTY Monthly PEV Growth

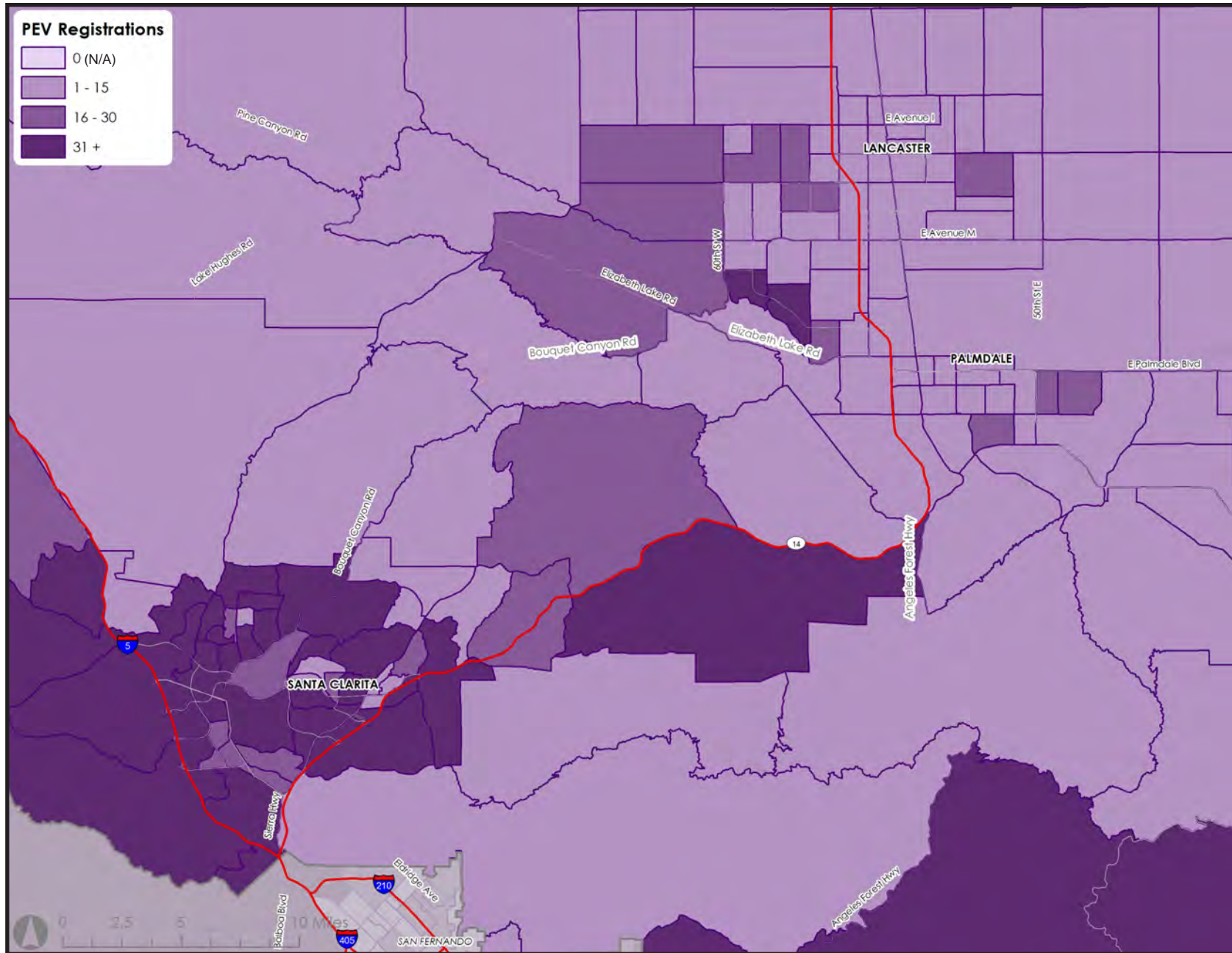


NORTH LOS ANGELES COUNTY Projected PEV Growth

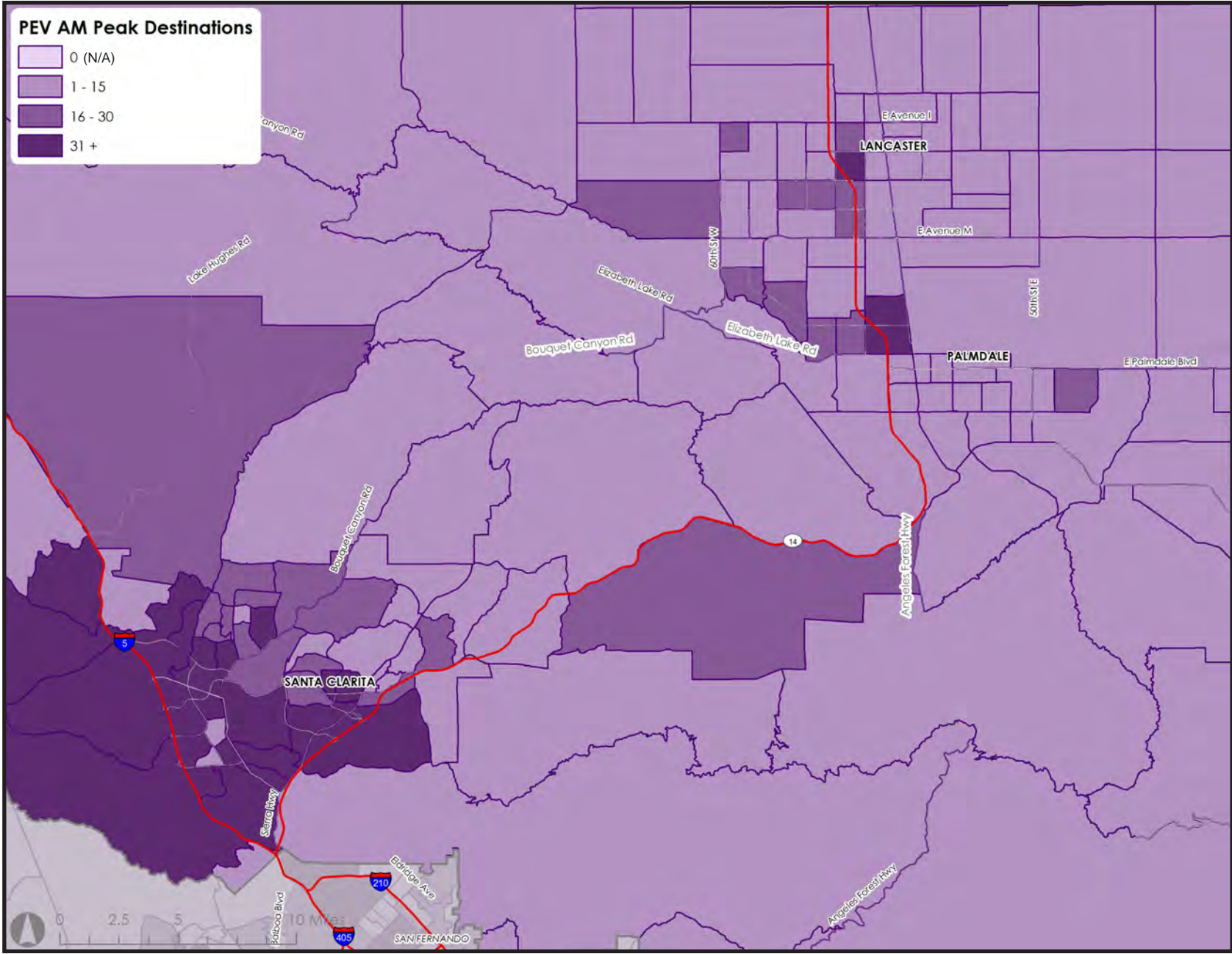


Year	Cumulative Predicted Sales
2016	15,526
2017	21,152
2018	27,636
2019	34,978
2020	43,178
2021	52,237
2022	62,154
2023	72,929
2024	84,562
2025	97,053

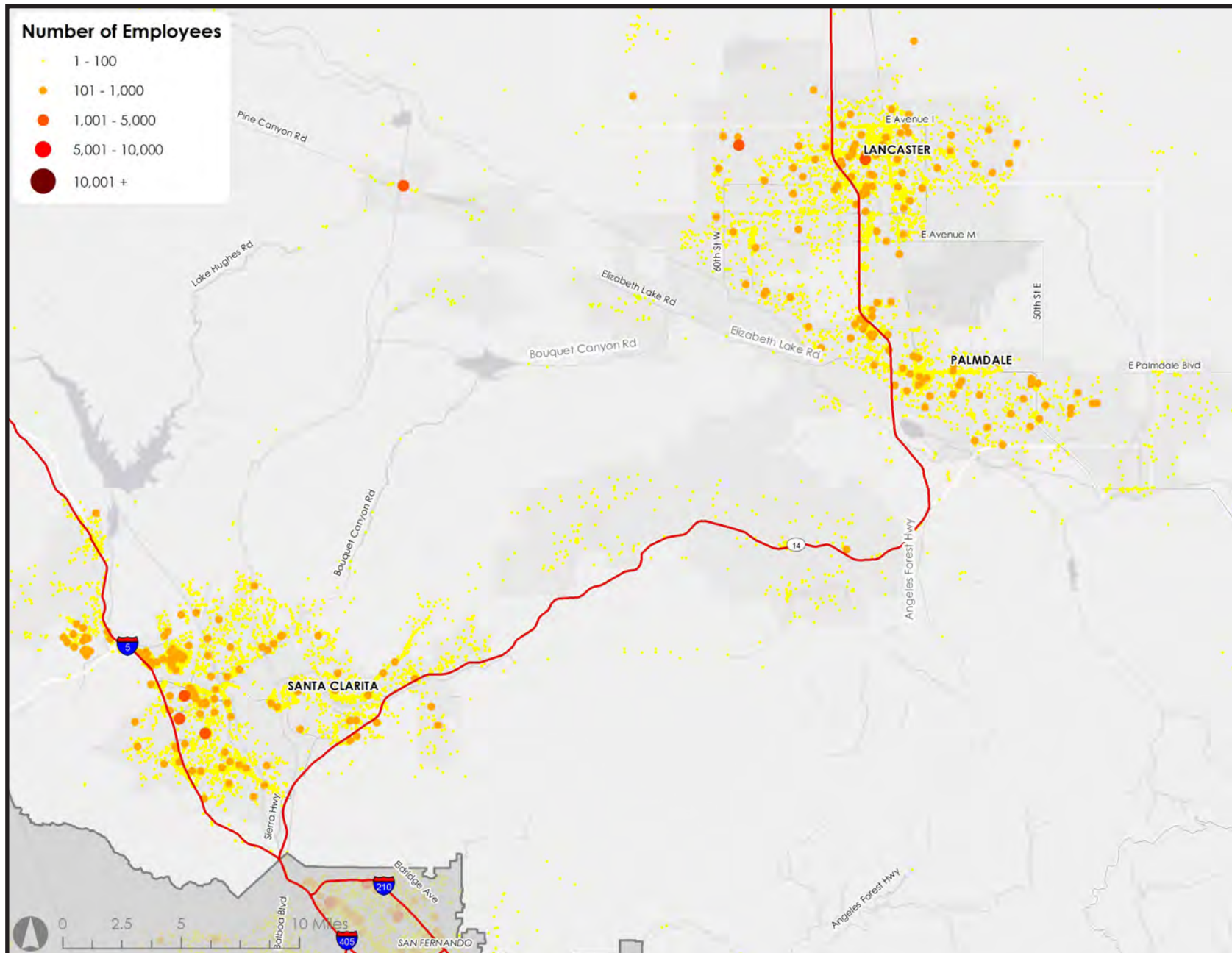
NORTH LOS ANGELES COUNTY PEV Registrations



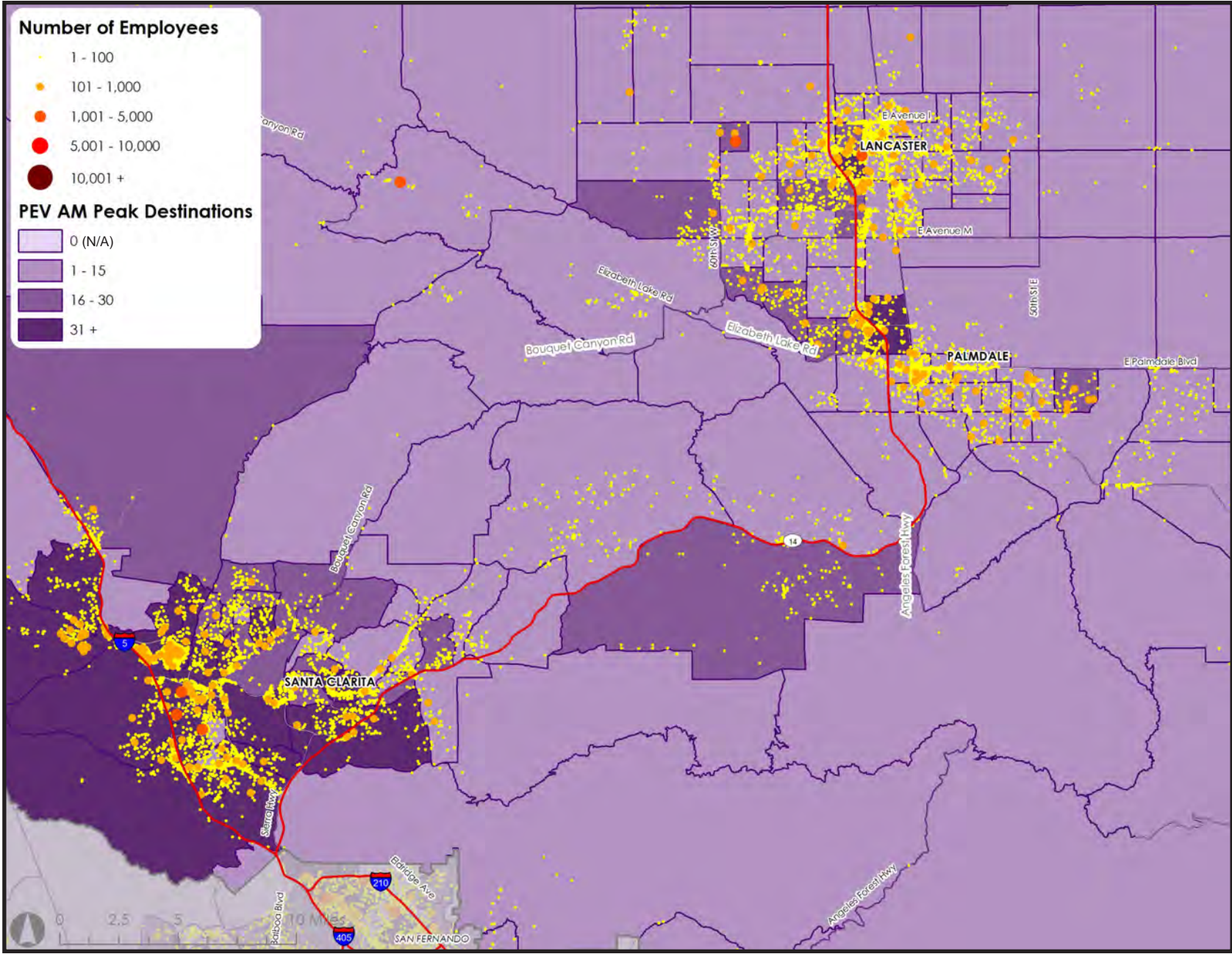
NORTH LOS ANGELES COUNTY PEV Peak Morning Destinations



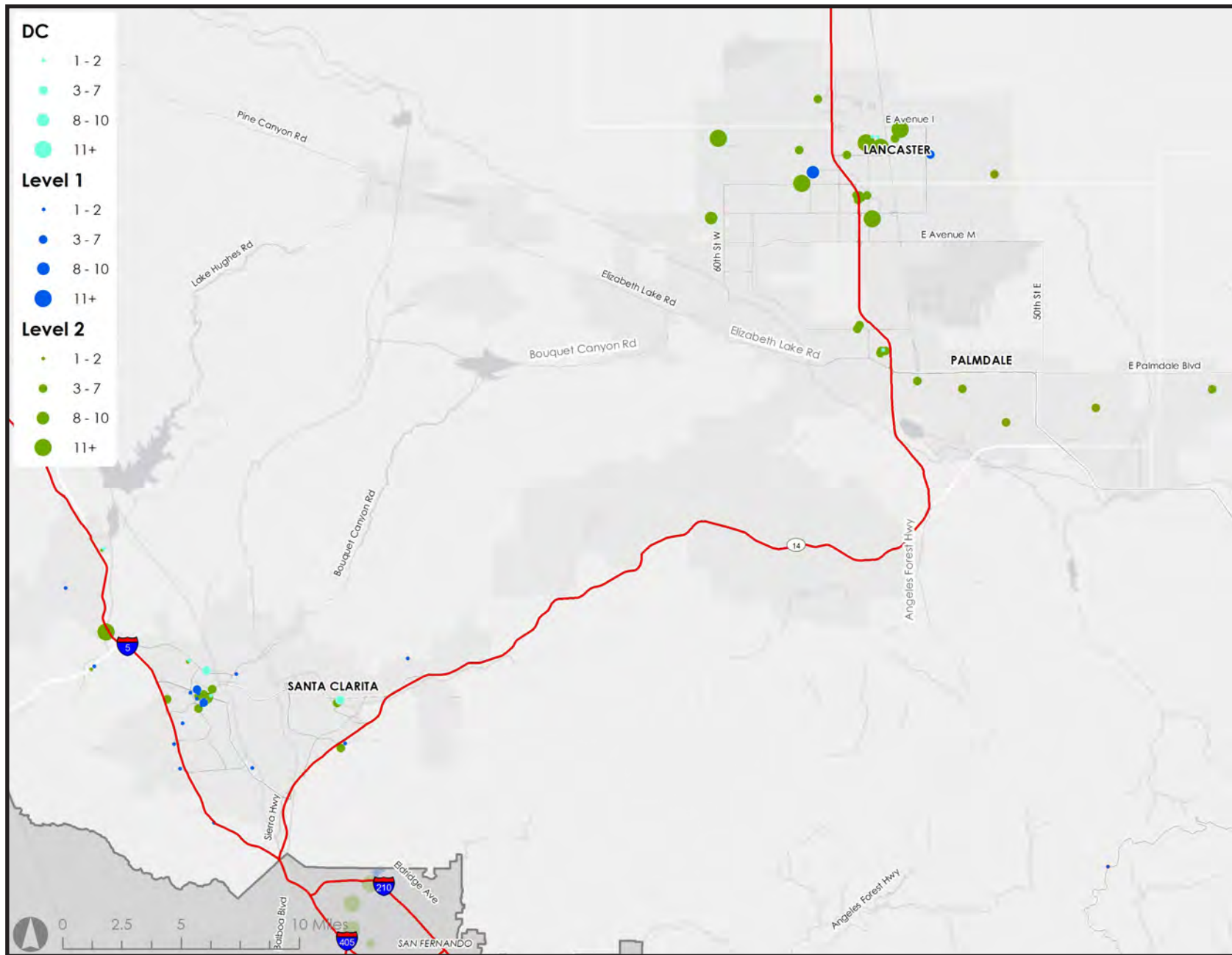
NORTH LOS ANGELES COUNTY Workplaces by Number of Employees



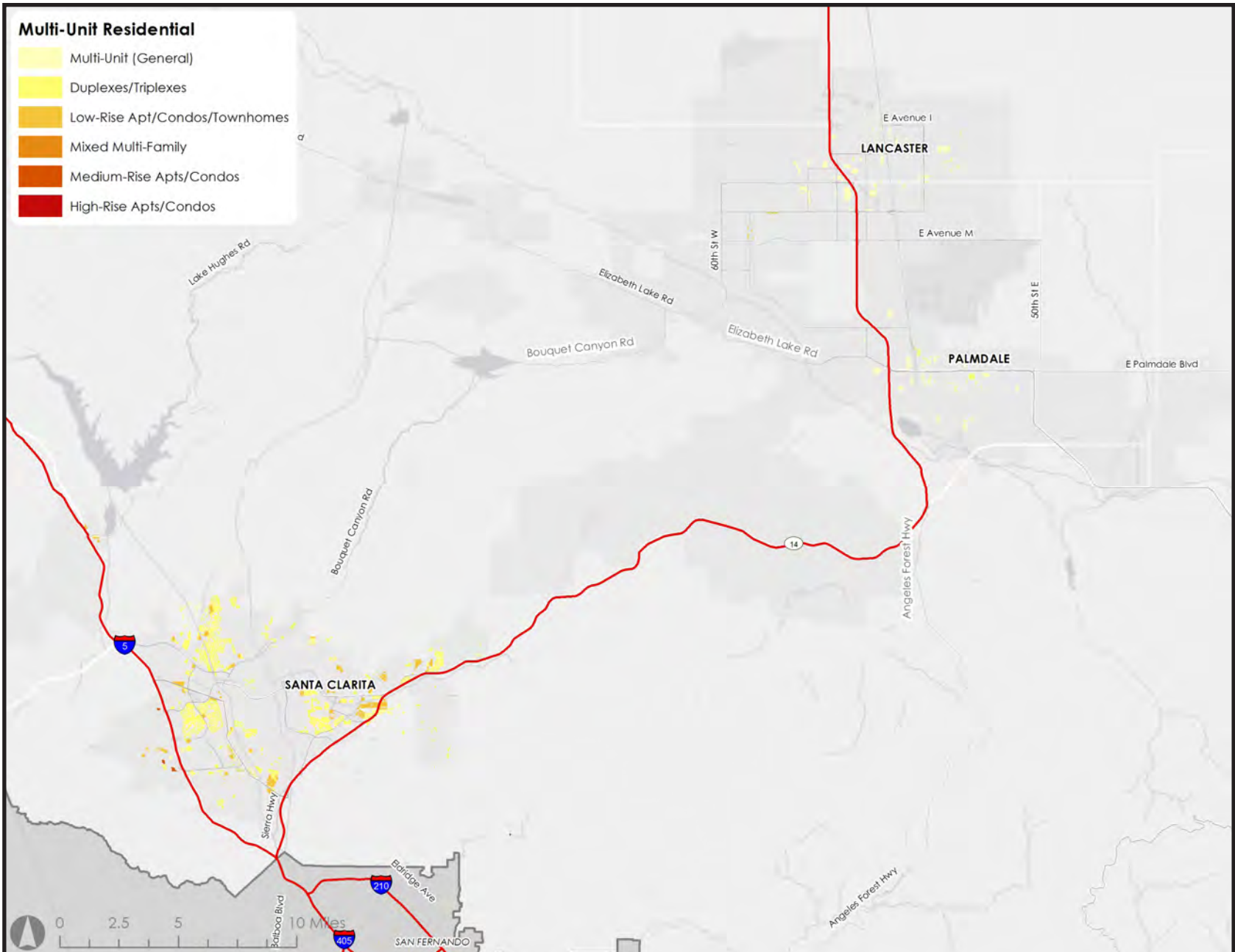
NORTH LOS ANGELES COUNTY PEV Peak Morning Destinations and Workplaces



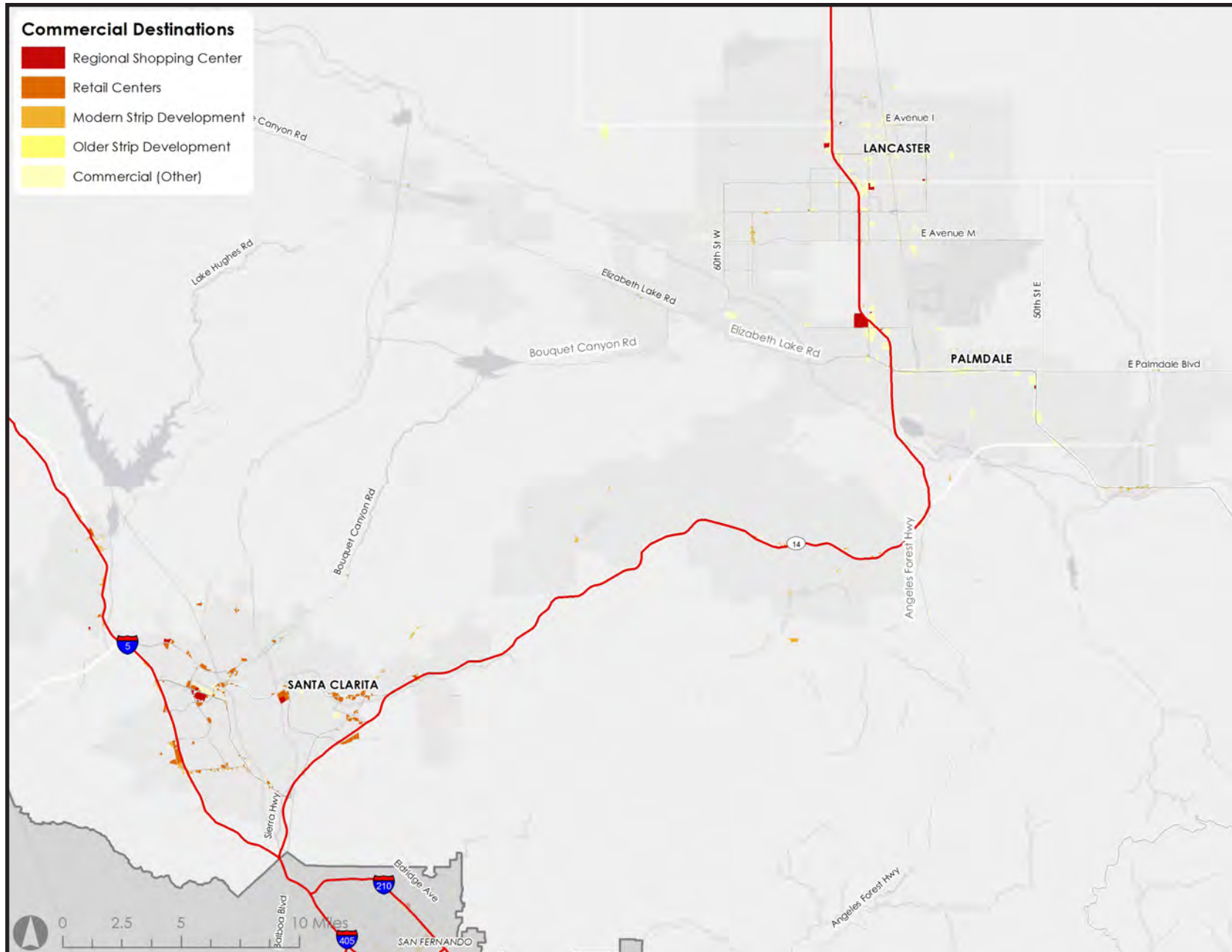
NORTH LOS ANGELES COUNTY Publicly Accessible Charging Stations



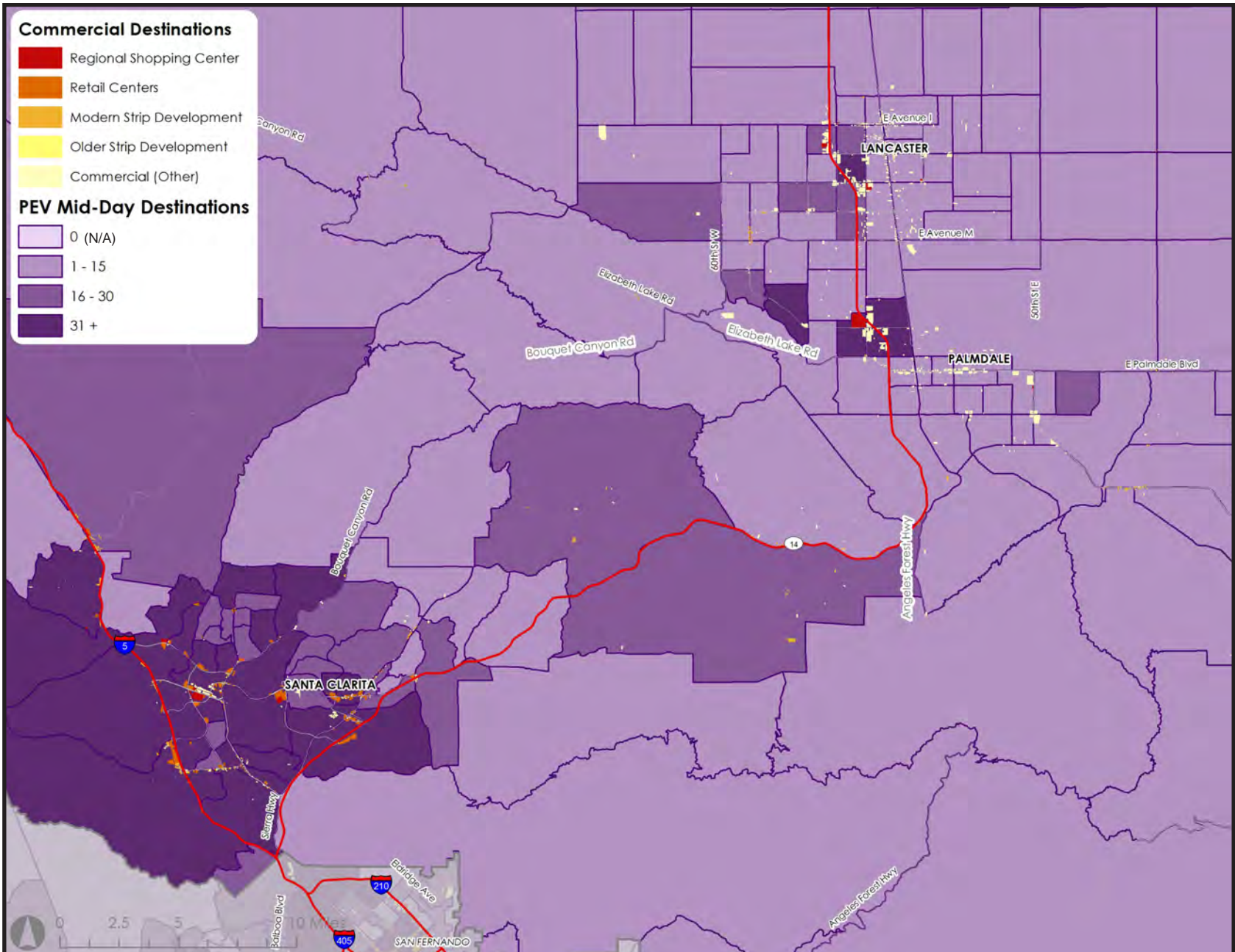
NORTH LOS ANGELES COUNTY Multi-Unit Residential Land Uses



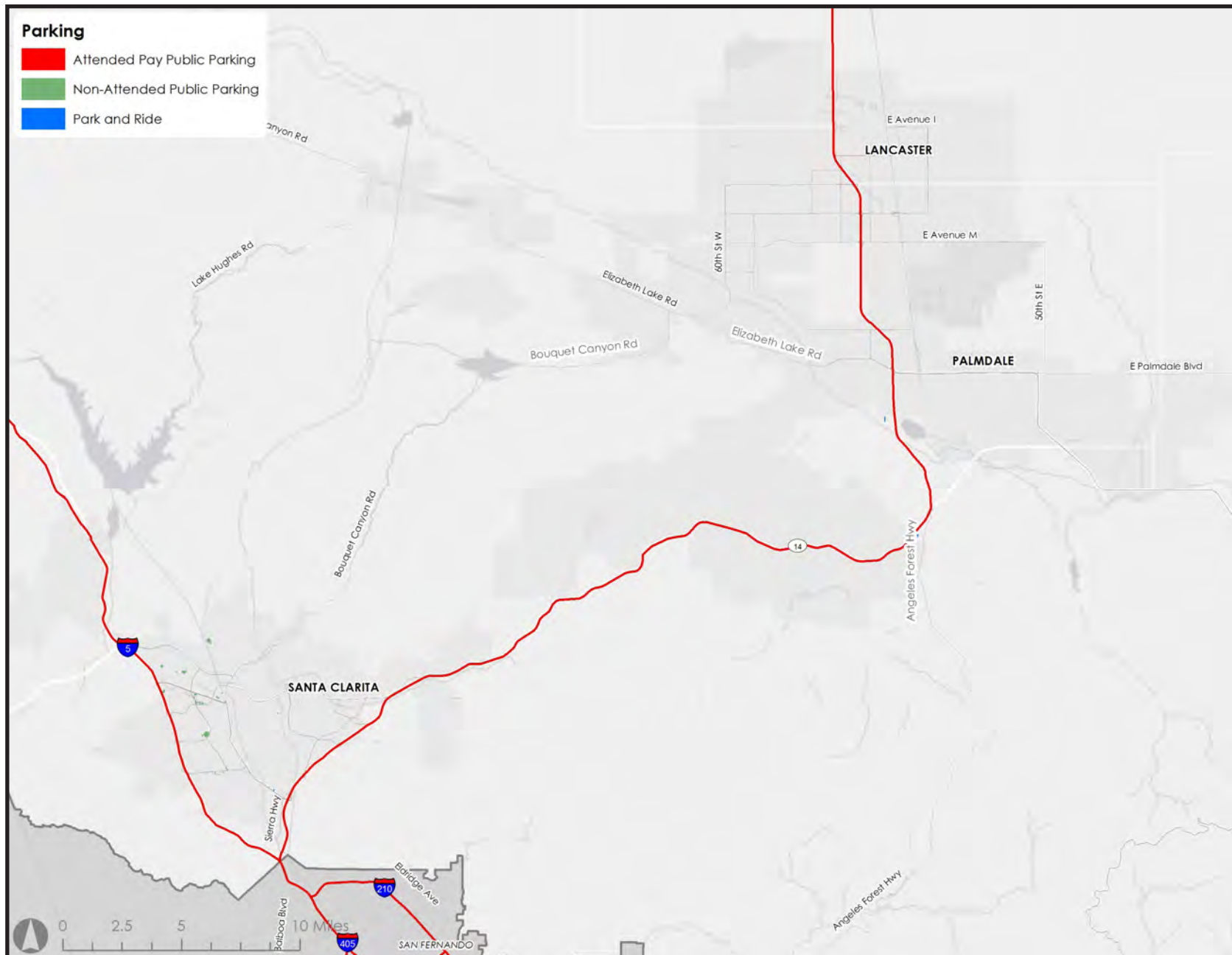
NORTH LOS ANGELES COUNTY Commercial (Retail) Destinations



NORTH LOS ANGELES COUNTY PEV Mid-Day Destinations and Commercial (Retail) Locations

