FRESNO COUNTY SB 743 IMPLEMENTATION REGIONAL GUIDELINES

Fresno Council of Governments

LSA

Updated June 2025

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Fresno Council of Governments

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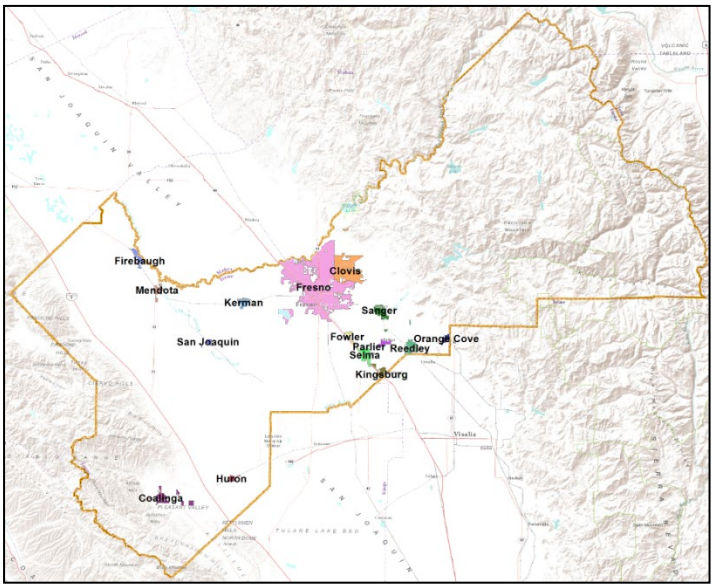
EXECUTIVE SUMMARY

Senate Bill (SB) 743, which became effective July 1, 2020, changes the way transportation impacts are determined in California Environmental Quality Act (CEQA) documents. SB 743 replaces the metric for determining transportation impacts using motor vehicle delay and level of service (LOS) to vehicle miles traveled (VMT) in CEQA traffic impact studies. As a result of the SB 743 final rulemaking and the implementation deadline of July 1, 2020, the Fresno Council of Governments (COG) has prepared this document as a regional guide for the 16 member jurisdictions (illustrated on Figure S-1) in order to assist the member agencies in their shift from a delay-based LOS approach to VMT. The local governments can take the recommendations in the regional guidelines as appropriate based on their individual circumstances (e.g., growth policies and economic development goals). Substantial evidence and explanation on establishing the "Region," VMT screening criteria, and VMT analysis thresholds are also described.



Source: County of Fresno GIS

Figure S-1: Fresno COG Member Jurisdictions—15 Incorporated Cities and County of Fresno

The following topics establish the steps for preparation of VMT analysis. Each topic is discussed in more detail in this report.

- **Definition of "Region:"** Entire Fresno County has been recommended as the region for VMT analysis purposes.

- **Standardized Screening Methods:** Projects within a Transit Priority Area that meet additional requirements (i.e., local-serving retail projects up to 50,000 square feet; residential, office, industrial, or mixed-use projects within low-VMT-generating areas; projects with high percentage affordable housing units; and projects that generate fewer than 500 daily trips) may be screened out from the need for a VMT analysis.

- **Appropriate VMT Significance Thresholds for Development Projects and Community/General Plans:** For all projects (except retail), a significance threshold of 87 percent of the existing regional average of the respective VMT will be the metric. For retail projects, a significance threshold of no net increase in total VMT will be the metric. For mixed-use projects, the VMT thresholds are based on the respective thresholds for the various land use components. Finally, for land use plans, the existing regional average VMT per capita, VMT per employee, and VMT per service population will be the thresholds of significance.

- **Appropriate VMT Significance Thresholds for Transportation Projects:** For capacity-enhancing transportation projects, no additional induced demand would typically be considered as the threshold of significance.

- **Feasible Mitigation Strategies:** A list of VMT mitigation measures applicable to development projects and land use plans in the context of the Fresno COG region are provided for projects that exceed the significance thresholds. Additionally, implementation of a future VMT mitigation bank, VMT mitigation exchange, and/or VMT impact fee are discussed as potential future regional VMT mitigation mechanisms.

The project applicants/analyst should use the latest version of Fresno COG Activity-Based Model (ABM) for VMT analysis purposes. The Fresno COG ABM is the regional travel demand model applicable to jurisdictions within Fresno County. The appropriate use of the Fresno COG ABM for VMT calculations is further elaborated in subsequent chapters of this document

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LIST OF ABBREVIATIONS AND ACRONYMS

AB	Assembly Bill
ABM	Activity-Based Model
ADT	average daily trips
CalEEMod	California Emissions Estimator Model
Caltrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CCR	California Code of Regulations
CCTS	Central California Travel Study
CEQA	California Environmental Quality Act
City	City of Fresno
CO_2e	carbon dioxide equivalent
COG	Council of Governments
EIR	Environmental Impact Report
EO	Executive Order
FAR	floor-to-area ratio
FAX	Fresno Area Express
FHWA	Federal Highway Administration
GHG	greenhouse gas
GWP	global warming potential
HOT	high-occupancy toll
HOV	high-occupancy vehicle
ITE	Institute of Transportation Engineers
LOS	level of service
MPO	Metropolitan Planning Organization
MT	metric tons
NCST	National Center for Sustainable Transportation
O-D	Origin-Destination
OPR	Governor's Office of Planning and Research

PRC	Public Resources Code
RSG	Resource Systems Group, Inc.
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
RTPA	Regional Transportation Planning Agency
SB	Senate Bill
SCAQMD	South Coast Air Quality Management District
SCS	Sustainable Communities Strategy
SHS	State Highway System
SOC	Statement of Overriding Considerations
TA	Technical Advisory
TDM	Transportation Demand Management
VMT	vehicle miles traveled

1.0 INTRODUCTION

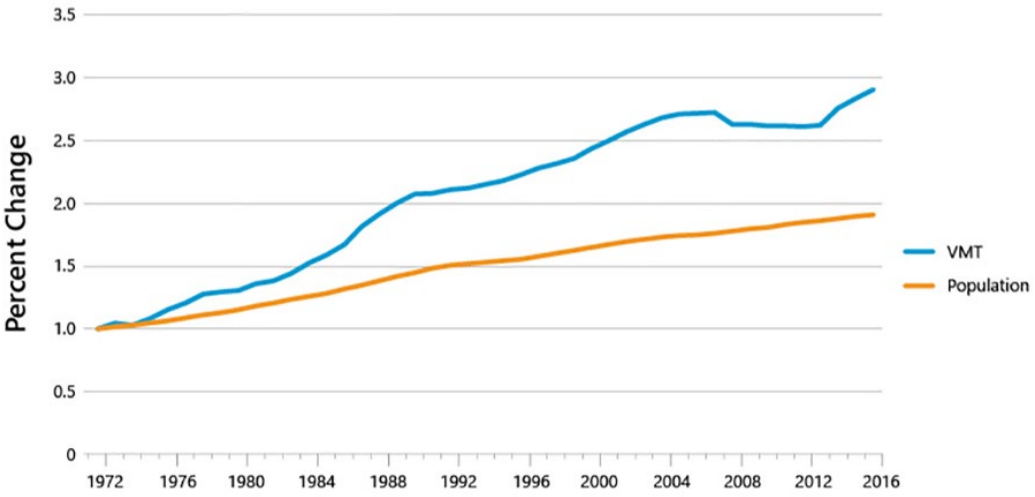
Senate Bill (SB) 743, which became effective July 1, 2020, changes the way transportation impacts are analyzed in the California Environmental Quality Act (CEQA) process. Most notably, rulemaking in support of SB 743 replaces motor vehicle delay, as measured by level of service (LOS), with vehicle miles traveled (VMT) as the metric for use in CEQA transportation impact assessments.

In January 2019, the Natural Resources Agency and the Governor's Office of Planning and Research (OPR) (currently Governor's Office of Land Use and Climate Innovation) codified SB 743 into the Public Resources Code (PRC) and the *State CEQA Guidelines.*

OPR published a Technical Advisory (TA) in December of 2018, as a resource to guide the assessment of the VMT metric, establish thresholds of significance, and recommend mitigation measures. The laws and rules governing the CEQA process are contained in the CEQA statute (PRC Section 21000 and following), the *State CEQA Guidelines* (California Code of Regulations [CCR], Title 14, Section 15000 and following), published court decisions interpreting CEQA, and locally adopted CEQA procedures. The TA is intended as a reference document; it does not have the weight of law. However, any decision to deviate from TA recommendations must be supported by substantial evidence.

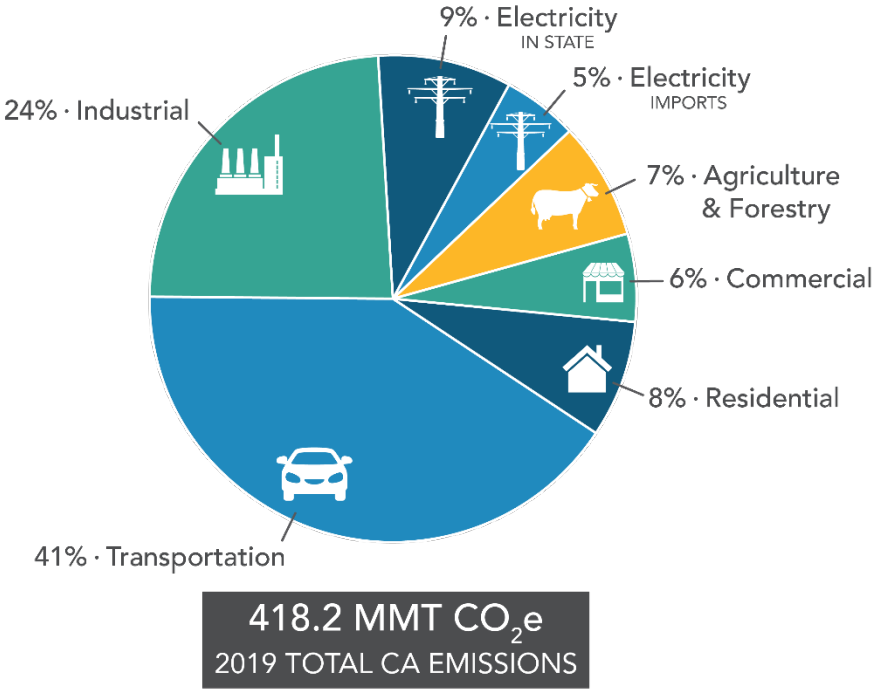
The State of California is committed to reducing greenhouse gas (GHG) emissions and achieving long-term climate change goals. As a means for achieving statewide sustainability and climate goals, California legislation is focused on reducing VMT to achieve statewide climate goals. As shown in Figure 1, over the last 45 years, across the State, VMT has far exceeded that of the State's population increase during the same period. As illustrated on Figure 2, transportation is the single largest sector contributing to California's GHG emissions. Approximately 41 percent of statewide GHG emissions are generated by the transportation sector, primarily passenger cars and light-duty trucks. State mandates pertaining to GHG emissions include reducing the number of single-occupancy vehicle trips and the length of vehicle trips.

To assist the member jurisdictions in shifting from LOS to VMT as the CEQA metric and help establish their own guidelines, the Fresno COG initiated an effort for developing regional guidance that will be applicable for projects within the Fresno region. This guidance document also aimed to provide substantial evidence and rationale for establishing VMT analysis requirements, thresholds of significance, screening criteria, and analysis methodology as well as feasible mitigation measures that will be applicable for projects within Fresno County. In July 2020, the Fresno COG adopted the *Fresno County SB 743 Implementation Regional Guidelines* and dedicated a section in the Fresno COG website to demonstrate a step-by-step process of recommended methodology for VMT analysis within the Fresno region. Some minor updates to the VMT thresholds were further implemented in January 2021. An online VMT screening tool and a Microsoft Excel-based VMT analysis tool for small projects were also developed and shared with the member jurisdictions to be used for purposes of VMT analysis.



Source: https://ca50million.ca.gov/transportation/

Figure 1: VMT Per Capita Compared to Population in California



Source: https://ww2.arb.ca.gov/ghg-inventory-data

Figure 2: 2019 GHG Emissions in California by Economic Sector

However, based on evaluation of VMT analysis practices throughout the Central Valley and within the entire State, as well as to account for an update to the Fresno COG ABM and corresponding VMT metric thresholds, an update of the *Fresno County SB 743 Implementation Regional Guidelines* is being prepared. That document provides a guide and substantial evidence for the Fresno COG and its member jurisdictions in setting the thresholds of significance for CEQA transportation studies.

This report is organized into the following seven chapters:

- **Chapter 1 – Introduction:** This chapter establishes the purpose and objective of this report.

- **Chapter 2 – Definition of Region: Vehicle Miles Traveled Context:** This chapter describes the comparative geographic baseline of a region for analysis purposes to determine the appropriate region for VMT analysis.

- **Chapter 3 – Project Screening:** The OPR acknowledges that certain projects are either low VMT generators or, by virtue of their location, would have a less than significant impact. This chapter provides the screening criteria to identify potentially exempt projects.

- **Chapter 4 – Threshold and VMT Analysis for Land Use Development Projects:** This chapter identifies the VMT thresholds of significance that would result in a significant CEQA impact. The actual VMT metric (either an efficiency rate or total VMT) is described. The process of VMT analysis is also described in this chapter.

- **Chapter 5 – Threshold and Induced VMT Analysis for Transportation Projects:** This chapter describes the method to evaluate significant CEQA impacts associated with transportation projects. Many non-vehicular capital projects are presumed to have a less than significant impact. Capacity enhancing projects may have significant impacts and may be subject to a detailed analysis that will include measuring induced travel.

- **Chapter 6 – Threshold Recommendations for Land Use Plans:** This chapter provides guidance and substantial evidence to support the region's treatment of land use plans and their related CEQA transportation impact analysis requirements.

- **Chapter 7 – Mitigation Strategies:** The discussion provided in this chapter is intended as a reference and guide for use in the identification of feasible VMT mitigation options that may be used to offset project-related VMT impacts. It should be noted that this discussion is not intended to represent a full list of VMT mitigation measures available or feasible to the City of Fresno (City). As in previous CEQA practice, it is generally the lead agency who identifies mitigation measures to offset the specific project-related impacts identified in an environmental document.

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2.0 DEFINITION OF REGION: VEHICLE MILES TRAVELED CONTEXT

To quantify a project's impact related to the VMT metric, a geographic context must be established. In the motor vehicle delay-based (LOS) analyses, a project study area is the geographic context for measuring a project's traffic impacts. A project study area is generally determined by the incremental increase in traffic generated by the project and the project's potential to create travel delays in the area. This generally includes intersections and roadway segments where the project would add a prescribed number of peak-hour trips. Lead agencies typically limit the LOS-based project study area boundaries within their jurisdictions.

Delay-based LOS analyses evaluate intersections or segments of roadways and so they consider portions of trips at specific locations and do not take into consideration the effect of the entire trip length (from starting location to ending location). Hence, unlike delay-based LOS analyses, VMT produces a regional impact that is not limited by roadway, intersection, or jurisdictional boundaries. The OPR acknowledges this in its TA (page 6), which states,

> *Lead agencies should not truncate any VMT analysis because of jurisdictional or other boundaries, for example, by failing to count the portion of a trip that falls outside the jurisdiction or by discounting the VMT from a trip that crosses a jurisdictional boundary.*

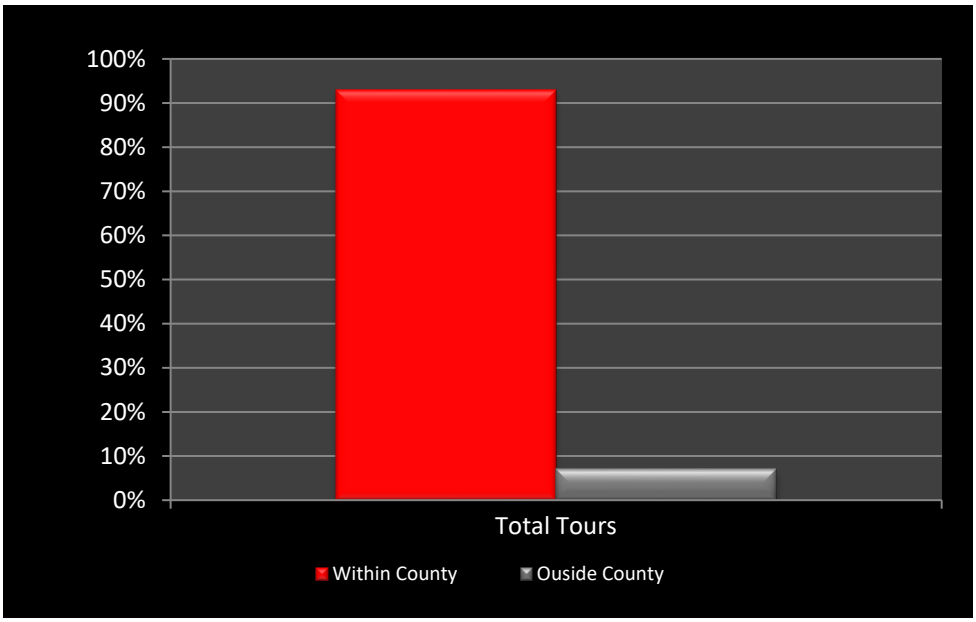
On a daily basis, the majority of trips are generated by the residents of the community or by residential land uses. Commute and school trips are typically considered mandatory trips for the residents. Also, based on a 2023 Central California Travel Study (CCTS), commute trips are the longest among trips by residents. Additionally based on the CCTS, the majority of trips are commute and shopping trips occurring between residential, office, and retail uses. Therefore, pursuant to the OPR TA, the recommendations for thresholds for the primary land use types (residential and office) are based on a comparison to a ***regional average.*** The OPR does not explicitly define the regional average, instead it recommends:

1. *In cases where the region is substantially larger than the geography over which most workers would be expected to live, it might be appropriate to refer to a smaller geography, such as county, that includes the area over which nearly all workers would be expected to live (page 16).*

2. *For residential projects in unincorporated county areas, the local agency can compare a residential project's VMT to (1) the region's VMT per capita, or (2) the aggregate population weighted VMT per capita of all cities in the region (page 15).*

LSA surveyed other large urbanized areas around the State to identify what region has been established for VMT thresholds. In most cases, the county boundary has been identified as the region selected for VMT analysis. Mobility can be studied using a trip-based approach or a tour-based approach. The OPR TA states that "*where available, tour-based assessment is ideal because it captures travel behavior more comprehensively*." A regional travel demand model, whether tour based or trip based, is one of the best available tools to estimate VMT. Since the Fresno COG uses an Activity-Based

Model (ABM),[1] a tour-based approach has been followed. The Fresno COG ABM was used to examine the tours into and out of Fresno County. As such, consistent with the OPR TA, only tours having origins or destinations or both within Fresno County were considered. External pass-through trips were not considered. As illustrated on Figure 3, out of the total tours, about 93 percent originate or are destined within Fresno County. The remaining 7 percent of tours are pass-through trips and do not have stops within Fresno County.



Source: Fresno COG Activity Based Model

Figure 3: Percentage of Total Tours Having Origins/Destinations Within Fresno County and Terminating Within or Outside the County

Because the majority of the tours are contained within Fresno County or have origins or destinations within the county, the Fresno County boundary may be used to define the region.

It should be noted that, for residential projects, the TA states:

> *Existing VMT per capita may be measured as regional VMT per capita or as city VMT per capita. Proposed development referencing a threshold based on city VMT per capita (rather than regional VMT per capita) should not cumulatively exceed the number of units specified in the [sustainable community strategy] SCS for that city, and should be consistent with the SCS.*

Therefore, in the previous effort, the Fresno COG recommended that each member evaluate the findings of the analysis to determine the appropriate region for its respective jurisdictions (i.e., the city boundary for residential project VMT evaluation). However, given that Fresno County is the recommended region for all other projects and all member jurisdictions are currently using Fresno

[1] Resource Systems Group, Inc. 2024. Fresno COG Activity Based Model Update, October. Website: https://www.fresnocog.org/wp-content/uploads/2023/11/FCOG-Model-Update-FINAL_Jan2025-7.pdf (accessed March 20, 2025).

County as the region, the Fresno COG recommends continuing the same approach and use the county boundary as the region.

The OPR guidance recommends consistency in approach. Once a region is established, that region should be used for all subsequent traffic analyses.

It should be recognized that the use of Fresno County as the region defines the comparative, or the denominator, in the identification of project-related impact. The numerator is the project's VMT contribution. This project-related VMT profile may go beyond the Fresno County boundary and should not be truncated by a jurisdictional boundary. For example, a new, large employment-generating land development proposed near Fresno County's northern boundary may include VMT from as far away as Madera, Tulare, or Kings Counties, or other communities in the San Joaquin Valley. In that case, it would be the responsibility of the applicant and their traffic study preparer to include the project VMT regardless of geographical limit to the satisfaction of the agency staff. This project-related VMT profile would be compared against the Fresno County regional average.

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3.0 PROJECT SCREENING

The TA does acknowledge that certain activities and projects may result in a reduction in VMT and GHG emissions and therefore may be assumed to produce a less than significant transportation impact. Due to a presumption of less than significant impact by meeting the following described criteria, a variety of projects may be screened out of SB 743-related VMT analysis requirements .

3.1 LAND USE DEVELOPMENT PROJECTS

The TA acknowledges that conditions may exist that would presume a land use development project has a less than significant impact. These factors may be size, location, proximity to transit, or trip-making potential. For example, land use development projects that have one or more of the following attributes may be presumed to create a less than significant impact:

- The project is within 0.5 mile of a transit priority area or a high-quality transit area and is consistent with the respective jurisdiction's General Plan, has a floor-to-area ratio (FAR) equal or greater than 0.75, does not provide more parking than what is required by the agency's Municipal Code, or does not reduce the number of affordable residential units. In accordance with SB 743, "transit priority areas" are defined as "*an area within one-half mile of a major transit stop that is existing or planned, if the planned stop is scheduled to be completed within the planning horizon included in a Transportation Improvement Program.*" A Major transit stop means: "*a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service of 15 minutes or less during the morning and afternoon peak commute periods.*" A high-quality transit area or corridor is a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours (see PRC § 21099, subds. (a)(7), (b)(1).)

  Figure 4 depicts transit priority areas within Fresno County, including high-quality transit areas (within 0.5 mile of a major transit stop) served by the Fresno Area Express (FAX) with service intervals of 15 minutes or less. Projects proposed in these areas may be presumed to have a less than significant transportation impact unless the project is inconsistent with the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), has an FAR less than 0.75, provides an excessive amount of parking, or reduces the number of affordable residential units identified in the agency's housing element for the proposed development.

- The project involves local-serving retail space of less than 50,000 square feet.
- The project has a high level of affordable-housing units.[2] Affordable housing units consists of low-income households, and research has shown that low-income households produce lower VMT compared to a market-rate housing unit.[3]
- The project generates fewer than 500 average daily trips (ADT) (see Section 3.1.1 below).

[2] The affordable-housing requirement to meet the screening criteria is to be determined by each Fresno COG jurisdiction.

[3] Newmark, Gregory L., and Peter M. Hass. 2015. *Income, Location, Efficiency, and VMT: Affordable Housing as a Climate Strategy.* Chicago, Illinois, Center for Neighborhood Technology.

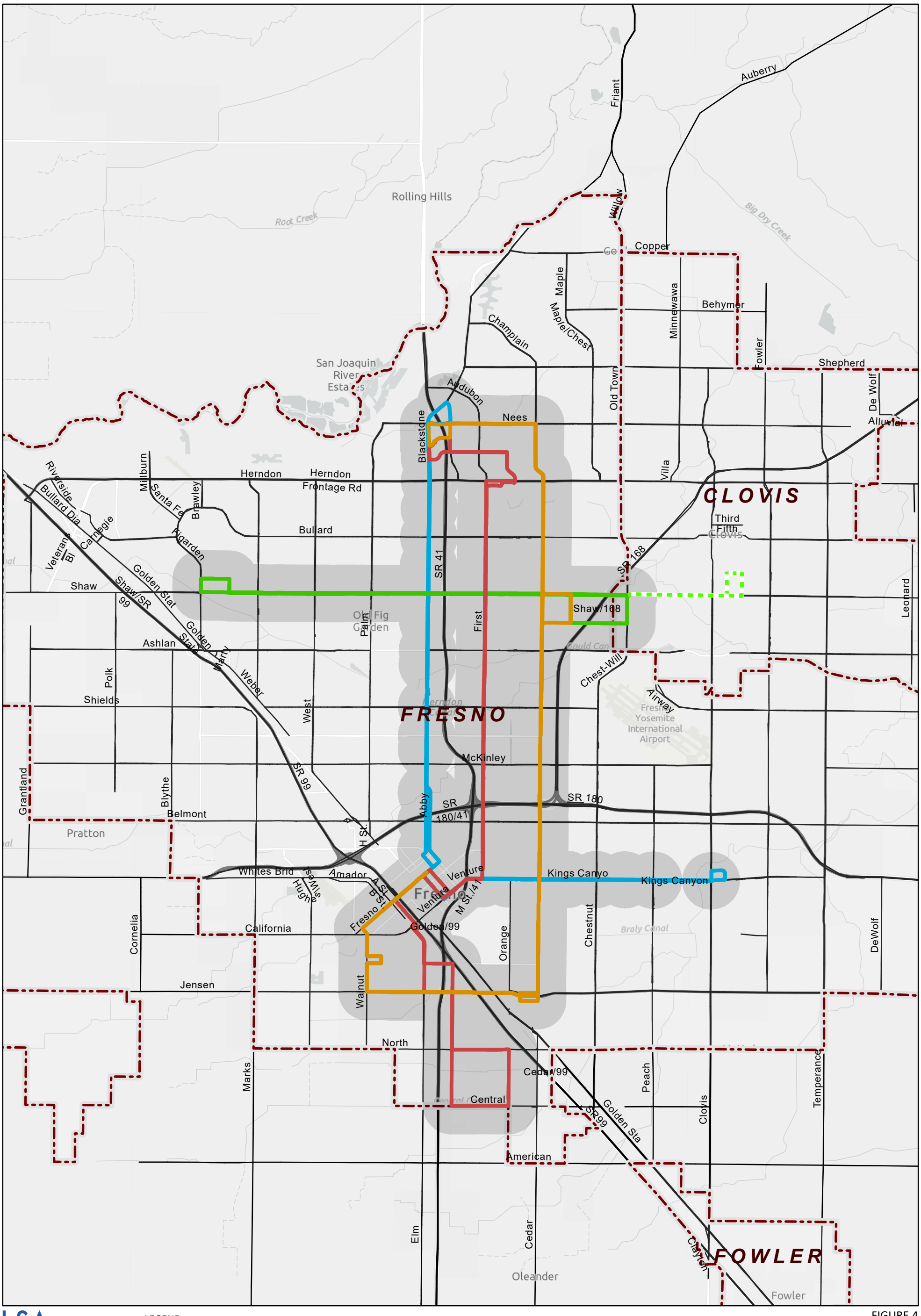

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FIGURE 4

LEGEND

- Cities with Sphere of Influence
- Half-Mile Buffer
- Route 1/Q (Bus Rapid Transit)
- Route 9
- Route 34
- Route 38
- Route 9 (Headway more than 15 Mins.)

0 4100 8200
FEET

Fresno County SB 743 Implementation Regional Guidelines

High-Quality Transit Area Within Fresno County

SOURCE: Fresno Area Express (FAX) (11/24), City of Fresno (04/20), ESRI

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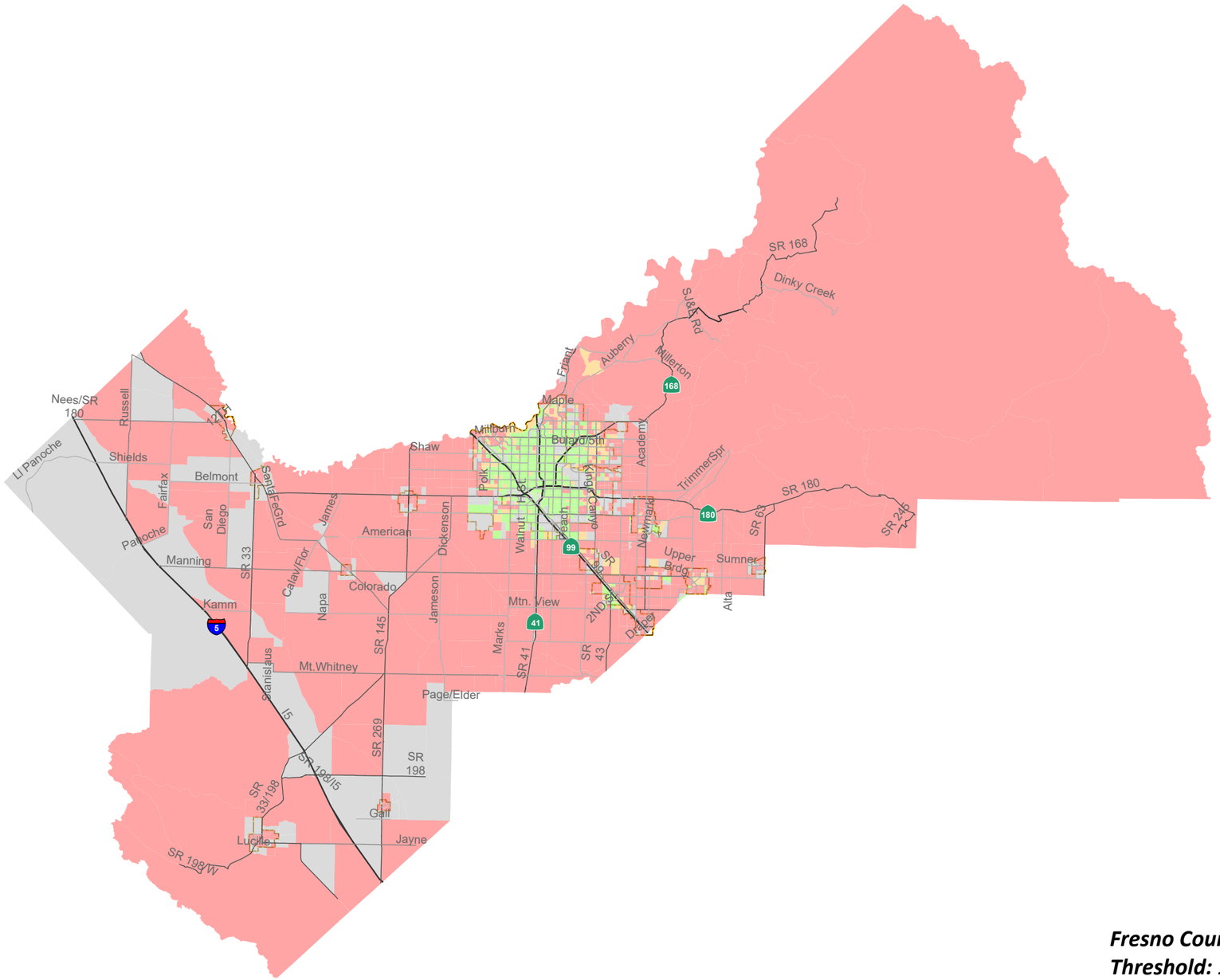
- The development of institutional/government and public service uses that support community health, safety, and welfare may also be screened from subsequent CEQA VMT analysis. These facilities (e.g., police stations, fire stations, government offices, utilities, public libraries, community centers, and refuse stations) would be a part of the community and, as public service, the VMT would be accounted for in the existing regional average. A decision whether a particular project can be categorized as a public service facility will be determined at the discretion of the lead agency. Similarly, any other similar use not included in the list can be approved on a case-by-case basis by the lead agency as applicable. As such, these uses would result in reduction in total VMT due to the proximity of these services within the community. Additionally, many of these facilities generate fewer than 500 ADT and/or use vehicles other than passenger cars or light-duty trucks. These other vehicle fleets are subject to regulation outside of CEQA, such as the California Air Resources Board (CARB) and the San Joaquin Valley Air Pollution Control District. The local jurisdiction will have the discretion to determine whether such facilities (i.e., those that provide safety, security, and serve the local communities) can be screened out from VMT analysis.
- Local parks, daycare centers, student housing projects on or adjacent to a college/university campus, local-serving gas stations, banks, and K–12 public schools typically help in reducing commute and VMT. As such, these land use projects can be screened out from VMT analysis.
- Redevelopment projects that result in an equal or net reduction in VMT can be considered to have less than significant VMT impact. A net reduction in VMT would occur if the land use proposed by the project would generate less VMT than the existing land use. A model-based VMT analysis may be required on a case-by-case basis to establish that the proposed project's total VMT is lower than the total VMT of the existing land use.
- Projects located in areas with low VMT may be screened out from further CEQA analysis. The TA acknowledges that residential and office projects that are located in areas having low VMT (which incorporate features such as density, mix of uses, and transit accessibility) tend to exhibit a similar VMT profile. This will also be applicable to other non-residential uses (non-retail) using the corresponding VMT metric for such projects (e.g., VMT per service population for industrial uses). Therefore, residential, office, industrial, or mixed-use projects that are consistent with the local jurisdiction's General Plan and located within low VMT areas (using the Fresno COG VMT Screening Tool and applying appropriate thresholds) can be presumed to have similar low VMT profiles and could be screened out from the need for further VMT analysis. It should be noted that if a project constitutes a General Plan Amendment or Zone Change, such projects need to be evaluated on a case-by-case basis by the respective jurisdiction to determine whether they will be eligible to be screened out if they are located within a low VMT zone. Additionally, for mixed-use project, each of the land use components need to be evaluated separately by their respective metrics to be eligible for being screened out using this criteria. Figure 5 illustrates the VMT per capita screening map for the region. Appendix A includes detailed VMT per capita screening maps for individual jurisdictions. Figure 6 illustrates the VMT per employee screening map for the region, and Figure 7 illustrates the VMT per service population screening map for the region. Appendix B provides detailed VMT per employee screening maps. Appendix C provides detailed VMT per service population screening maps.



Fresno County Average VMT per Capita: 17.63
Threshold: 13%

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Cities Including Sphere of Influence

VMT per Capita

- Less than 5 Households
- Less than 15.34
- 15.34 - 17.63
- Greater than 17.63

FIGURE 5

Fresno County SB 743 Implementation Regional Guidelines

VMT per Capita Screening Map for Fresno County

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

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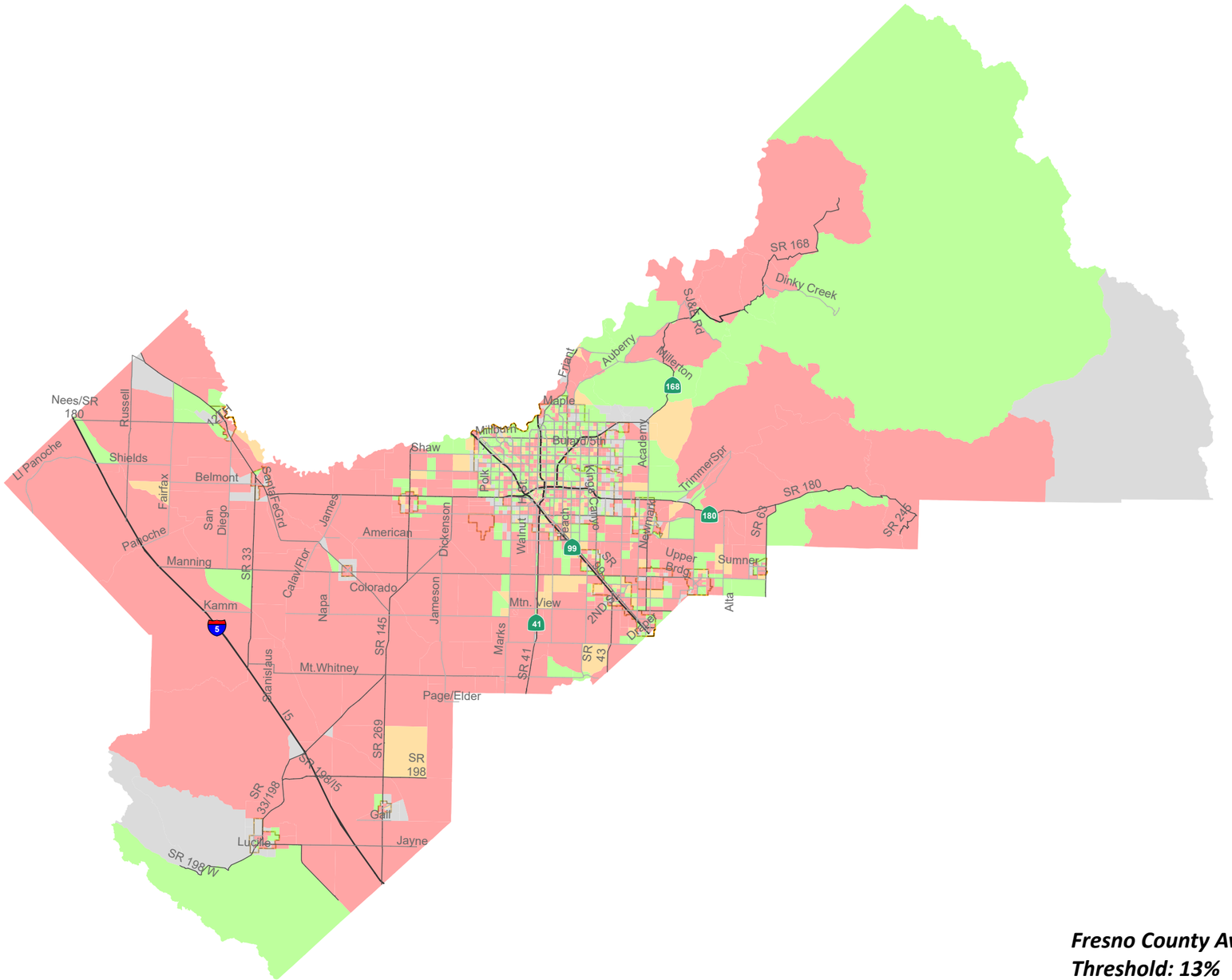

Fresno County Average VMT per Employee: 18.23
Threshold: 13%

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Cities Including Sphere of Influence

VMT per Employee

- Less than 5 Employment
- Less than 15.86
- 15.86 - 18.23
- Greater than 18.23

FIGURE 6

Fresno County SB 743 Implementation Regional Guidelines

VMT per Employee Screening Map for Fresno County

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

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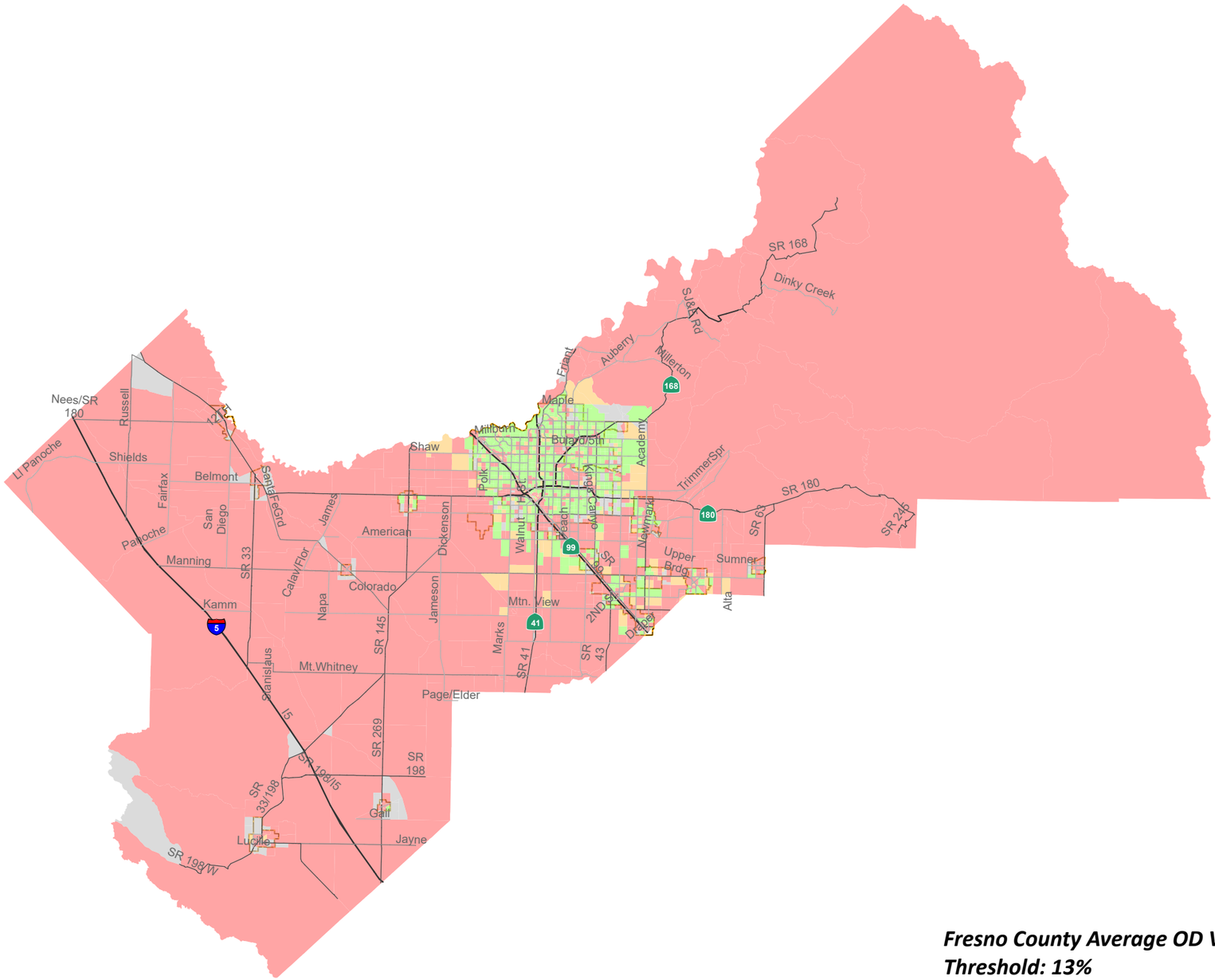

Fresno County Average OD VMT per Service Population: 33.25
Threshold: 13%

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Cities Including Sphere of Influence

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

FIGURE 7

Fresno County SB 743 Implementation Regional Guidelines

OD VMT per Service Population Screening Map for Fresno County

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

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The Fresno COG VMT Screening Tool can be used to determine whether a land use development project may be screened from a detailed VMT analysis. The VMT screening tool is available on the Fresno COG website at https://www.fresnocog.org/project/sb743-regional-guidelines-development/.