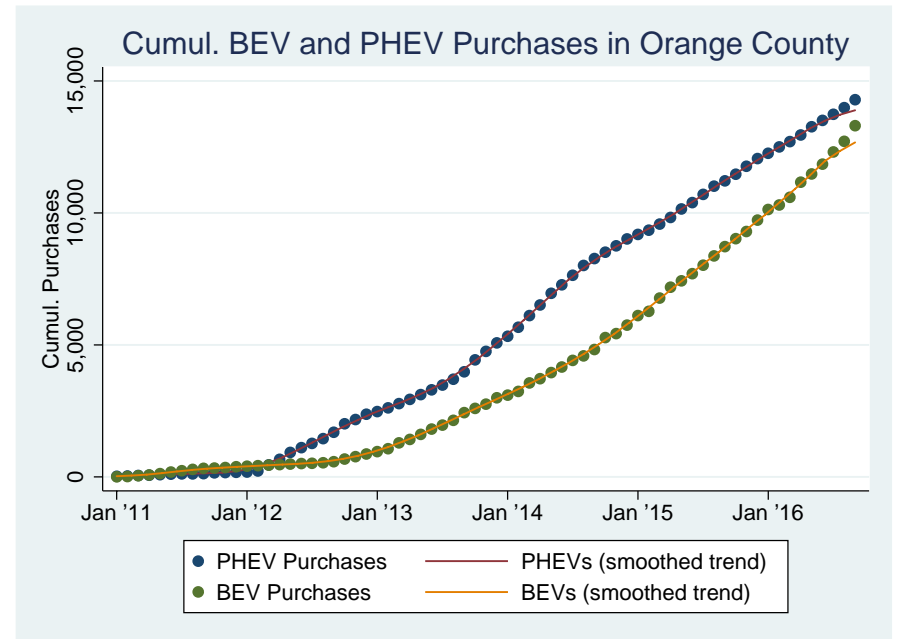
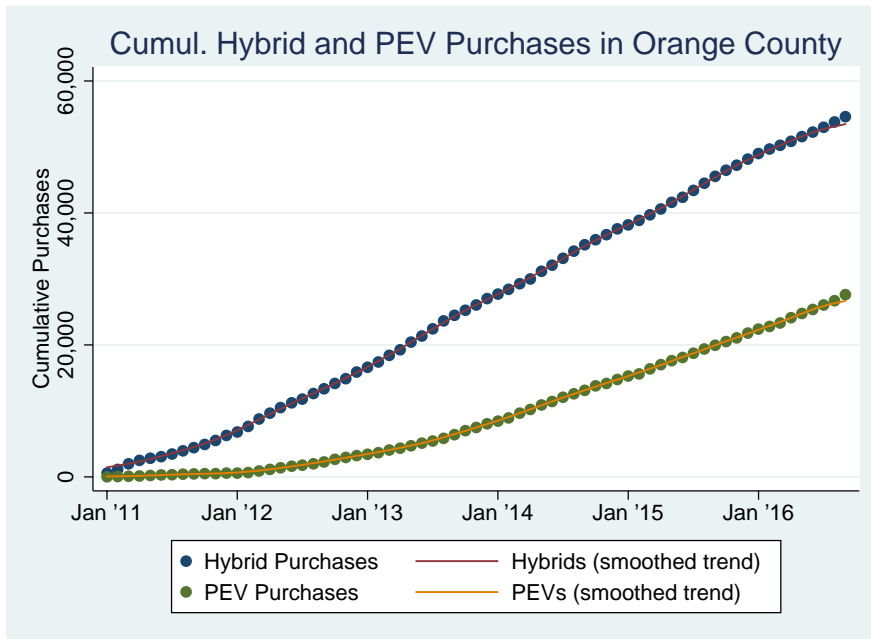


NORTH LOS ANGELES COUNTY Stand-alone Parking Facilities



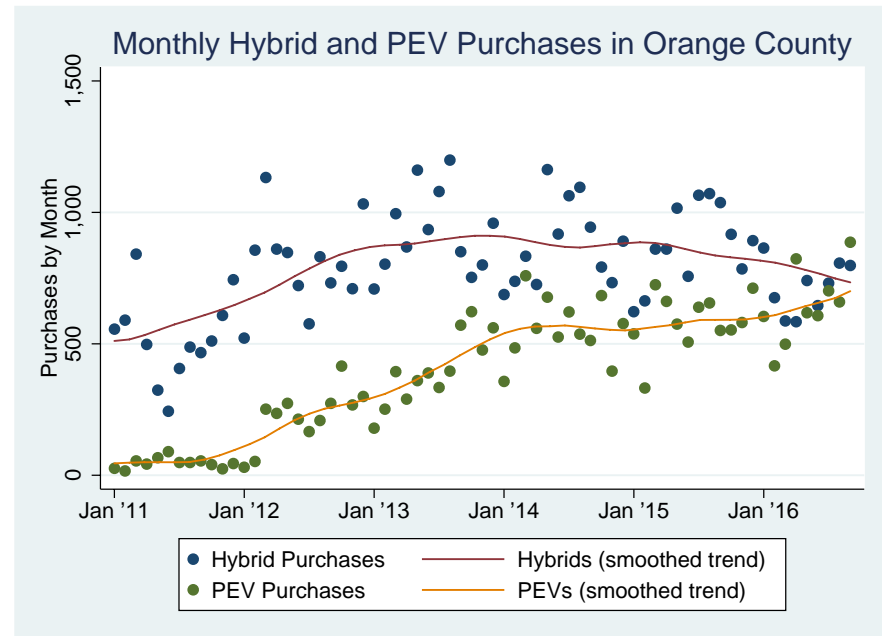
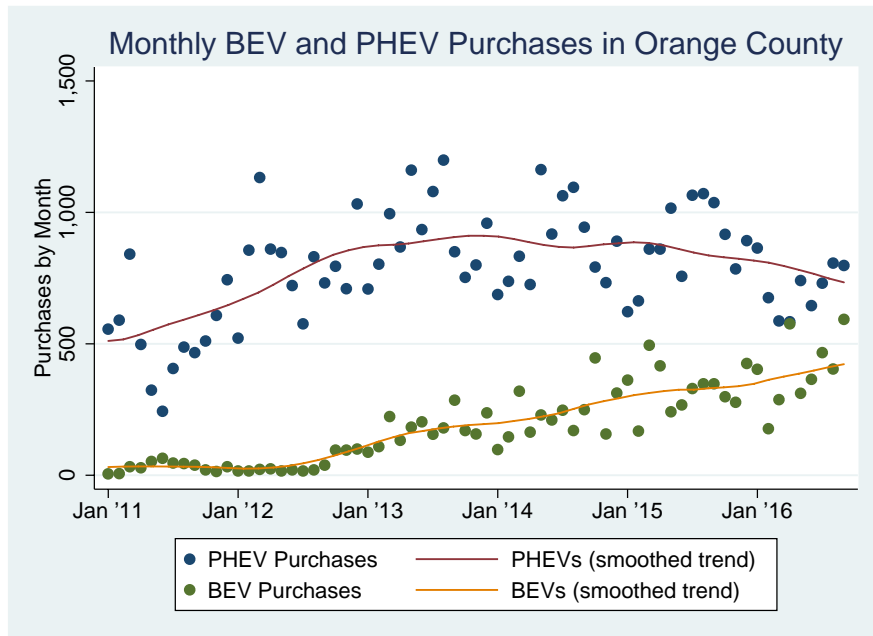
ORANGE COUNTY COUNCIL OF GOVERNMENTS

Cumulative PEV Growth



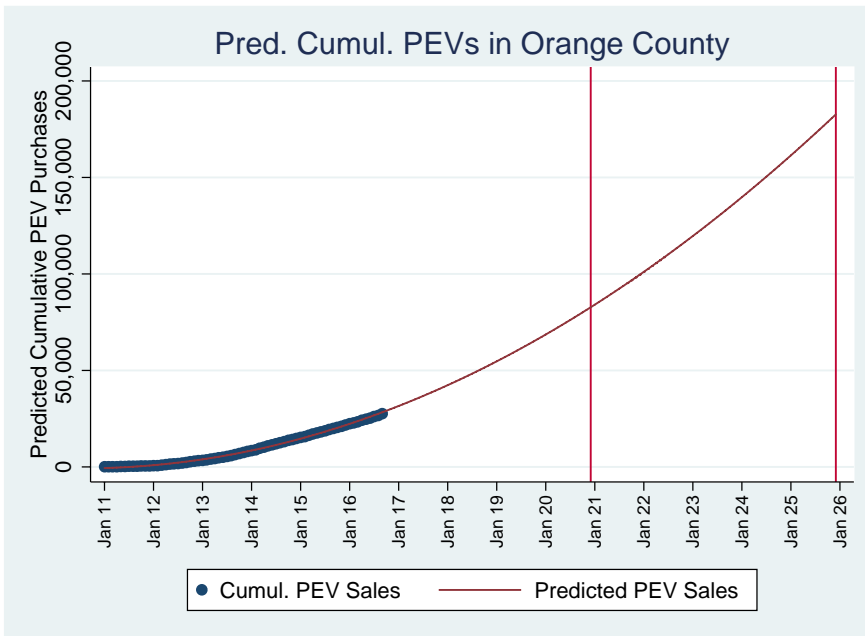
ORANGE COUNTY COUNCIL OF GOVERNMENTS

Monthly PEV Growth



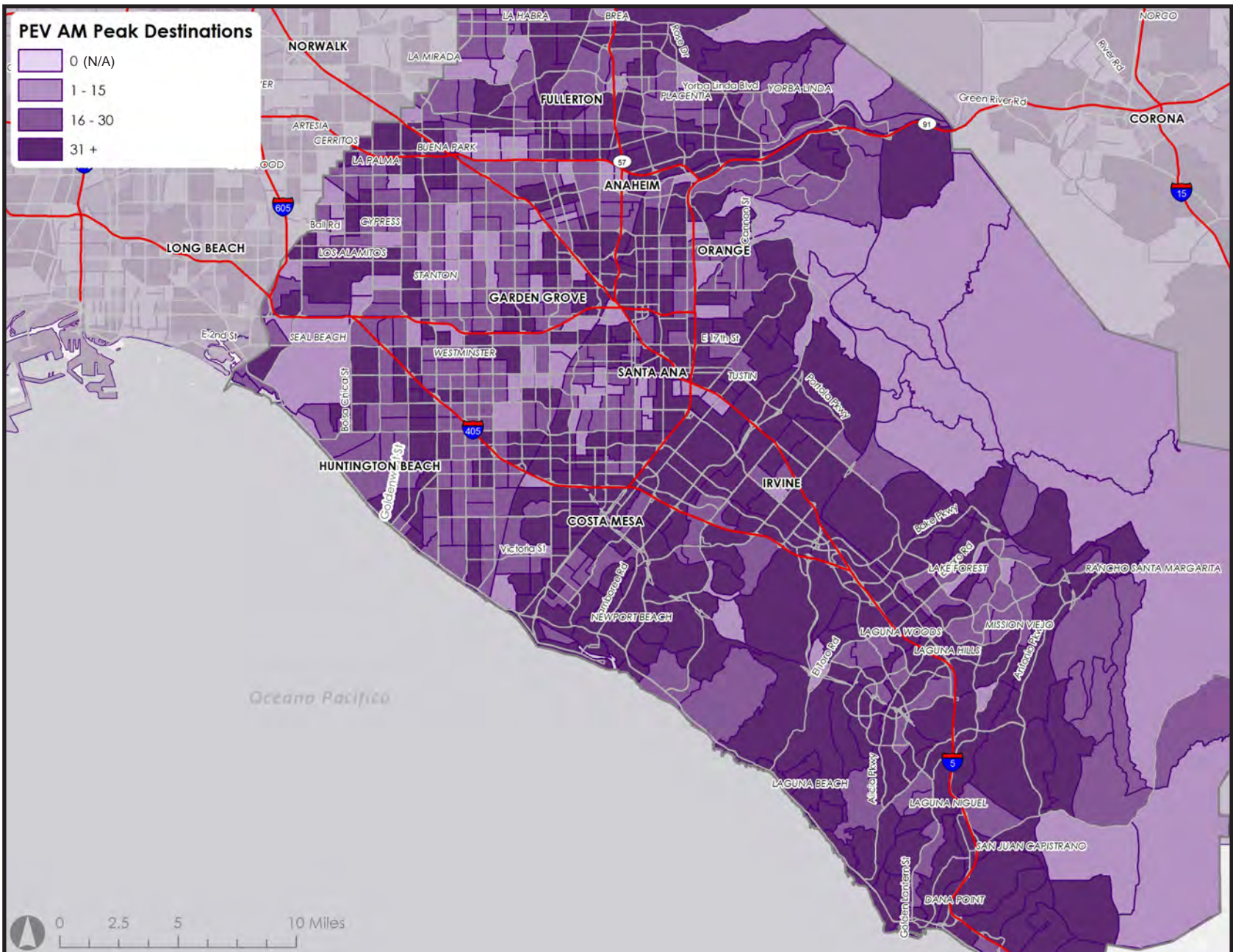
ORANGE COUNTY COUNCIL OF GOVERNMENTS

Projected PEV Growth

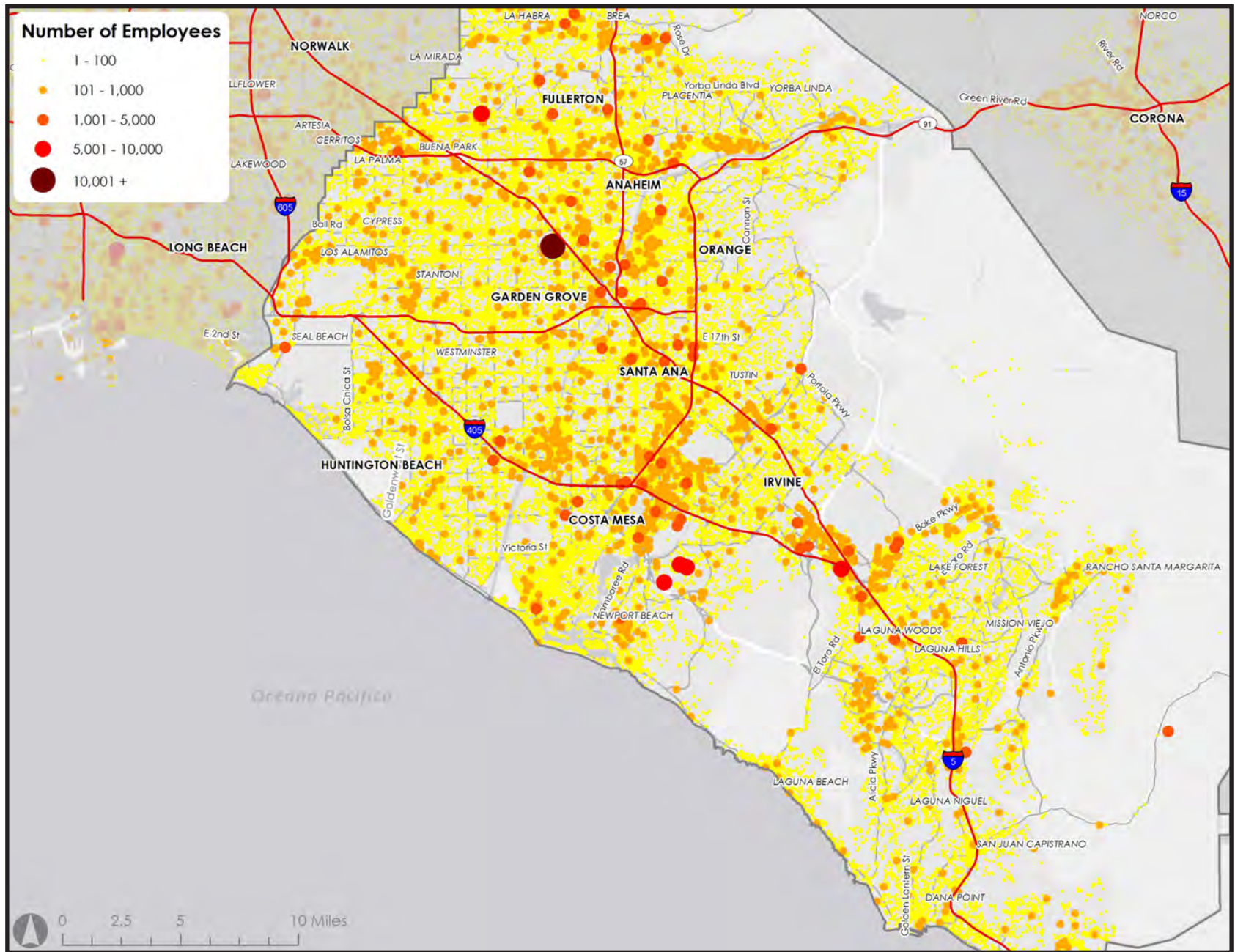


Year	Cumulative Predicted Sales
2016	30,749
2017	41,414
2018	53,633
2019	67,406
2020	82,732
2021	99,613
2022	118,046
2023	138,034
2024	159,575
2025	182,670

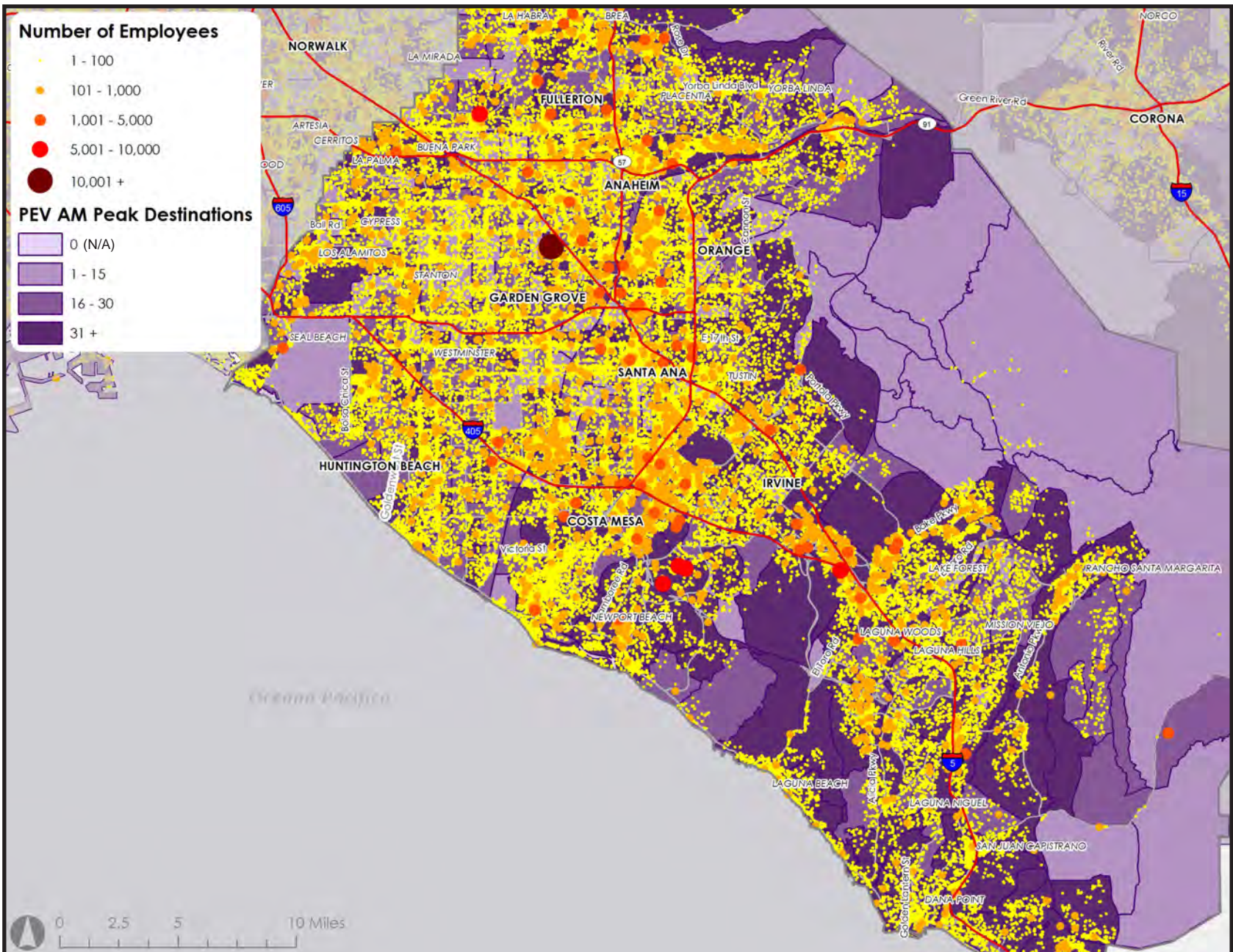
ORANGE COUNTY COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations



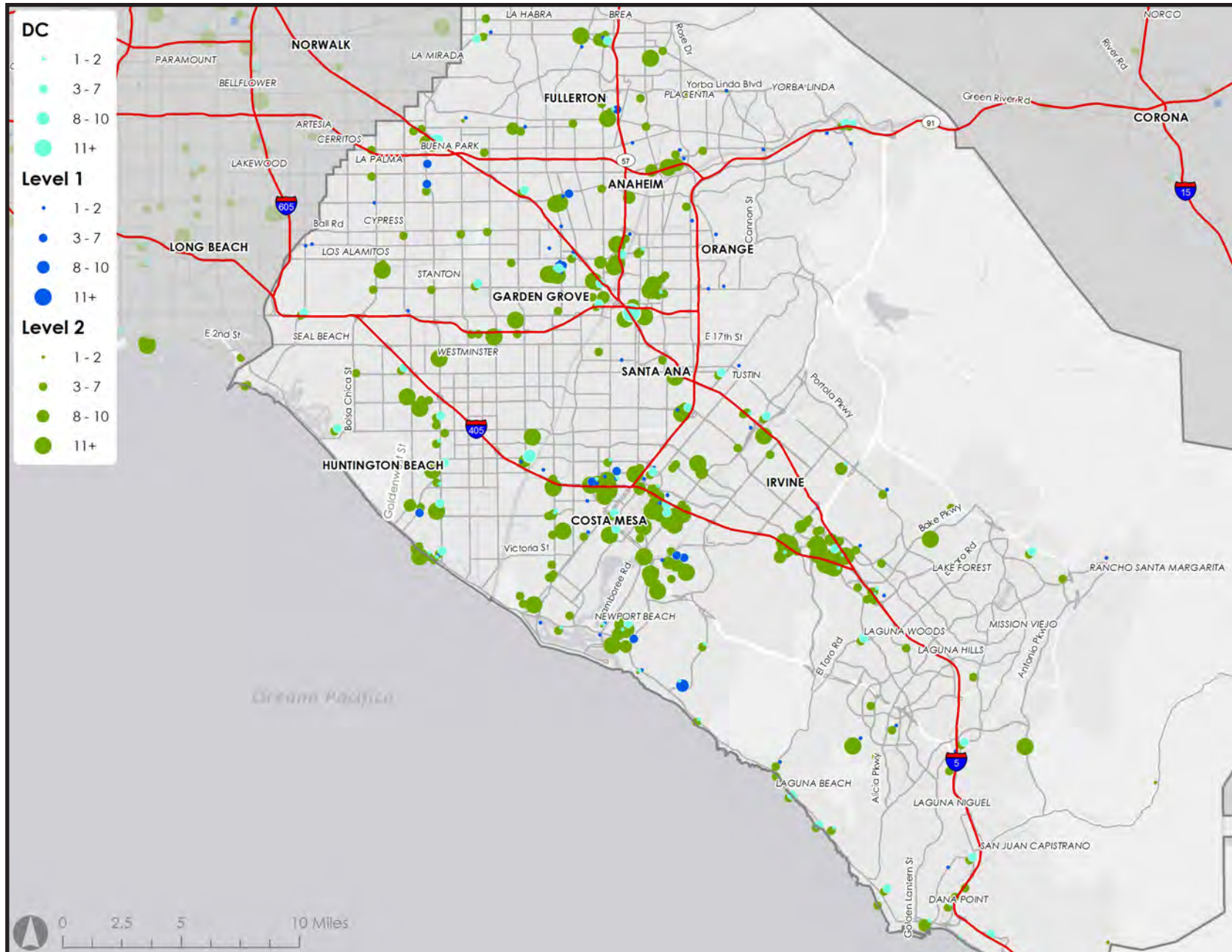
ORANGE COUNTY COUNCIL OF GOVERNMENTS Workplaces by Number of Employees



ORANGE COUNTY COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations and Workplaces

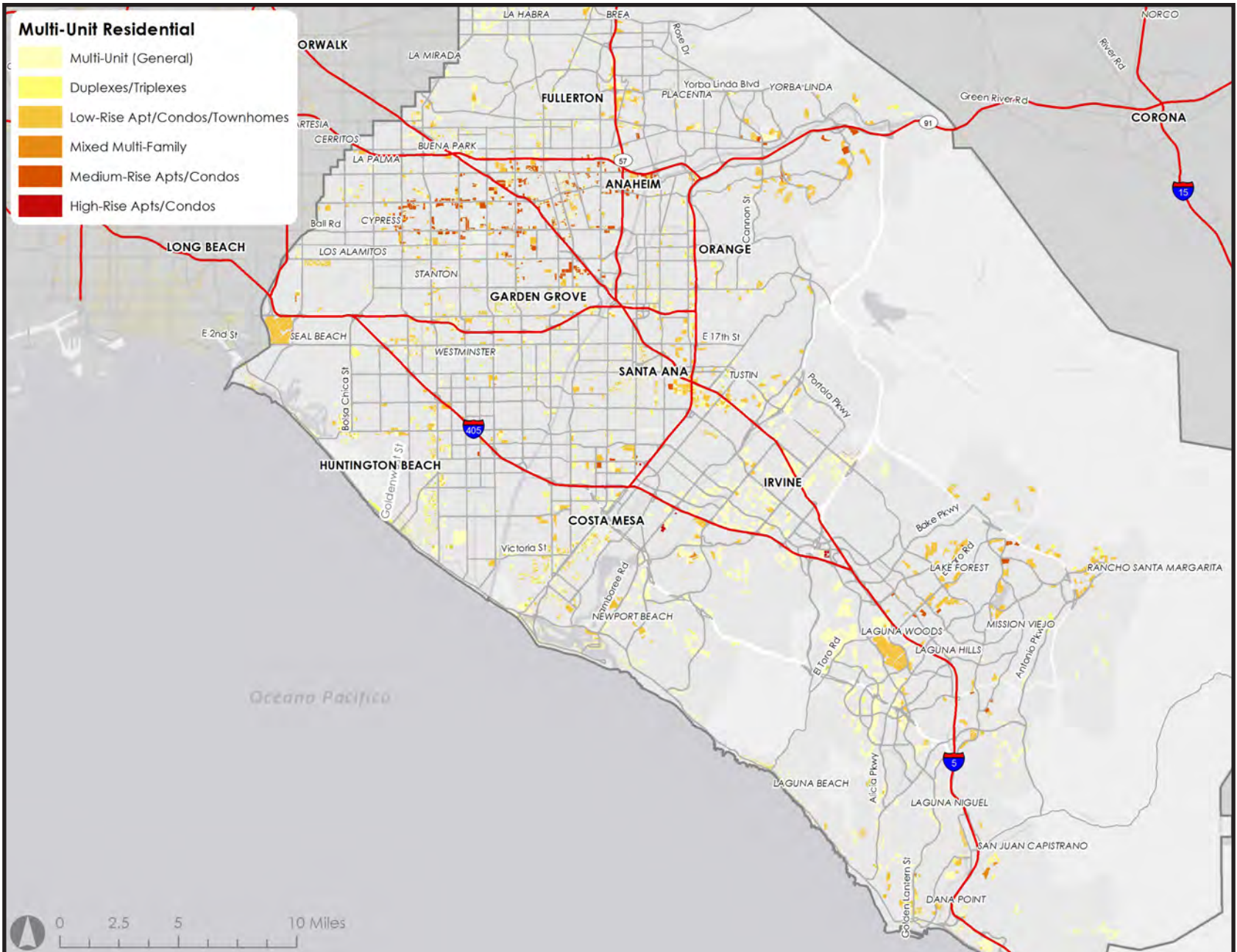


ORANGE COUNTY COUNCIL OF GOVERNMENTS Publicly Accessible Charging Stations

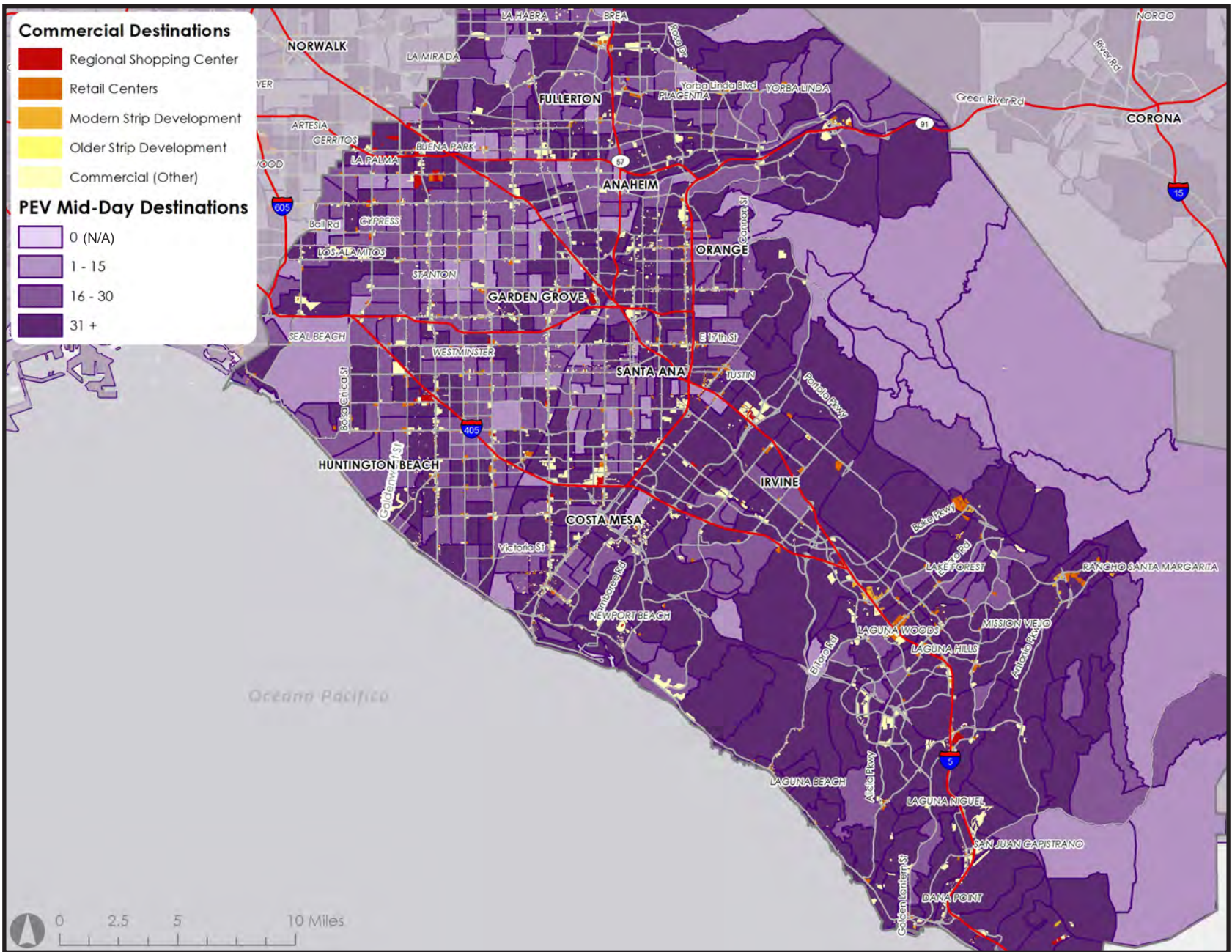


ORANGE COUNTY COUNCIL OF GOVERNMENTS

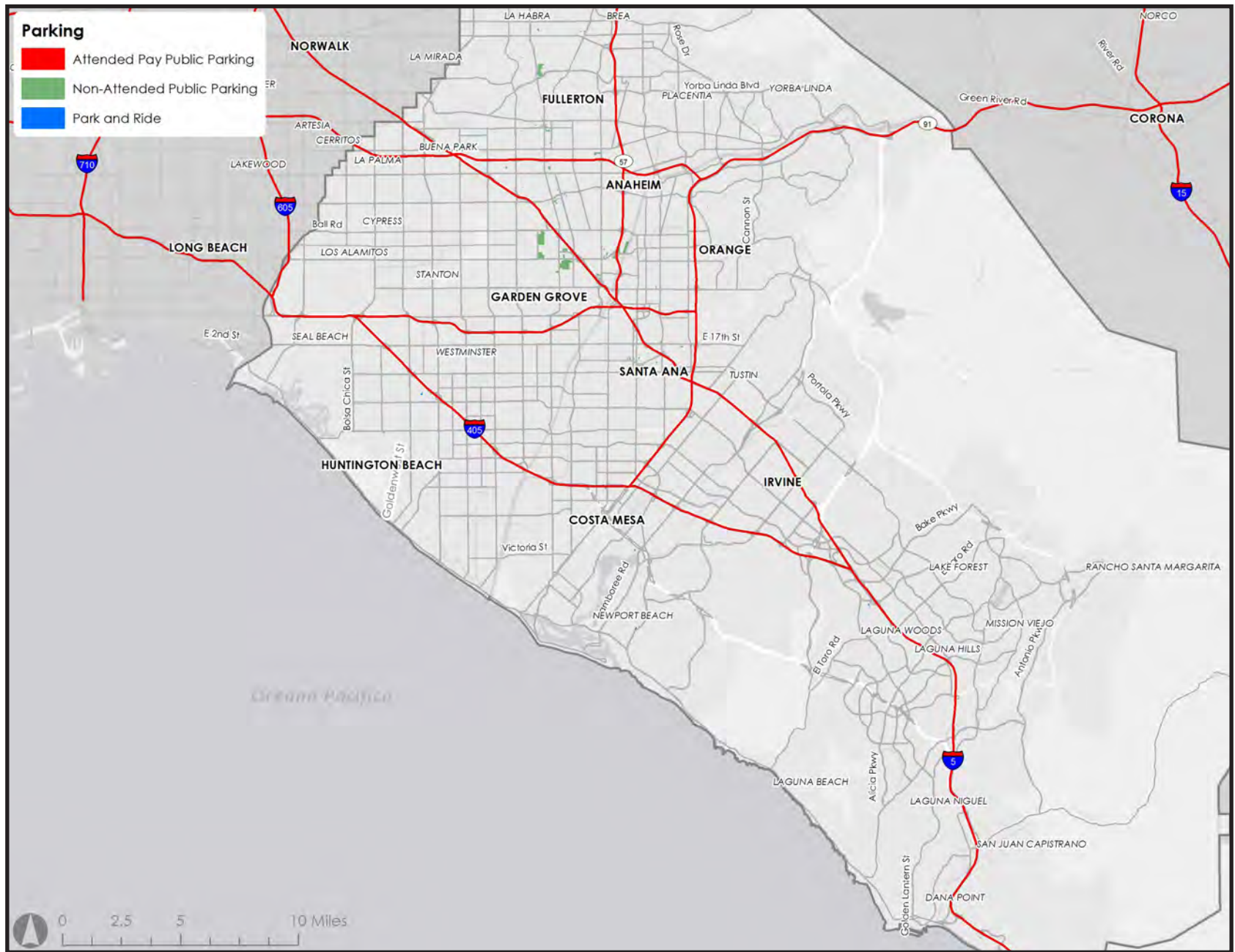
Multi-Unit Residential Land Uses



ORANGE COUNTY COUNCIL OF GOVERNMENTS PEV Mid-Day Destinations and Commercial (Retail) Locations