- The 2022 *State CEQA Guidelines* Section 15007 (c) states that "*if a document meets the content requirements in effect when the document is sent out for public review, the document shall not need to be revised to conform to any new content requirements in Guideline amendments taking effect before the document is finally approved*." Therefore, if a development/land use plan/transportation project is already cleared by a certified Environmental Impact Report (EIR) or an adopted Negative Declaration/Mitigated Negative Declaration, then subsequent projects that are consistent with the approved project will not require a new VMT analysis unless mandated by another section of the *State CEQA Guidelines*.

Based on the individual agency traffic study guidelines or existing *State CEQA Guidelines*, other conditions may apply to screen out projects. Consistency with other plans to reduce GHG emissions may also reflect substantial evidence supporting a screening out, or the agencies may adopt the OPR TA recommendations in total.

3.1.1 Average Daily Trips Thresholds

Under Section 15301(e)(2) of the *State CEQA Guidelines*, existing facilities, including additions to existing structures of up to 10,000 square feet are exempt from CEQA review if the project is located in an area where public infrastructure is available to allow for maximum planned development and the project is not located in an environmentally sensitive area.

As stated in the OPR TA, for projects that have a linear increase in trip generation with respect to the building footprint, the daily trip generation is anticipated to be between 110 and 124 trips per 10,000 square feet. Therefore, based on this assumption, the OPR recommends 110 ADT as the daily trip screening threshold. As mentioned, this recommendation is not based on any analysis of GHG reduction but rather on a CEQA Categorical Exemption.

Therefore, the following trip screening thresholds are being proposed for Fresno COG member jurisdictions based on a reduction of GHG emissions.

The California Emissions Estimator Model (CalEEMod) is a tool provided by the California Air Resources Board (CARB) and is accepted as the statewide standard to evaluate air quality and GHG emission impacts for CEQA assessment. As such, CalEEMod was used to characterize the effect of changes in project-related ADT to the resulting GHG emissions. To account for geographical relevance, LSA calculated average trip lengths from the Fresno COG ABM as applicable for the region. The trip lengths were calculated for various trip purposes. Table A shows the resulting annual VMT and GHG emissions produced by incremental ADT for single-family residential projects.

Table A: Representative VMT and GHG Emissions from CalEEMod

Average Daily Trips	Annual VMT	Vehicular GHG Emissions (MT CO_2e/yr)	Total Project GHG Emissions (MT CO_2e/yr)
100	324,120	126.6	523.4
200	648,240	253.3	650.0
300	972,360	379.9	776.7
400	1,296,480	506.5	903.3
500	1,620,600	633.2	1,029.9
750	2,430,900	949.7	1,346.5
1,000	3,241,200	1,266.3	1,663.1
1,500	4,861,800	1,899.4	2,296.2

Source: CalEEMod Version 2022.1.
CalEEMod = California Emissions Estimator Model
GHG = greenhouse gas
MT CO_2e/yr = metric tons of carbon dioxide equivalent per year
VMT = vehicle miles traveled

Under CEQA, a GHG emissions threshold can vary between 3,000 metric tons (MT) of carbon dioxide equivalent[4] (CO_2e) per year (as recommended by the South Coast Air Quality Management District (SCAQMD)) and 1,100 MT CO_2e (as recommended by Sacramento Metropolitan Air Quality Management District [SMAQMD]). For purposes of this analysis, the threshold of 1,100 MT CO_2e has been utilized as a conservative estimate and is more appropriately applicable to the San Joaquin Valley region, including Fresno County. As shown in Table A, a project with less than 500 ADT would generally be expected to have total project emissions of less than 1,100 MT CO_2e/year. LSA conducted this exercise for several other land uses to identify appropriate GHG screening thresholds. Table B shows the potential maximum GHG screening thresholds (up to 1,100 MT) for these land uses.

Table B: CO_2e Emission Rates by Land Use Type

Land Use	DU or TSF	Total MT CO_2e Per Year	Annual MT CO_2e Per DU or TSF
Single-Family Residential	68 DU	1,082	15.9
Low-Rise Multifamily Residential	97 DU	1,100	11.3
Mid-Rise Multifamily Residential	130 DU	1,097	8.4
Office	79 TSF	1,100	13.9
Warehouse	320 TSF	1,100	3.4
Light Industrial	130 TSF	1,092	8.4
Hotel	101 TSF	1,090	10.8
Medical Office	29 TSF	1,091	37.6
Hospital	44 TSF	1,093	24.6
Shopping Plaza	25.5 TSF	1,090	42.7
Strip Retail Plaza	23.4 TSF	1,097	46.9

Source: California Emissions Estimator Model (CalEEMod) Version 2022.1.
DU = dwelling units
MT CO_2e = metric tons of carbon dioxide equivalent
TSF = thousand square feet

[4] CO_2e is a concept developed to provide one metric that includes the effects of numerous GHGs. The global warming potential (GWP) of each GHG characterizes the ability of each GHG to trap heat in the atmosphere relative to another GHG. The GWPs of all GHGs are combined to derive the CO_2e.

The GHG analysis above concludes that projects with up to 500 ADT may be screened out from VMT analysis. Therefore, for Fresno COG member jurisdictions, a threshold of 500 ADT may be applied to land use projects. Historically, most of the jurisdictions require traffic studies (LOS analysis) for projects that generate 50 or more peak-hour trips. Since 1 peak-hour trip equates to approximately 10 ADT, 50 peak-hour trips would equate to approximately 500 ADT. It is prudent to take a conservative approach and important to be consistent with previous methodologies and past precedence. Therefore, 500 ADT may be determined as the screening criteria for development projects, which also takes precedence from previous transportation analysis procedures. A sample list of project sizes generating fewer than 500 daily vehicle trips that are eligible for exemption from a VMT analysis are included in Table C.

Table C: VMT Screening Thresholds for Sample Land Uses

Land Use	Size of Projects
Single-Family Residential[1]	53 DU
Low-Rise Multifamily Residential[2]	74 DU
Mid-Rise Multifamily Residential[3]	110 DU
Office	46.125 TSF
Warehouse	292.397 TSF
Light Industrial	102.669 TSF
Hotel	62 Rooms
Medical Office[4]	13.888 TSF
Hospital	22 Beds

Note: Project sizes have been determined based on trip generation rates obtained from the ITE *Trip Generation Manual* (11th Edition).

1 The project sizes have been provided for single-family detached residential only.

2 The project sizes have been provided for low-rise multifamily residential (not close to rail transit) only.

3 The project sizes have been provided for mid-rise multifamily residential (not close to rail transit) only.

4 The project sizes have been provided for stand-alone medical office buildings only.

DU = dwelling units

ITE = Institute of Transportation Engineers

TSF = thousand square feet

3.2 TRANSPORTATION PROJECTS

The primary factor to consider for transportation projects is the potential to increase vehicle travel, sometimes referred to as "induced travel." Based on the OPR TA, while the lead agency has discretion to continue to use a delay-based LOS analysis for CEQA disclosure of transportation projects, changes in vehicle travel must also be quantified. The lead agency may solely use VMT analysis for CEQA disclosure of transportation projects, but can also require an LOS analysis for design, traffic operations, and safety purposes. The OPR TA lists a series of projects that would not likely lead to a substantial or measurable increase in vehicle travel and therefore would not require an induced travel analysis. The California Department of Transportation (Caltrans) recently published the updated version of the *Transportation Analysis Under CEQA* in September 2024, which also provides a list of project types adopted from the OPR TA that are not likely to lead to measurable and substantial increases in vehicle travel. These include the following:

- *Rehabilitation, maintenance, replacement, safety, and repair projects designed to improve the condition of existing transportation assets (e.g., highways; roadways; bridges; culverts; Transportation Management System field elements such as cameras, message signs, detection, or signals; tunnels; transit systems; and assets that serve bicycle and pedestrian facilities) and that do not add additional motor vehicle capacity.*
- *Roadside safety devices or hardware installation such as median barriers and guardrails.*
- *Roadway shoulder enhancements to provide "breakdown space," dedicated space for use only by transit vehicles, to provide bicycle access, or to otherwise improve safety, but which will not be used as automobile vehicle travel lanes.*
- *Addition of an auxiliary lane of less than 1 mi in length designed to improve roadway safety, or auxiliary lane extensions that result in a total auxiliary lane length greater than one mile and project level effects are not substantial and measurable.*
- *Installation, removal, or reconfiguration of traffic lanes that are not for through traffic, such as left, right, and U-turn pockets, two-way left-turn lanes, emergency truck pullovers, or emergency breakdown lanes that are not utilized as through lanes.*
- *Addition of roadway capacity on local (FHWA functional classification (Class) 7) or collector (Class 5 and 6) streets, provided the project also substantially improves conditions for pedestrians, cyclists, and, if applicable, transit.*
- *Conversion of existing general-purpose lanes (including ramps) to managed lanes or transit lanes, or changing lane management in a manner that would not substantially increase vehicle travel assuming no change in managed lane occupancy (e.g., general purpose (GP) to high occupancy vehicle (HOV), high occupancy toll (HOT), or fully priced lane, HOV to HOT lane, HOV or HOT to fully priced lane, and HOV-2+ to HOV-3+ or higher).*
- *Addition of a new lane that is permanently restricted to use only by transit vehicles.*
- *Reduction in the number of through lanes.*
- *Grade separation to separate vehicles from rail, transit, pedestrians, or bicycles, or to replace a lane in order to separate preferential vehicles (e.g., HOV, HOT, or trucks) from general vehicles.*
- *Installation, removal, or reconfiguration of traffic control devices, including Transit Signal Priority (TSP) features.*
- *Installation of traffic metering systems, detection systems, cameras, changeable message signs, and other electronics designed to optimize vehicle, bicycle, or pedestrian flow.*
- *Timing of signals to optimize vehicle, bicycle, or pedestrian flow.*
- *Installation of roundabouts or traffic circles.*
- *Installation or reconfiguration of traffic calming devices.*
- *Adoption of or increase in tolls.*
- *Initiation of a new transit service.*
- *Conversion of streets from one-way to two-way operation with no net increase in the number of general purpose or continuous through traffic lanes.*
- *Removal or relocation of off-street or on-street parking spaces.*

- *Adoption or modification of on-street parking or loading restrictions (including meters, time limits, accessible spaces, and preferential/reserved parking permit programs).*
- *Addition of traffic wayfinding signage.*
- *Rehabilitation and maintenance projects that do not add motor vehicle capacity.*
- *Addition of new or enhanced bike or pedestrian facilities on existing streets/highways or within existing public rights-of-way.*
- *Addition of Class I bike paths, trails, multi-use paths, or other off-road facilities that serve nonmotorized travel*
- *Installation of publicly available alternative fuel/charging infrastructure.*
- *Addition of passing lanes, truck climbing lanes, or truck brake-check lanes in rural areas that do not increase overall vehicle capacity along the corridor.*
- *HOV bypass lanes on on-ramps*
- *Local (Class 7) and collector (Class 5 and 6) roads in rural areas that don't include sidewalks where there would be no pedestrian traffic to use them*
- *Lanes through grade-separated interchanges without additional receiving lanes downstream*
- *Adding vehicle storage to a ramp without further reconfiguration*
- *Park and Ride facilities*
- *Truck size and weight inspection stations*

Additionally, transit and active transportation projects generally reduce VMT and therefore may be presumed to cause a less than significant impact on transportation. This presumption may apply to all passenger rail projects, bus and bus rapid-transit projects, and bicycle and pedestrian infrastructure projects. The agency may use this CEQA presumption of less than significant impact to aid in the prioritization of capital projects because the CEQA process for any of these project types would be more streamlined than other capacity-enhancing capital projects.

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4.0 THRESHOLD AND VMT ANALYSIS FOR LAND USE DEVELOPMENT PROJECTS

4.1 THRESHOLDS FOR LAND USE PROJECTS

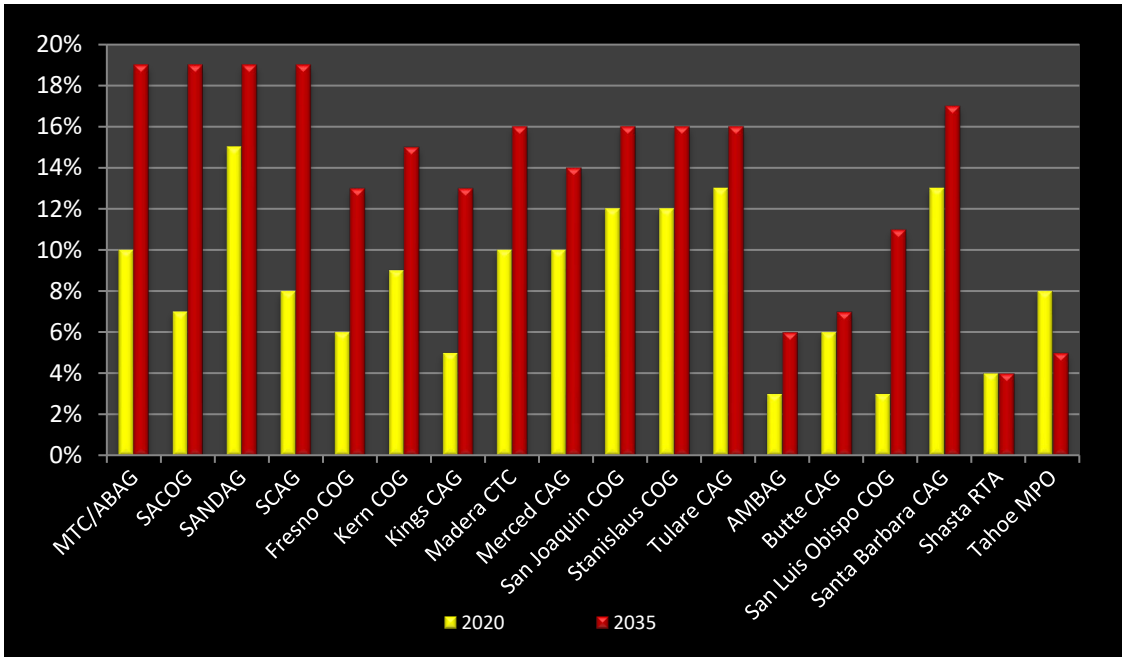
The OPR TA states that SB 743 and all CEQA VMT transportation analyses refer to automobiles. In the OPR TA, the term automobile refers to on-road passenger vehicles, specifically cars and light duty trucks (page 4). Heavy-duty trucks can be addressed in other CEQA sections (air quality, GHG, noise, and health risk assessment analysis) and are subject to regulation in a separate collection of rules under CARB jurisdiction. This approach was amplified by Chris Ganson, Senior Advisor for Transportation at the OPR, in a recent presentation at the Fresno COG (October 23, 2019) and by Ellen Greenberg, the Caltrans Deputy Director for Sustainability, at the San Joaquin Valley Regional Planning Agencies' Directors' Committee meeting (January 9, 2020).

The OPR has identified the subject of the thresholds as the primary trips in the home-based typology: specifically, home-based work tours. This includes residential uses, office uses, and retail uses. The home-based work tour type is the primary tour making during the peak hours of commuter traffic in the morning and evening periods.

The impact of transportation has shifted from congestion to climate change, and the purpose of the CEQA analysis is to disclose and ultimately reduce GHG emissions by reducing the number and length of automobile trips. As part of the SB 375 land use/transportation integration process and GHG goal setting, the State and Regional Transportation Planning Agencies (RTPAs) have agreed to reduce GHG through integrated land use and transportation planning by a statewide average of approximately 15 percent by 2035. Figure 8 illustrates SB 375 regional GHG emissions reduction targets for all 18 Metropolitan Planning Organizations (MPOs) in California that CARB established in 2018. Furthermore, in its 2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals, the CARB recommends total VMT per capita rates approximately 15 percent below existing conditions.

The OPR TA therefore recommends:

- *A proposed (residential) project exceeding a level of 15 percent below existing regional average VMT per capita may indicate a significant transportation impact.*
- *A similar threshold would apply to office projects (15 percent below existing regional average VMT per employee).*
- *VMT generated by retail projects exceeding 50,000 sf would indicate a significant impact for any net increase in total VMT.*



Source: https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-program/regional-plan-targets.

Figure 8: SB 375 Regional Plan Climate Targets for California's 18 MPOs

The CARB establishes GHG targets for each of the 18 MPOs in the State, reviews the Sustainable Communities Strategies (SCSs) and makes a determination whether the SCSs would achieve GHG reduction targets if implemented. In the spring of 2018, the CARB adopted new GHG targets for all the 18 MPOs in the State based on the 2017 Scoping Plan and other new data as illustrated on Figure 8. The CARB established a 13 percent GHG reduction target for 2035 for Fresno County. The State recognizes that Fresno County's contribution to the aggregate 15 percent statewide GHG emission reduction is 13 percent. Other regions may achieve different amounts of GHG emission reductions (between 4 to 19 percent) to achieve the aggregate statewide goal.[5] As such, reduction in GHG directly corresponds to reduction in VMT. The method of reducing GHG by 13 percent is to reduce VMT by 13 percent as well, since VMT is the largest contributor to GHG emissions.

Therefore, Fresno COG member jurisdictions may establish a threshold for land use developments, specifically residential and office, of 87 percent of the existing regional average as indicative of a significant transportation impact.

For retail projects, an increase in total regional roadway VMT with implementation of the project would indicate a significant transportation impact. In general, the addition of new retail re-diverts a majority of trips from existing retail locations located farther away. Given the potential redistribution of a majority of trips rather than an addition of trips, a comparison of total regional roadway VMT is appropriate to determine whether the retail project would benefit in overall reduction of regional VMT. Therefore, a net reduction in total VMT would be the appropriate metric to determine VMT

[5] The latest GHG targets by region can be found at https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-program/sb-375-regional-targets.

impacts for such projects. Total roadway VMT needs to be calculated using the final roadway assignment outputs from the Fresno COG ABM.

Other discrete land uses are not identified for threshold development in the OPR TA. However, consistent with the 13 percent reduction target for other non-residential projects, a significance threshold of 87 percent of existing regional average VMT per employee is recommended.

An exception of metric would be hotels, hospitals, medical offices, and related projects. These land uses are service-oriented facilities that include both visitors/patients and employees. Therefore, for such projects, an Origin-Destination (O-D) VMT per service population (population/users + employment) VMT metric would be the recommended metric. Any other similar use could be evaluated using the same metric subject to approval of the methodology by the agency on a case-by-case basis. As such, a significance threshold of 87 percent of the existing regional average VMT per service population may be applied for these projects.

Additionally, for industrial land uses, including High-Cube warehouse, warehouse, light industrial, manufacturing, and similar truck intensive uses, the O-D VMT per service population would be the recommended metric, since this metric accounts for both passenger vehicle and truck VMT. A significance threshold of 87 percent of existing regional VMT per service population may also be applied as a threshold for such projects.

If the agency wishes to establish some other threshold that is less stringent than the 13 percent recommended for land use projects, a body of substantial evidence would be necessary.

Mixed-use projects are recommended to be analyzed for each land use component of the project using the most appropriate VMT metric .Credit for internal trip capture should be made. Internal trip capture may be calculated using the latest edition of the Institute of Transportation Engineers (ITE) *Trip Generation Handbook* (for smaller projects), the Fresno COG ABM (for larger projects), or other applicable sources approved by the agency. The appropriate methodology for calculating a project's internal capture would be determined in consultation with the lead agency staff. The significance threshold for these projects are recommended to be the respective VMT thresholds for its different land use components.

4.2 LAND USE PROJECT VMT ANALYSIS/MITIGATION PROCESS

Figure 9 illustrates the VMT screening methodology for development entitlement projects. Additionally, Figures 10-A through 10-C illustrate the VMT analysis methodology for non-screened projects. It provides the path from application filing through determination of impacts. It is presented as the standard process; each development application is considered unique and may create alternative or modified steps through the process. Each step that diverges from this standard process should be accompanied with substantial evidence demonstrating compliance with other climate change and GHG emission reduction laws and regulations.

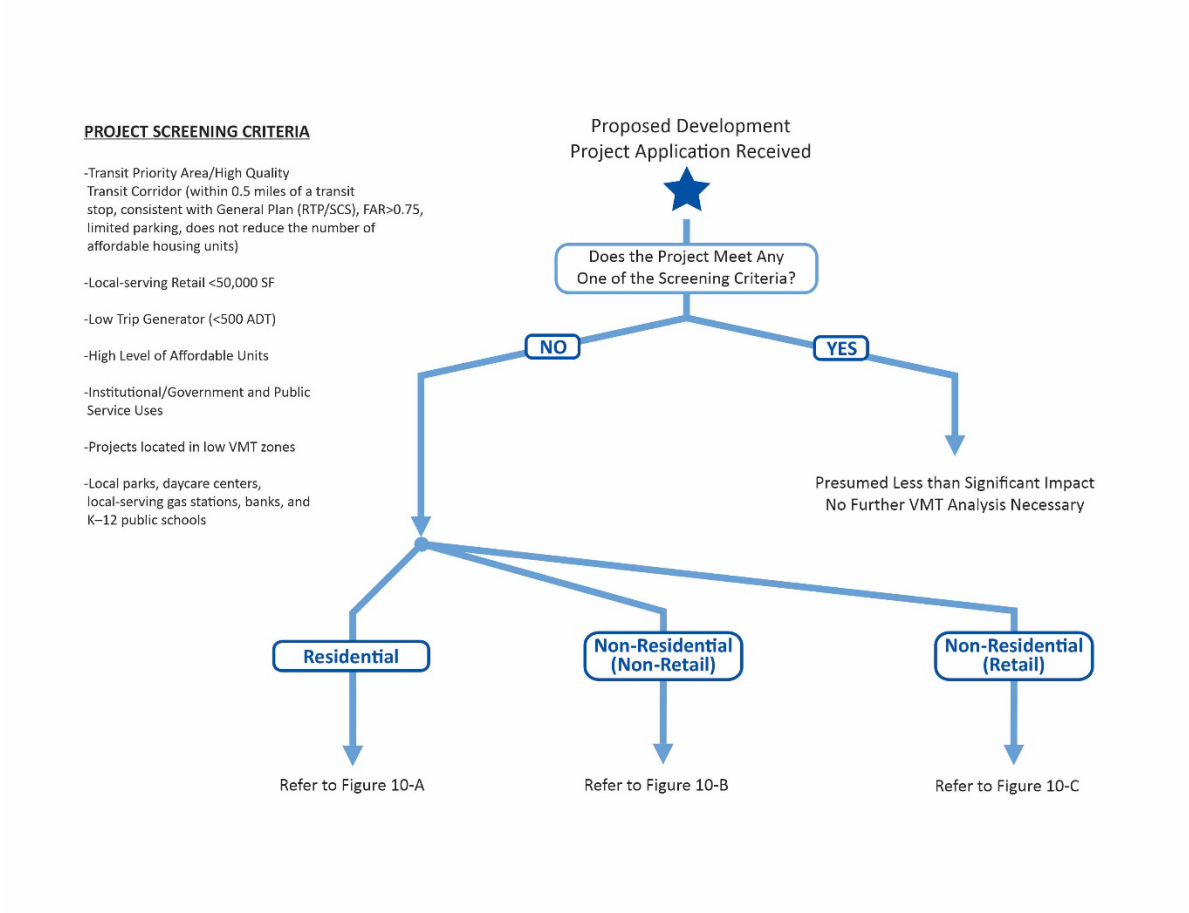


Figure 9: VMT Screening Methodology for Development Projects

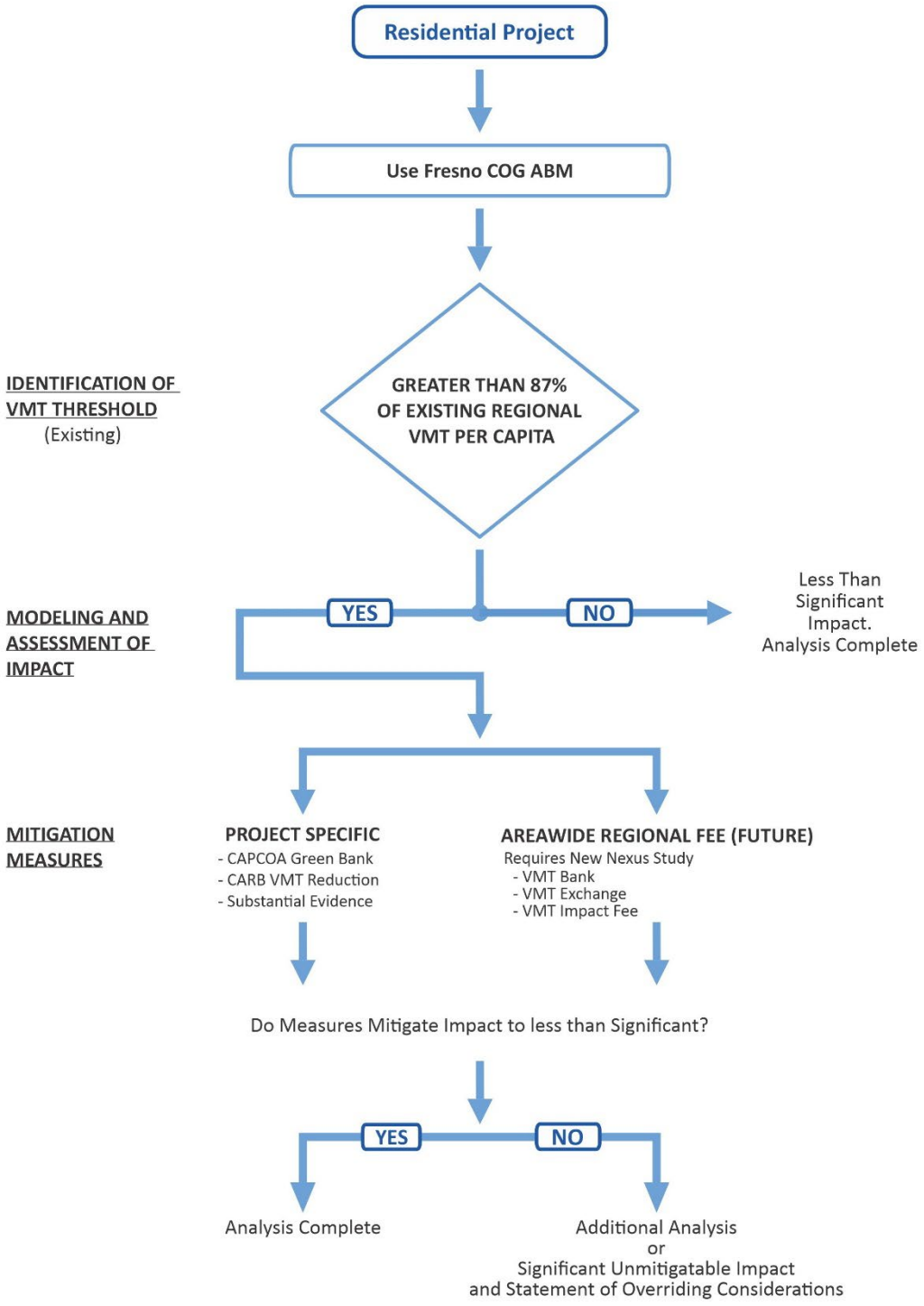


Figure 10-A: VMT Analysis Methodology for Residential Projects

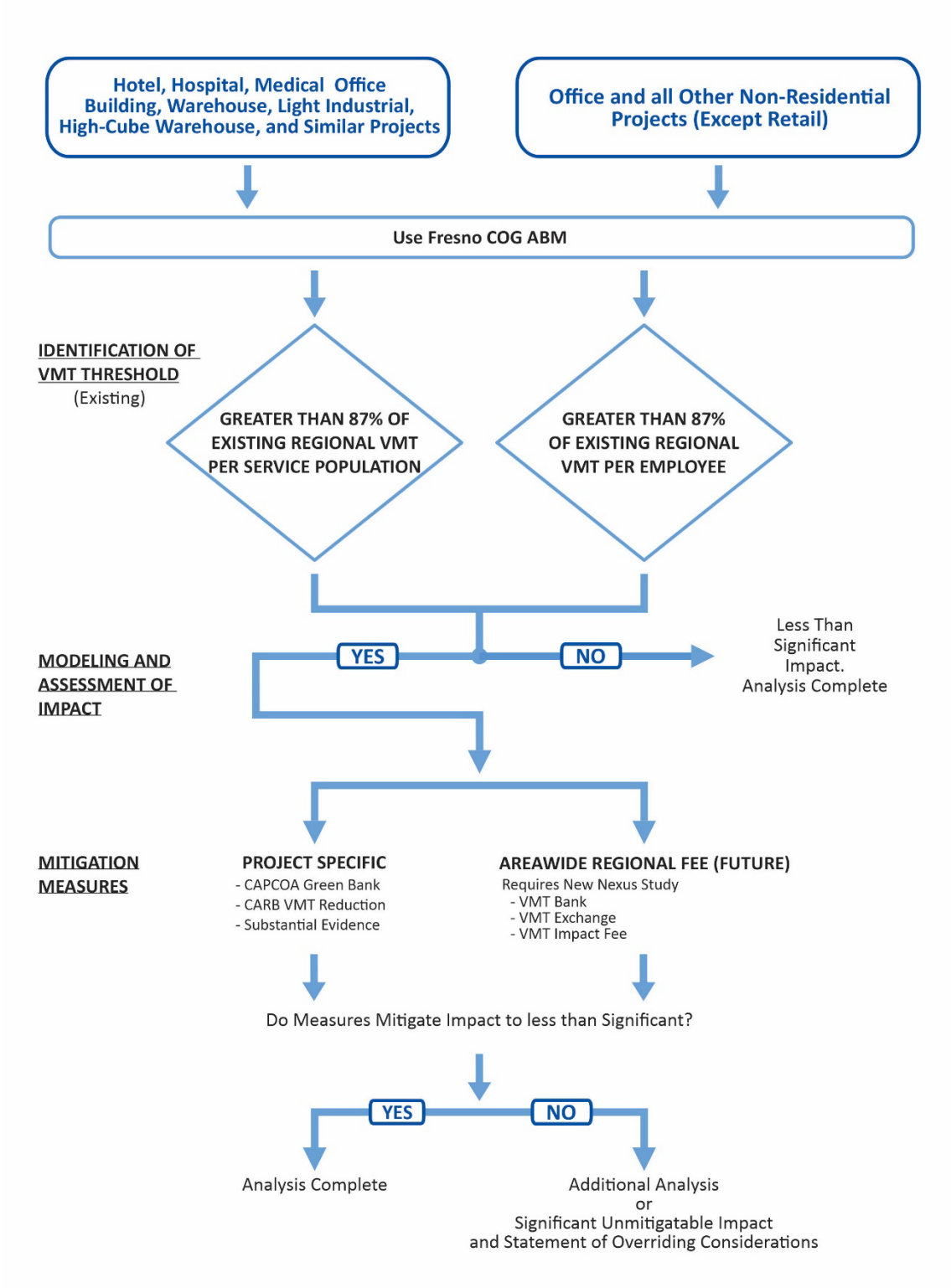


Figure 10-B: VMT Analysis Methodology for Non-Retail Non-Residential Projects

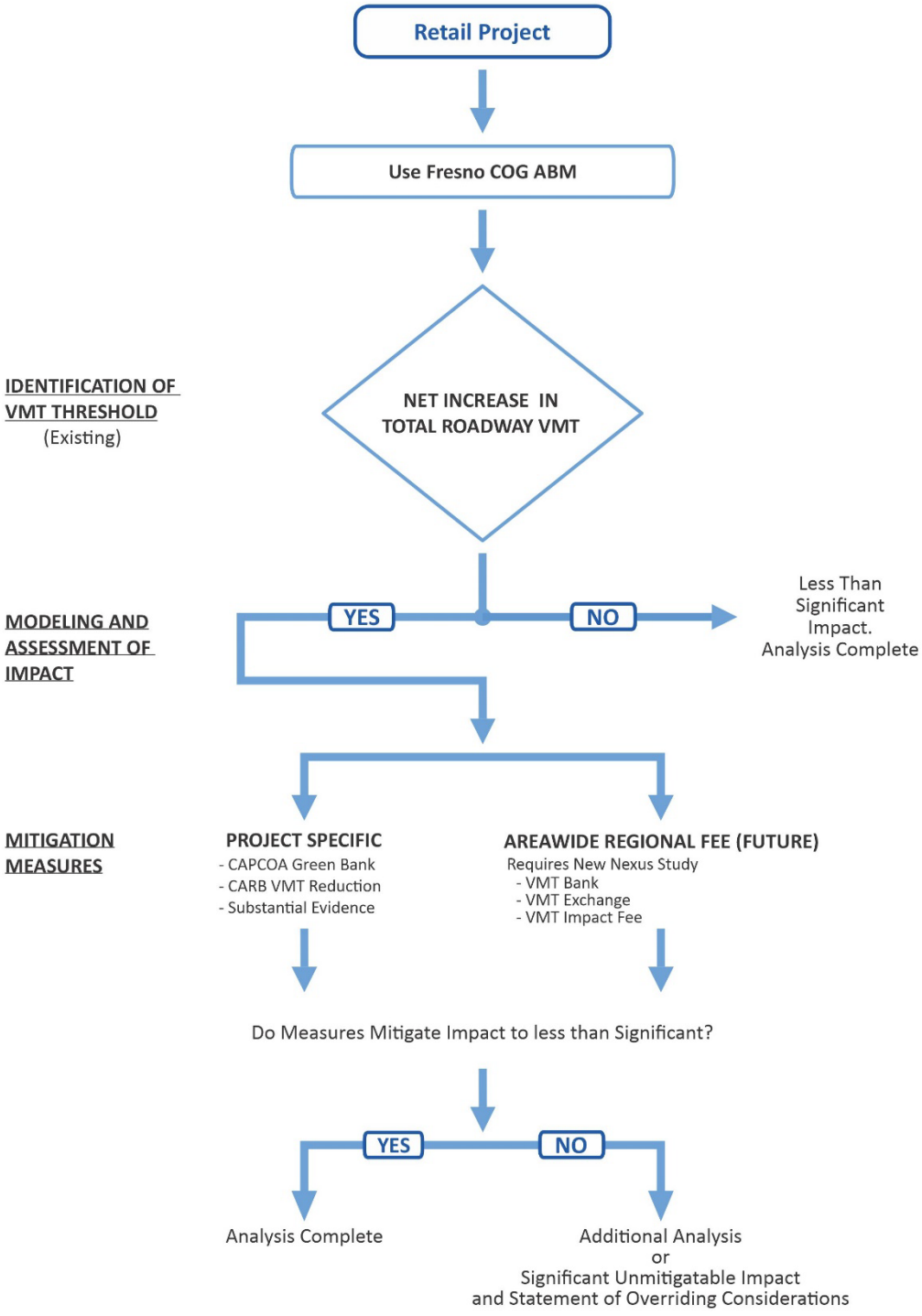


Figure 10-C: VMT Analysis Methodology for Retail Projects

4.2.1 Agency Communication

At the outset of the project development process, the applicant shall provide a detailed project description, including area/number of units and potential number of residents/employees added or created by the project, and the applicable VMT analysis methodology. Key elements include a description of the project in sufficient detail to generate trips and the potential catchment area (i.e., trip lengths if no modeling is undertaken), estimated project VMT, project design features that may reduce the VMT from the project development, and the project location and associated existing regional VMT percentages. Further, the applicant or their consultant shall prepare a transportation analysis scope of work for review and approval by the agency.

Projects that will influence Caltrans facilities may be subject to the Caltrans Local Development-Intergovernmental Review program. As part of the program, Caltrans may review the VMT analysis methodology, findings, and mitigation measures to ensure consistency with statewide standards.

4.2.2 Project Screening

Once a development application is filed and determined to be complete for processing purposes, project screening may commence. If the project meets any one of the screening criteria, it may be presumed to have a less than significant transportation impact. No further VMT analysis would be necessary. The CEQA document should enumerate the screening criterion and how the project meets or exceeds the applicable threshold. If project screening does not apply, a VMT analysis may be required. The extent of this analysis may be a simple algebraic demonstration or a more sophisticated traffic modeling exercise. This distinction is addressed later.

4.2.3 Development Project VMT Analysis

The project land use type will determine the appropriate metric to use (i.e., VMT per capita, VMT per employee, VMT per service population, or total VMT). Appropriate VMT metrics for different land uses are stated in Table D.

Table D: VMT Metrics for Land Use Projects

Land Use	VMT Metric
Residential	VMT per Capita
Office	VMT per Employee
Retail	Total VMT
Hotel, Hospital, Medical Office Building, Warehouse, Light Industrial, High-Cube Warehouse, or other Truck-Intensive Use	VMT per Service Population
Mixed-Use, Land Use Plan (General Plan/Specific Plan)	Respective VMT metrics for its different land use components
Other Land Uses	VMT per Employee

VMT = vehicle miles traveled

4.2.3.1 Large Project VMT Analysis

For all development projects, use of the Freno COG ABM is recommended unless the project includes a special land use that is difficult to analyze using a travel demand model. For the latter, the lead agency may require a qualitative analysis or an analysis using empirical data as applicable to the project.

Next, the project generated VMT (per capita, per employee, per service population, or total) should be compared to the appropriate significance threshold provided in Table E. If the project VMT metric is less than the significance threshold, the project is presumed to create a less than significant impact. No further VMT analysis for CEQA purposes would be required.

Table E: Significance Thresholds for VMT Analysis

VMT Metric	Threshold	Regional Average
VMT per Capita	15.34	17.63
VMT per Employee	15.86	18.23
VMT per Service Population	28.93	33.25

Source: Fresno COG ABM (2019 Base Year).
ABM = Activity-Based Model
COG = Council of Governments
VMT = vehicle miles traveled

Should project VMT metrics exceed the significance threshold, mitigation measures will be required. It should be noted that the thresholds identified in Table E are based on the current version of the Fresno COG ABM (updated in 2024). These thresholds are subject to change when a newer version of the Fresno COG ABM is available.

4.2.4 Mitigation Measures

State law requires the project applicant to identify feasible offsets to mitigate significant VMT impacts generated by the proposed project. . These can come from the mitigation strategies provided by the agency (Appendices E, F, and G), or selected by the applicant based on their CEQA project experience and expertise. A proposed mitigation measure must be supported by substantial evidence illustrating that the measure will mitigate VMT impacts to less than significant. The agency must approve and accept the final VMT mitigation program ascribed to the project and the related VMT percentage reduction.

If it is determined that the selected VMT mitigation measures effectively reduce the project impact to less than the applicable threshold, the project is presumed to have an impact mitigated to a less than significant level for purposes of CEQA. No further VMT analysis is required. If the project's VMT impact cannot be mitigated to less than significant, the agency may (1) request the project be redesigned to reduce the VMT impact, or (2) require the preparation of an EIR with a Statement of Overriding Considerations (SOC) for the transportation impacts associated with the project. All feasible mitigation measures must be assigned to and carried out by the project even if an EIR/SOC is prepared.

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5.0 THRESHOLD AND INDUCED VMT ANALYSIS FOR TRANSPORTATION PROJECTS

The 2020 *State CEQA Guidelines* include Section 15064.3.b.(2) to address transportation projects. It reads:

> *For roadway capacity projects, agencies have the discretion to determine the appropriate measure of transportation impact consistent with CEQA and other applicable requirements.*

Lead agencies may continue to use delay and LOS for transportation projects for design and traffic operations purposes as long as impacts related to "other applicable requirements" are disclosed. This has generally been interpreted as VMT impacts and other State climate change objectives. These other applicable requirements may be found in other parts of an environmental document (i.e., air quality, GHG) or may be provided in greater detail in the transportation section.