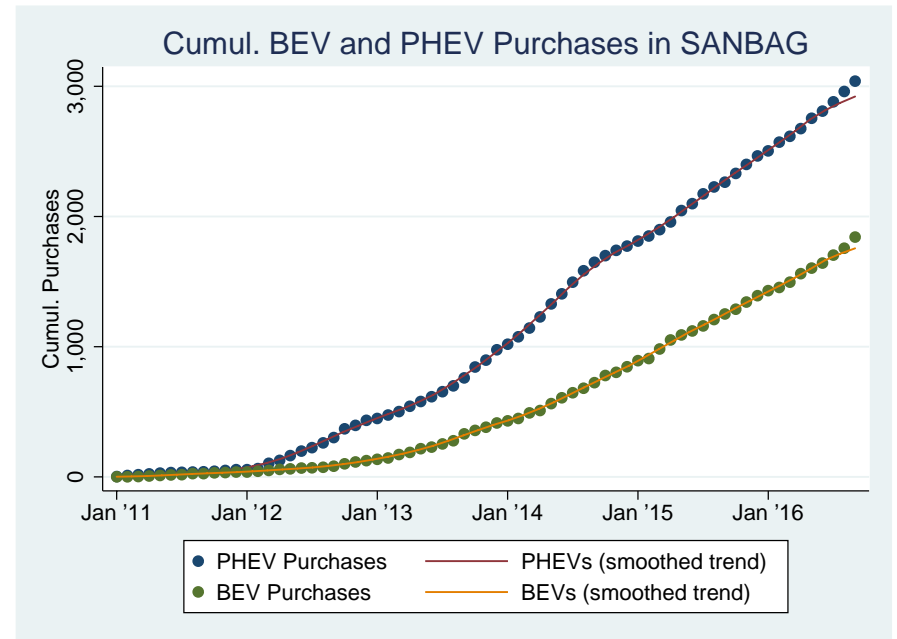
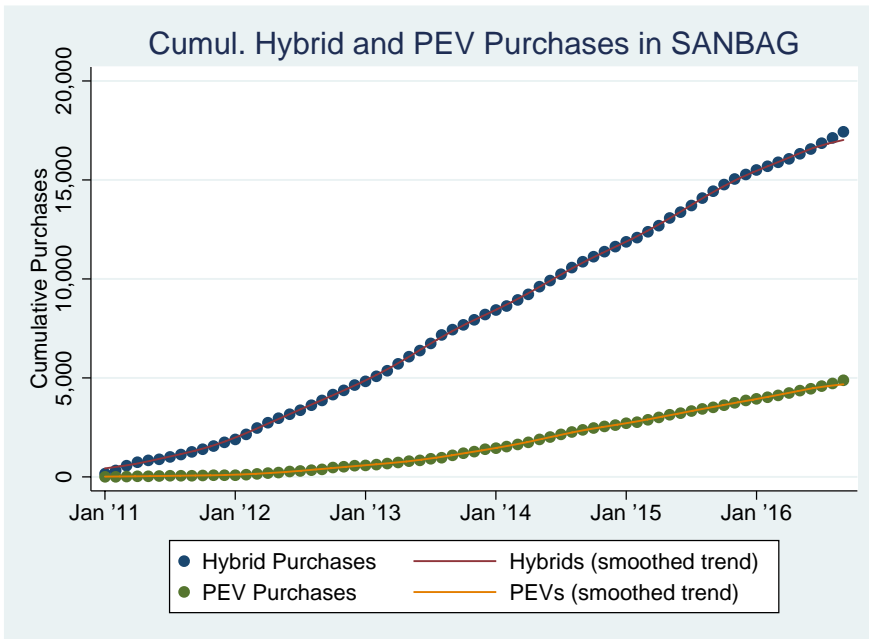


ORANGE COUNTY COUNCIL OF GOVERNMENTS Stand-alone Parking Facilities



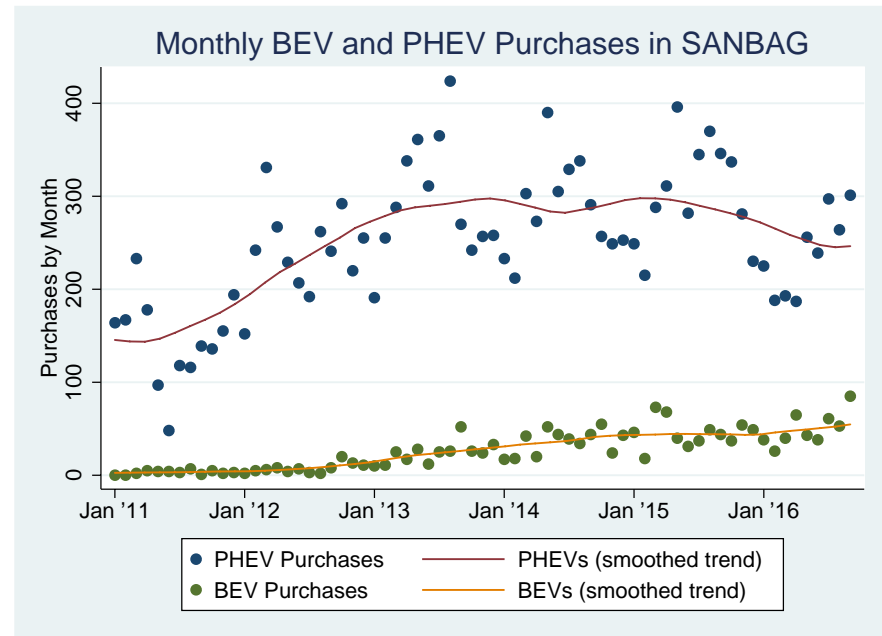
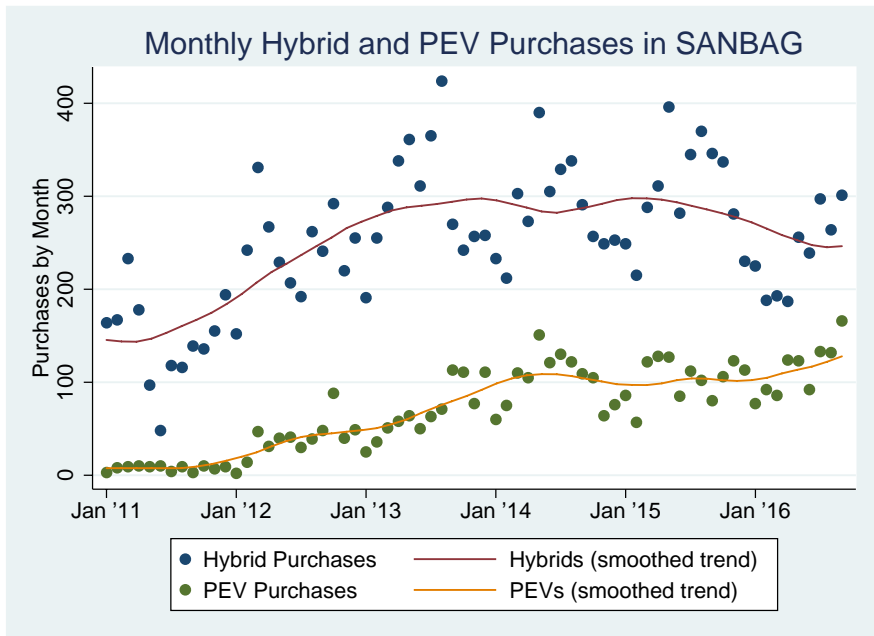
SAN BERNARDINO ASSOCIATED GOVERNMENTS

Cumulative PEV Growth



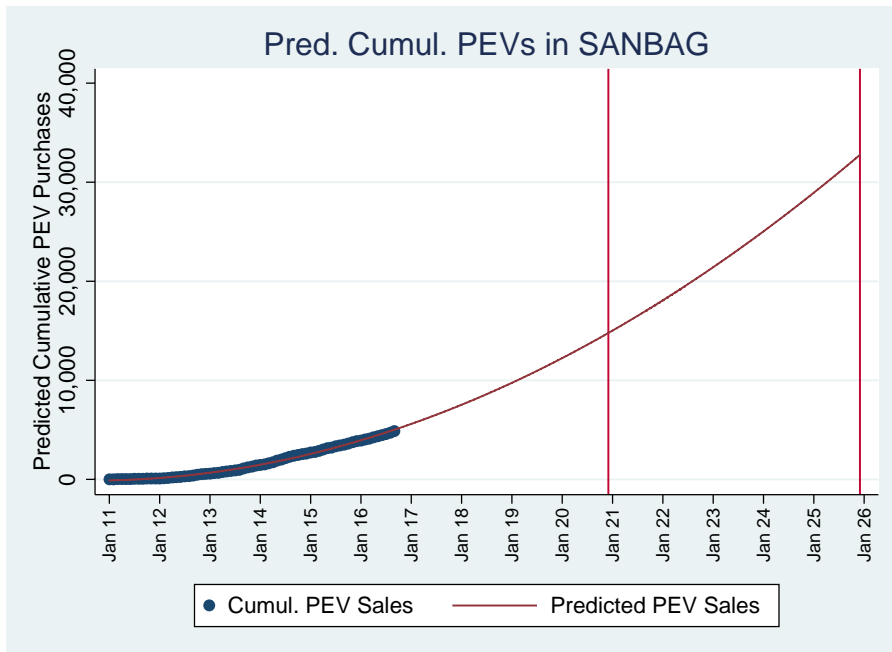
SAN BERNARDINO ASSOCIATED GOVERNMENTS

Monthly PEV Growth



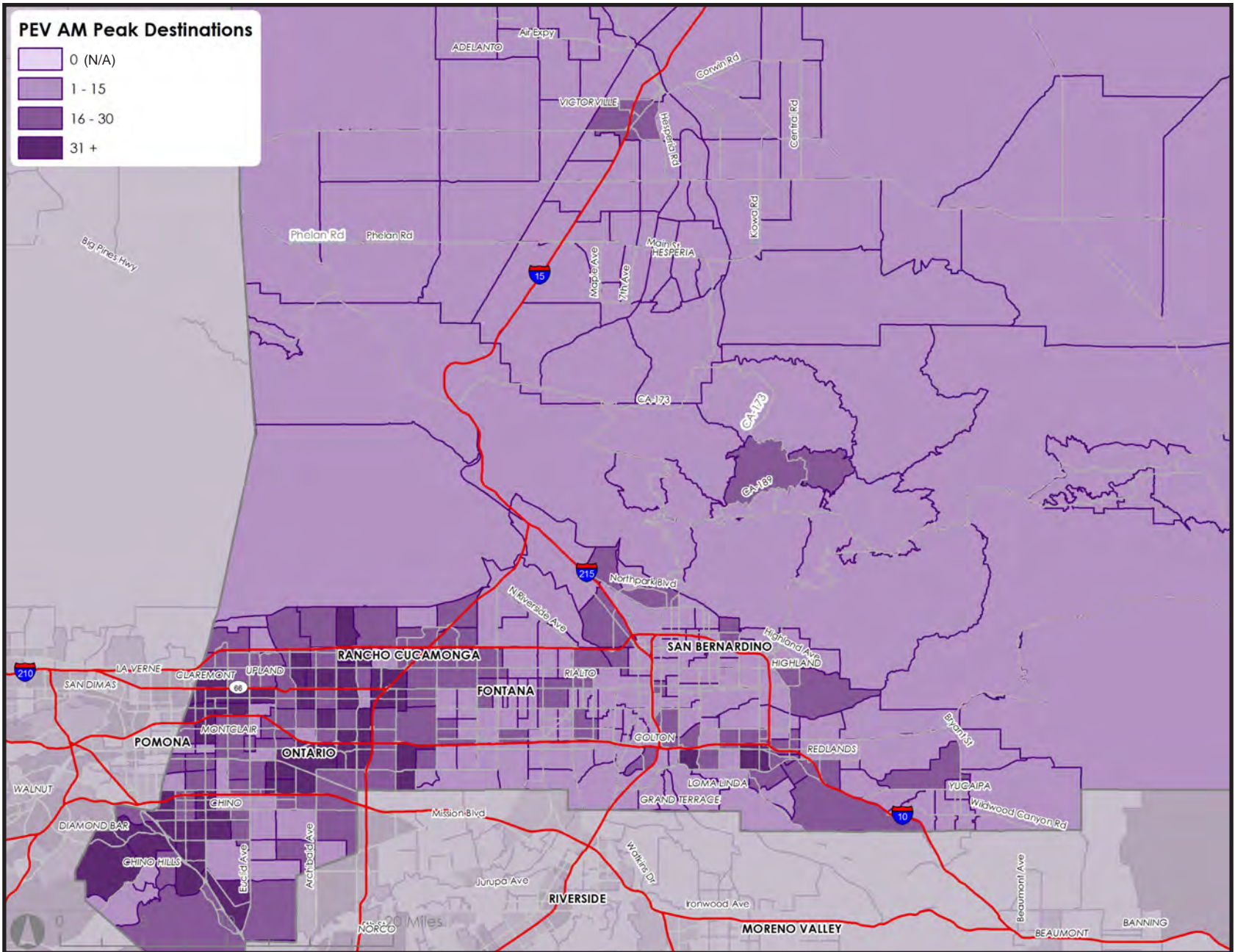
SAN BERNARDINO ASSOCIATED GOVERNMENTS

Projected PEV Growth

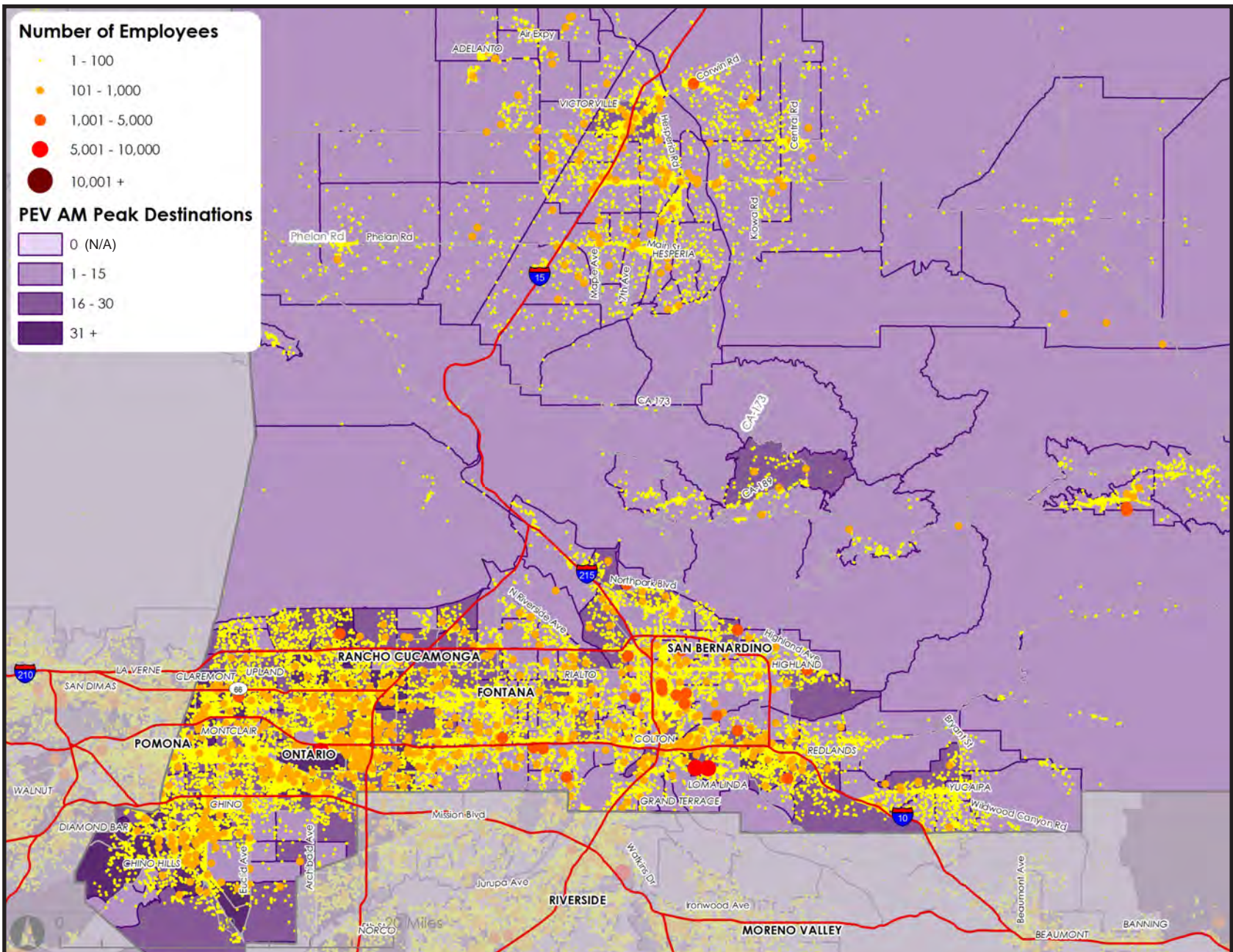


Year	Cumulative Predicted Sales
2016	5,451
2017	7,361
2018	9,553
2019	12,025
2020	14,779
2021	17,814
2022	21,129
2023	24,726
2024	28,604
2025	32,763

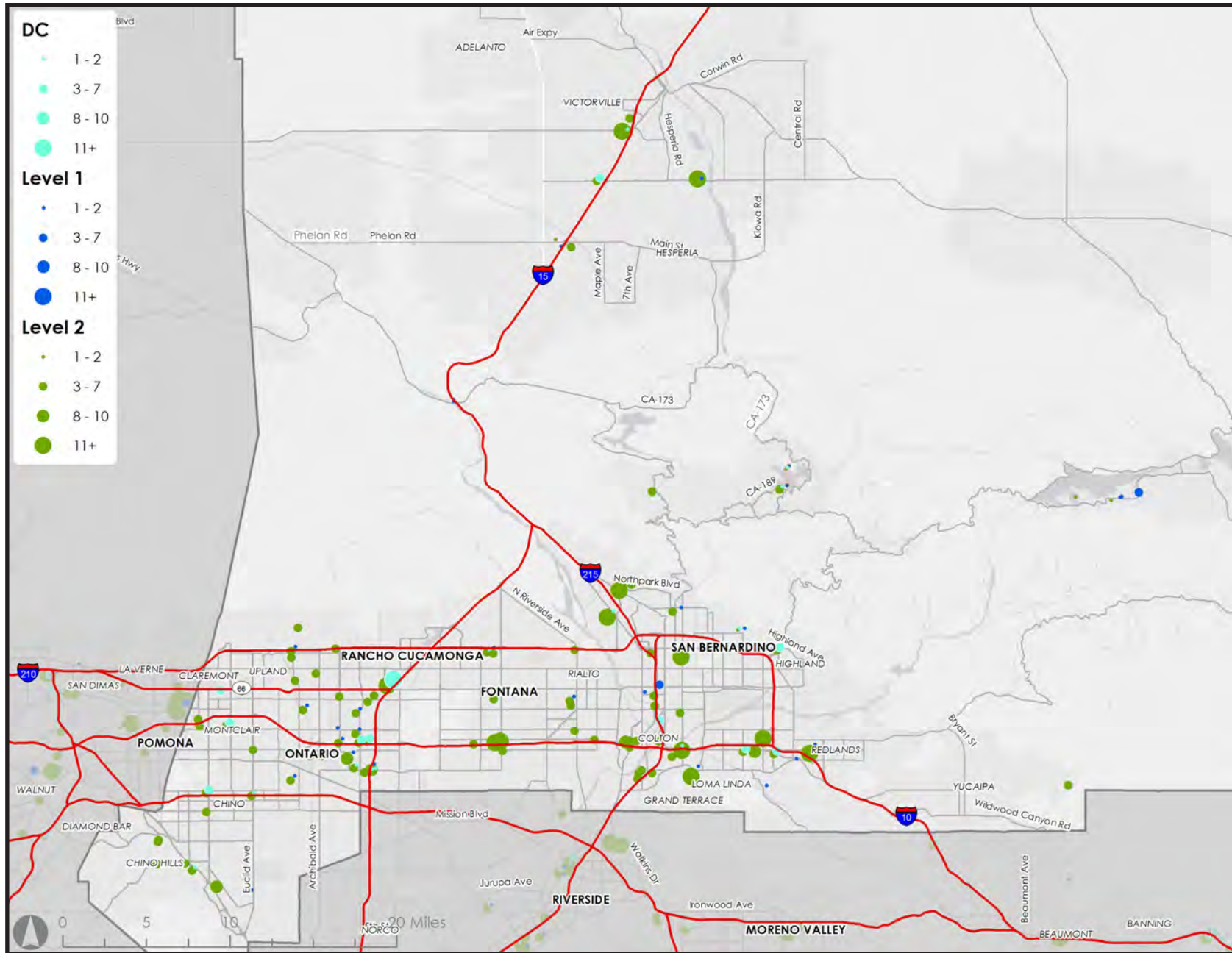
SAN BERNARDINO ASSOCIATED GOVERNMENTS PEV Peak Morning Destinations



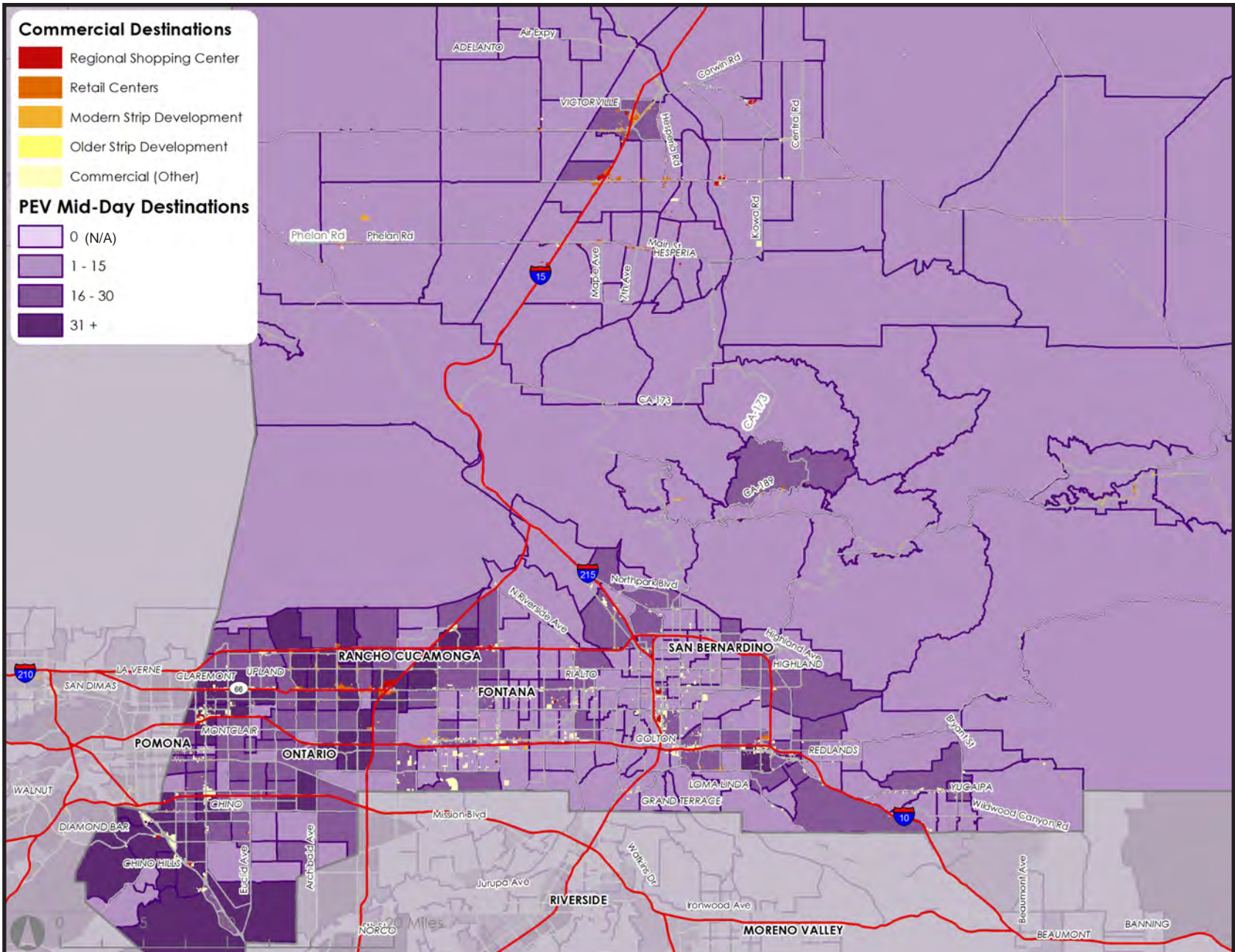
SAN BERNARDINO ASSOCIATED GOVERNMENTS PEV Peak Morning Destinations and Workplaces



SAN BERNARDINO ASSOCIATED GOVERNMENTS Publicly Accessible Charging Stations

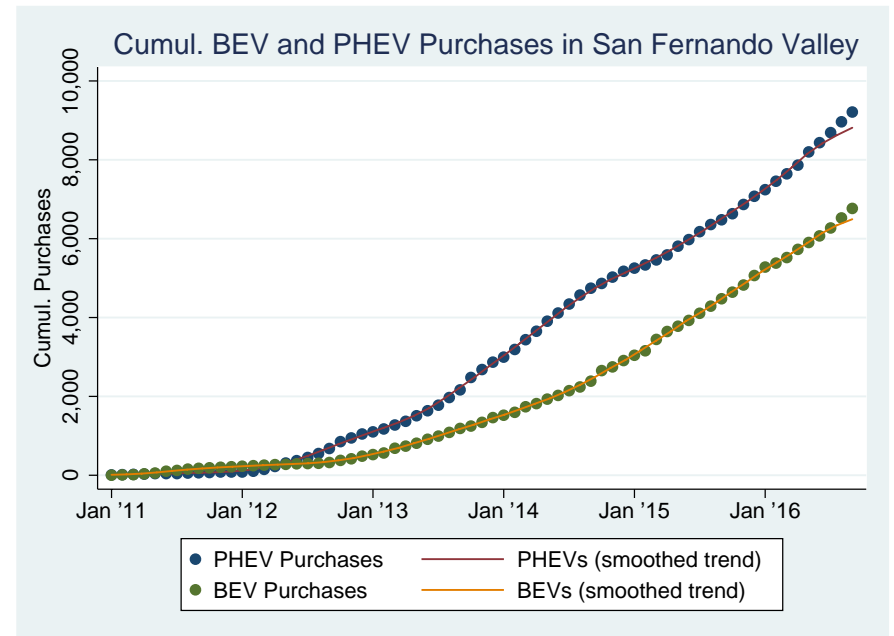
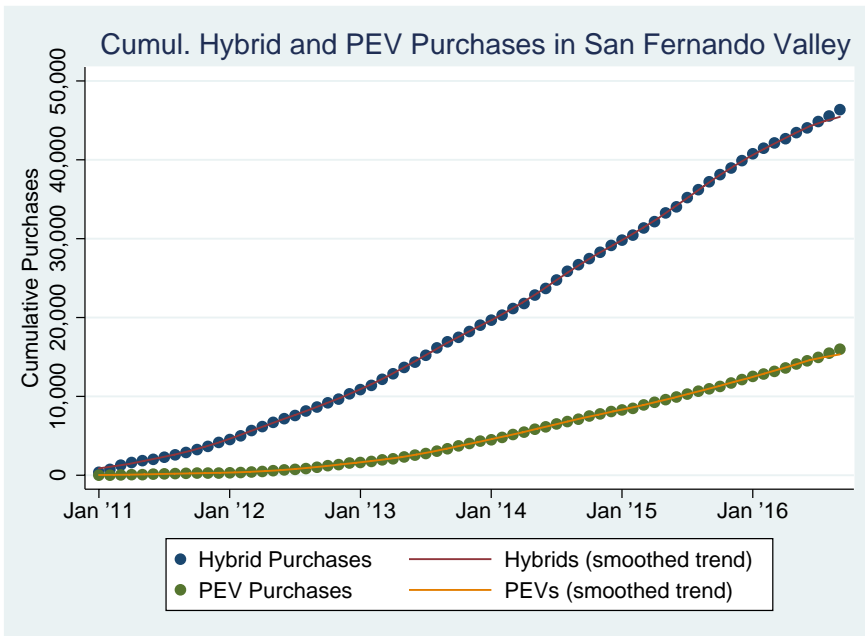


SAN BERNARDINO ASSOCIATED GOVERNMENTS PEV Mid-Day Destinations and Commercial (Retail) Locations



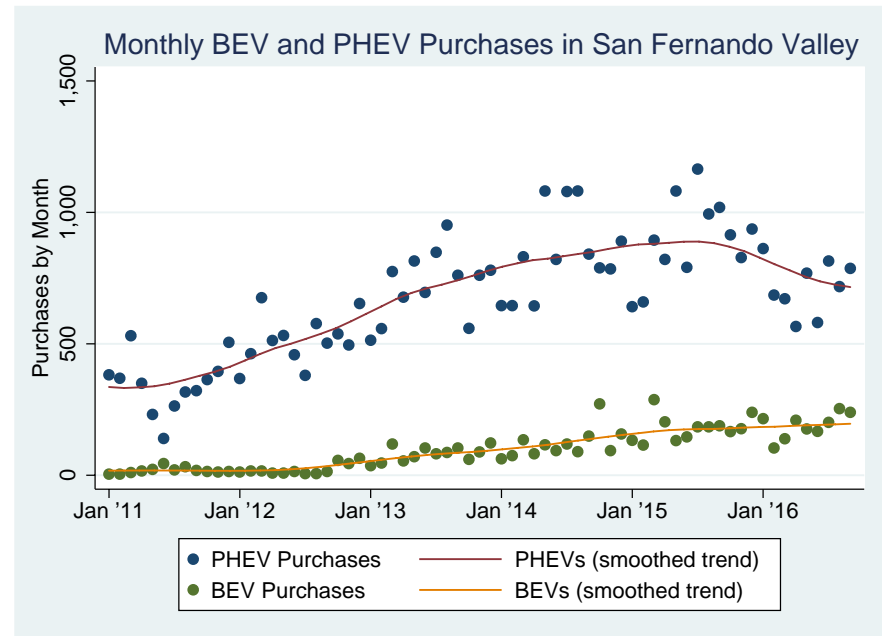
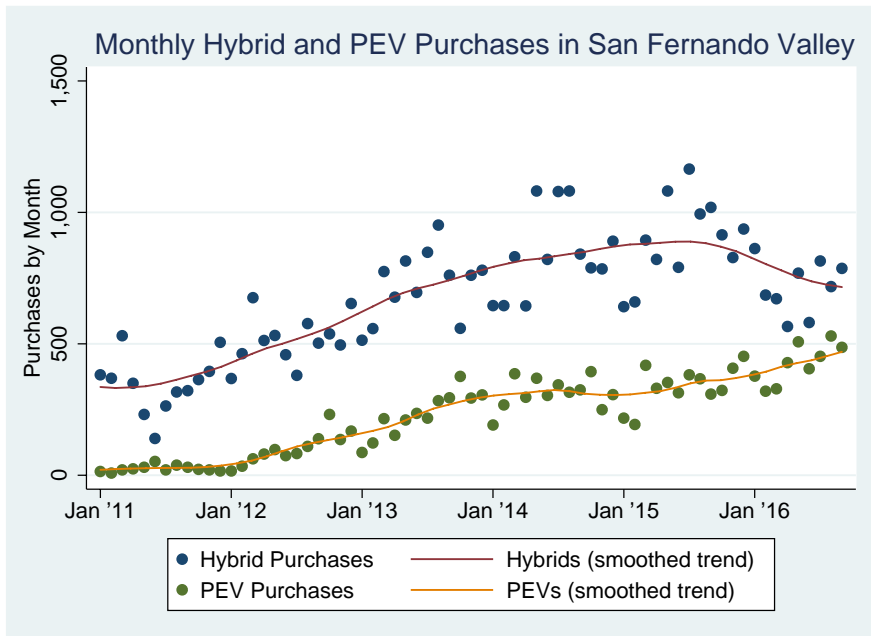
SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS

Cumulative PEV Growth



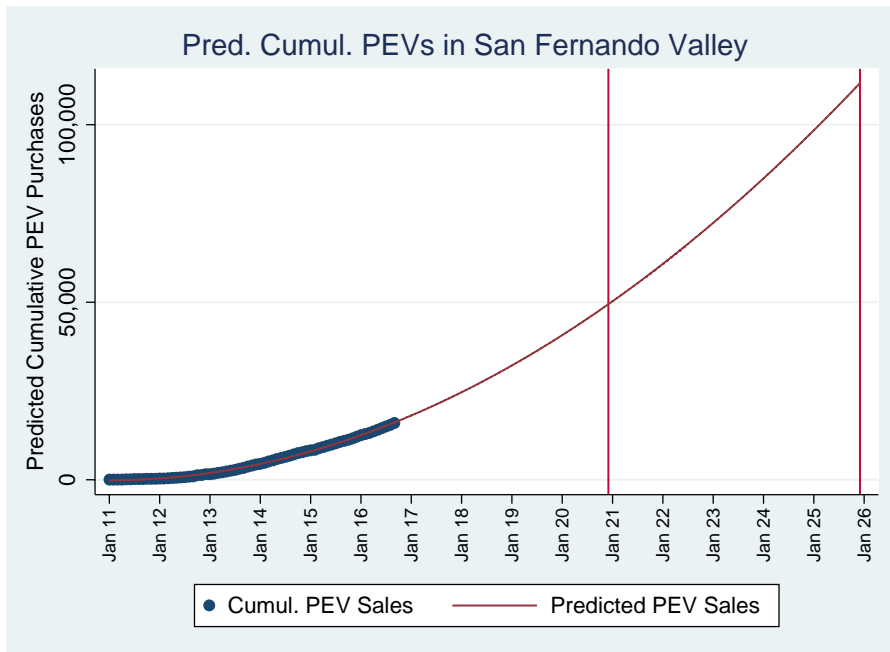
SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS

Monthly PEV Growth



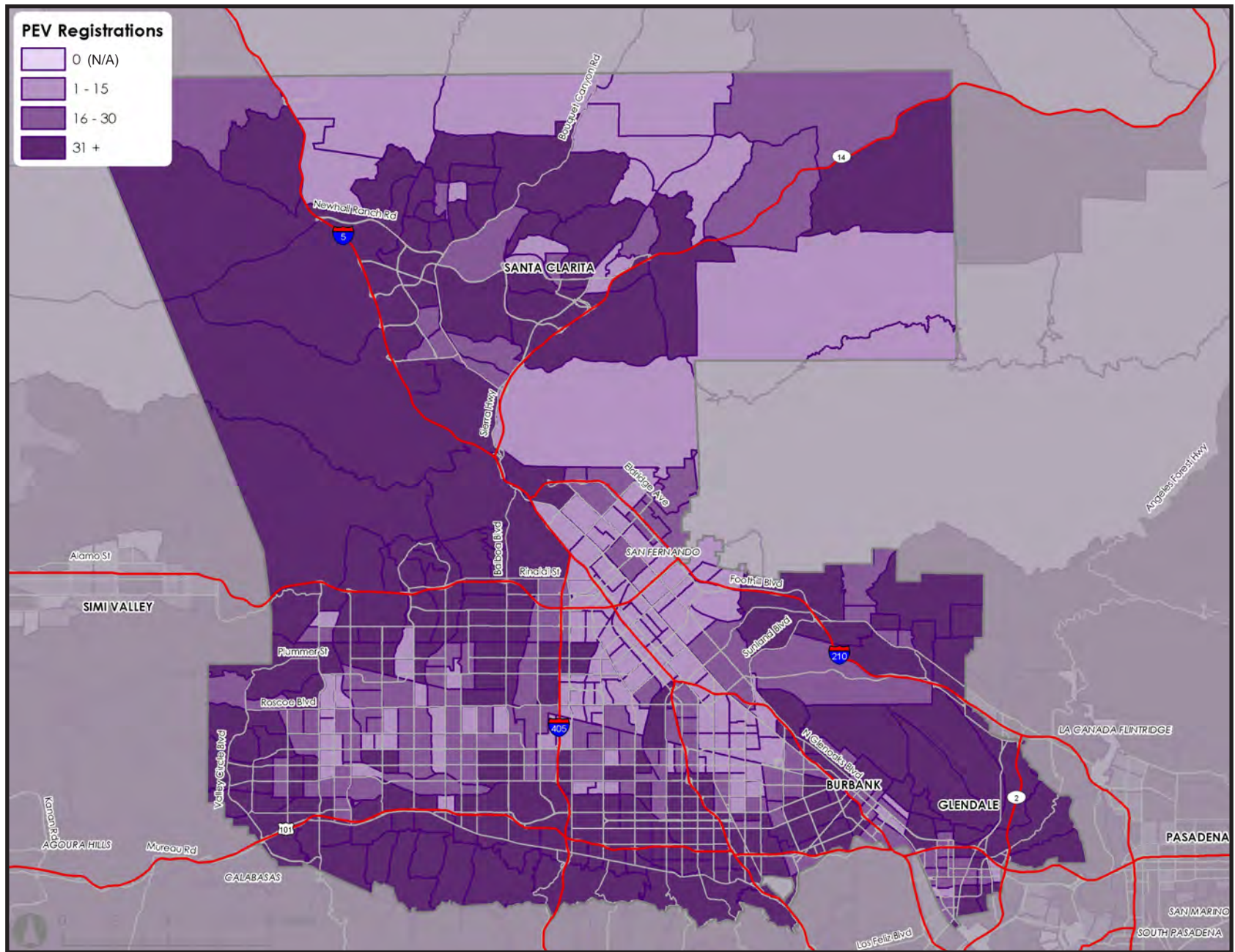
SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS

Projected PEV Growth

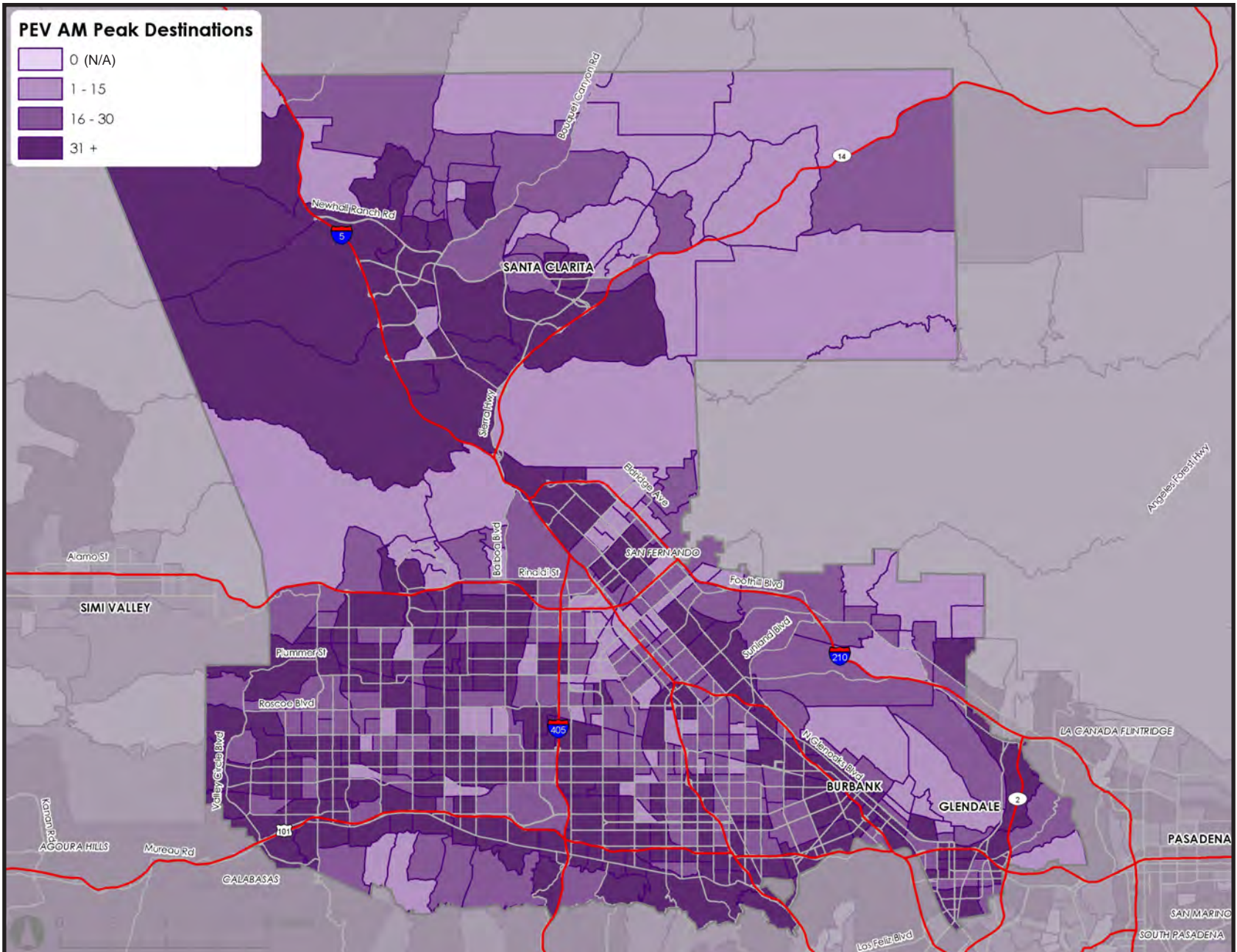


Year	Cumulative Predicted Sales
2016	17,607
2017	24,068
2018	31,527
2019	39,985
2020	49,442
2021	59,897
2022	71,352
2023	83,806
2024	97,259
2025	111,711

SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS PEV Registrations

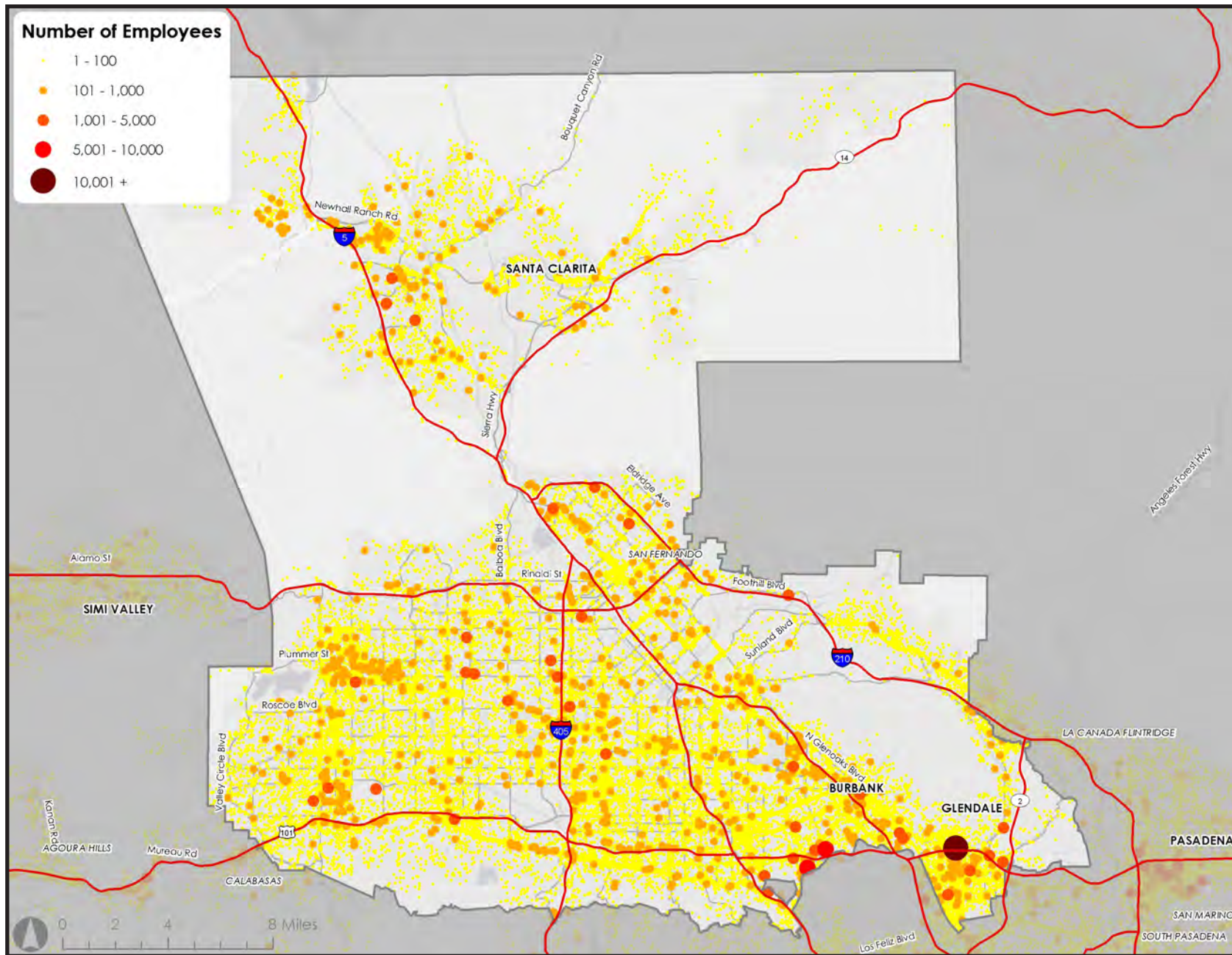


SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations

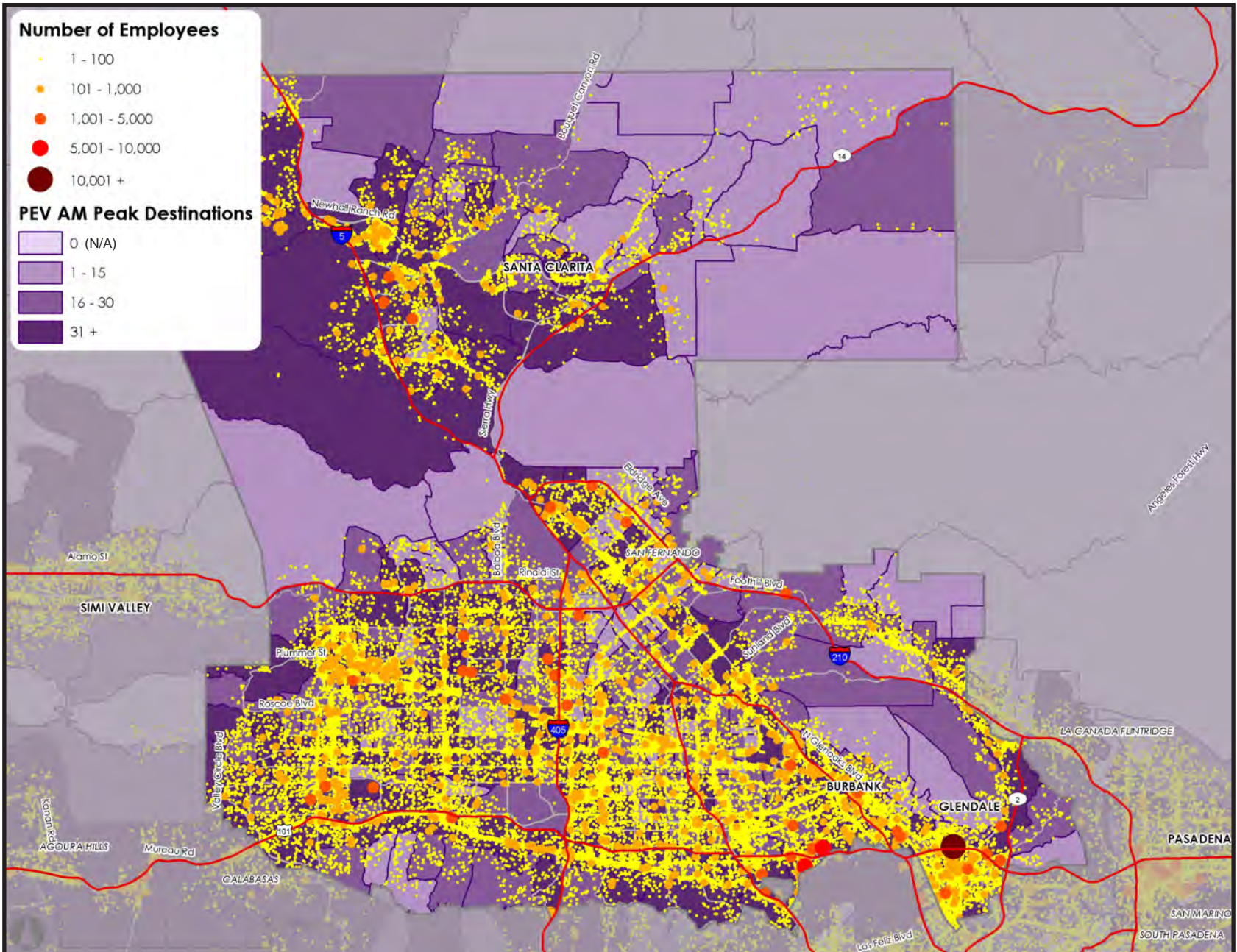


SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS

Workplaces by Number of Employees

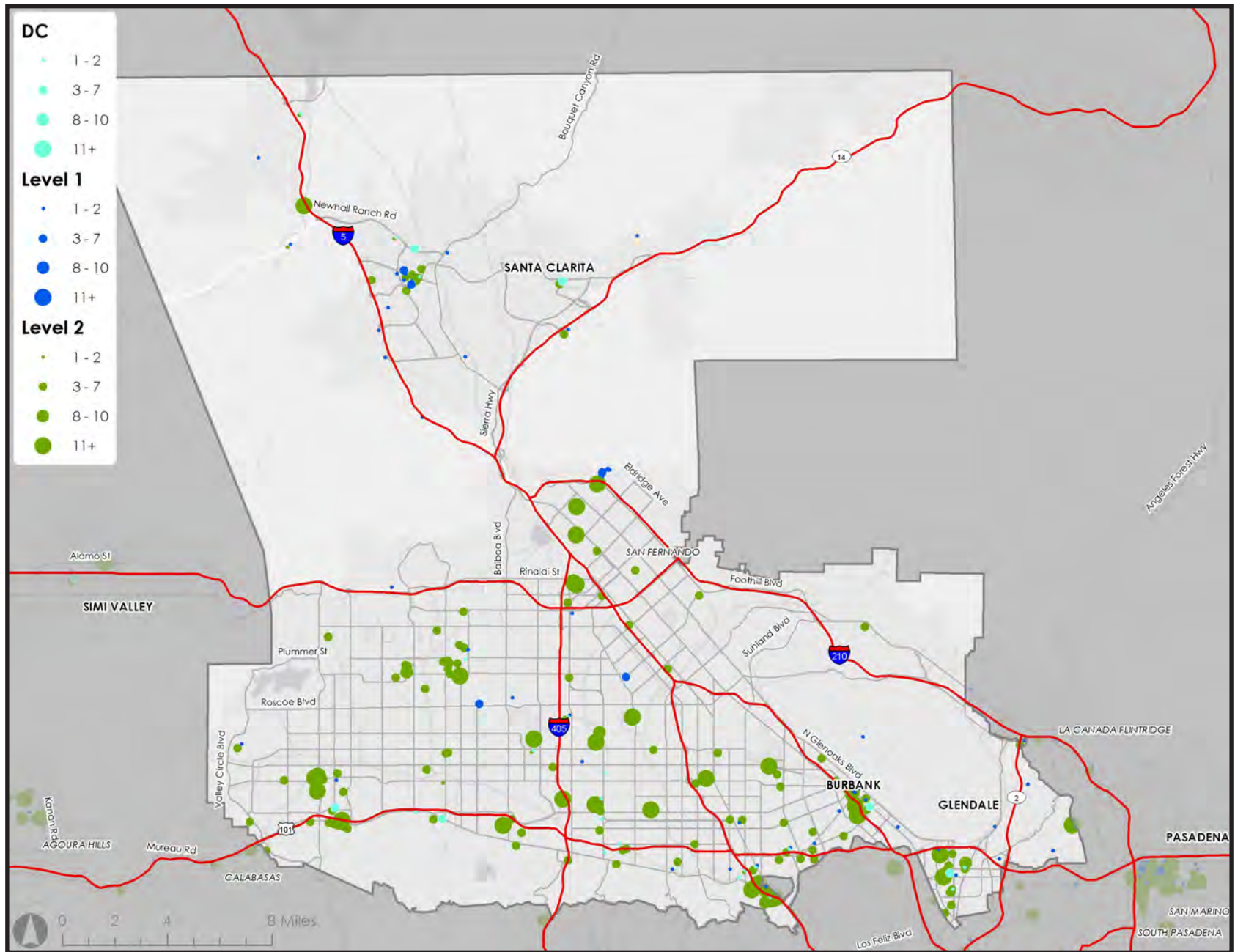


SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations and Workplaces



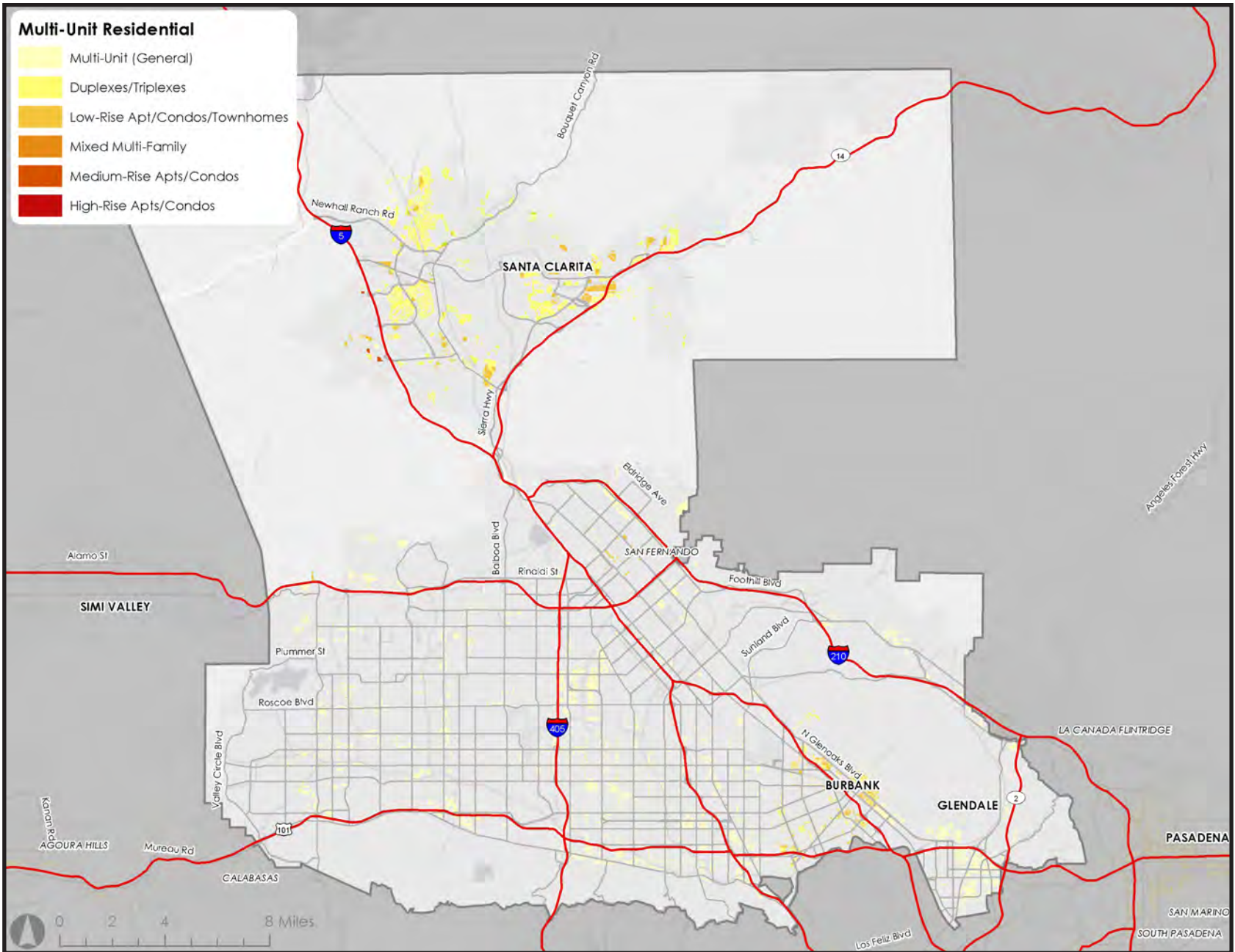
SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS

Publicly Accessible Charging Stations



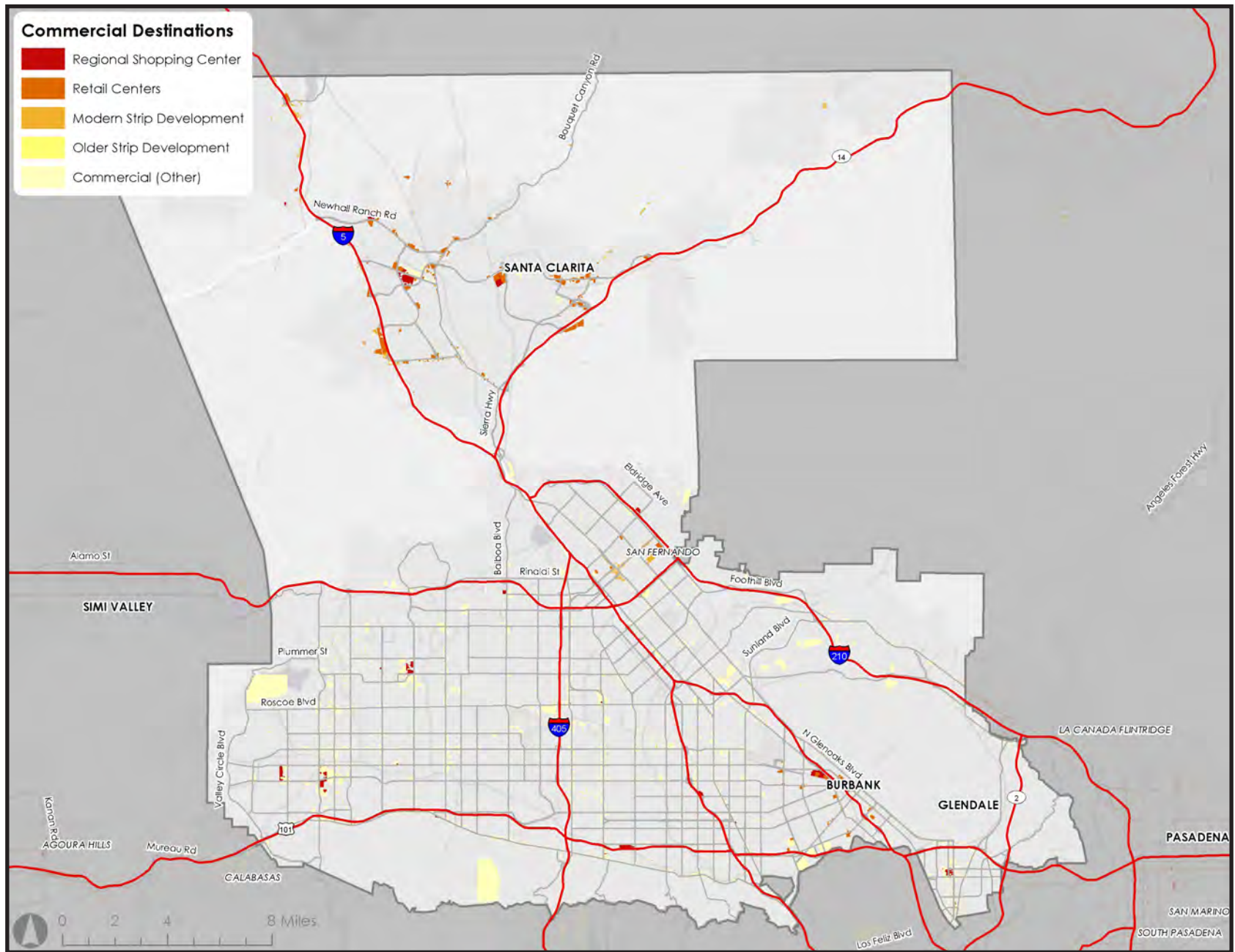
SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS

Multi-Unit Residential Land Uses



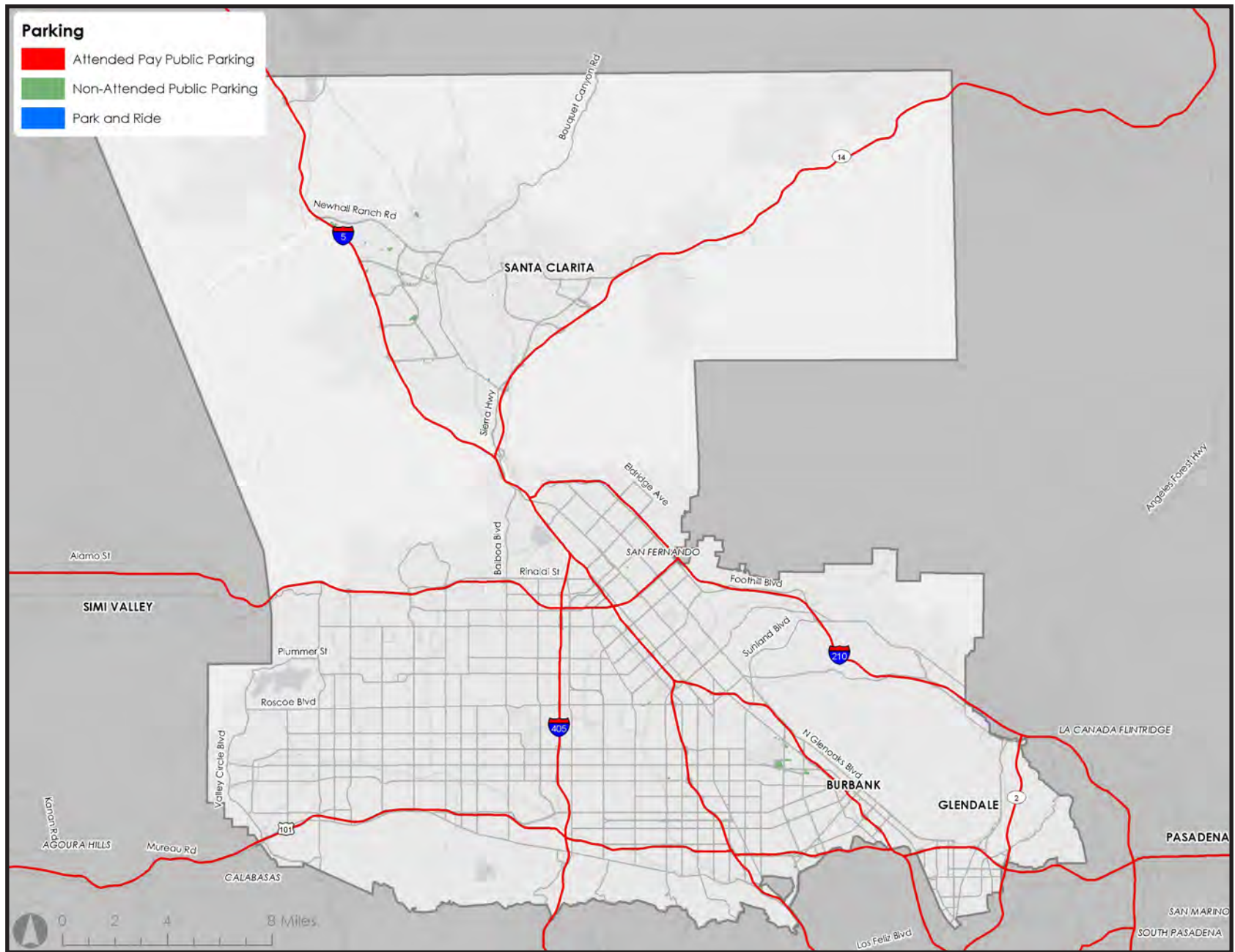
SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS

Commercial (Retail) Destinations



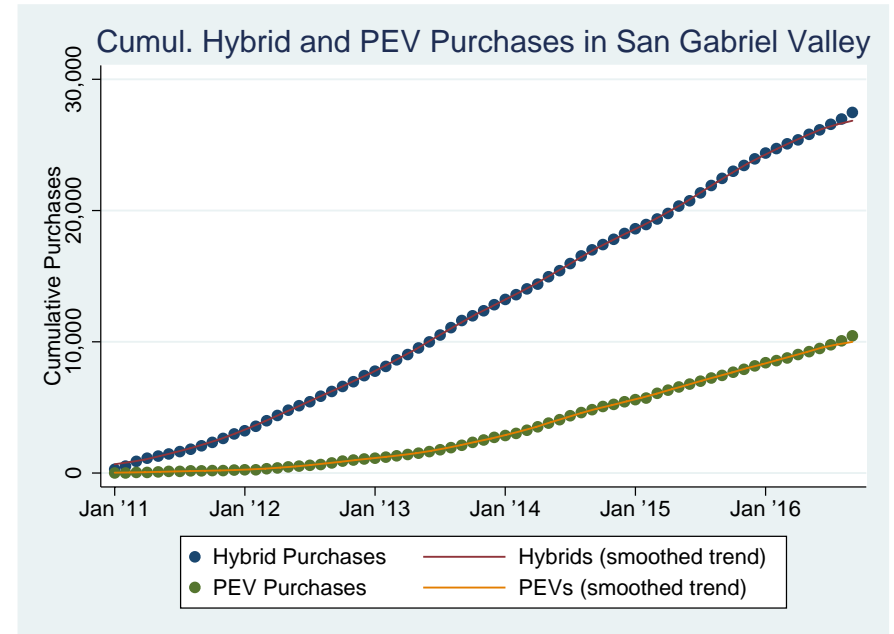
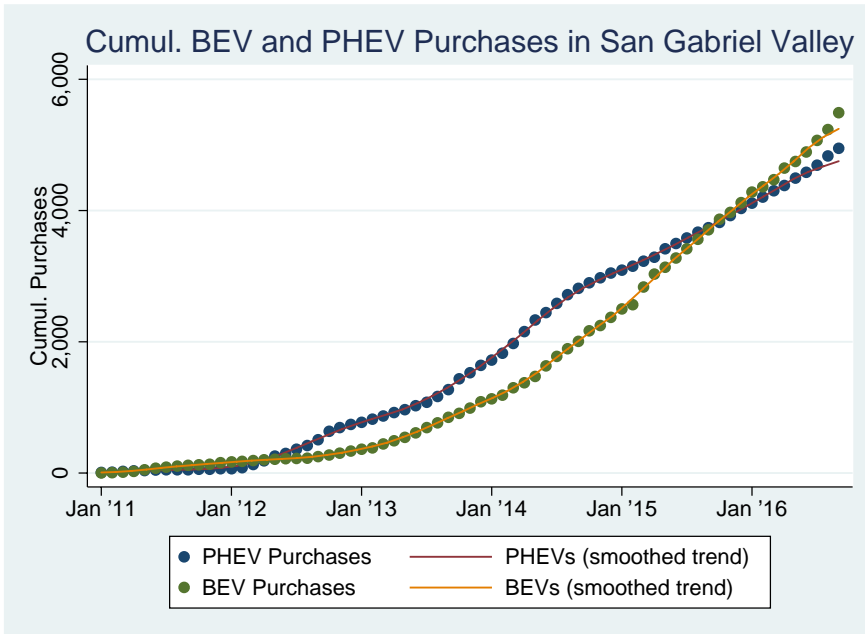
SAN FERNANDO VALLEY COUNCIL OF GOVERNMENTS

Stand-alone Parking Facilities



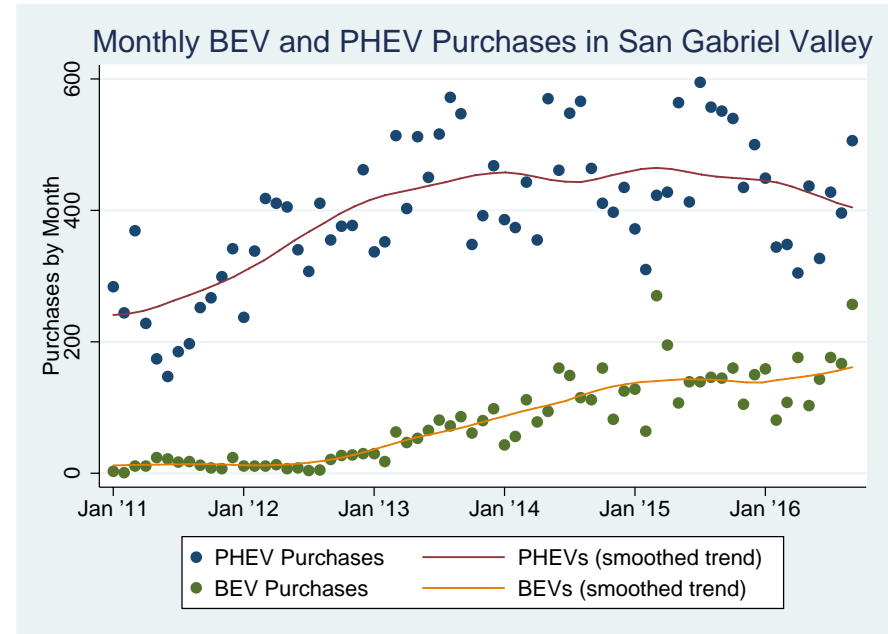
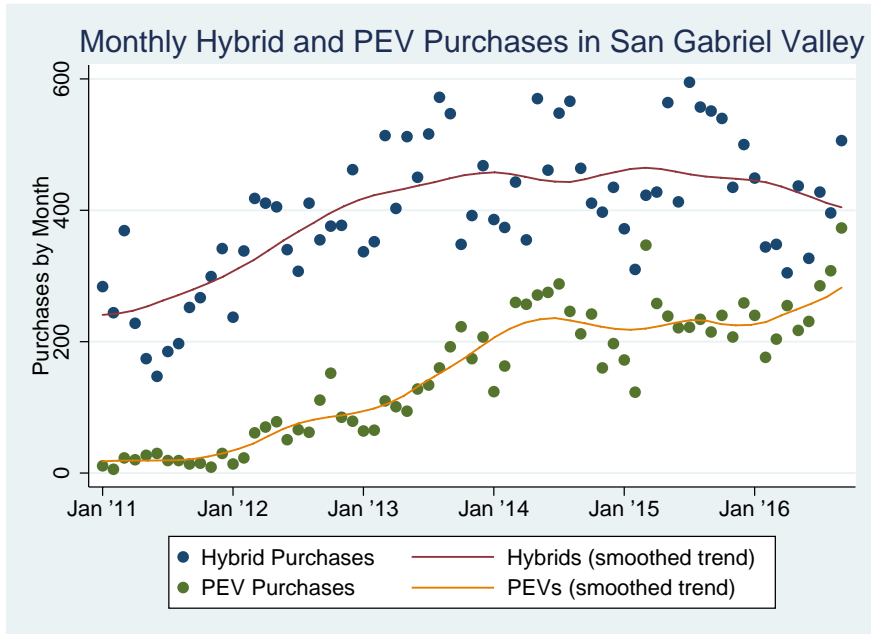
SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS

Cumulative PEV Growth



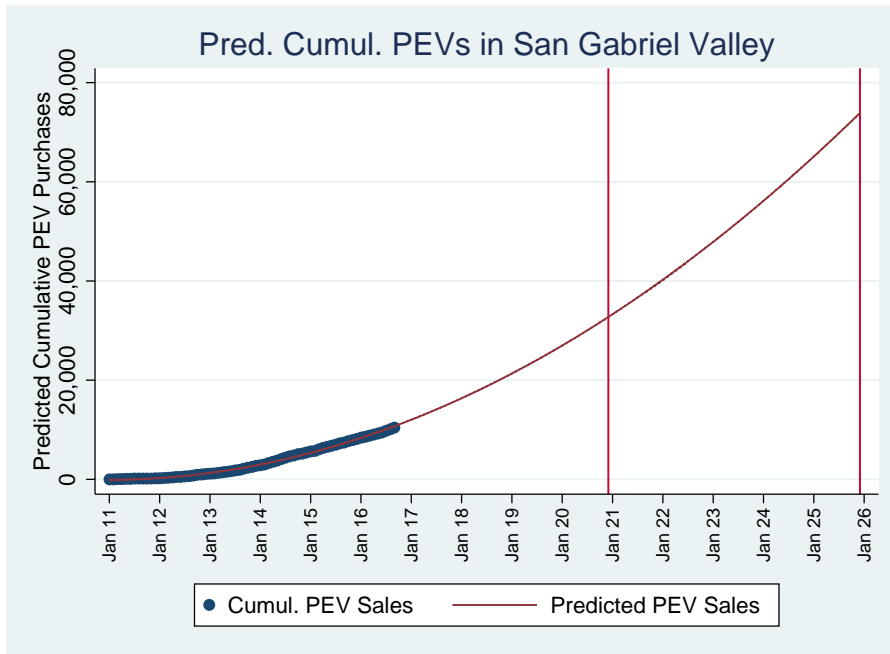
SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS

Monthly PEV Growth



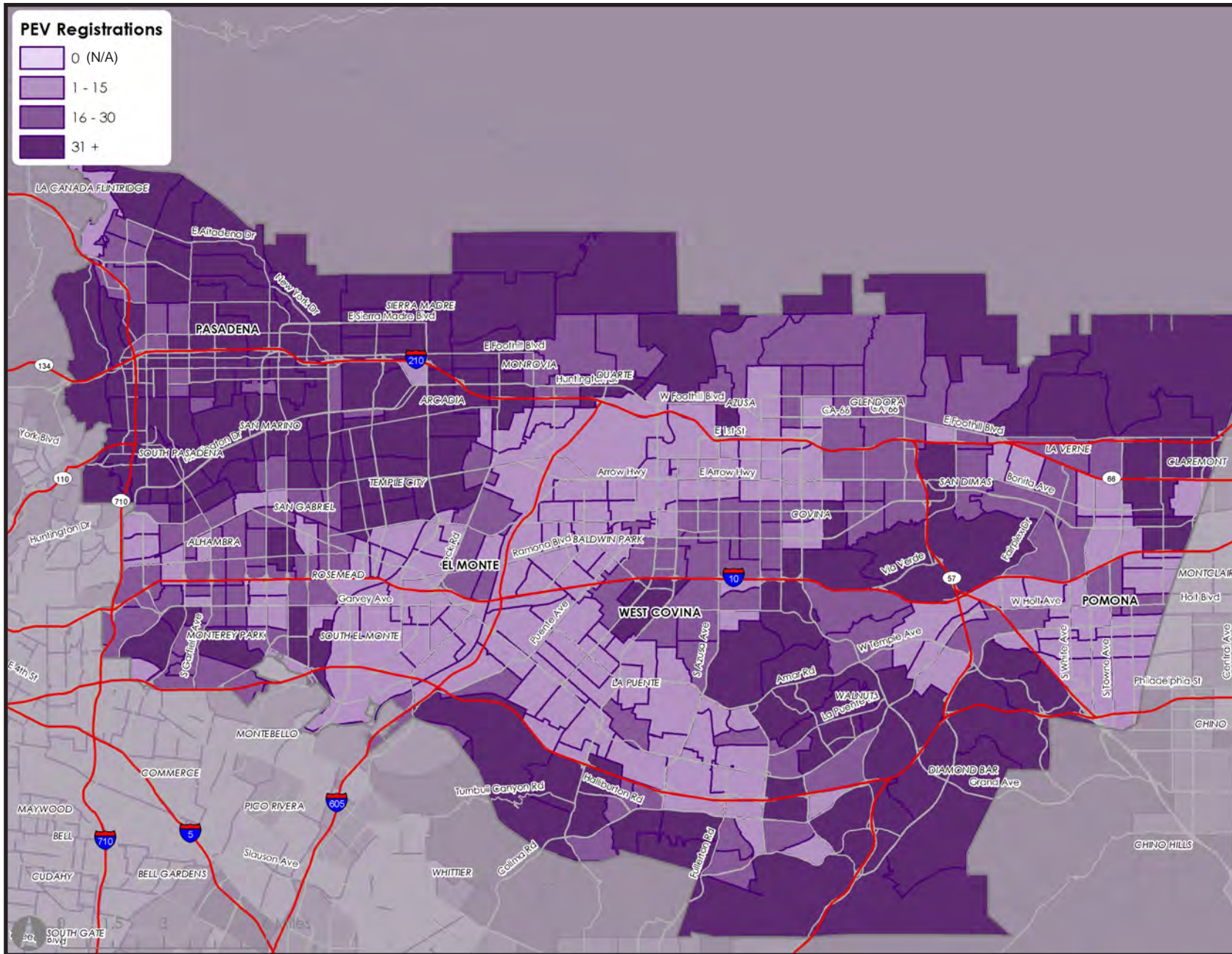
SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS

Projected PEV Growth



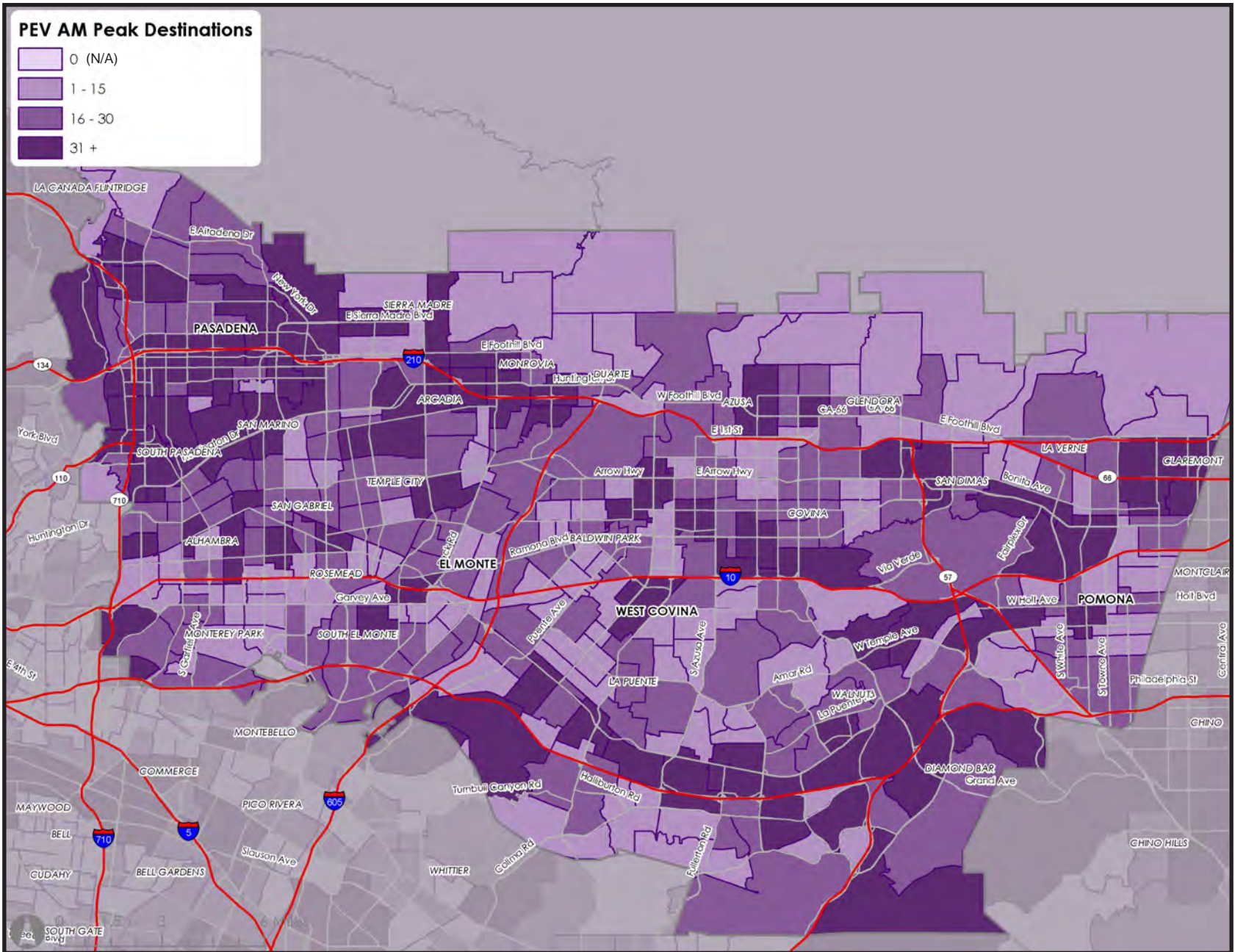
Year	Cumulative Predicted Sales
2016	11,694
2017	15,968
2018	20,901
2019	26,493
2020	32,744
2021	39,654
2022	47,223
2023	55,451
2024	64,338
2025	73,884

SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS PEV Registrations



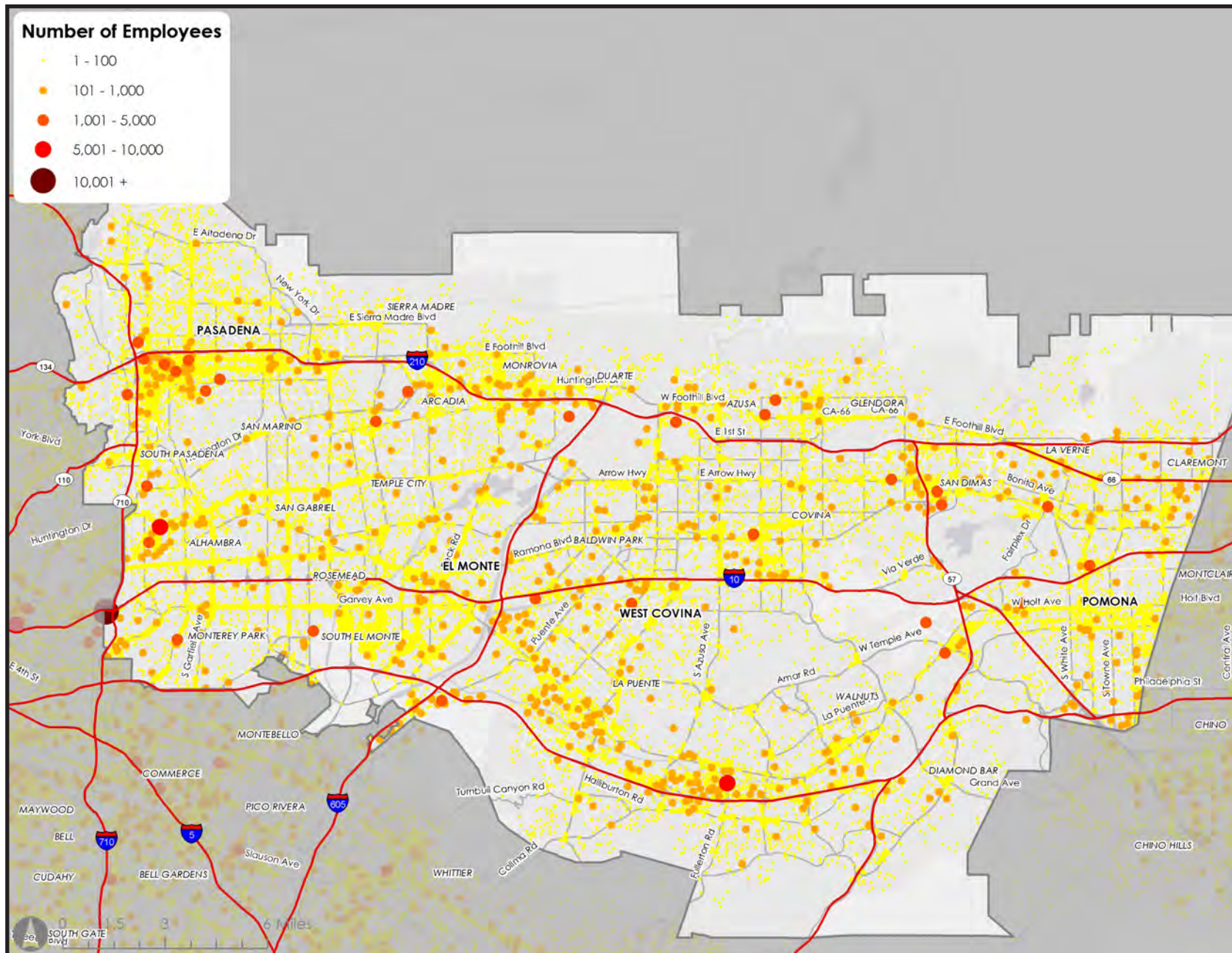
SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS

PEV Peak Morning Destinations

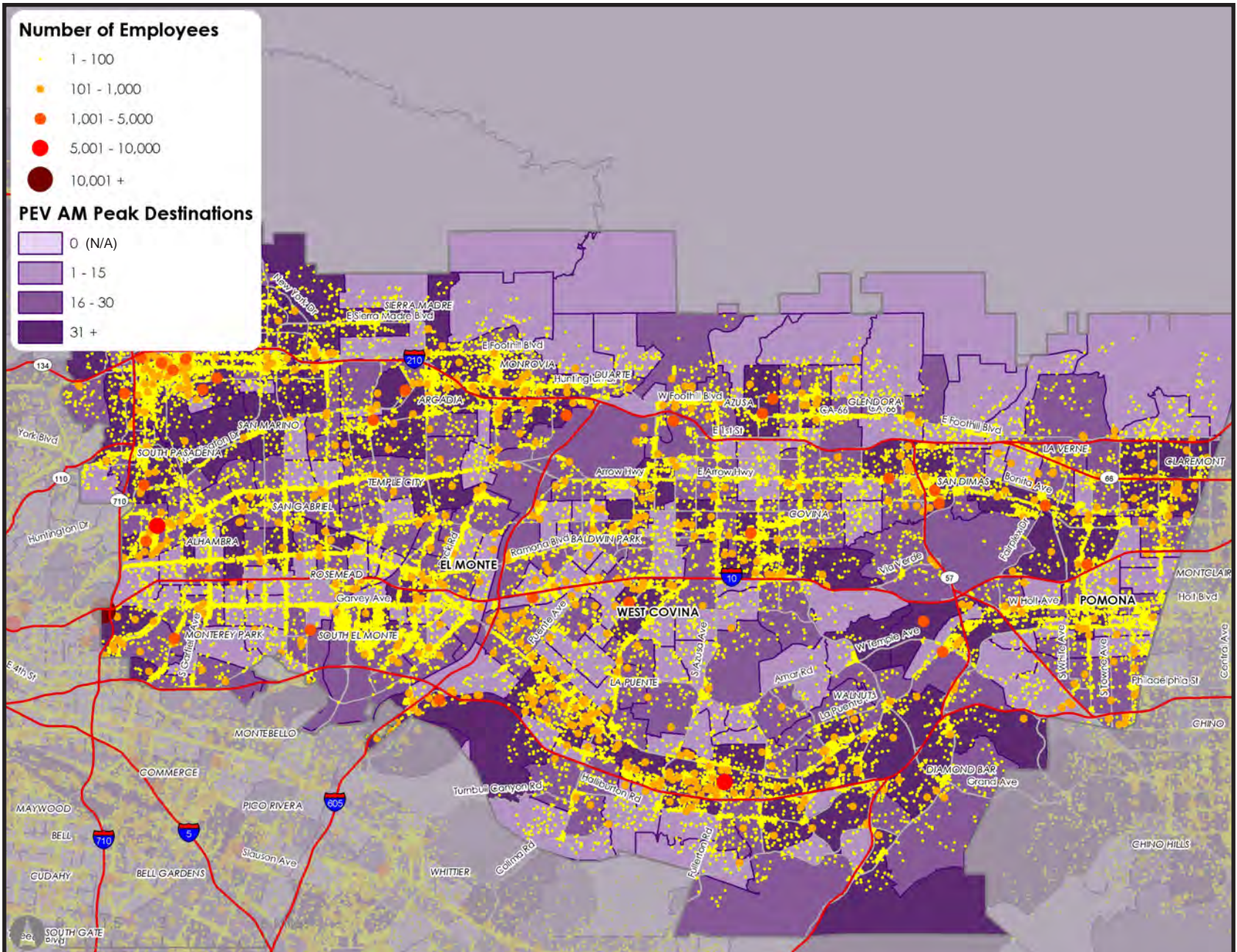


SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS

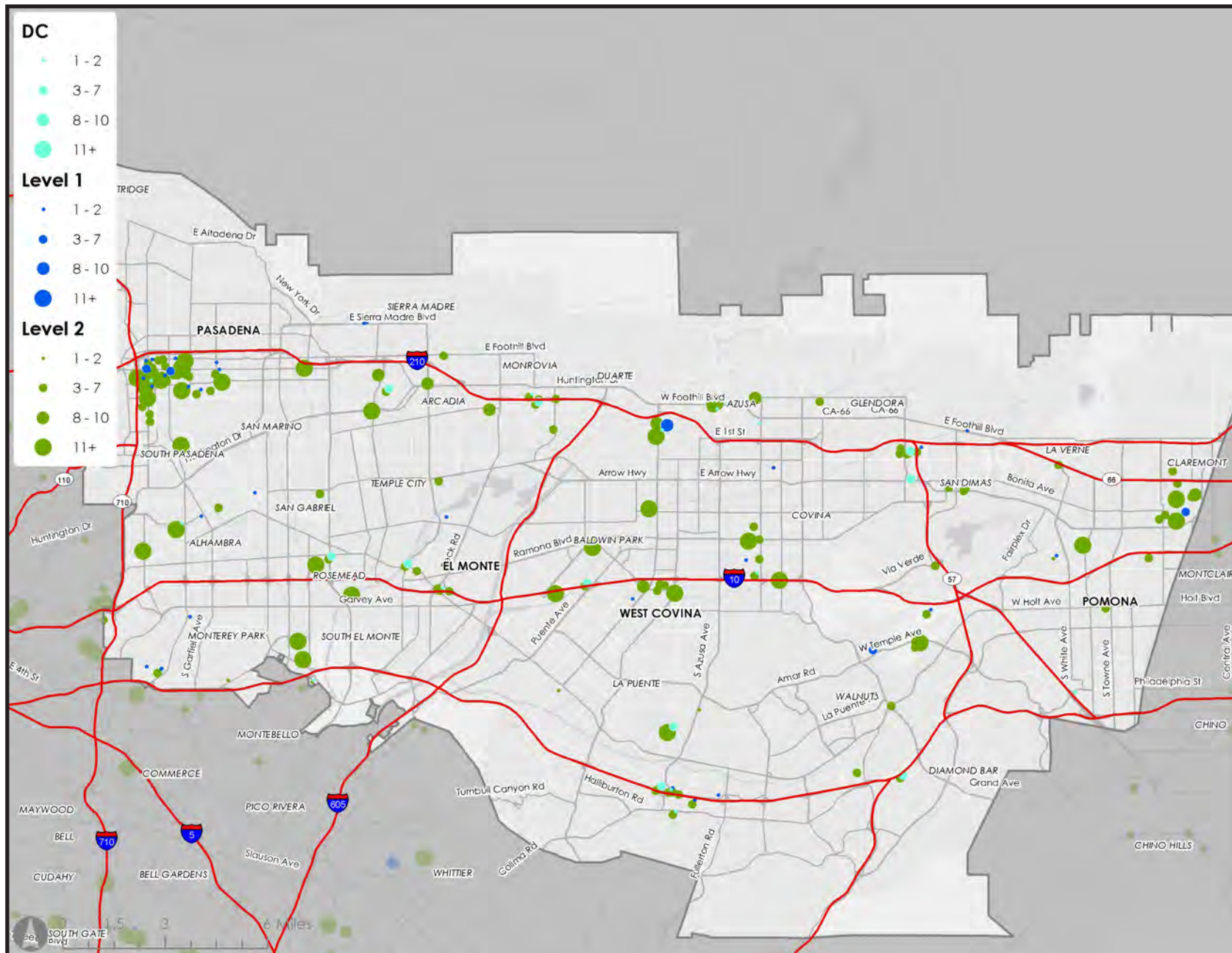
Workplaces by Number of Employees



SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations and Workplaces

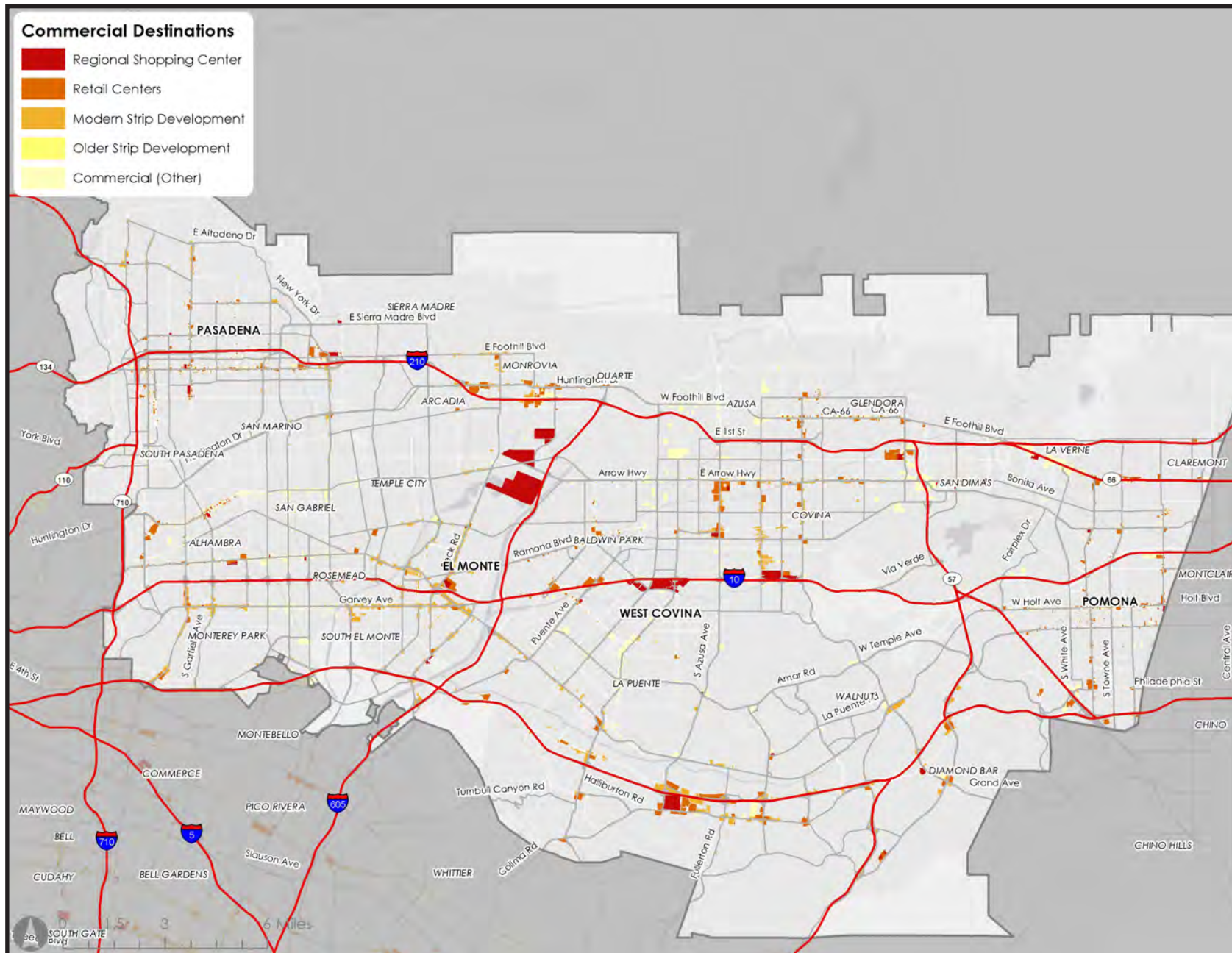


SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS Publicly Accessible Charging Stations



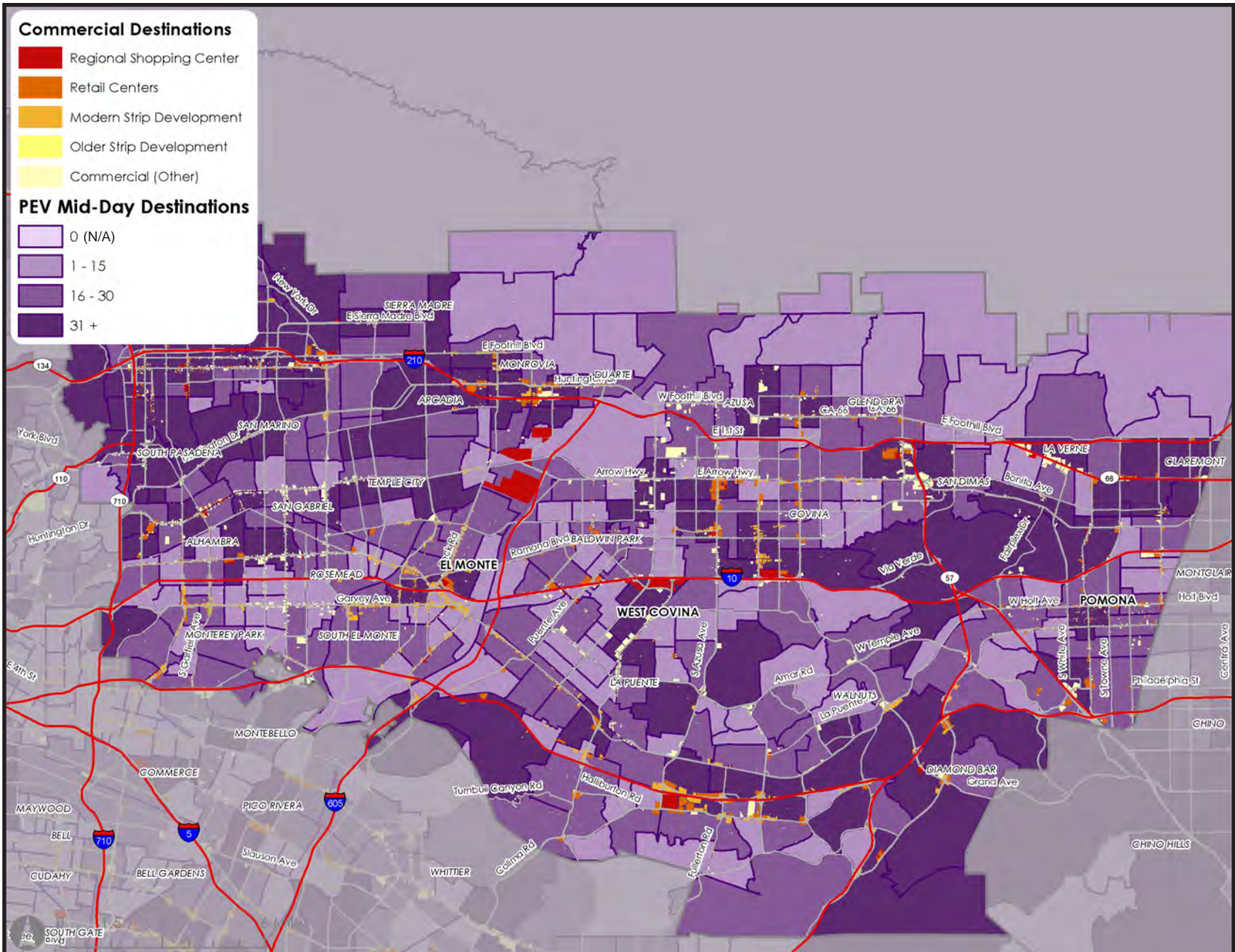
SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS

Commercial (Retail) Destinations



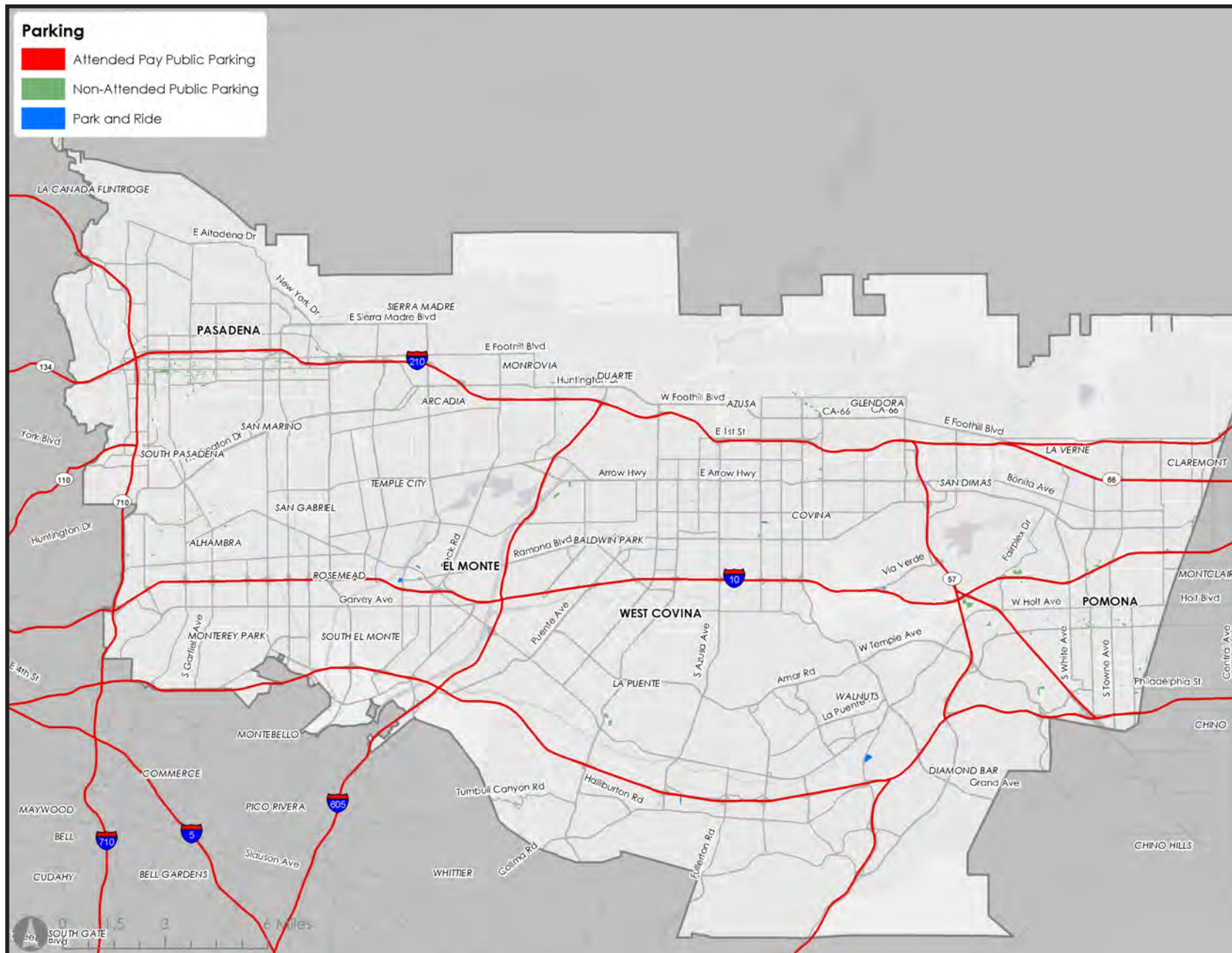
SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS

PEV Mid-Day Destinations and Commercial (Retail) Locations



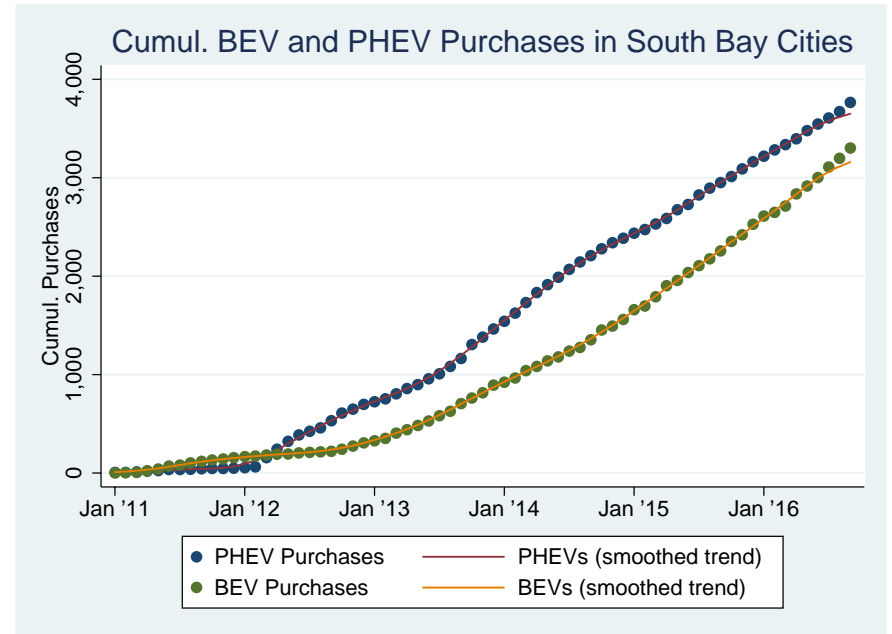
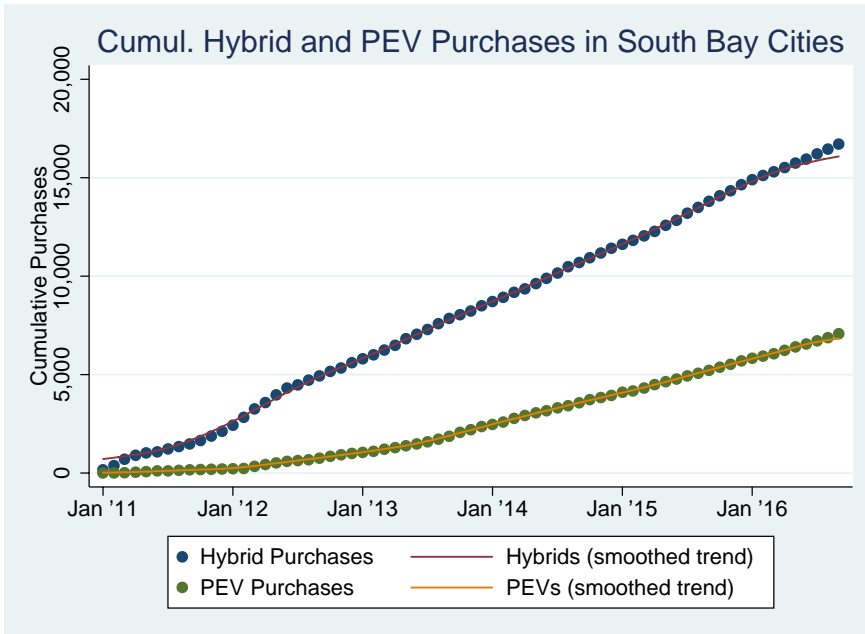
SAN GABRIEL VALLEY COUNCIL OF GOVERNMENTS