For projects on the State Highway System (SHS), Caltrans will use and will require sponsoring agencies to use VMT as the CEQA metric, and Caltrans will "*require a supporting induced travel analysis for capacity-increasing transportation projects on the SHS*."[6]

The assessment of a transportation project's VMT should disclose the VMT without the project and the difference in VMT with the project. Any growth in VMT attributable to the transportation project would result in a significant impact.

Capacity improvement projects have the potential of producing significant transportation impacts because they are likely to induce travel. According to the OPR TA, induced travel is the additional vehicle travel that is caused by the new capacity on the roadway. The induced travel could include route switching, time-of-day change, model shift, longer trips, new trips to existing destinations, and additional travel due to new development. Many traffic models have limited abilities to forecast new trips and new developments associated with the capacity improvements because their land use or socioeconomic databases are fixed to a horizon date. The OPR TA refers to a limited set of reports that would indicate elasticities.

The most recent major study[7] estimates an elasticity of 1.0, meaning that every 1 percent change in lane miles results in a 1 percent change in VMT for interstate (Class 1) facilities. For other major roadways, the elasticity is estimated between 0.66 and 0.9.

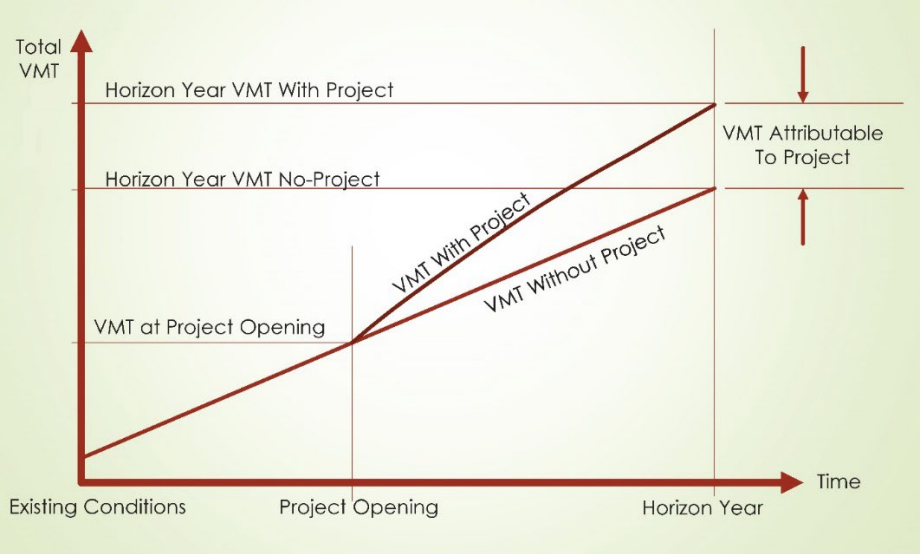
6 California Department of Transportation (Caltrans). 2024. Transportation Analysis Framework, Second Edition.

7 Duranton, Gilles, and Matthew A. Turner. 2011. *The Fundamental law of Road Congestion: Evidence from US Cities.* Pittsburgh. Pennsylvania. American Economic Review 101, page 24.

The OPR TA presents one method to identify the induced growth, as follows:

> *To estimate VMT impacts from roadway expansion projects:*
>
> 1. *Determine the total lane-miles over an area that fully captures travel behavior changes resulting from the project (generally the region, but for projects affecting interregional travel look at all affected regions).*
> 2. *Determine the percentage change in total lane miles that will result from the project.*
> 3. *Determine the total existing VMT over that same area.*
> 4. *Multiply the percentage increase in lane miles by the existing VMT, and then multiply that by the elasticity from the induced travel literature:*
>
> *[% increase in lane miles] × [existing VMT] × [elasticity] = [VMT resulting from the project]*

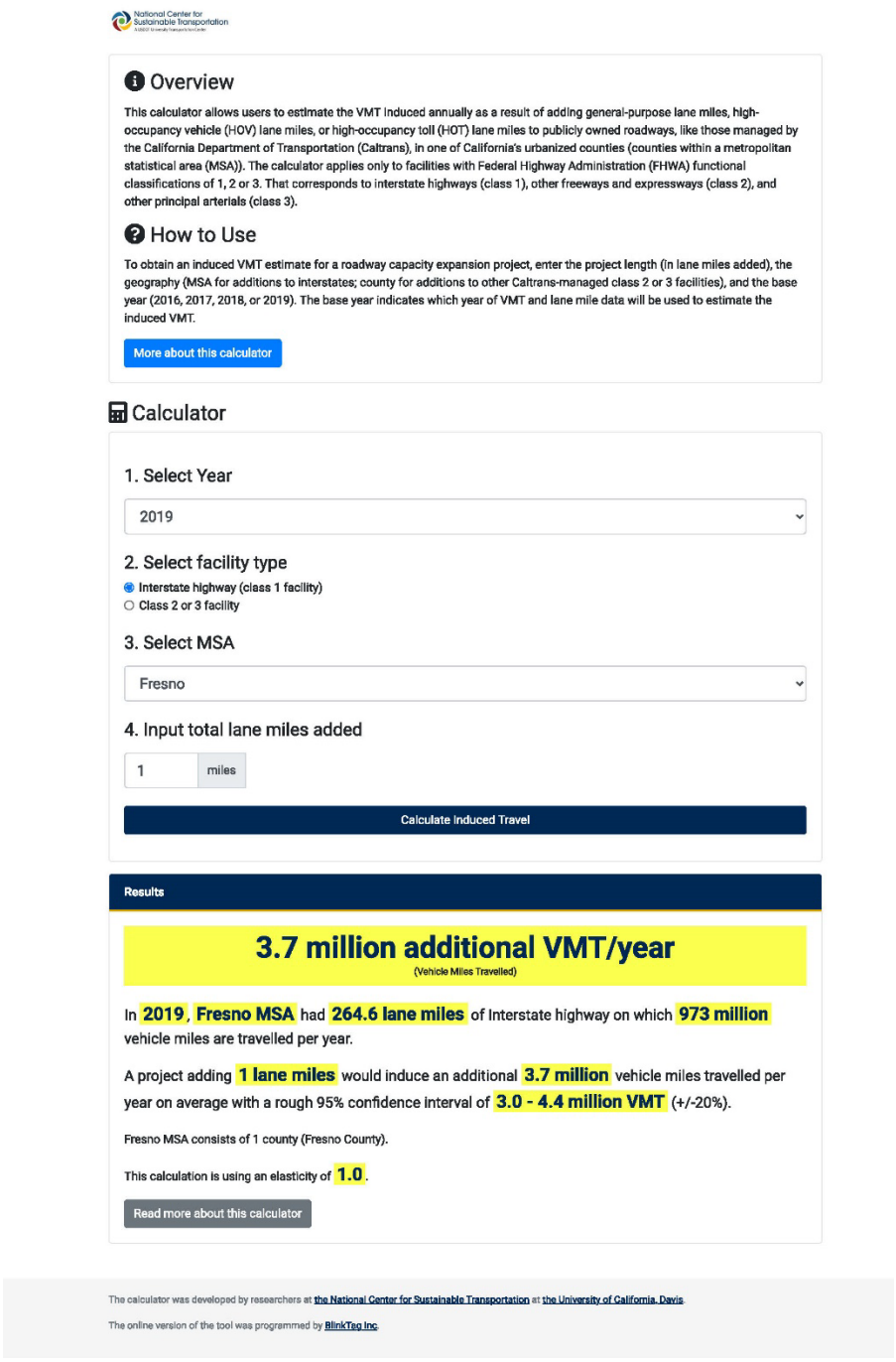
Figure 11 provides a representative illustration of induced VMT attributable to a project.



Source: Presentation – Caltrans Transportation Analysis under CEQA or TAC: Significance Determinations for Induced Travel Analysis (SHCC Pre-Release Session 2 Jeremy Ketchum, Division of Environmental Analysis, Caltrans, March 2, 2020).

Figure 11: Induced Travel – VMT Attributable to a Project

Caltrans has identified a computerized tool that estimates VMT generation from transportation projects. It was developed by the National Center for Sustainable Transportation (NCST) at University of California, Davis and is based on elasticities and the relationship of lane mile additions and growth in VMT. It uses Federal Highway Administration (FHWA) definitions of facility type and ascribes VMT increases to each facility. Output includes increases on million vehicle miles per year. For Fresno County (County in MSA with Class 1 facility), this is the Caltrans recommended tool for all its VMT analyses of capital projects on the SHS. The NCST tool is available at https://travelcalculator.ncst.ucdavis.edu/. Figure 12 provides an illustration of that tool.



Source: https://travelcalculator.ncst.ucdavis.edu/

Figure 12: Caltrans Induced Travel Calculator

The TA provides other options to identify induced growth- and project-related VMT. These include:

1. ***Employ an expert panel.*** *An expert panel could assess changes to land use development that would likely result from the project. This assessment could then be analyzed by the travel demand model to assess effects on vehicle travel. Induced vehicle travel assessed via this approach should be verified using elasticities found in the academic literature.*

2. ***Adjust model results to align with the empirical research.*** *If the travel demand model analysis is performed without incorporating projected land use changes resulting from the project, the assessed vehicle travel should be adjusted upward to account for those land use changes. The assessed VMT after adjustment should fall within the range found in the academic literature.*

3. ***Employ a land use model, running it iteratively with a travel demand model.*** *A land use model can be used to estimate the land use effects of a roadway capacity increase, and the traffic patterns that result from the land use change can then be fed back into the travel demand model. The land use model and travel demand model can be iterated to produce an accurate result.*

The TA provides a final warning:

> *Whenever employing a travel demand model to assess induced vehicle travel, any limitation or known lack of sensitivity in the analysis that might cause substantial errors in the VMT estimate (for example, model insensitivity to one of the components of induced VMT described above) should be disclosed and characterized, and a description should be provided on how it could influence the analysis results. A discussion of the potential error or bias should be carried into analyses that rely on the VMT analysis, such as greenhouse gas emissions, air quality, energy, and noise.*

Due to the lack of sensitivity of the NCST tool to project location, roadway type, congestion level, surrounding land uses, and localized trip characteristics, it was determined that the Fresno COG ABM is able to provide a more robust and comprehensive estimation of the VMT generated by capacity projects if combined with an integrated land use modeling process. The Fresno COG ABM is a tour-based model that is sensitive to route switching, mode shift, time-of-day change, longer trips, and new trips to existing destinations due to capacity improvements to the transportation system. In order to address the induced travel generated from new land use due to capacity improvements, which the ABM is not sensitive to by itself, Fresno COG staff and the Resource Systems Group, Inc. (RSG) are working to prepare a detailed iterative and integrated process for the induced VMT analysis. The methodology would look at induced VMT from new land uses generated by transportation capacity improvement projects. It would provide iterative and incremental feedback between the Fresno COG ABM and the land use growth allocation model such that changes in the traffic network are incorporated into land use allocation and vice-versa. For capacity projects that are not under Caltrans' jurisdiction, it is recommended that the Fresno COG ABM, in combination with the expanded land use tool, be utilized to calculate project-related induced VMT. As illustrated on Figure 11, VMT attributable to the project must be calculated by evaluating no project and with project conditions under the horizon year scenario using the Fresno COG ABM. Net increase in induced VMT will result in a significant impact for the proposed project.

Figure 13 illustrates a conceptual overview of the methodology to be followed to calculate induced demand. As illustrated on Figure 13, the effect of induced VMT will be required to be evaluated with an integrated land use and travel demand modeling process.

A detailed description of the integrated process for estimating induced VMT is provided in Appendix D.

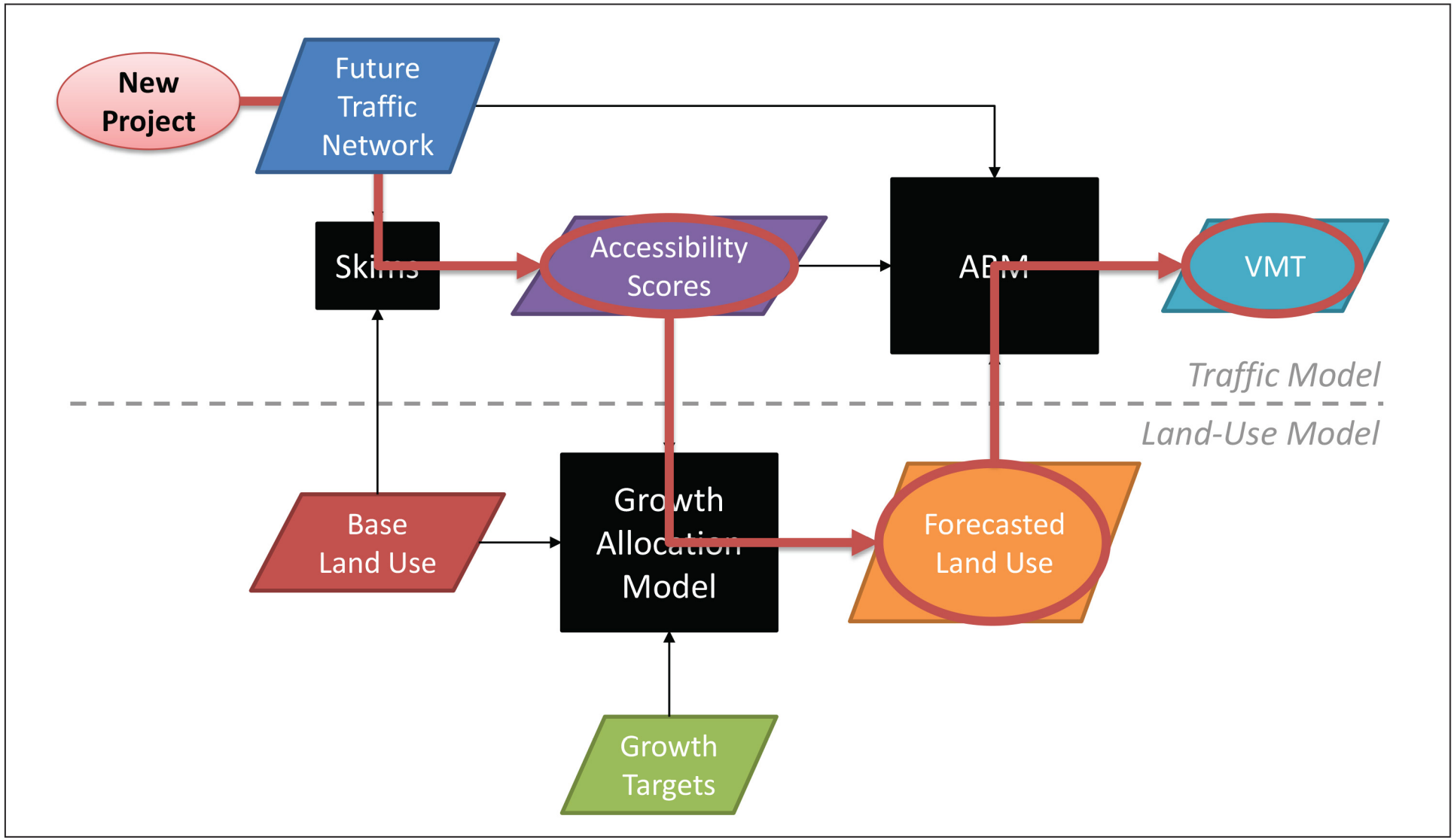


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FIGURE 13

Fresno County SB 743 Implementation Regional Guidelines

Conceptual Methodology for Calculating Induced Demand for Transportation Projects

SOURCE: Fresno Council of Governments

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6.0 THRESHOLD RECOMMENDATIONS FOR LAND USE PLANS

The OPR TA has provided guidance on traffic analyses for land use plans in the TA. The TA reiterates previous direction regarding individual land use assessments:

- Analyze the VMT outcomes over the full area over which the plan may substantively affect travel patterns (the definition of region).

- VMT should be counted in full rather than split between origins and destinations (the full impact of the project VMT).

Specifically, on page 18, the OPR TA states, "*A general plan, area plan, or community plan may have a significant impact on transportation if proposed new residential, office or retail land uses would in aggregate exceed the respective thresholds recommended above*." This recommendation refers to a threshold of exceeding 87 percent of the existing regional average, for residential and office uses and no net gain for retail land uses.

To assess a land use plan, use of a traffic-forecasting tool is recommended. Therefore, the Fresno COG recommends using the Fresno COG ABM to assess VMT for land use plans. The total VMT for the plan should be identified for all tour types and all potential VMT contributors within the plan area. Model runs shall be conducted for the existing base year and the horizon year (the future year scenario analyzed in the agency general plan or regional RTP) with project (plan).

The SB 375 process establishes ambitious and achievable GHG reduction targets for the 18 MPOs in the State. Achievements of these targets are to be accomplished through the integration of land use and transportation planning processes, not solely through the imposition of regulation on passenger cars and light-duty trucks. CARB reviews the SCS that is produced as part of the RTP developed by each of the State's MPOs. The SCS details the strategies and programs the regional agencies are planning to implement to achieve their designated GHG emission reduction targets. CARB approved the new GHG reduction targets for all the 18 MPOs in the State in the spring of 2018. The 2018 targets are applicable to the third SCSs for the MPOs. It should be noted that the CARB is estimated to update the MPO targets in 2026 and is currently engaging with the MPOs through workshops for the new targets.

Other legislative mandates and State policies speak to GHG reduction targets. A sample of these include:

- Assembly Bill (AB) 32 (2006) requires statewide GHG emissions reductions to 1990 levels by 2020 and continued reductions beyond 2020.

- SB 32 (2016) requires at least a 40 percent reduction in GHG emissions from 1990 levels by 2030.

- Executive Order (EO) B-30-15 (2015) sets a GHG emissions reduction target of 40 percent below 1990 levels by 2030.

- EO S-3-05 (2005) sets a GHG emissions reduction target of 80 percent below 1990 levels by 2050.

- EO B-16-12 (2012) specifies a GHG emissions reduction target of 80 percent below 1990 levels by 2050 specifically for transportation.

These mandates suggest that a land use plan consistent with the regional RTP/SCS would generally help achieve the target GHG reductions for the region.

California PRC Section 15064.3(b)(4) states (in part) the following:

> *A lead agency has discretion to choose the most appropriate methodology to evaluate a project's vehicle miles traveled, including whether to express the change in absolute terms, per capita, per household, or in any other measure.*

Since VMT is the largest contributor to GHG emissions, a land use plan consistent with a regional RTP/SCS GHG reductions target does not constitute a significant VMT impact. Therefore, the recommended methodology for conducting VMT assessments for land use plans shall be the comparison of existing VMT per capita, VMT per employee, and/or VMT per service population for the region with the respective expected horizon year VMT metrics for the different land use components (VMT per capita, VMT per employee, and/or VMT per service population) of the land use plan (project). If there is a net increase in the VMT metric under horizon year conditions, then the project would have a significant impact.

7.0 MITIGATION STRATEGIES

When a lead agency identifies a significant CEQA impact according to the thresholds described in the report, the agency must identify feasible mitigation measures in order to avoid or substantially reduce that impact. Unlike LOS impacts, which may be mitigated with location-specific motor vehicle delay improvements, VMT impacts typically require a more regional approach to mitigation, including the provision of incentives to effect changes in travel behavior. Enforcement of mitigation measures will still be subject to the mitigation monitoring requirements of CEQA, as well as the regular police powers of the agency. These measures can also be incorporated as a part of plans, policies, regulations, or project designs.

7.1 DEFINITION OF MITIGATION

Section 15370 of the *2020 State CEQA Guidelines* defines mitigations as follows:

> *"Mitigation" includes:*
>
> *a. Avoiding the impact altogether by not taking a certain action or parts of an action.*
>
> *b. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.*
>
> *c. Rectifying the impact by repairing, rehabilitating, or restoring the impacted environment.*
>
> *d. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.*
>
> *e. Compensating for the impact by replacing or providing substitute resources or environments, including through permanent protection of such resources in the form of conservation easements.*

Section 15097 of the *State CEQA Guidelines* states:

> *The public agency shall adopt a program for monitoring or reporting on the revisions which it has required in the project and the measures it has imposed to mitigate or avoid significant environmental effects. A public agency may delegate reporting or monitoring responsibilities to another public agency or to a private entity which accepts the delegation; however, until mitigation measures have been completed the lead agency remains responsible for ensuring that implementation of the mitigation measures occurs in accordance with the program.*

VMT mitigations may not necessarily be physical improvements; rather, they are complex in nature and will significantly depend on changes in human behavior. Therefore, it will be important that lead agencies develop a proper monitoring program to ensure the implementation of these mitigation measures throughout the life of a project in compliance with CEQA. Lead agencies must also coordinate with other responsible agencies as part of this monitoring program to evaluate the ongoing feasibility and durability of the mitigations.

Historically, mitigation measures for LOS-based transportation impacts have addressed either trip generation reductions or traffic-flow-capacity enhancements. LOS mitigation measures typically include physical infrastructure improvements, adding capacity to intersections, roadways, ramps, and

freeways. However, Transportation Demand Management (TDM) actions, active transportation amenities, and other measures designed to reduce the number of new single-occupancy vehicle trips are also possible mitigation strategies.

VMT mitigation measures are significantly different. Most VMT mitigations may seem feasible from a theoretical perspective, but practical implementation of these strategies as formal CEQA mitigation measures in perpetuity is yet to be tested. Several of these mitigations are contextual and behavioral in nature. Their success will depend on the size and location of the project as well as expected changes in human behavior. For example, a project providing a bike share program does not necessarily guarantee a behavioral change within the project's population; the level of improvement may be uncertain and subject to the whim of the population affected.

LOS mitigations (e.g., addition of turn lanes) focus more on rectifying a physical CEQA impact (strategy "c" of *State CEQA Guidelines* Section 15370). On the contrary, the majority of VMT mitigations (e.g., commute trip-reduction programs) will aim at reducing or eliminating an impact over time through preservation and monitoring over the life of the project (strategy "d" of *State CEQA Guidelines* Section 15370). Additionally, some VMT mitigations (e.g., those focused on land use/location-based policies) will aim at minimizing impacts by reducing the number of trips generated by the projects (strategy "b" of *State CEQA Guidelines* Section 15370).

Furthermore, it may be that identified VMT impacts cannot be mitigated at the project level. Most VMT impacts occur in the context of the regional scale of analysis. The incremental change in VMT associated with a project in the particular setting in which it may be located would suggest a greater VMT deficit than individual strategies can offset. Only a regional solution (e.g., completion of a transit system, purchase of more transit buses, or gap closure of an entire bicycle master plan system) may offer the incremental change necessary to reduce the VMT impact to a level of insignificance. Also, VMT, as a proxy for GHG emissions, may not require locational specificity. A project does not necessarily need to diminish the VMT at the project site to gain benefit in VMT and GHG reduction in the State. Offsets in an area where the benefit would be greater will have a more effective reduction in VMT and GHG and contribute to the regional and State's ultimate climate goals. This regional perspective provides the basis for the cap-and-trade strategies.

These issues of regional scale, appropriate and timely fair share contributions from projects and/or local jurisdictions (partial versus comprehensive participation), and geographic ambiguity confound the certainty of agency's identification of VMT mitigation measures. Section 15126.4 of the *State CEQA Guidelines* states, "*Where several measures are available to mitigate an impact, each should be discussed and the basis for selecting a particular measure should be identified.* ***Formulation of mitigation measures shall not be deferred until some future time*** [emphasis added]." Certainty does not yet exist that partial participation in VMT mitigation measures is permissible. Regional VMT mitigation is considered the most effective method for large-scale VMT reduction, yet the cost and implementation barriers are greater in most cases than one project can undertake. The only exception may be where VMT mitigation strategies are provided at a regional level in the form of mitigation banks, fees, and exchanges and the projects are subject to contribute to these fee programs consistent with applicable provision to ensure compliance and consistency with CEQA and other legal requirements.

PRC Section 21099 (b) (4) states, "*This subdivision [requiring a new transportation metric under CEQA] does not preclude the application of local general plan policies, zoning codes, conditions of approval, thresholds, or any other planning requirements pursuant to the police power or any other authority.*" Hence, despite the fact that automobile delay will no longer be considered a significant impact under CEQA, the lead agency would still require projects to meet the LOS standards designated in its zoning code or general plan. Therefore, this report is not intended to supersede LOS assessment in the agency's evaluation of projects, and the project would still be required to propose LOS improvements for congestion relief in addition to VMT mitigation strategies as required by CEQA.

7.2 MITIGATION MEASURES

7.2.1 Land Use Development Projects and Community/General Plans

Mitigations and project alternatives for VMT impacts have been suggested by the OPR and are included in the TA. VMT mitigations can be extremely diverse and can be classified under several categories (e.g., land use/location, road pricing, transit improvements, commute trip reduction strategies, and parking pricing/policy). However, the issue with VMT mitigations is the quantitative measurement of the relief provided by the strategies. How much VMT reduction does a TDM program, a bike share program, a transit route, or 1 mile of sidewalk provide? Improvements related to VMT reduction strategies have been quantified in sources such as the California Air Pollution Control Officers Association (CAPCOA) *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity (CAPCOA Manual)* (September 2024) and various resources provided by the CARB. This information is generally presented with a wide range of potential VMT reduction percentages.

Source: https://abc30.com/3126364/

Bus Rapid Transit in City of Fresno

This report does not, however, confirm the existence of substantial evidence supporting the application of any such mitigation measures to projects within the region. If a CAPCOA mitigation measure will be considered for a project, it must be determined, through substantial evidence, that the mitigation measure will result in VMT reduction in the manner suggested. For example, if a mitigation measure's VMT reduction will be calculated by use of a mathematical formula, the formula, including each of its components, must be analyzed to confirm that they reflect the conditions existing in the region, and the analysis must be supported by substantial evidence. In other words, a mitigation measure that is reliant upon a formula developed utilizing data from and conditions in a locale that is dissimilar to the region may be inapplicable to a project within the region. Similarly, any mitigation measure suggested by CAPCOA that depends on cited reports or studies must be assessed to determine whether substantial evidence

Source: https://www.fresnocog.org/project/measure-c/

Fresno County Transportation Authority's Measure C Program

confirms that such reports and studies apply to the conditions under which a proposed project will be developed. Mitigation measures should not be utilized merely because they are suggested by CAPCOA or another organization.

Appendix E is a summary of the different VMT mitigation measures and project alternatives stated in the CAPCOA Green Book (only those strategies directly attributed to transportation). For any VMT mitigation measure, the project applicant should be required to provide substantial evidence while identifying a project-specific value.

Source: https://www.fresno.gov/publicworks/wp-content/uploads/sites/17/2016/09/170022FresnoATPFinal012017.pdf

Bike Routes in the City of Fresno

Appendix F provides a list of mitigations for land use development projects based on the research work performed by Deborah Salon, Marlon G. Boarnet, Susan Handy, Steven Spears, and Gil Tal with the support of CARB. For a few mitigation measures, Fresno COG staff conducted additional research as applicable to the Fresno COG region using the Fresno COG ABM and locally available empirical data. Based on that analysis, specific VMT reduction percentages were developed for these mitigation measures. Details about these mitigation measures are provided in the *Fresno County SB 743 Implementation Regional Guidelines – Technical Report* (March 2021).

For all other mitigation measures, the project applicant will be required to provide substantial evidence while identifying a project-specific value. In case that information is not available, consistent with Fresno COG recommendations, the project should apply the low-point of provided ranges for VMT reduction. Where a mitigation strategy does not have an identified VMT reduction range, the project applicant would be required to provide a reduction estimate supported by evidence.

As for land use plans, the potential mitigation measures for community/general plans would be similar to those for land use development projects, with certain modifications. The OPR TA does not specifically state any VMT mitigations for land use plans. However, the transportation impact study guidelines for the San Diego Region list potential mitigation measures. These measures have been summarized in Appendix G along with corresponding VMT reduction percentages obtained from CAPCOA.

It must be noted that Appendices E through G provide only summaries of the mitigations stated in the sources mentioned above. The reader should refer to the original source for further details and for subsequent updates to the mitigation measures. Also, Appendices E through G do not provide an exhaustive list of mitigation measures to offset the CEQA impacts. Other measures can also be accepted by agencies based on provision of substantial evidence.

As additional mitigation measures are developed to offset VMT impacts in the future for the *State CEQA Guidelines* process, linkages between the strategy and the incremental effect and quantified offset must be made. This can be based on other sources' observations and measurements or the agency's experience in these practices. The key to mitigation is to base its efficacy on real and substantial evidence.

7.2.2 Transportation Projects

Although OPR provides detailed guidance on how to assess induced-growth impacts associated with transportation projects, it leaves the subject of mitigation measures vague. Only four strategies are suggested as mitigation measures:

- Tolling new lanes to encourage carpools and fund transit improvements.
- Converting existing general-purpose lanes to high-occupancy vehicle (HOV) or high-occupancy toll (HOT) lanes.
- Implementing or funding off-site travel demand management.
- Implementing Intelligent Transportation Systems strategies to improve passenger throughput on existing lanes.

Source: https://medium.com/@davidcanepa/toll-lanes-good-for-the-rich-bad-for-the-environment-4f1ec24105d3

Toll Lanes

No quantified reduction percentage is allocated to these strategies, and LSA could find no substantial evidence that would provide guidance to levels of significance after implementation of these strategies. Review of the four recommended strategies suggests that the OPR is directing strategies away from general-purpose mixed-flow lanes on expressways, freeways, and arterial highways. Inasmuch as these are the project descriptions and Purpose and Need, the project intent and the project mitigation may be at odds. The lead agency would be subject to an SOC for the capital project VMT impact.

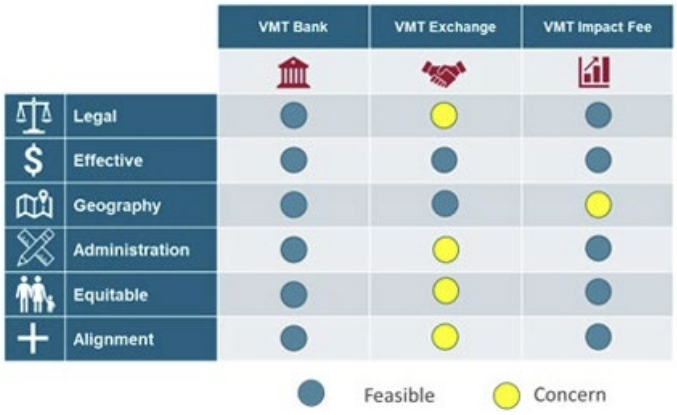
7.3 FUNDING MECHANISMS

The change in the metric for transportation impacts from LOS to VMT will lead to a shift in impacts and mitigation measures from being local and project-specific to being more regional in nature. The OPR acknowledges the regional nature of VMT impacts and states that regional VMT reduction programs and fee programs (in-lieu fees and development impact fees) may be appropriate forms of mitigation. Fee programs are particularly useful to address cumulative impacts. It is very important for the agencies to coordinate with the RTPA or the MPO to develop such mitigation programs that would fund transit, develop active transportation plans, etc. These programs are regional in nature and best suited for administration by the regional agency. Regional agencies may also wish to coordinate with appropriate stakeholders, including participating local jurisdictions, developers, and other interests while conducting nexus studies and checking for rough proportionality and compliance with CEQA.

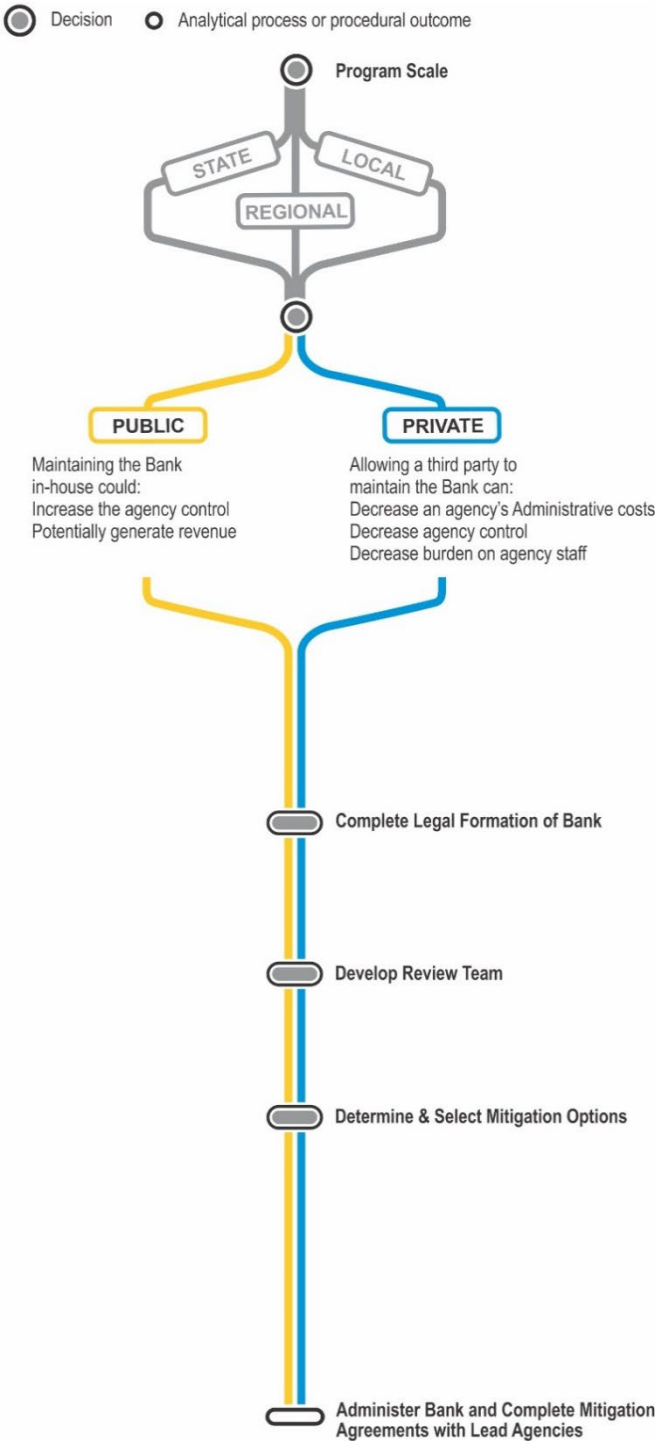
Most of the VMT mitigations included in Appendix C are applicable in urban areas. They are less effective in suburban and rural contexts, where TDM strategies may become diluted or are not applicable. Thus, site-specific strategies are more suitable in urban areas, whereas program-level strategies are more suitable for projects in suburban/rural areas. In the latter approach, cumulative contributions for development mitigations can pay for VMT reduction strategies that would not be feasible for the individual projects to implement themselves. Apart from fee programs, program-

based mitigation approaches may include mitigation exchanges and mitigation banks. The mitigation exchange concept requires a developer to implement a predetermined project that would reduce VMT in order to propose a new one. On the other hand, the concept of mitigation banks seeks to establish monetary values for VMT reductions so that developers can purchase VMT reduction credits.

As previously stated, VMT impacts are more regional in nature. Hence, there might be requirements for mitigations outside the control of the lead agency, and without consent from the agency controlling the mitigations, the impacts might remain significant and unavoidable. Additionally, identification of regional improvements where projects can contribute their fair share to mitigate impacts might prove to be difficult. Therefore, it is recommended that local agencies work collaboratively within their regions to ultimately establish fee programs, mitigation banks, and exchanges as the most efficient way to establish a regional mitigation pathway where the projects can contribute. Procedural flow charts for VMT banks, exchanges, and impact fees are provided on the following pages. The Fresno COG is currently conducting a regional VMT mitigation program study regarding regional VMT mitigation programs. Phase I of the study has been completed with a feasibility study on various mitigation approaches/programs. After completing the project analyses, outreach, framework evaluations, and reviewing all considerations, it was determined that a fee-based VMT mitigation program is a feasible option for the Fresno COG region. In addition, it was determined that VMT banking would be the most appropriate initial program framework for implementation in the Fresno region. Fresno COG will be conducting the Phase II of this study next year to establish the regional VMT mitigation framework.

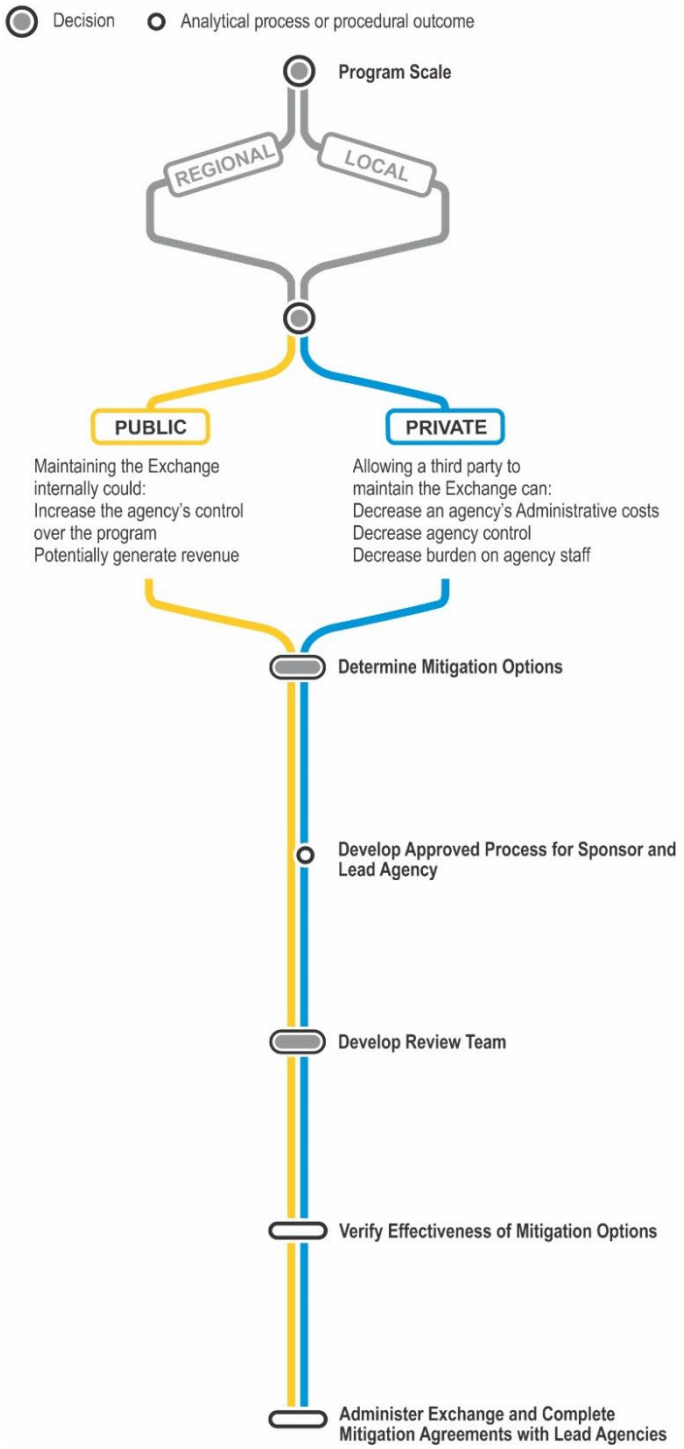


Fresno COG Regional VMT Mitigation Program Evaluation



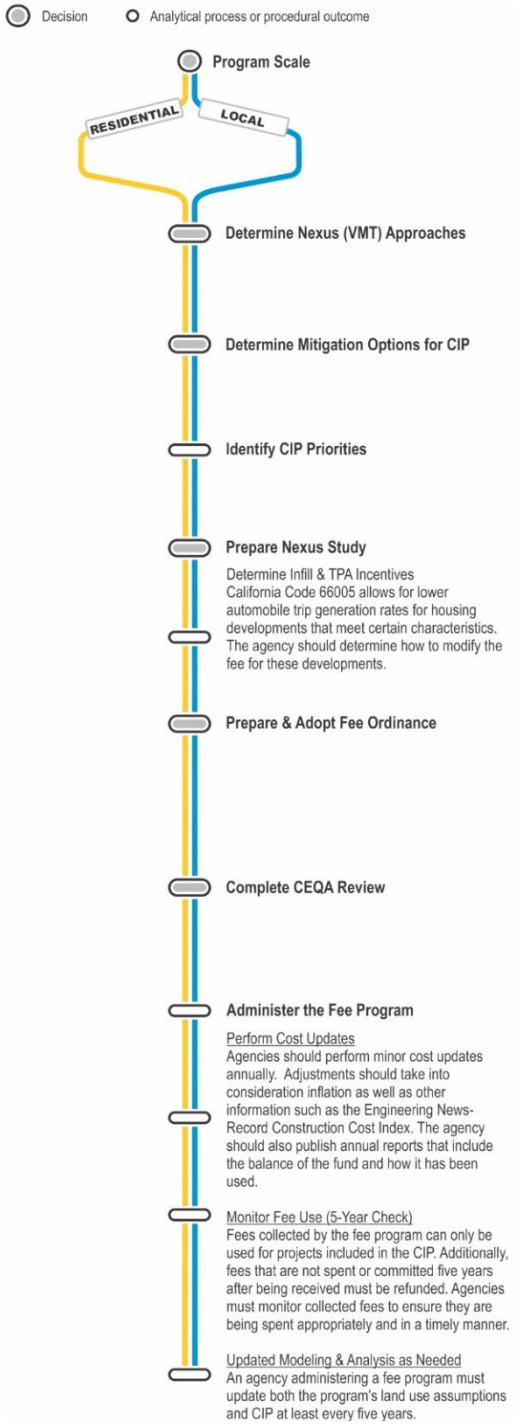
Source: VMT Mitigation Through Banks and Exchanges: Understanding New Mitigation Approaches. A White Paper by Fehr & Peers (January 2020).