Stand-alone Parking Facilities



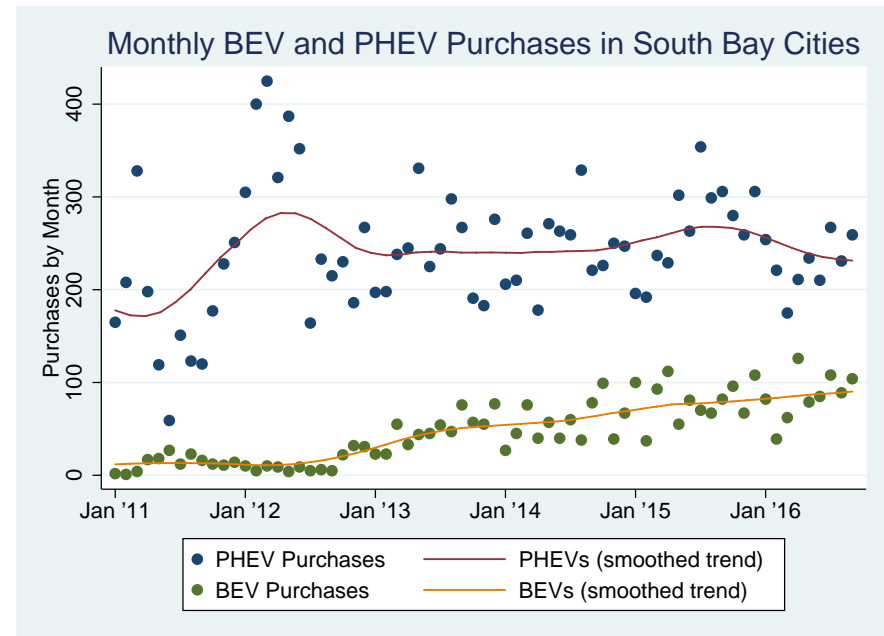
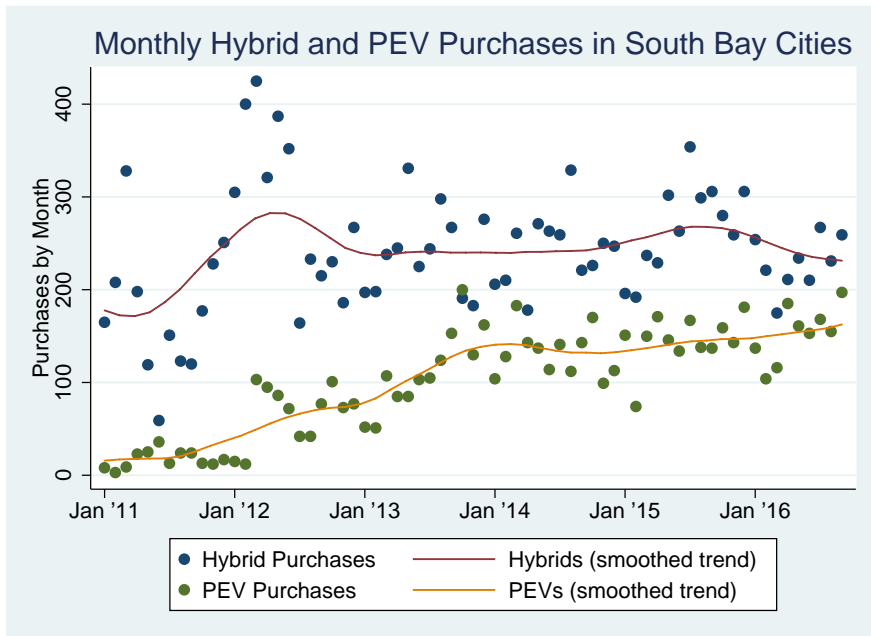
SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

Cumulative PEV Growth



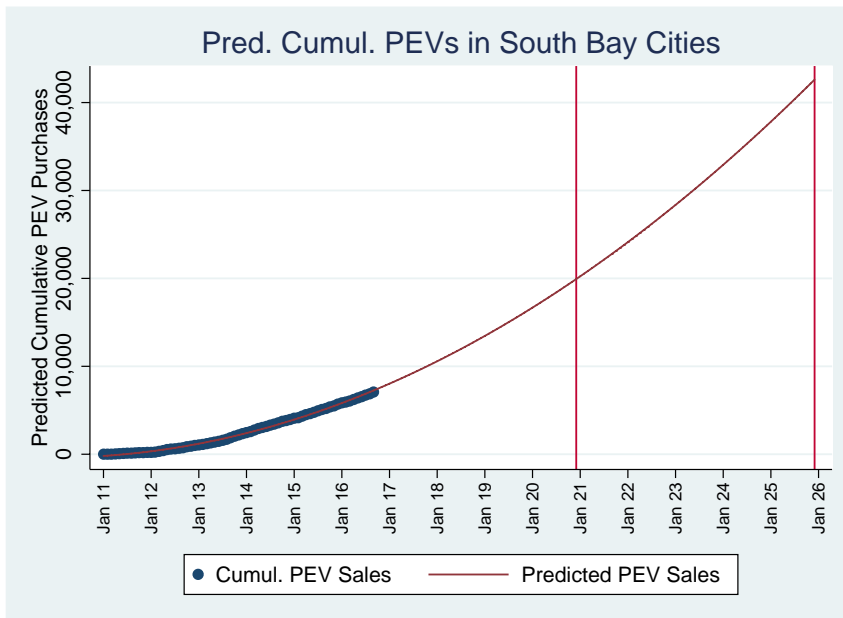
SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

Monthly PEV Growth



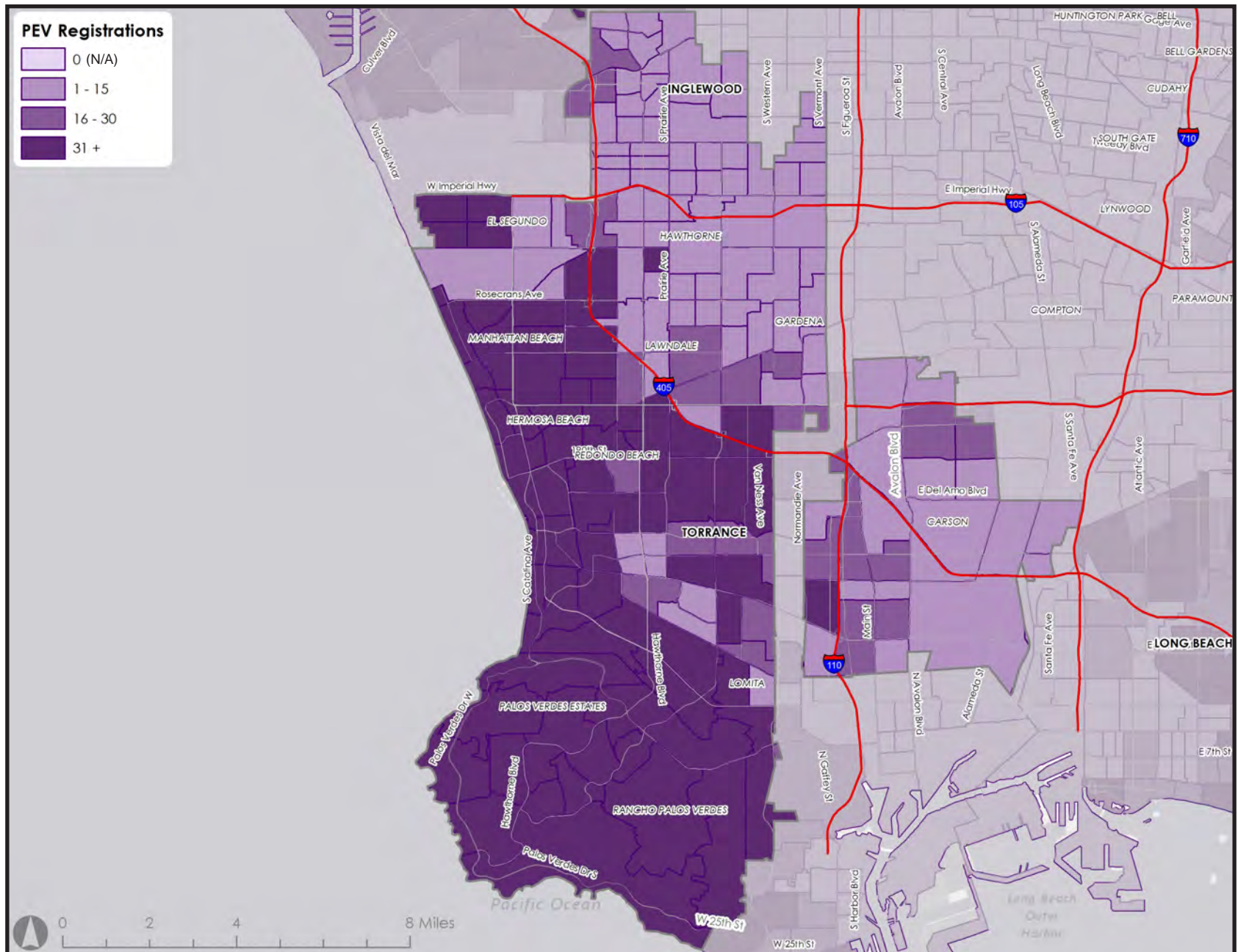
SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

Projected PEV Growth



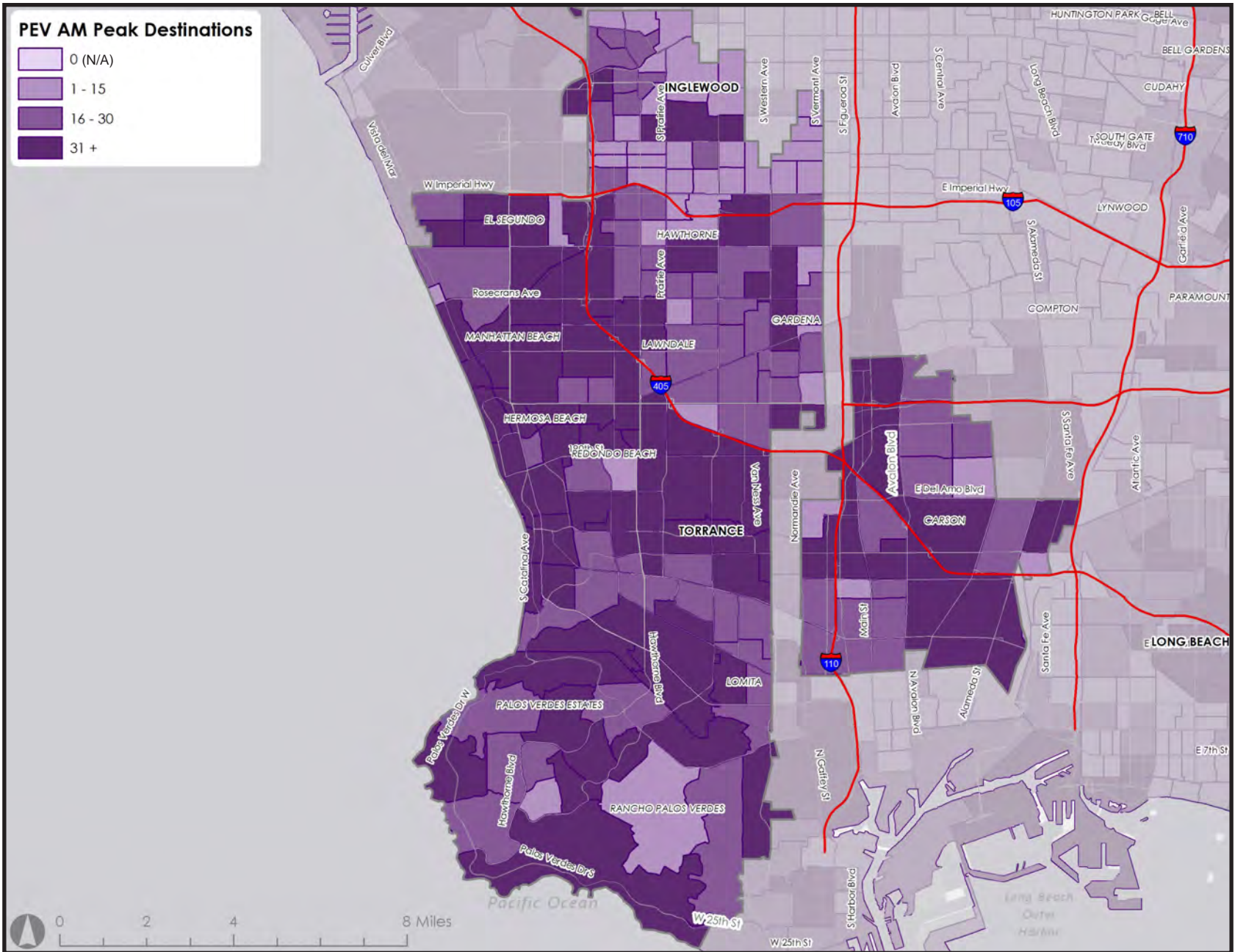
Year	Cumulative Predicted Sales
2016	7,833
2017	10,352
2018	13,207
2019	16,399
2020	19,927
2021	23,791
2022	27,991
2023	32,528
2024	37,401
2025	42,610

SOUTH BAY CITIES COUNCIL OF GOVERNMENTS PEV Registrations

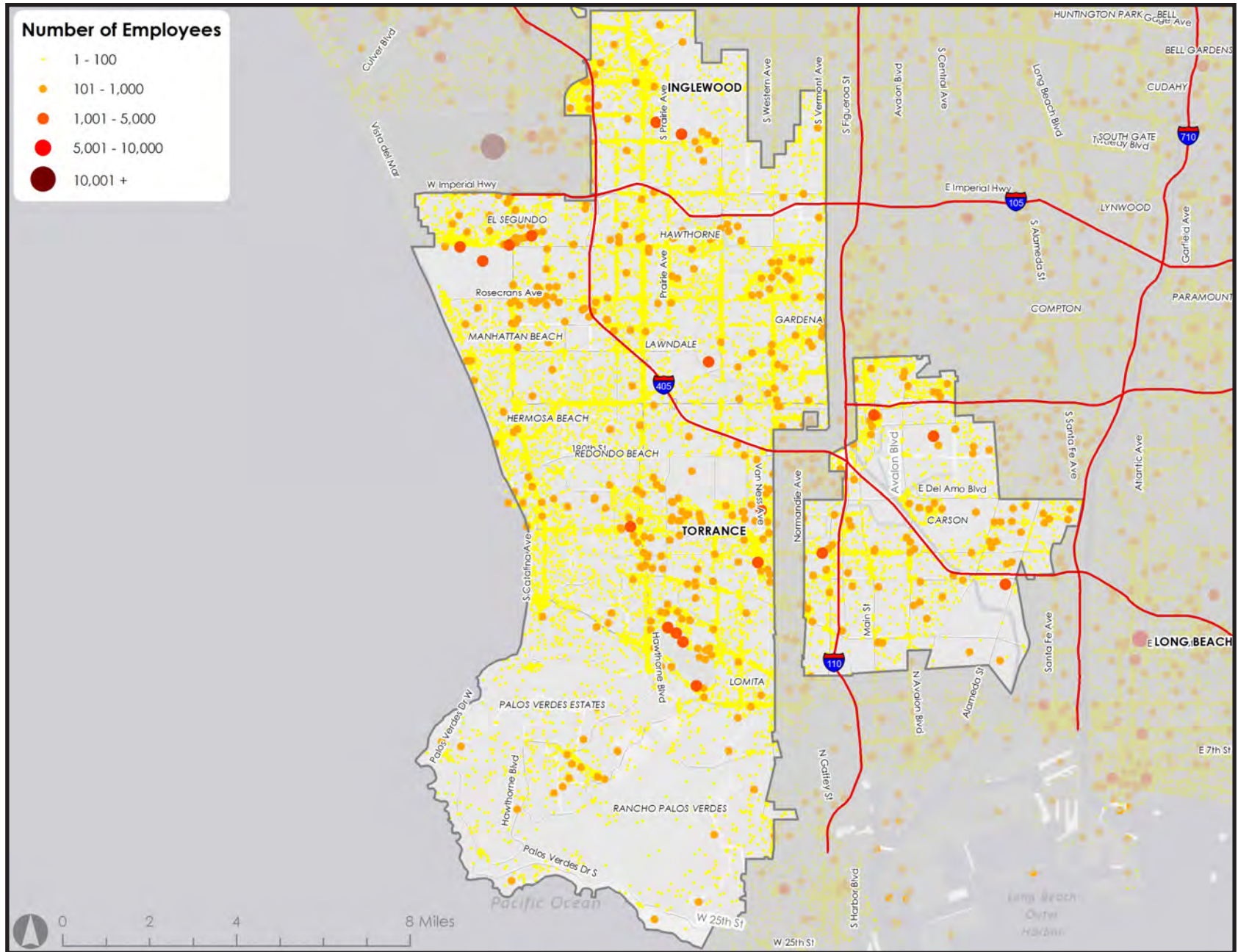


SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

PEV Peak Morning Destinations

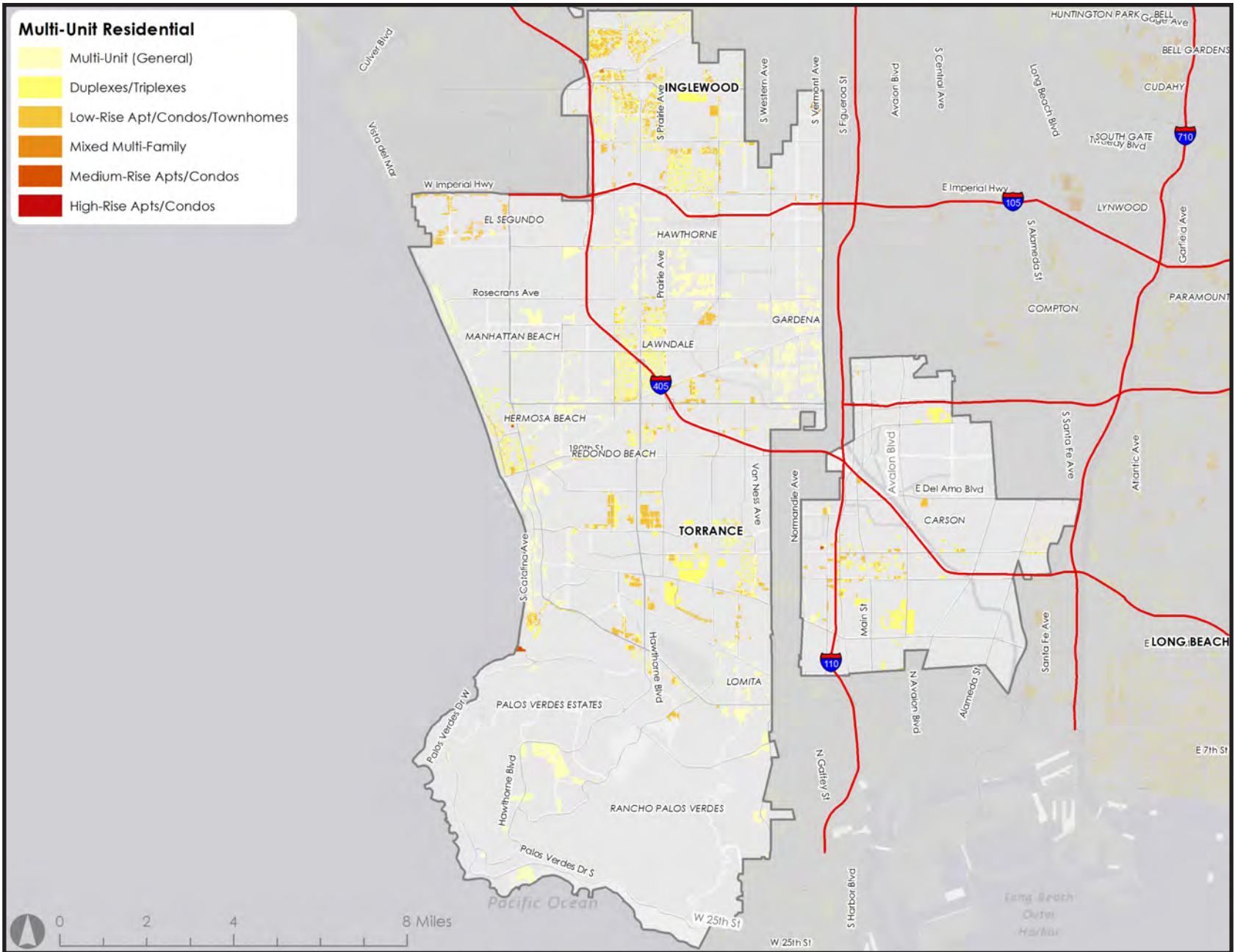


SOUTH BAY CITIES COUNCIL OF GOVERNMENTS Workplaces by Number of Employees



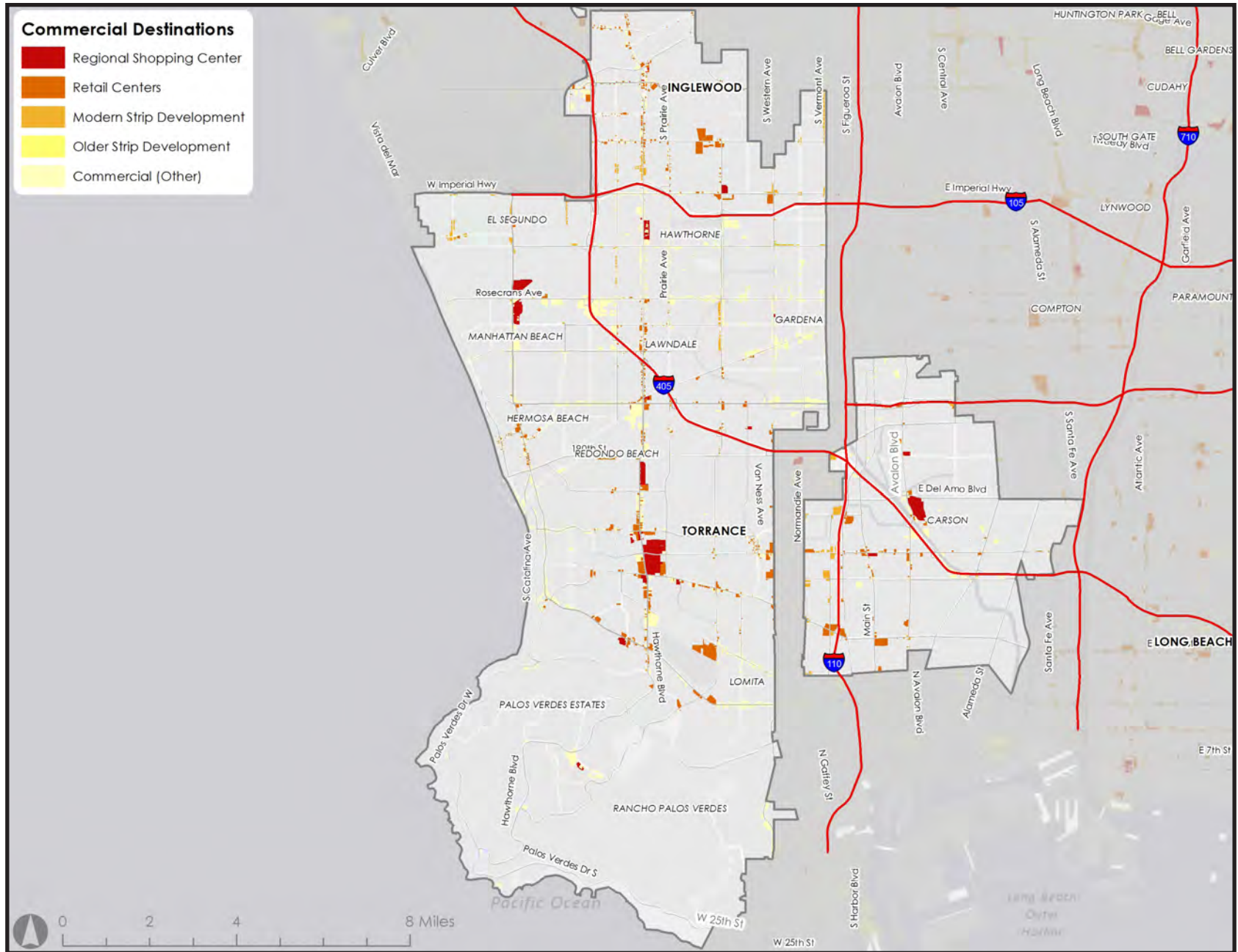
SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

Multi-Unit Residential Land Uses

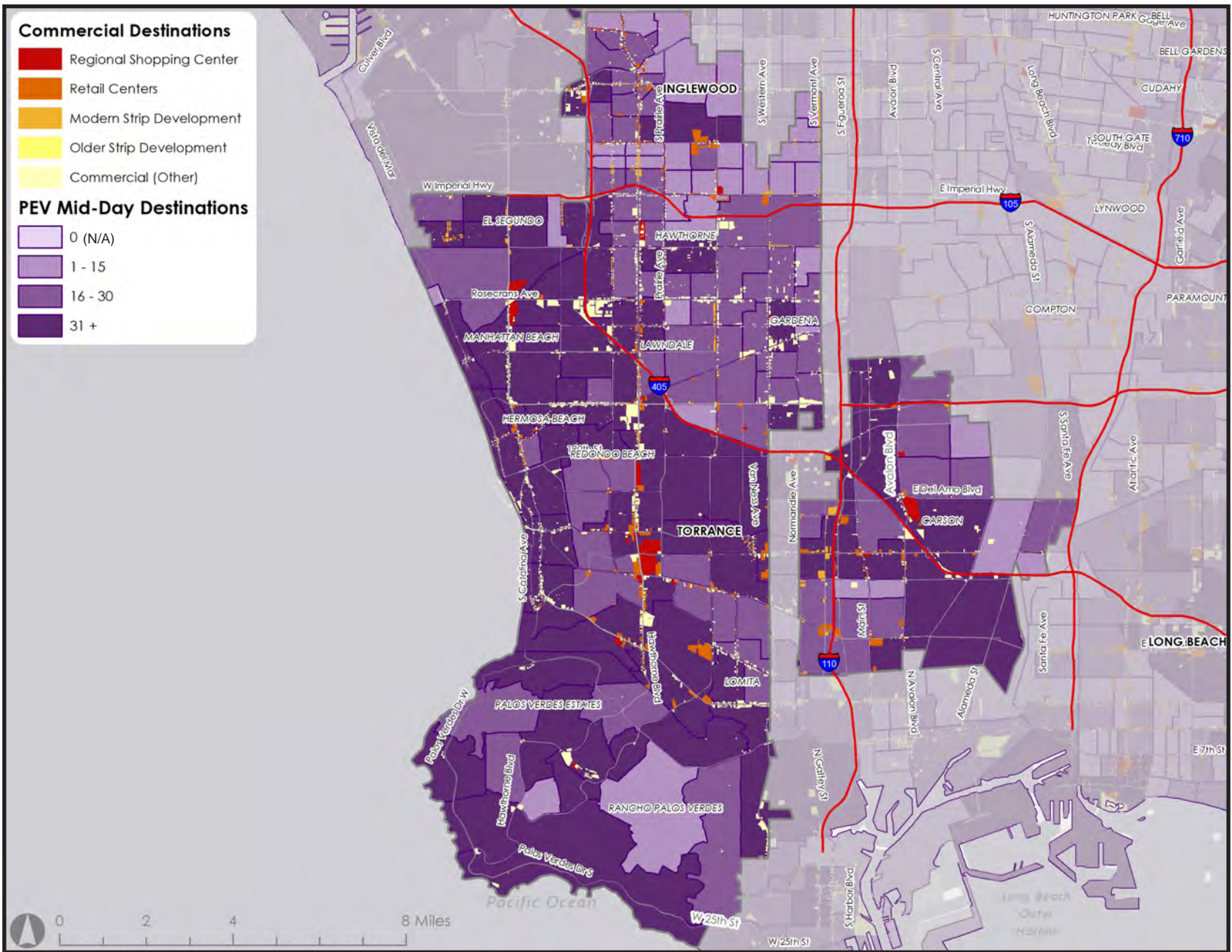


SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

Commercial (Retail) Destinations

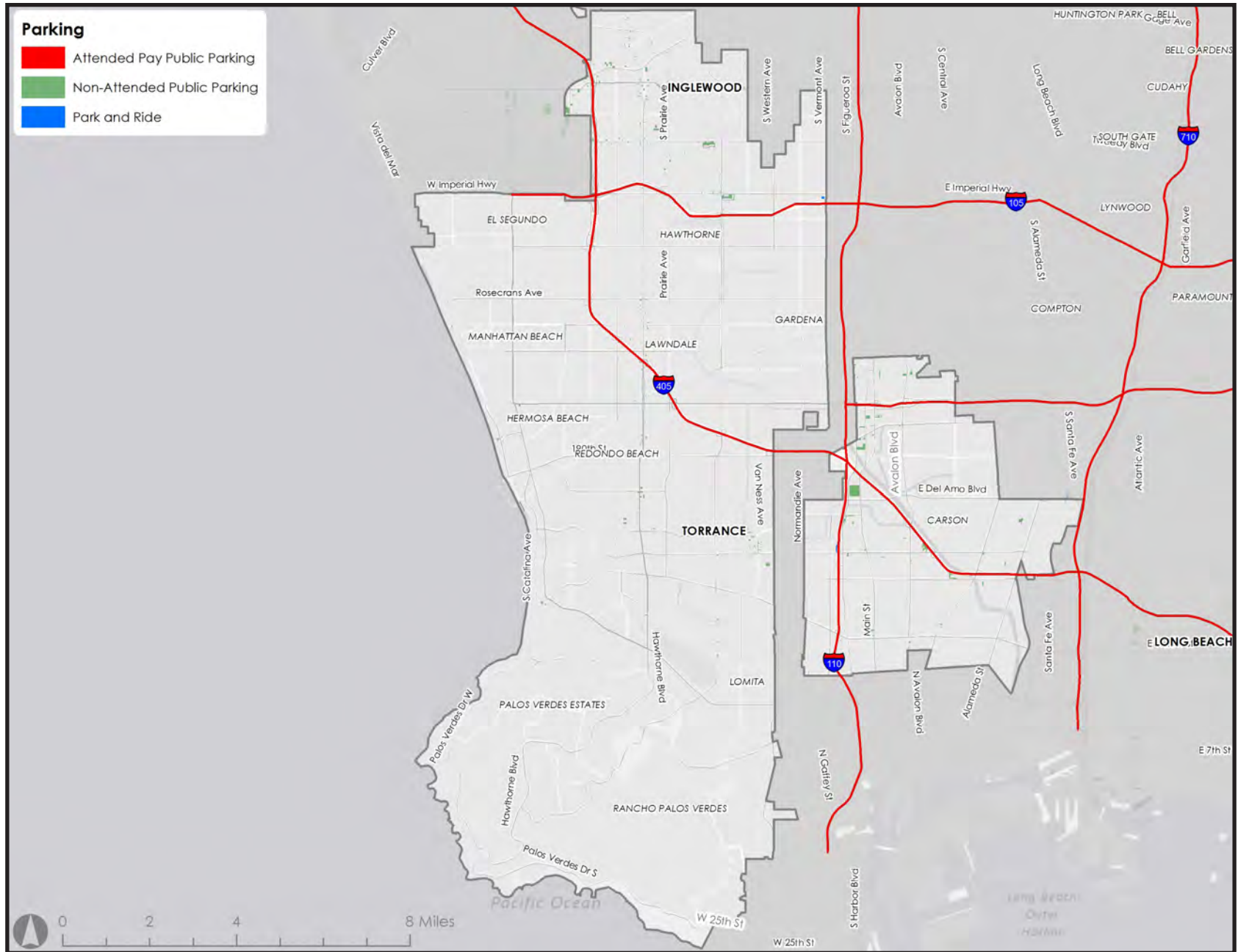


SOUTH BAY CITIES COUNCIL OF GOVERNMENTS PEV Mid-Day Destinations and Commercial (Retail Locations)



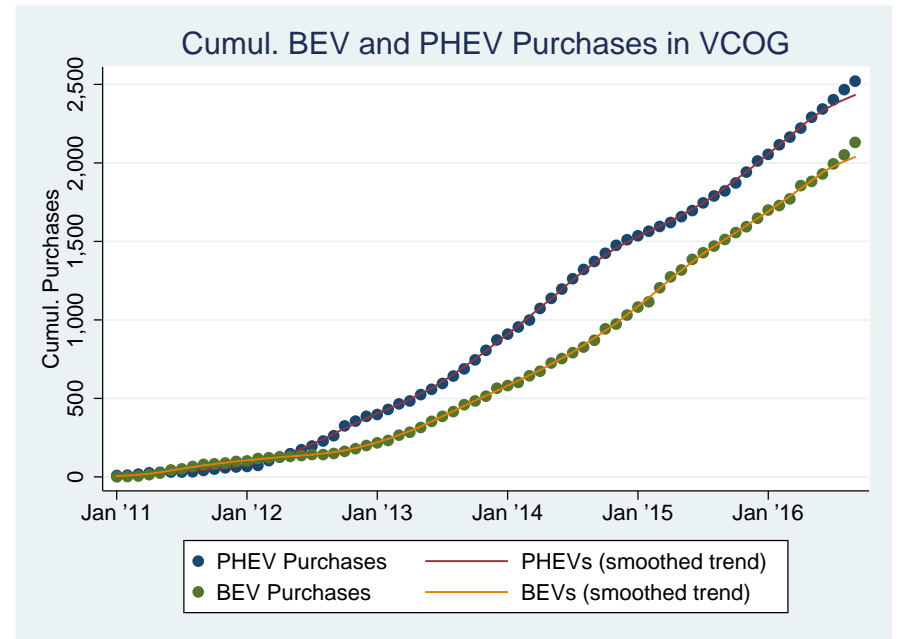
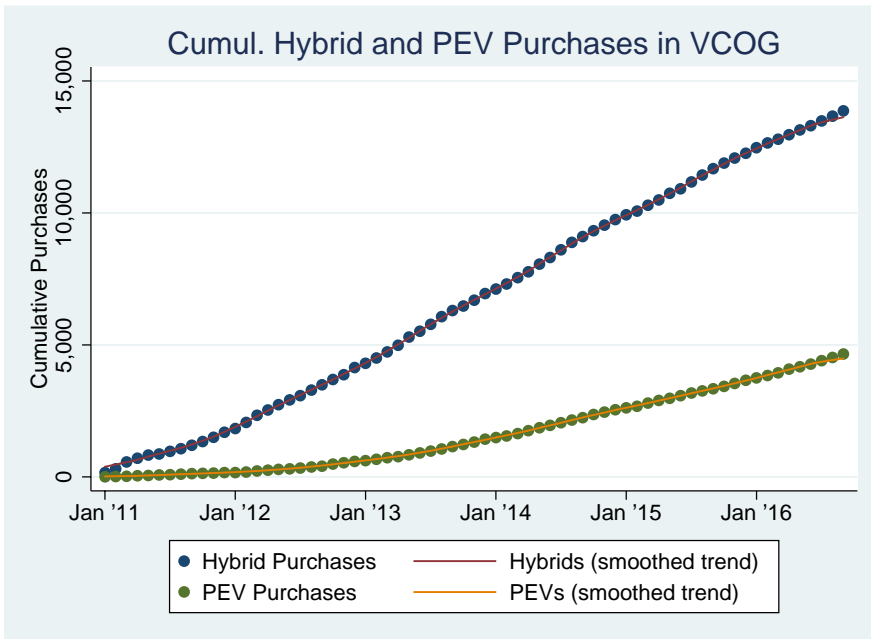
SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

Stand-alone Parking Facilities



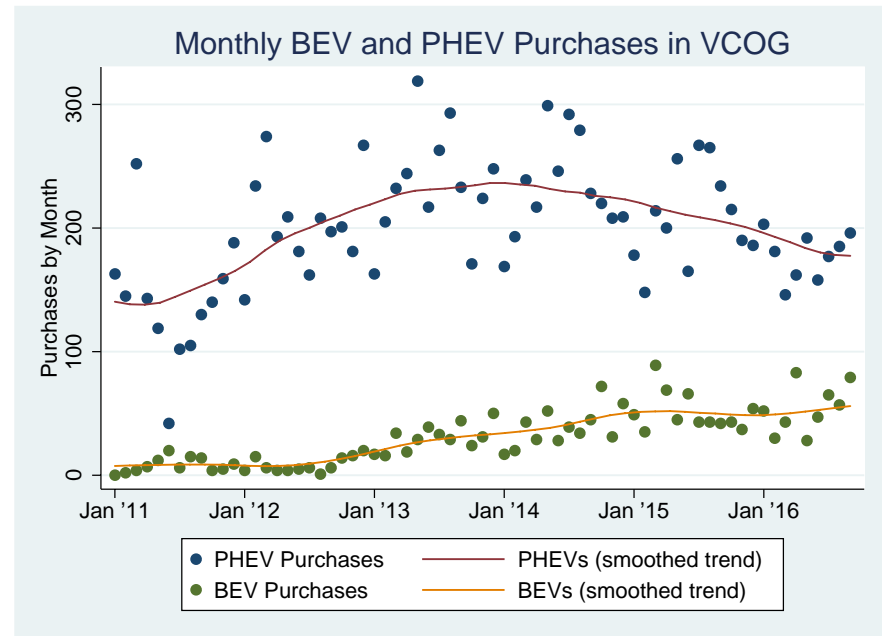
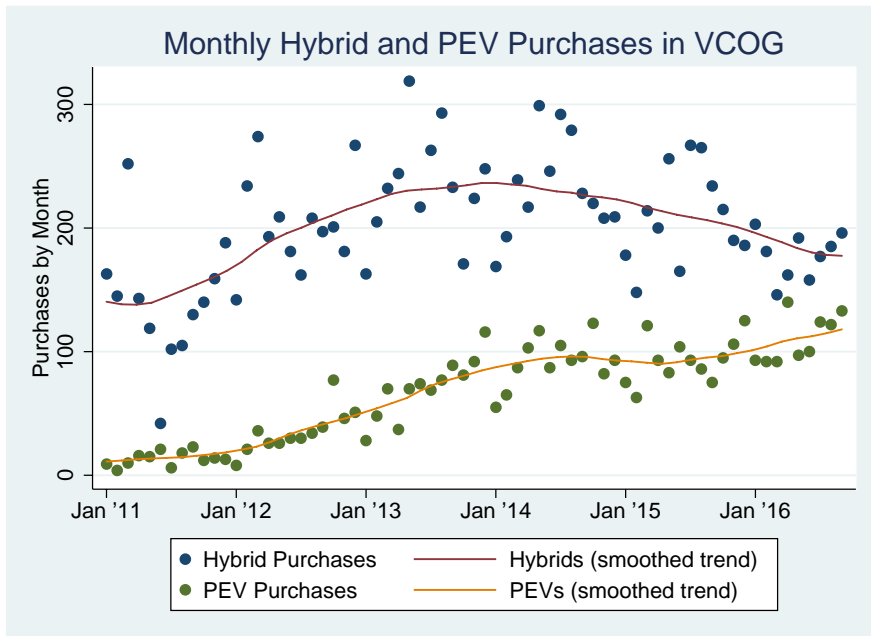
VENTURA COUNCIL OF GOVERNMENTS

Cumulative PEV Growth

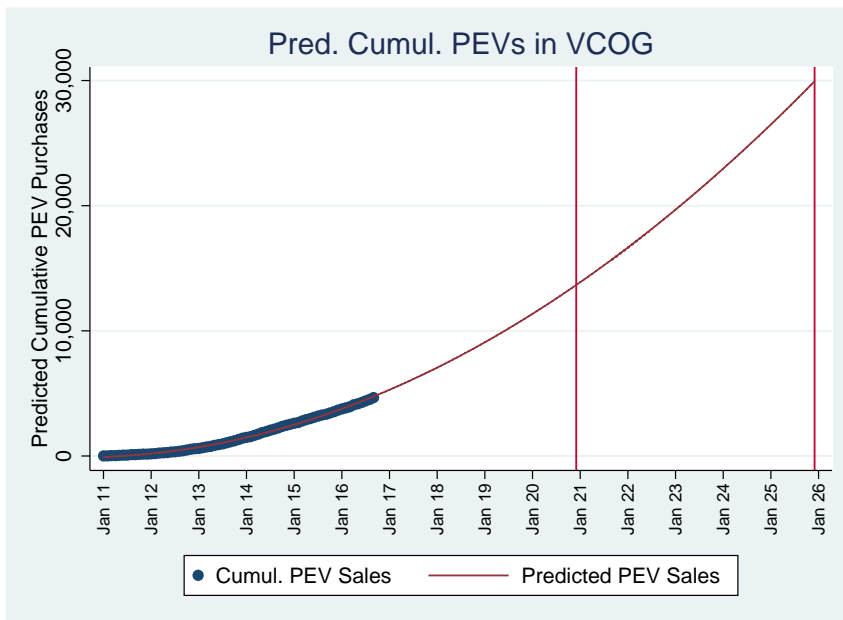


VENTURA COUNCIL OF GOVERNMENTS

Monthly PEV Growth

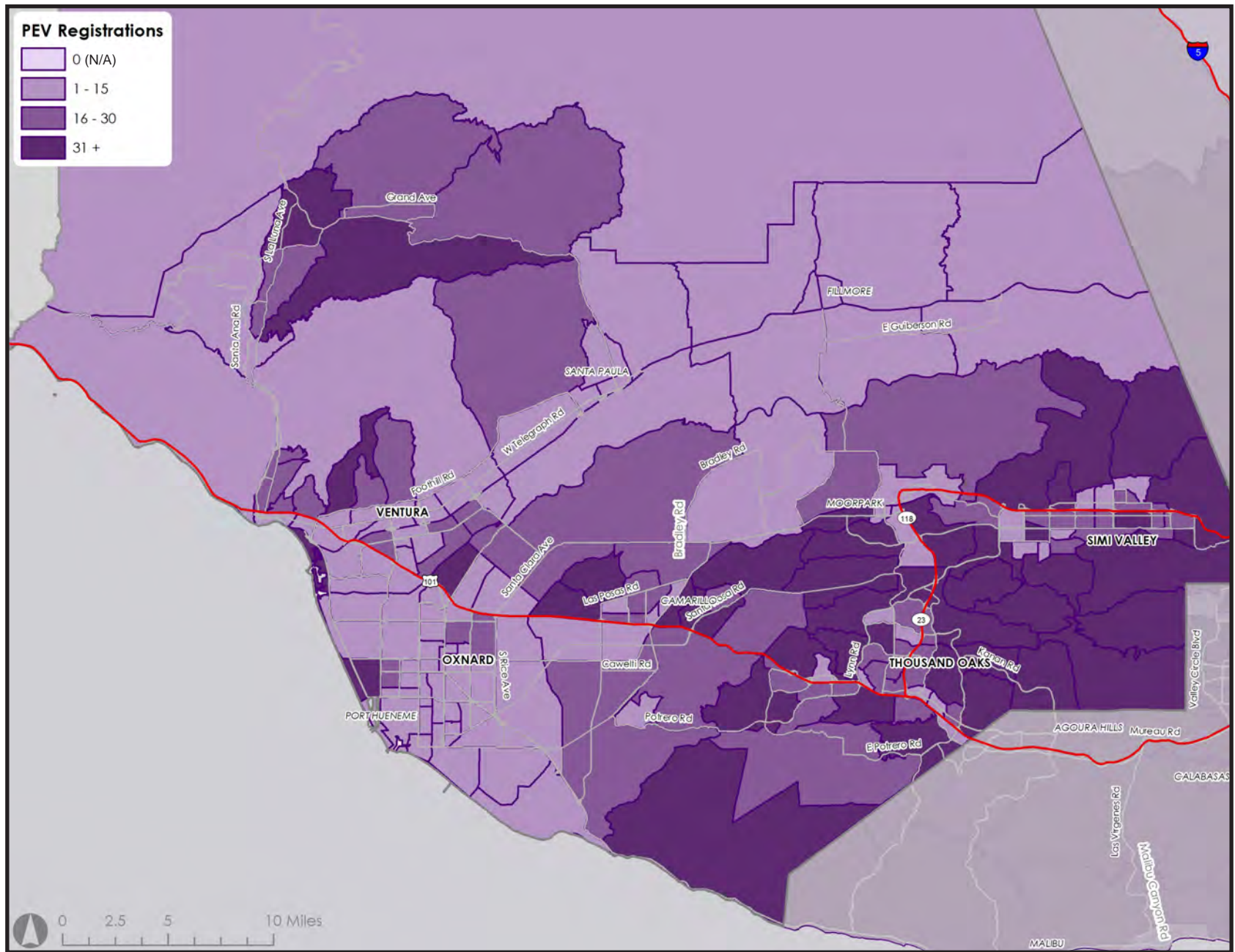


VENTURA COUNCIL OF GOVERNMENTS Projected PEV Growth

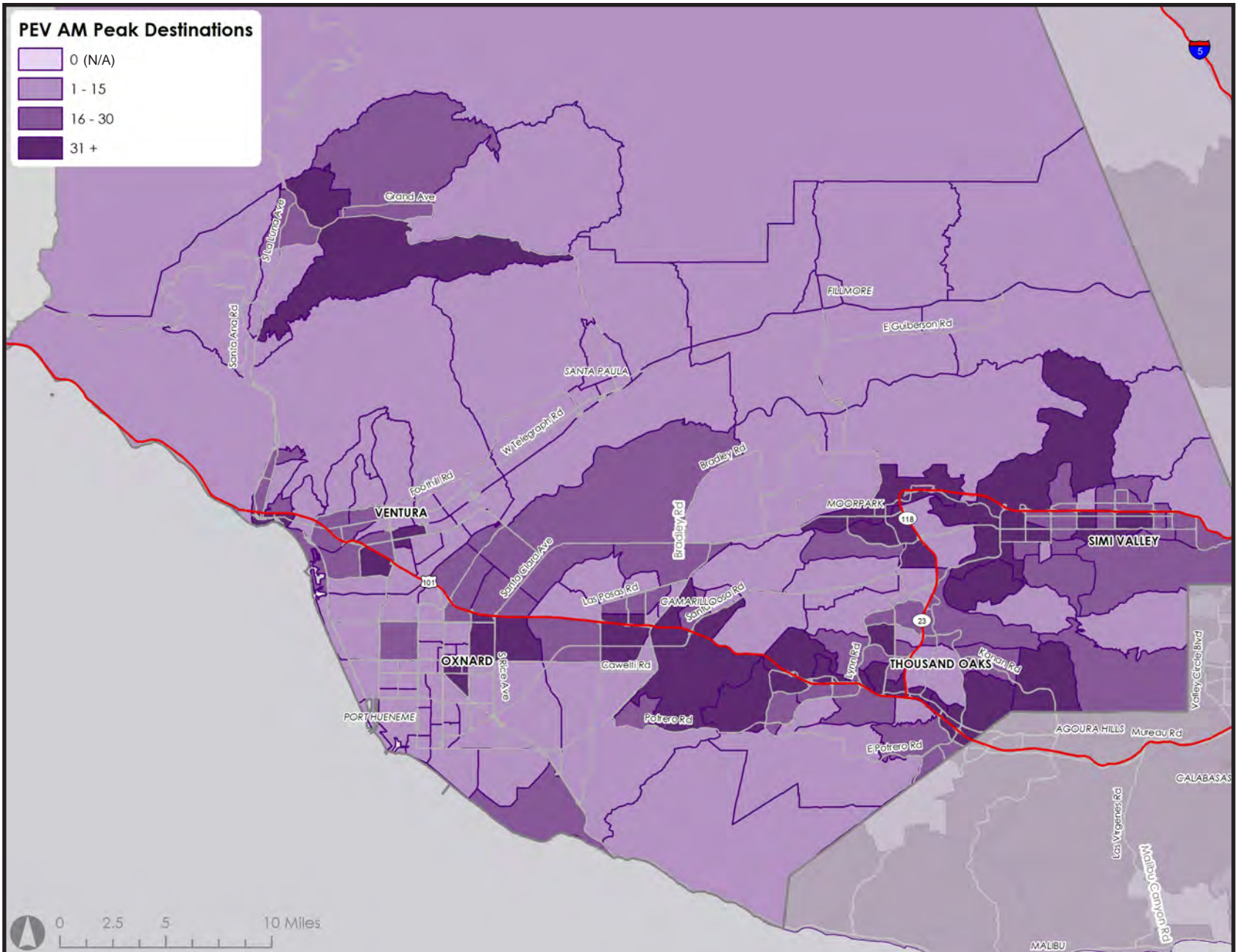


Year	Cumulative Predicted Sales
2016	5,155
2017	6,906
2018	8,908
2019	11,161
2020	13,664
2021	16,419
2022	19,424
2023	22,681
2024	26,188
2025	29,946

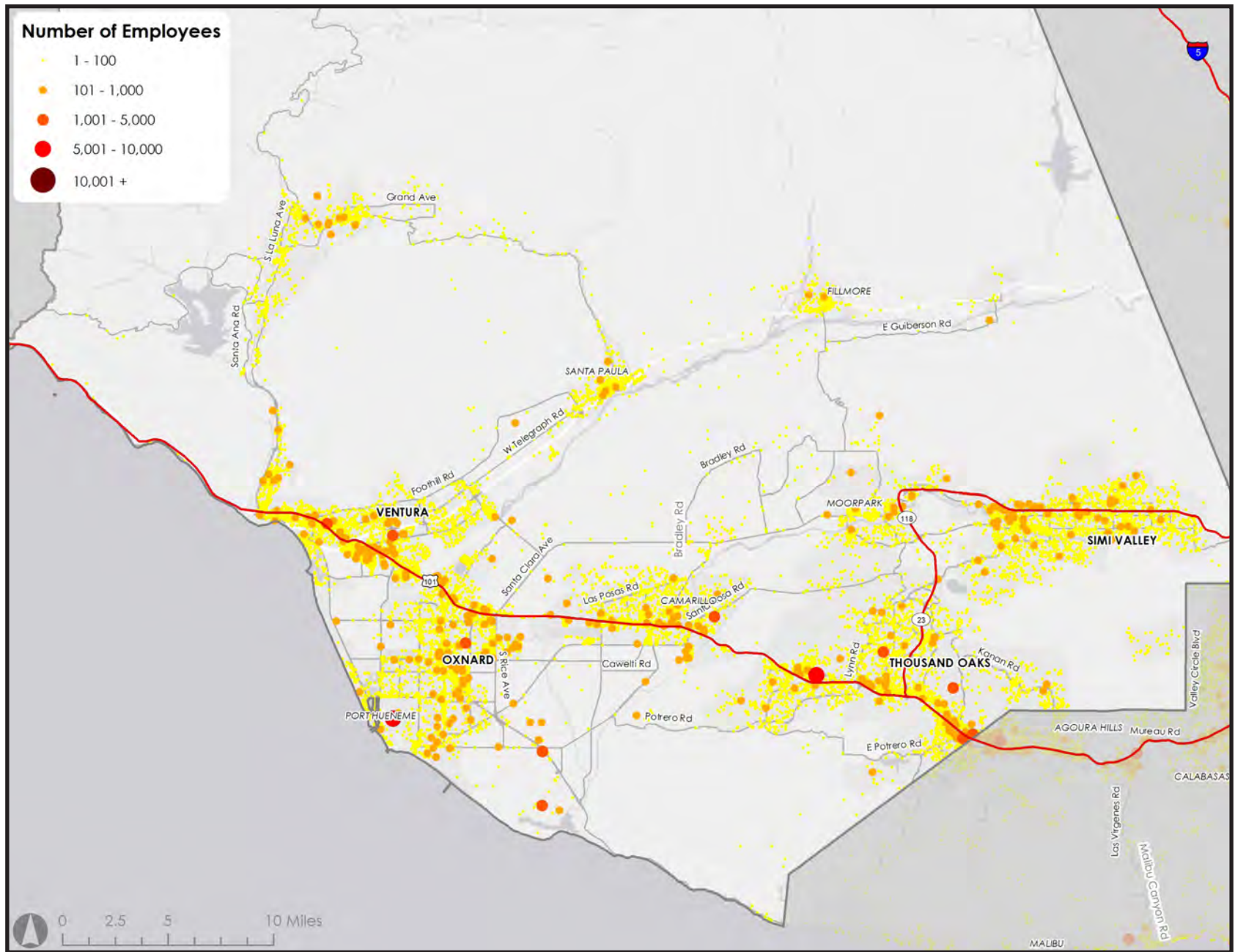
VENTURA COUNCIL OF GOVERNMENTS PEV Registrations



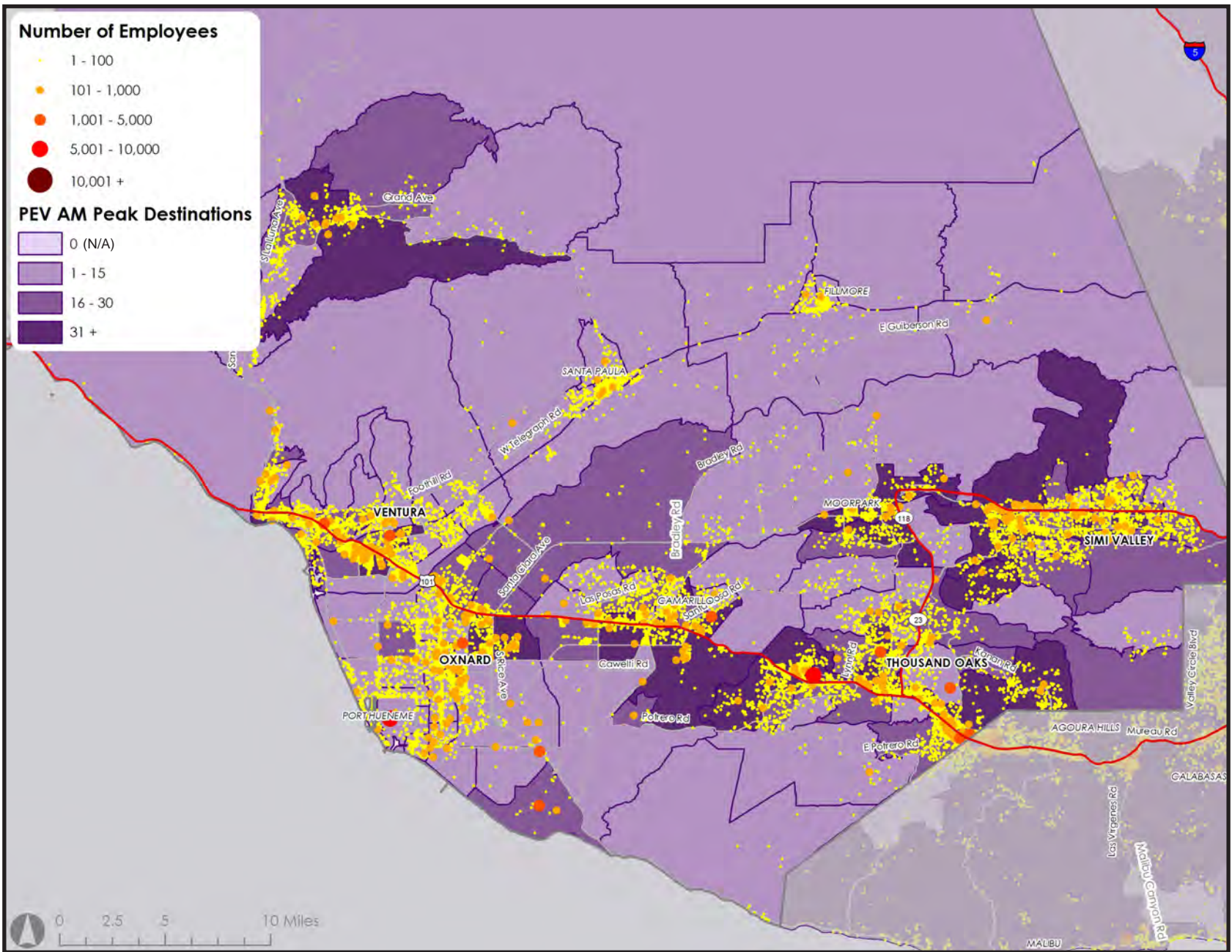
VENTURA COUNCIL OF GOVERNMENTS PEV Morning Peak Destinations



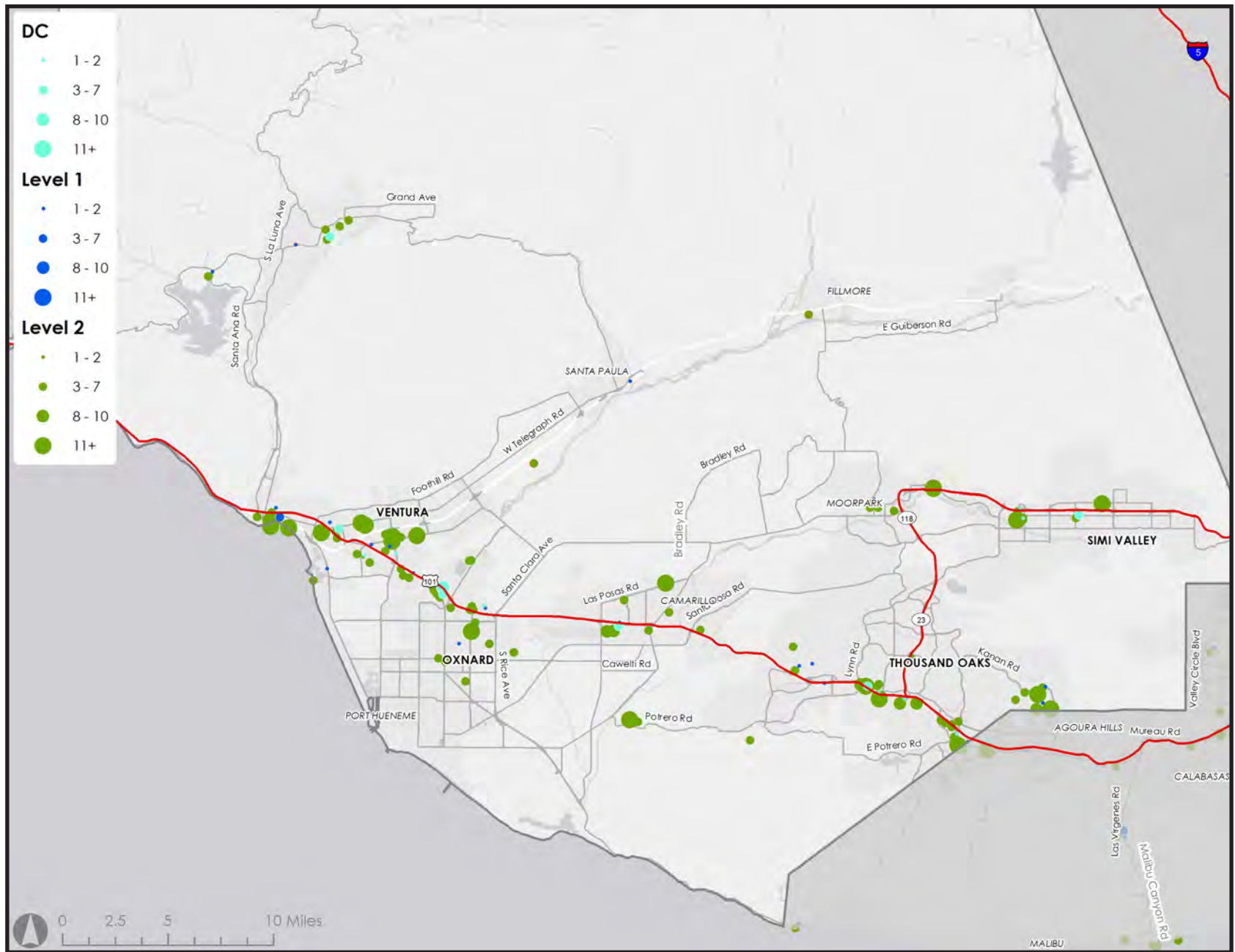
VENTURA COUNCIL OF GOVERNMENTS Workplaces by Number of Employees



VENTURA COUNCIL OF GOVERNMENTS PEV Morning Peak Destinations and Workplaces



VENTURA COUNCIL OF GOVERNMENTS Publicly Accessible Charging Stations

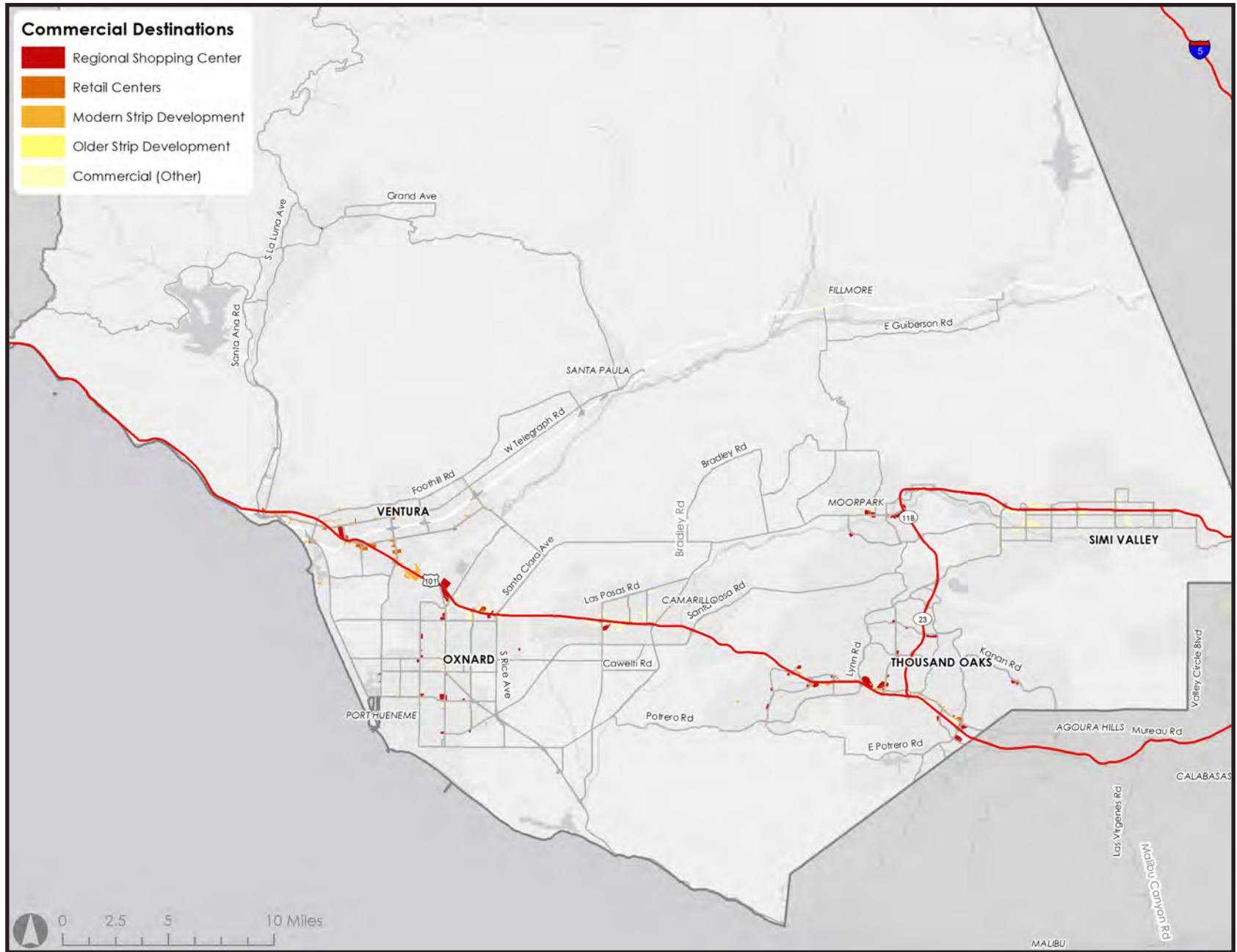


VENTURA COUNCIL OF GOVERNMENTS

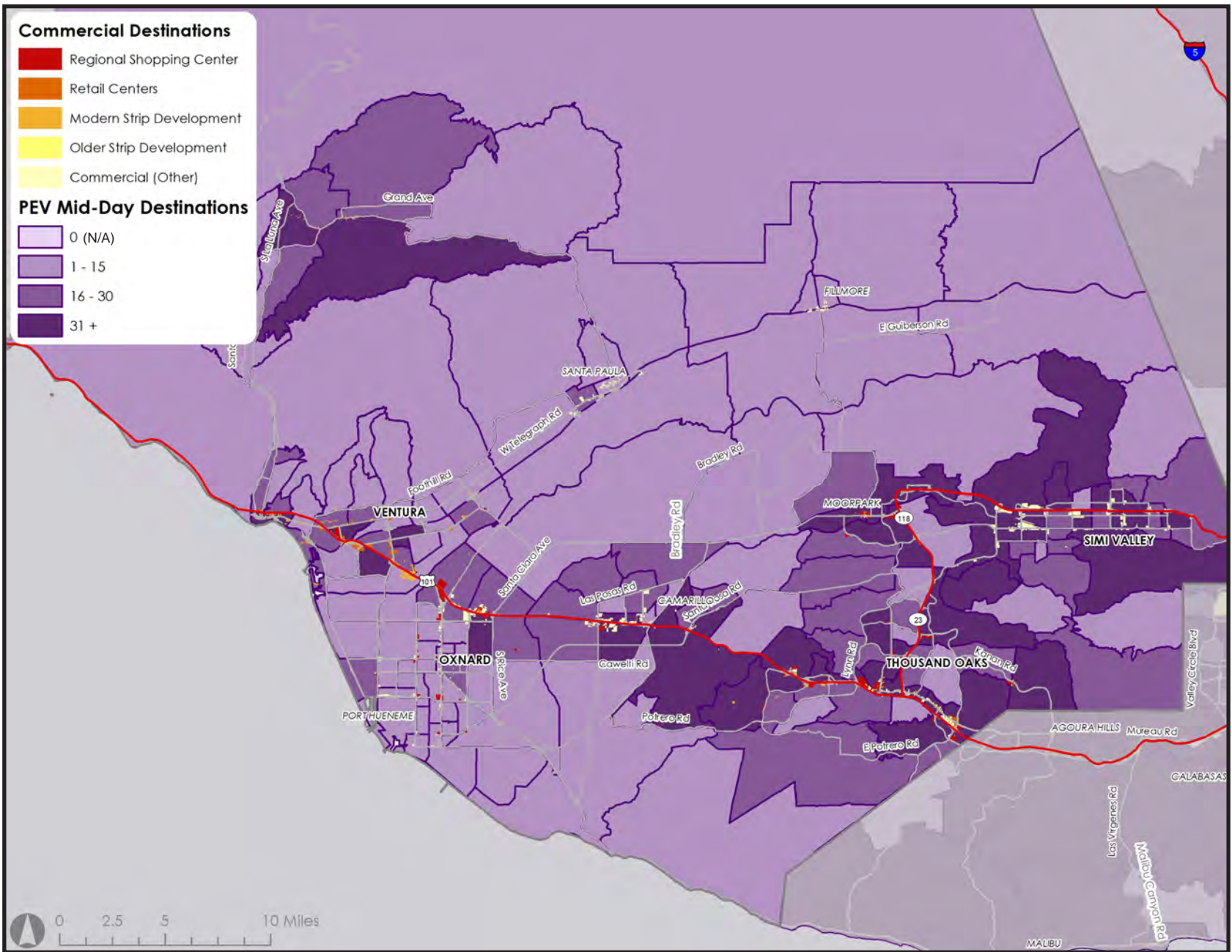
Multi-Unit Residential Land Uses



VENTURA COUNCIL OF GOVERNMENTS Commercial (Retail) Destinations



VENTURA COUNCIL OF GOVERNMENTS PEV Mid-Day Destinations and Commercial (Retail) Locations

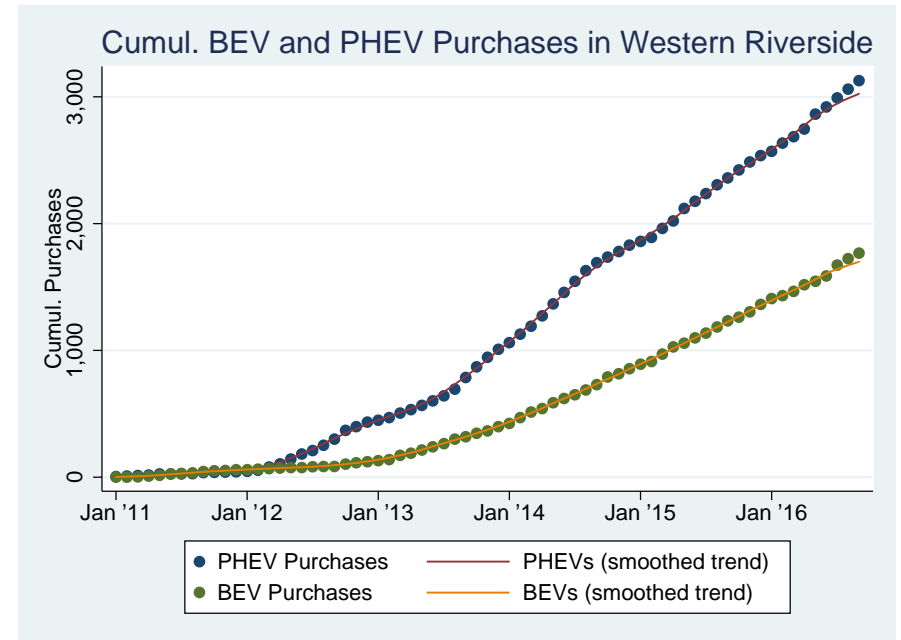
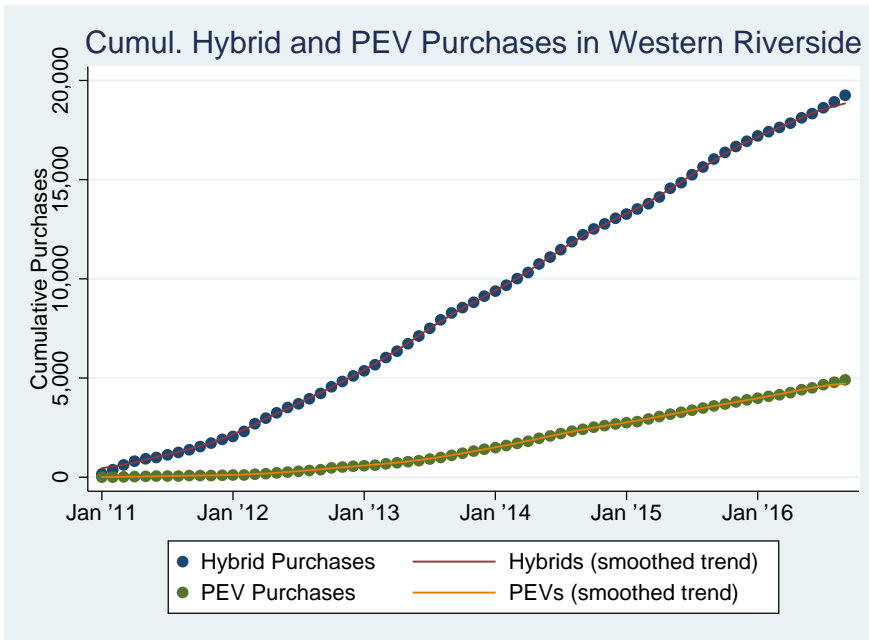