Procedural Flow Chart – VMT Bank



Source: VMT Mitigation Through Banks and Exchanges: Understanding New Mitigation Approaches. A White Paper by Fehr & Peers (January 2020).

Procedural Flow Chart – VMT Exchange



Source: Understanding New Mitigation Approaches. A White Paper by Fehr & Peers (January 2020).

Procedural Flow Chart – VMT Impact Fee

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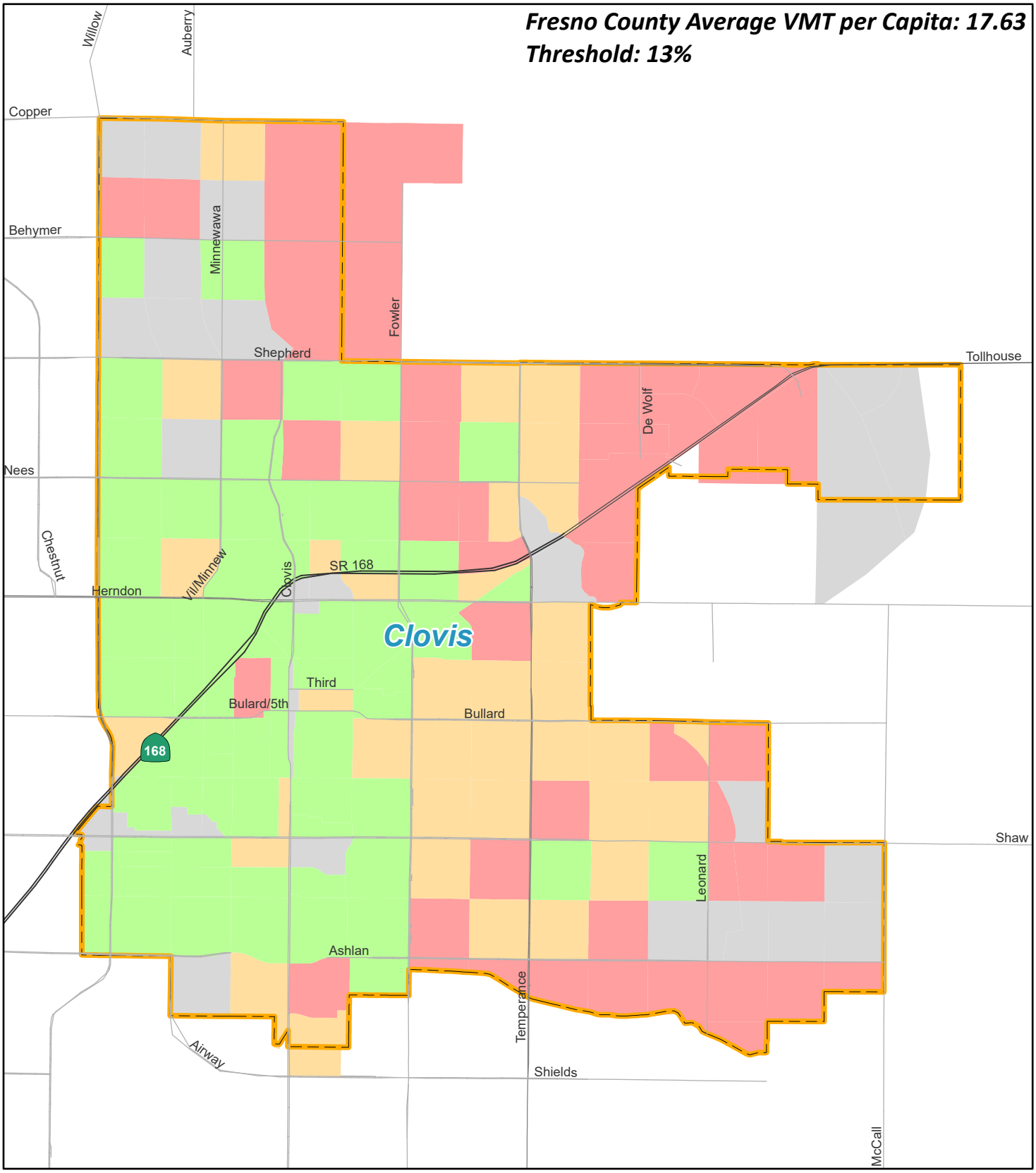
APPENDIX A

VMT PER CAPITA SCREENING MAPS FOR MEMBER JURISDICTIONS


Fresno County Average VMT per Capita: 17.63
Threshold: 13%
Willow
Auberry
Copper
Behymer
Minnewawa
Fowler
Shepherd
Tollhouse
De Wolf
Nees
Chestnut
Herndon
Viì/Minnew
Clovis
SR 168
Clovis
Third
Bulard/5th
Bullard
168
Shaw
Leonard
Ashlan
Temperance
Airway
Shields
McCall
LSA
VMT per Capita
Less than 5 Households
Less than 15.34
15.34 - 17.63
Greater than 17.63
Cities Including Sphere of Influence
Appendix A-1
N
0
3000
6000
FEET
Fresno County SB 743 Implementation Regional Guidelines
City of Clovis - Existing VMT per Capita
SOURCE: Fresno COG Activity Based Travel Demand Model (2019)
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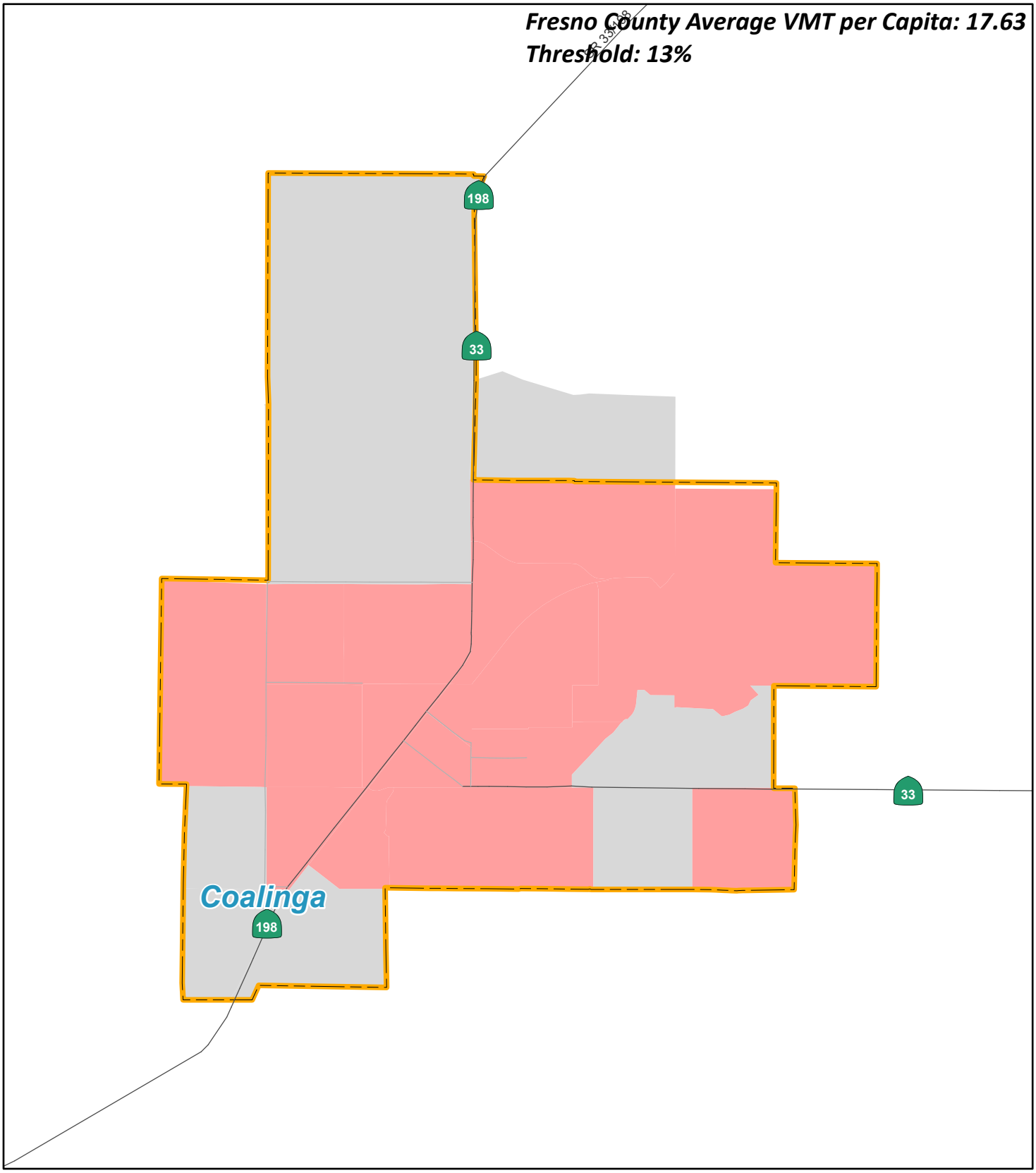

LSA

VMT per Capita

Less than 5 Households

Greater than 17.63

Cities Including Sphere of Influence

Appendix A-2

N

0 1750 3500

FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Coalinga - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

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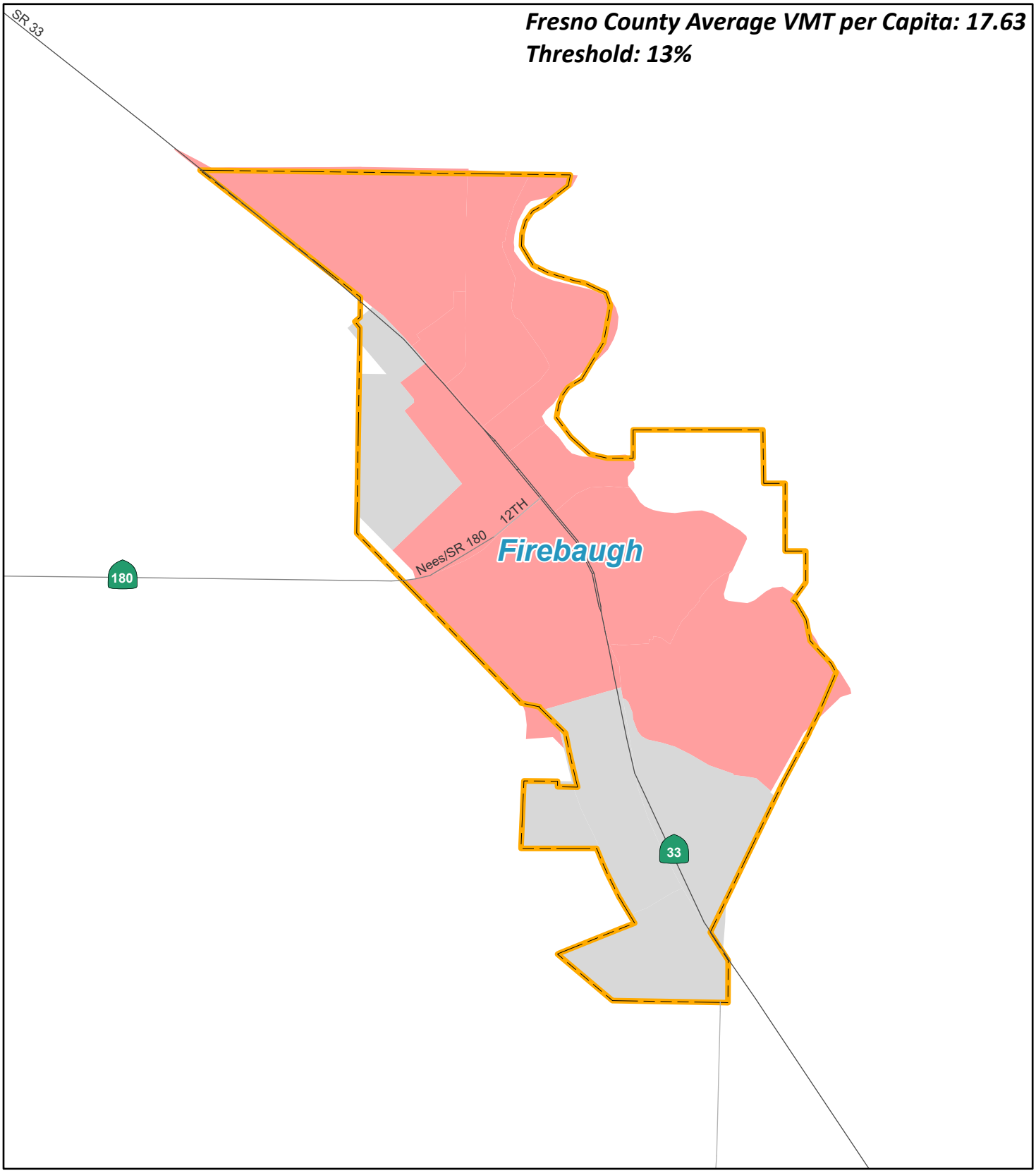


LSA

VMT per Capita

Less than 5 Households

Greater than 17.63

Cities Including Sphere of Influence

Appendix A-3

N

0 1750 3500

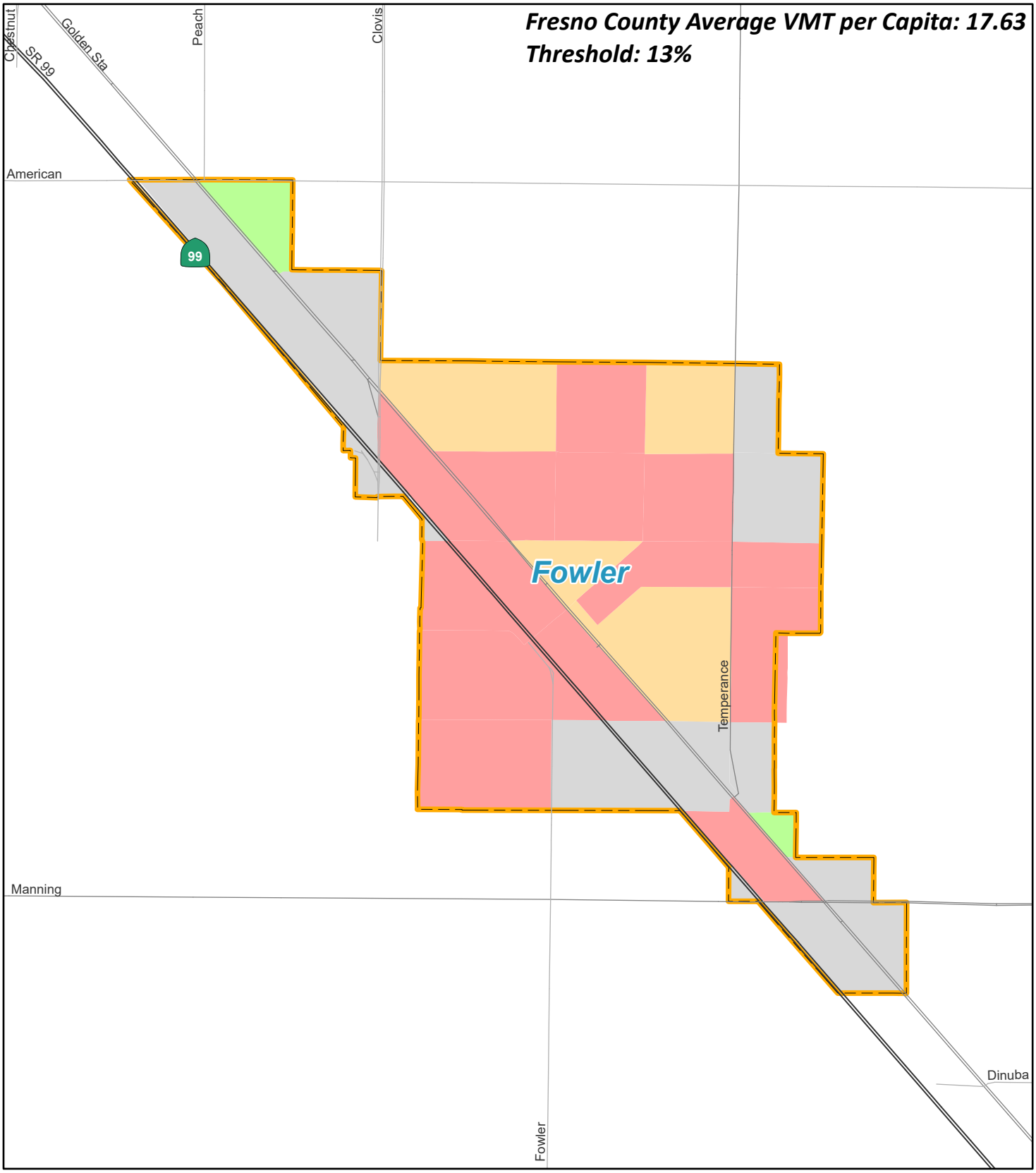
FEET

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

Fresno County SB 743 Implementation Regional Guidelines

City of Firebaugh - Existing VMT per Capita

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Capita

- Less than 5 Households
- Less than 15.34
- 15.34 - 17.63
- Greater than 17.63

Cities Including Sphere of Influence

Appendix A-4

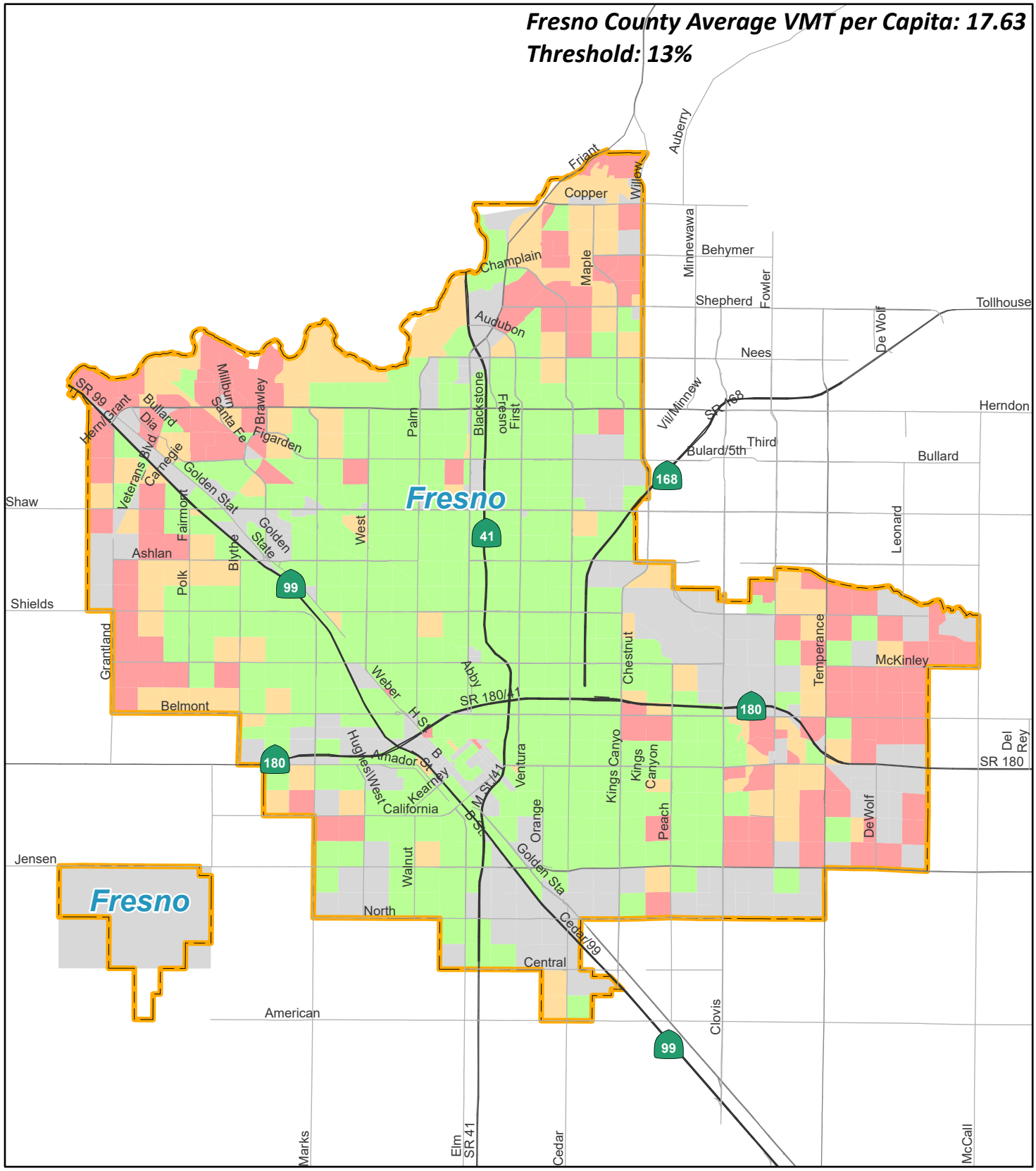
0 2000 4000
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Fowler - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