VENTURA COUNCIL OF GOVERNMENTS Stand-alone Parking Facilities



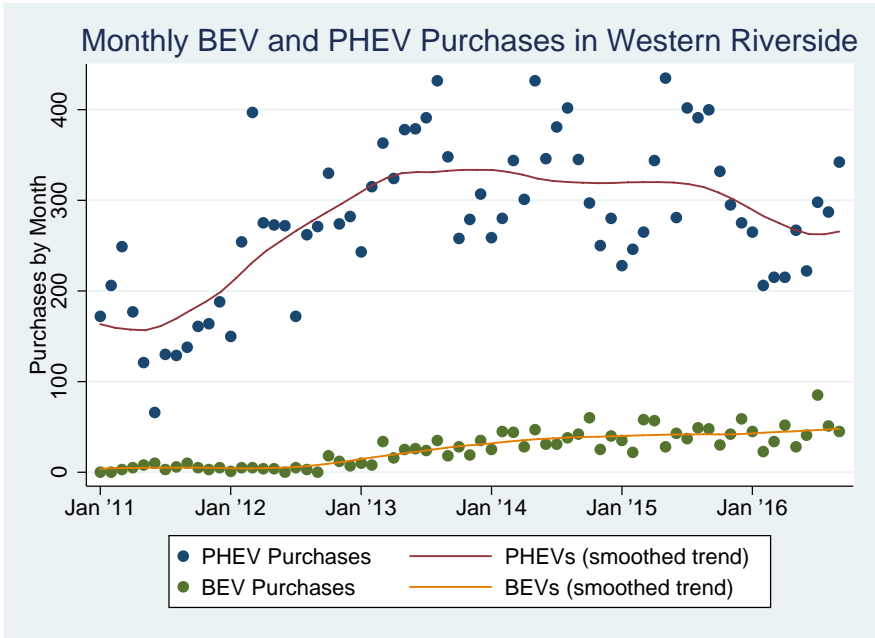
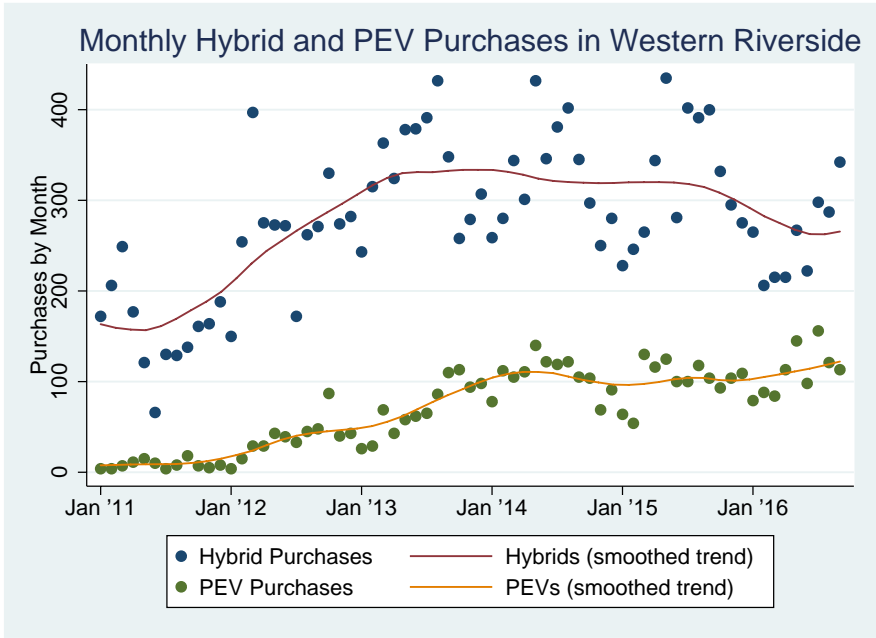
WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS

Cumulative PEV Growth



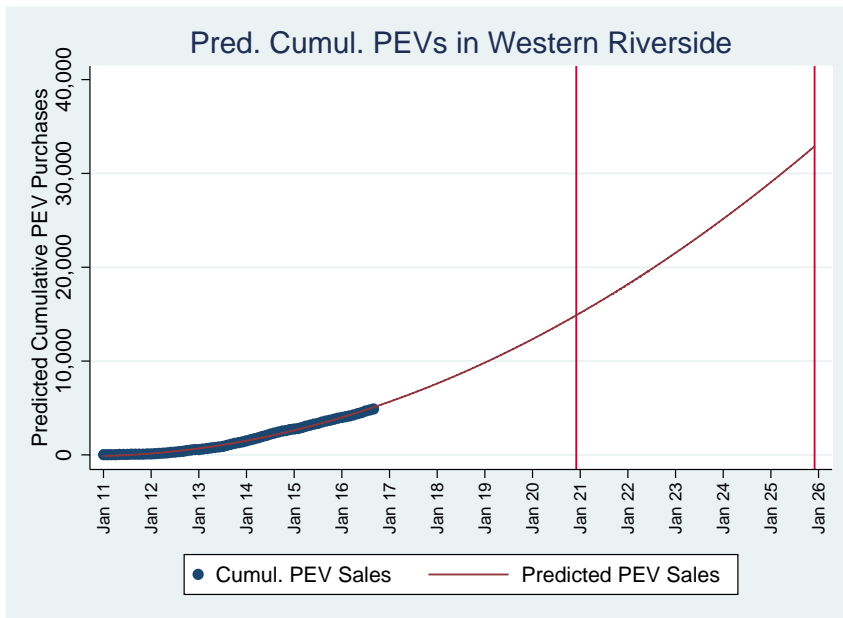
WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS

Monthly PEV Growth



WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS

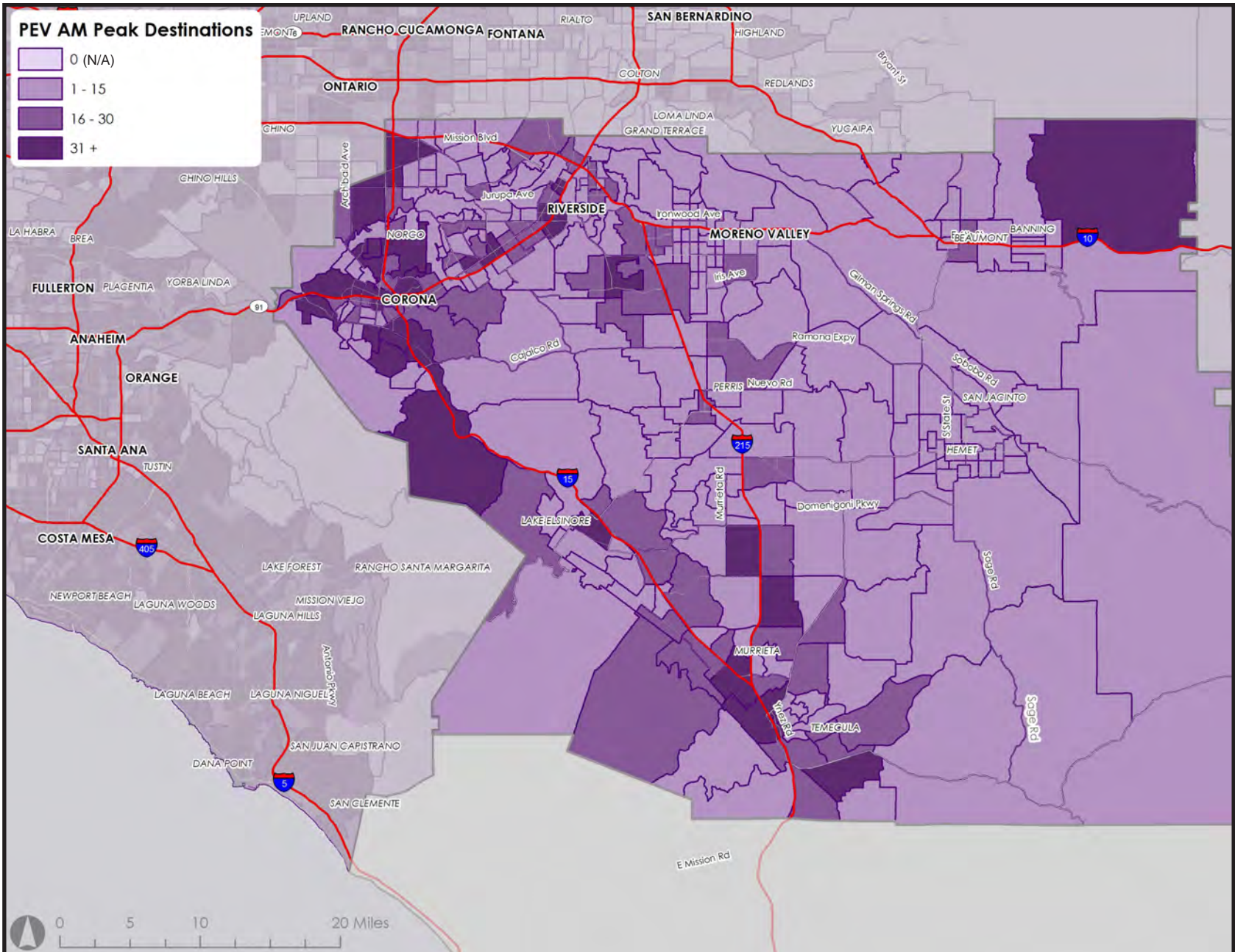
Projected PEV Growth



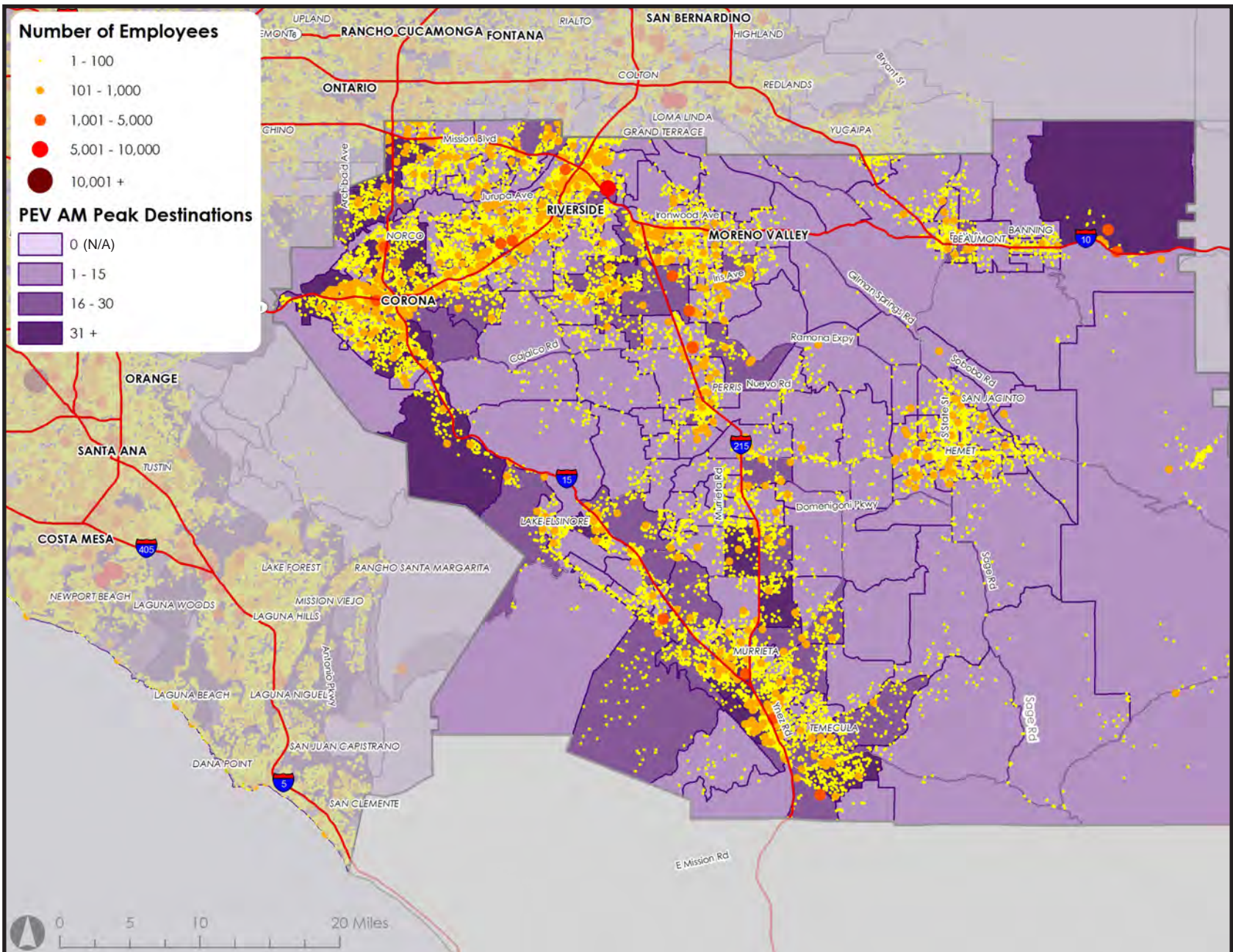
Year	Cumulative Predicted Sales
2016	5,516
2017	7,436
2018	9,637
2019	12,118
2020	14,880
2021	17,922
2022	21,244
2023	24,846
2024	28,729
2025	32,892

WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS

PEV Peak Morning Destinations

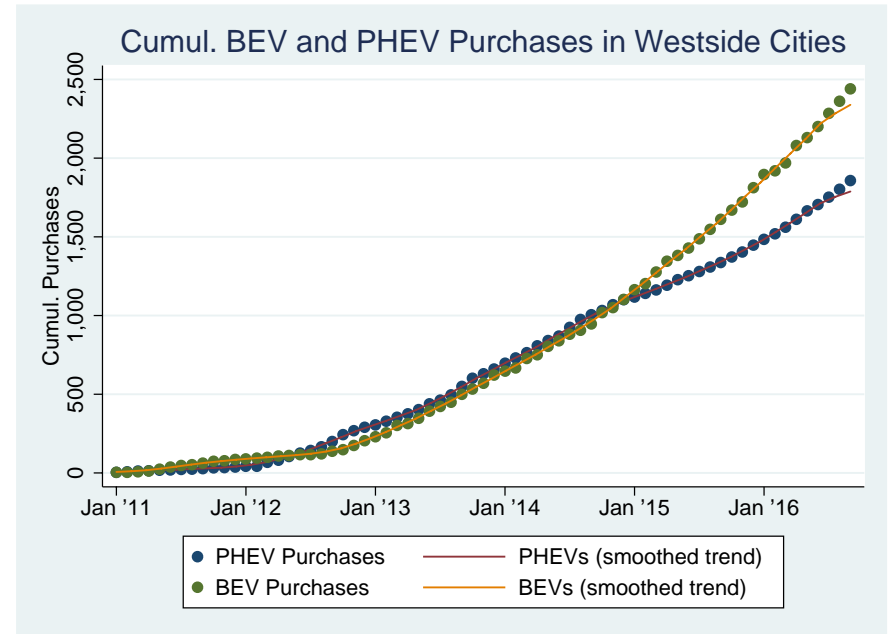
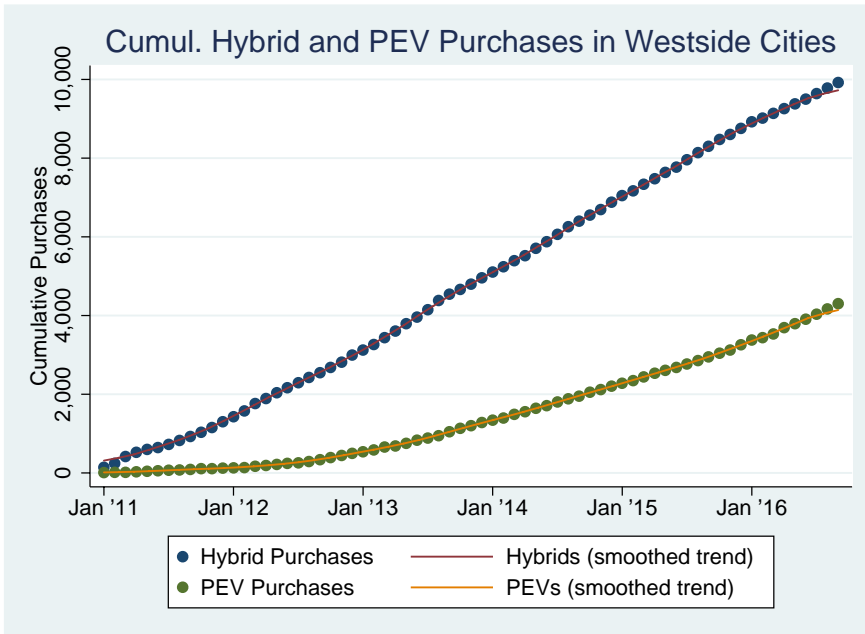


WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations and Workplaces



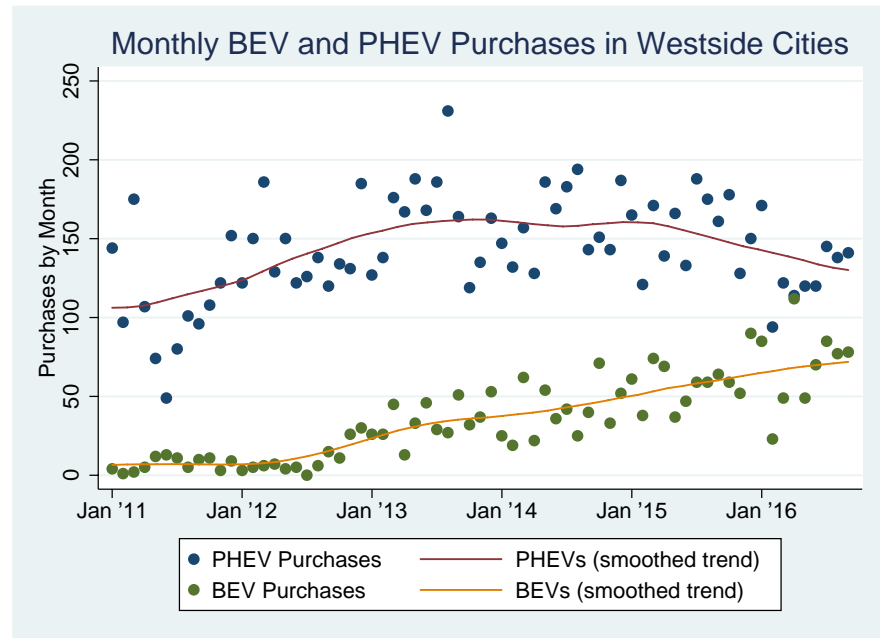
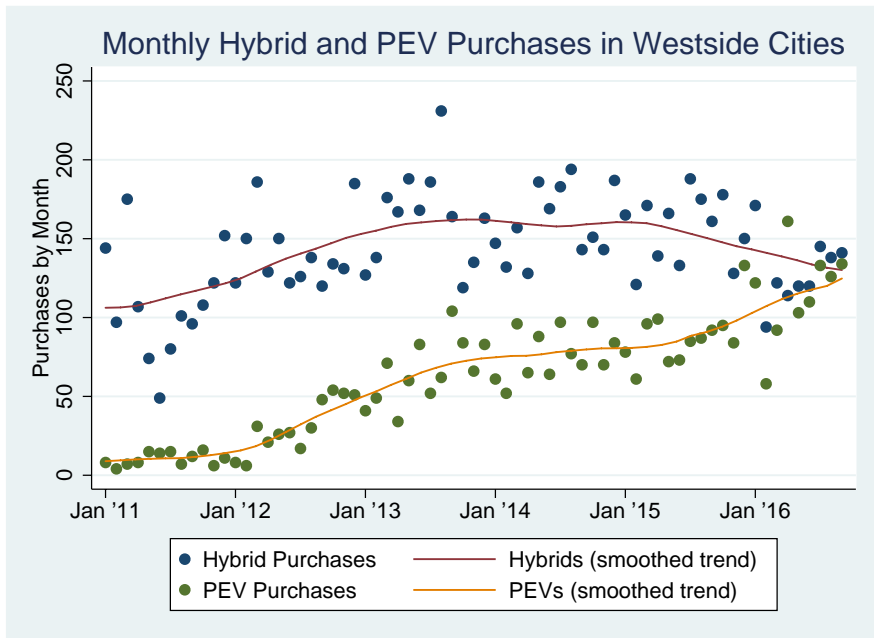
WESTSIDE CITIES COUNCIL OF GOVERNMENTS

Cumulative PEV Growth



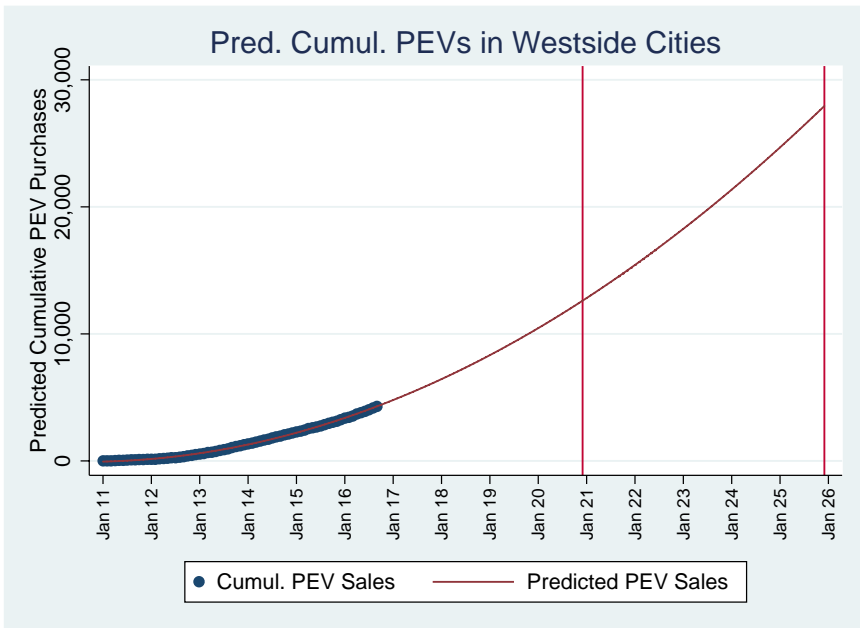
WESTSIDE CITIES COUNCIL OF GOVERNMENTS

Monthly PEV Growth



WESTSIDE CITIES COUNCIL OF GOVERNMENTS

Projected PEV Growth



Year	Cumulative Predicted Sales
2016	4,668
2017	6,295
2018	8,161
2019	10,268
2020	12,614
2021	15,199
2022	18,025
2023	21,090
2024	24,395
2025	27,940

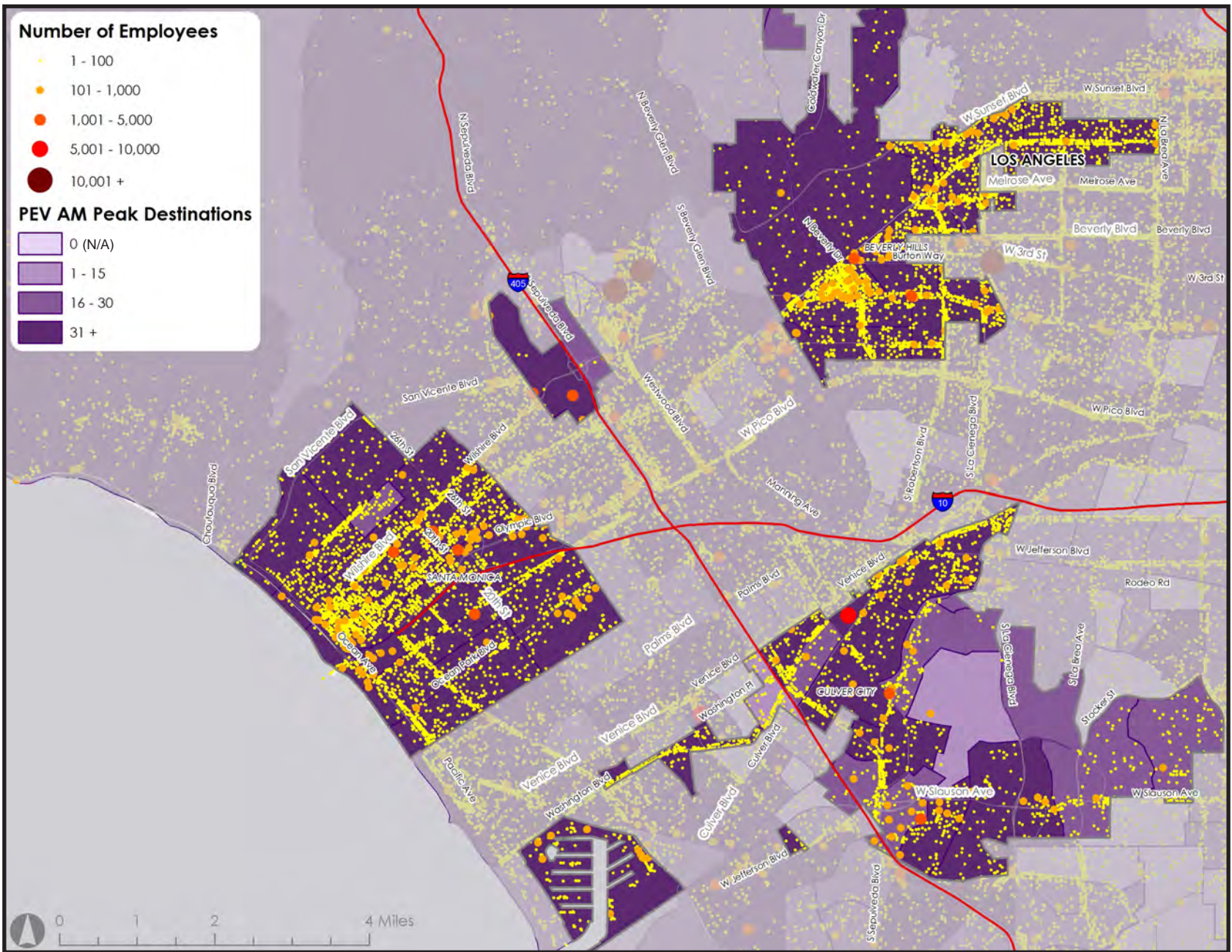
WESTSIDE CITIES COUNCIL OF GOVERNMENTS PEV Registrations



WESTSIDE CITIES COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations

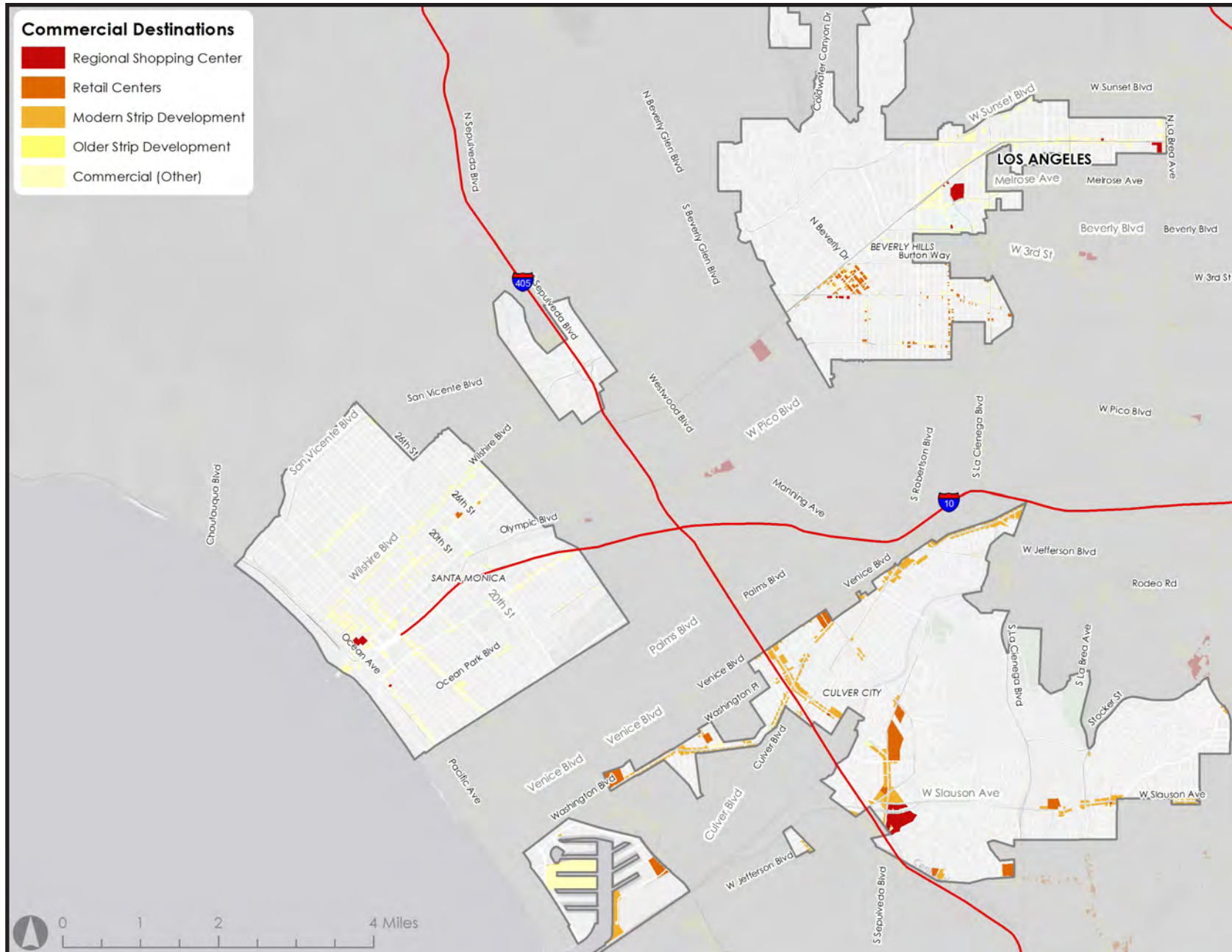


WESTSIDE CITIES COUNCIL OF GOVERNMENTS PEV Peak Morning Destinations and Workplaces



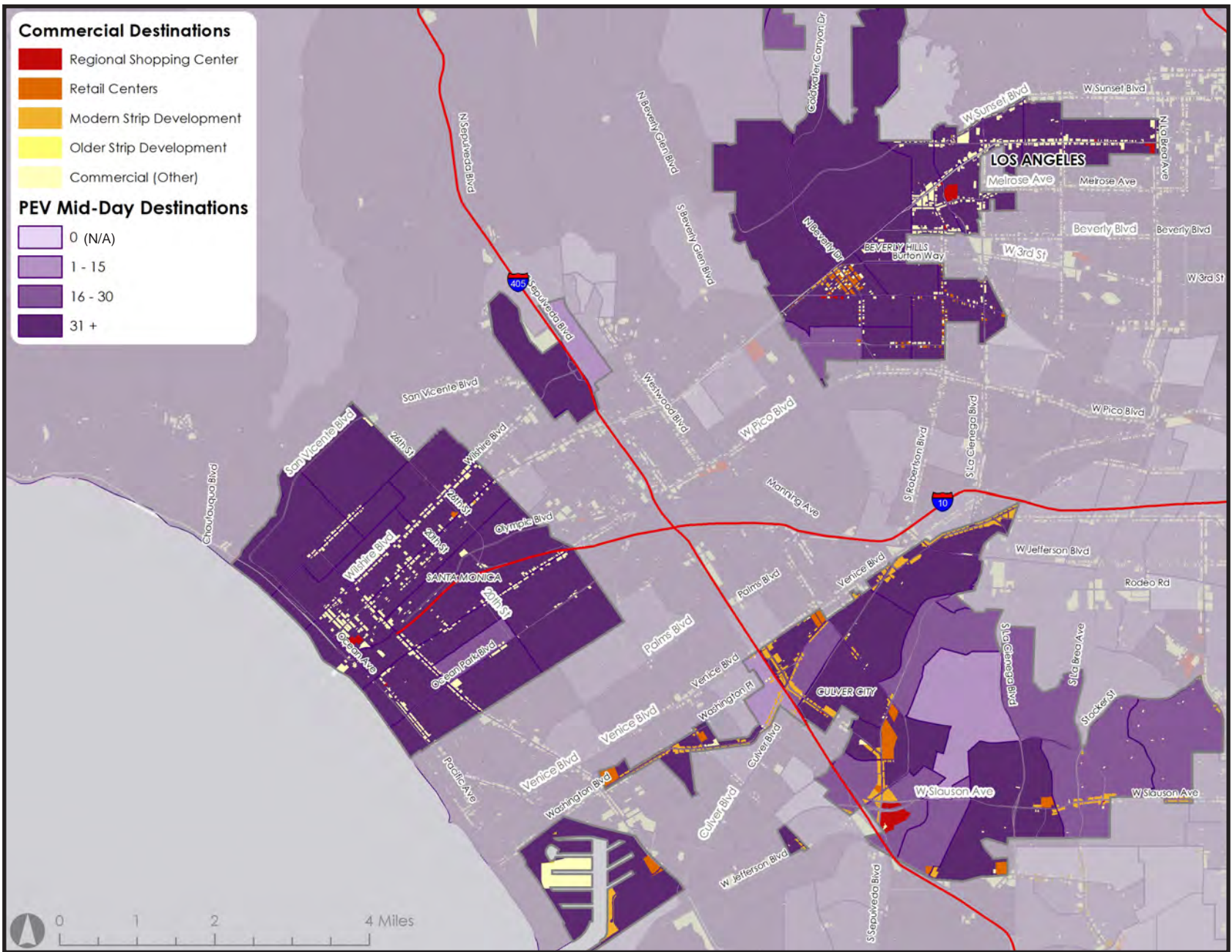
WESTSIDE CITIES COUNCIL OF GOVERNMENTS

Commercial (Retail) Destinations



WESTSIDE CITIES COUNCIL OF GOVERNMENTS

PEV Mid-Day Destinations and Commercial (Retail) Locations



WESTSIDE CITIES COUNCIL OF GOVERNMENTS

Stand-alone Parking Facilities