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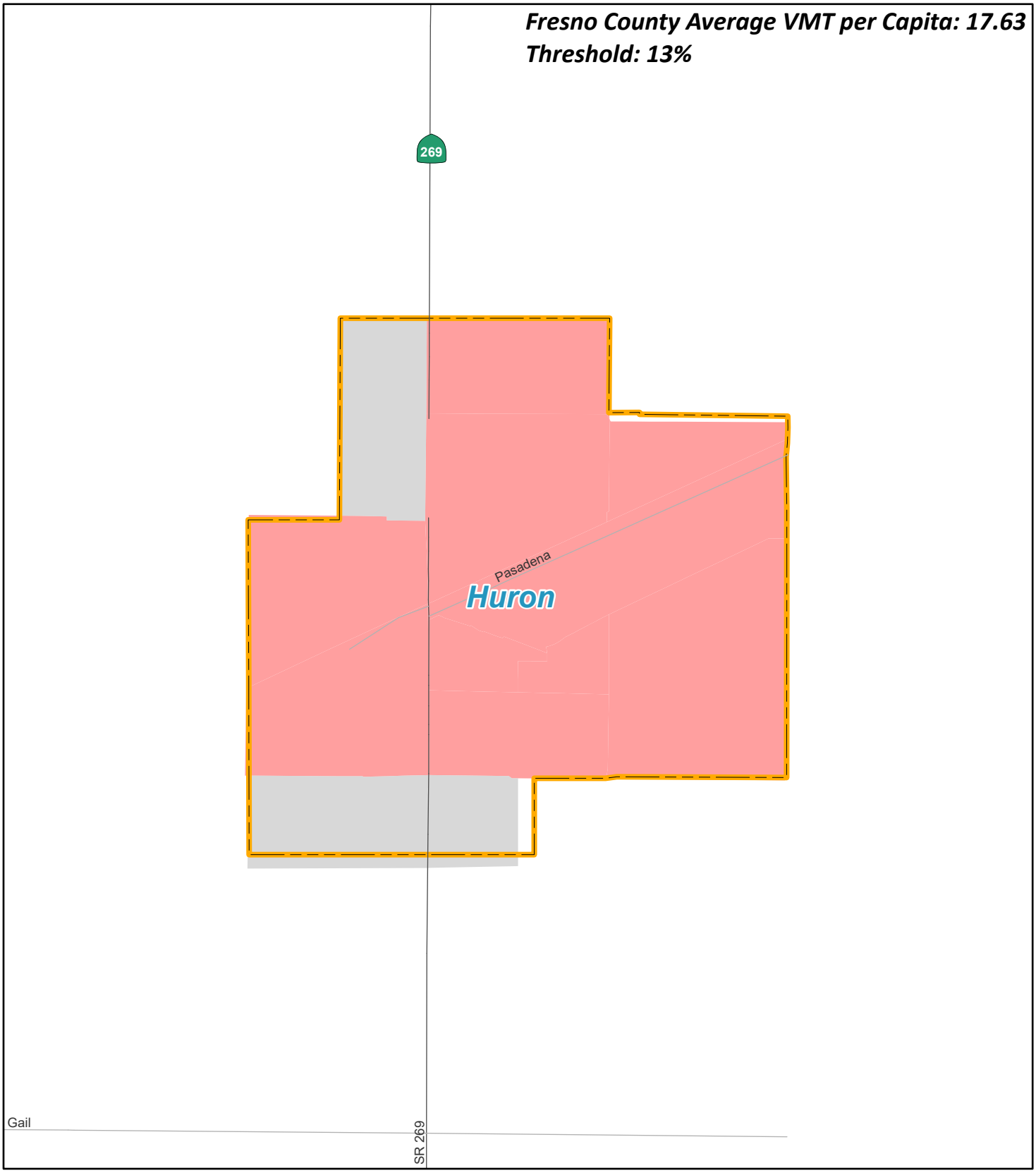


LSA

VMT per Capita

Less than 5 Households

Greater than 17.63

Cities Including Sphere of Influence

Appendix A-6

N

0 1000 2000

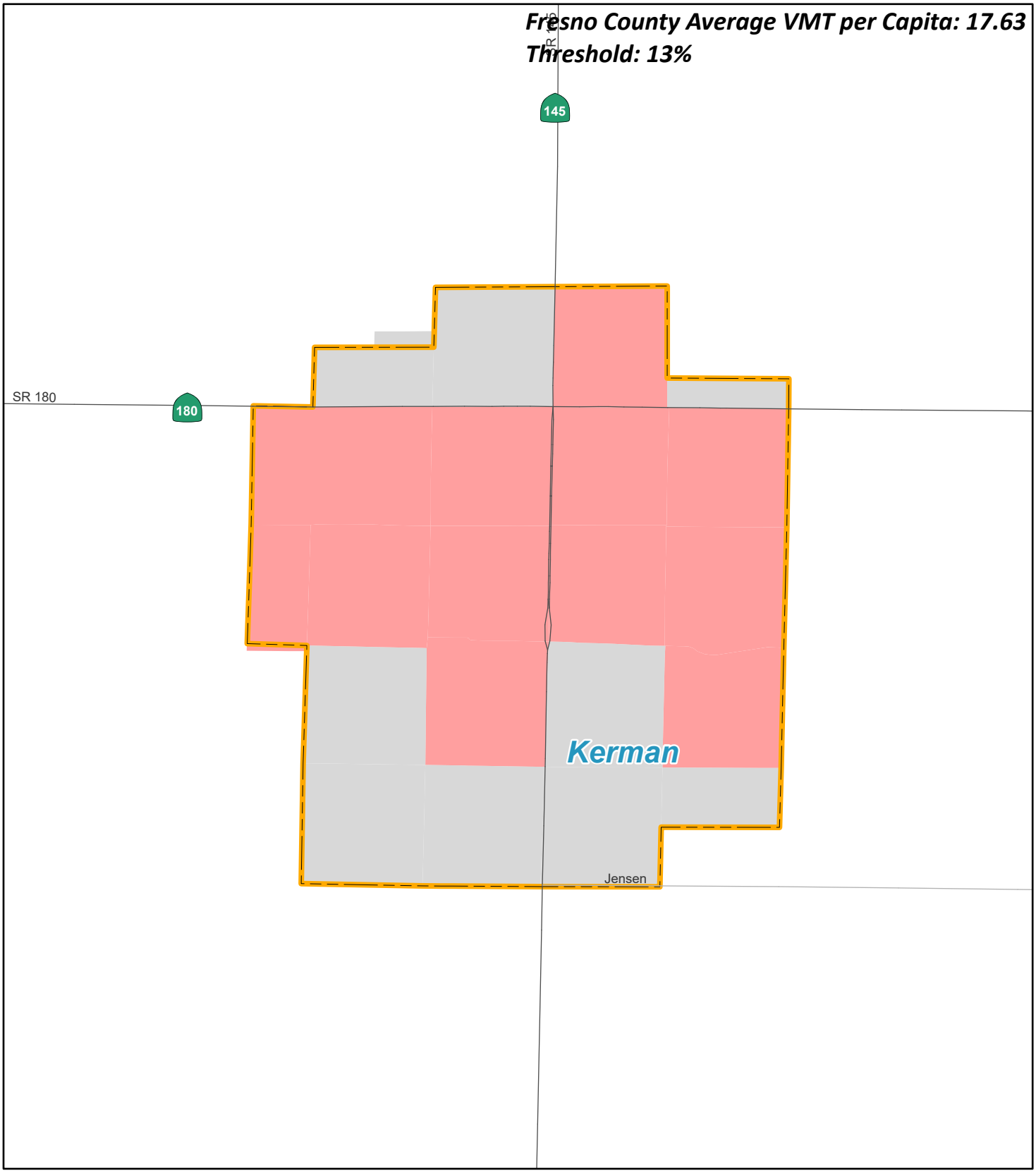
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Huron - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Capita

Less than 5 Households

Greater than 17.63

Cities Including Sphere of Influence

Appendix A-7

N

0 1500 3000

FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Kerman - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

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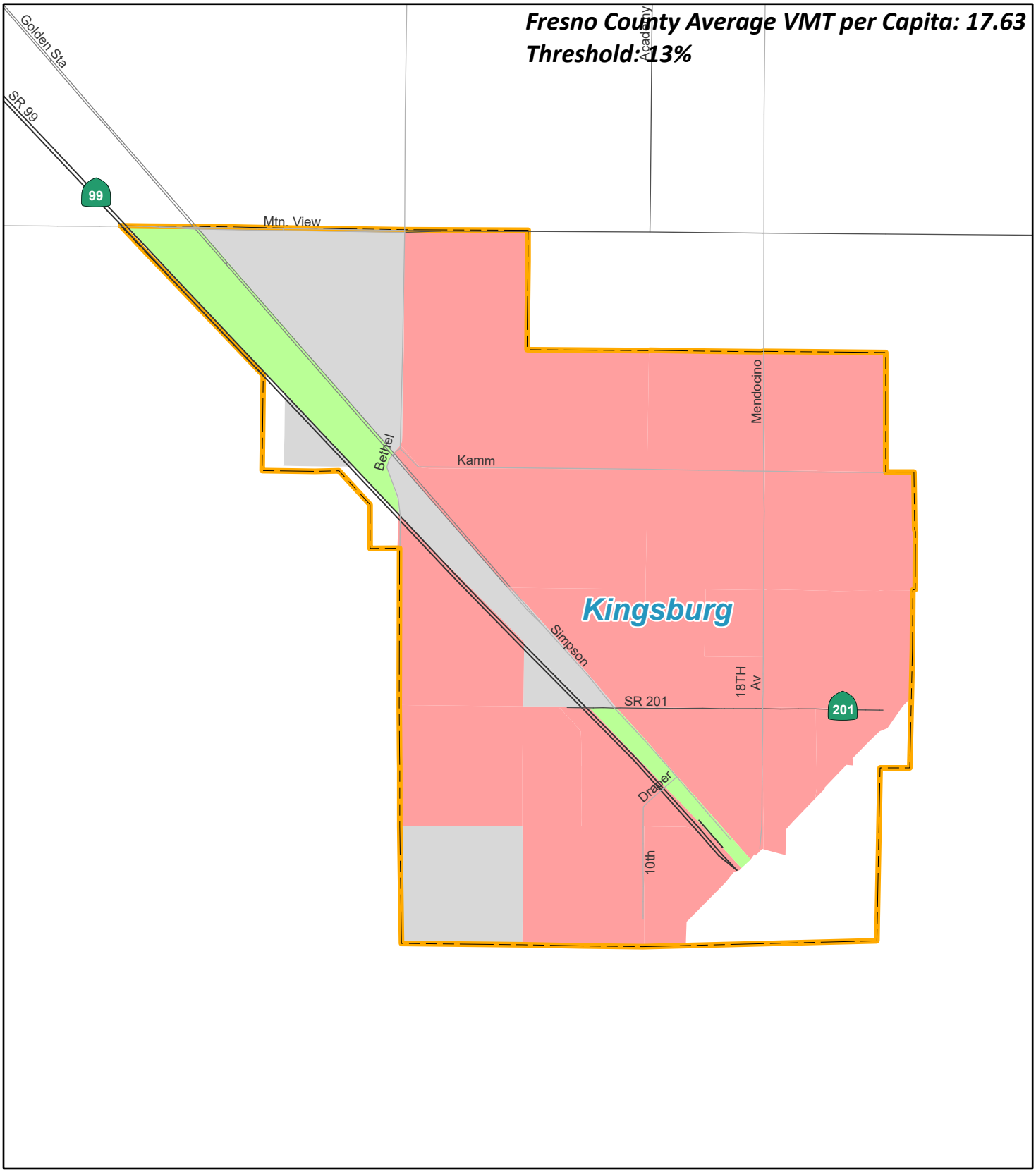

LSA

VMT per Capita

- Less than 5 Households
- Less than 15.34
- Greater than 17.63

Cities Including Sphere of Influence

Appendix A-8

N

0 1500 3000

FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Kingsburg - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

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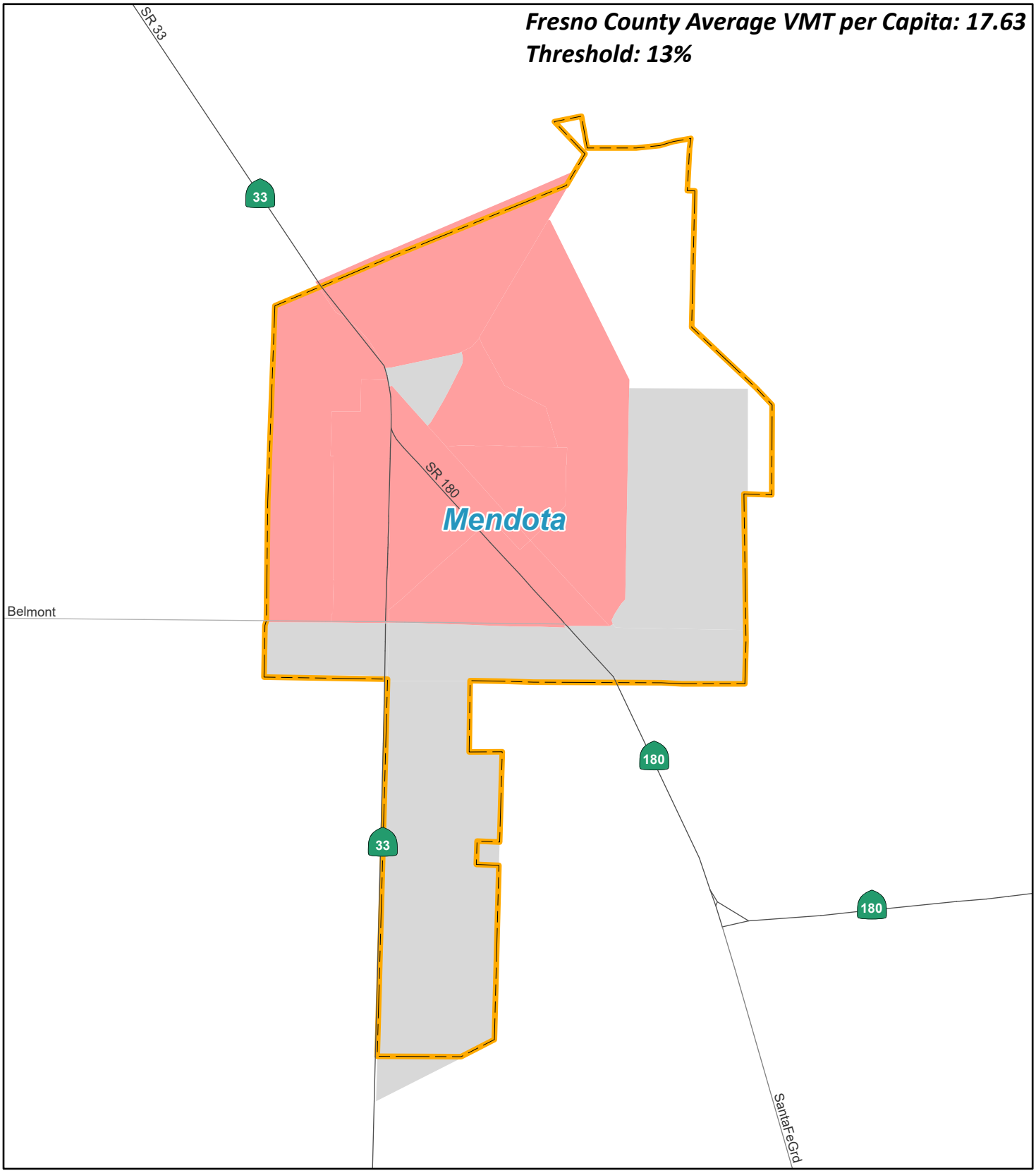


LSA

VMT per Capita

Less than 5 Households

Greater than 17.63

Cities Including Sphere of Influence

Appendix A-9

N

0 1500 3000

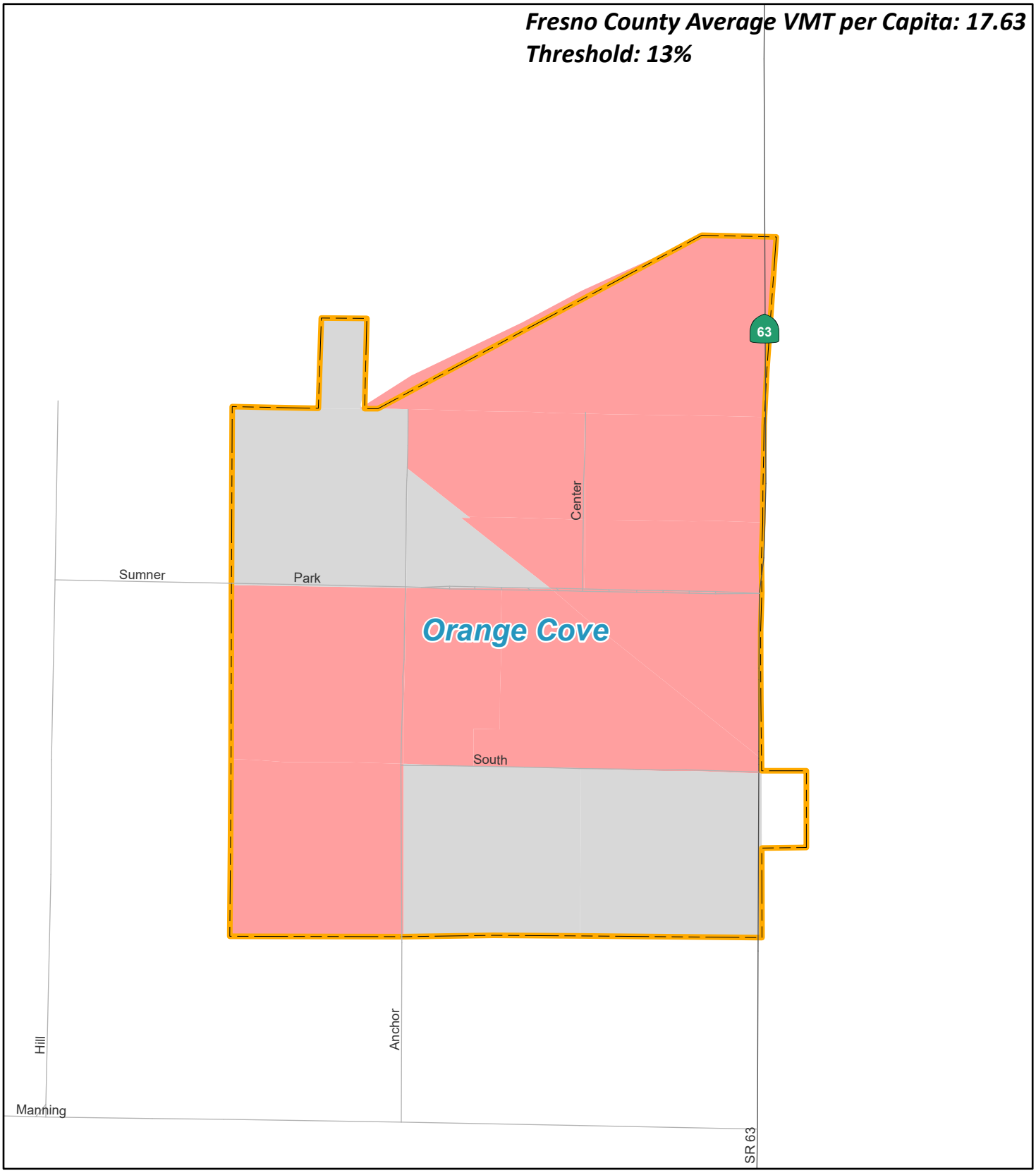
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Mendota - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Capita

Less than 5 Households

Greater than 17.63

Cities Including Sphere of Influence

Appendix A-10

N

0 1000 2000

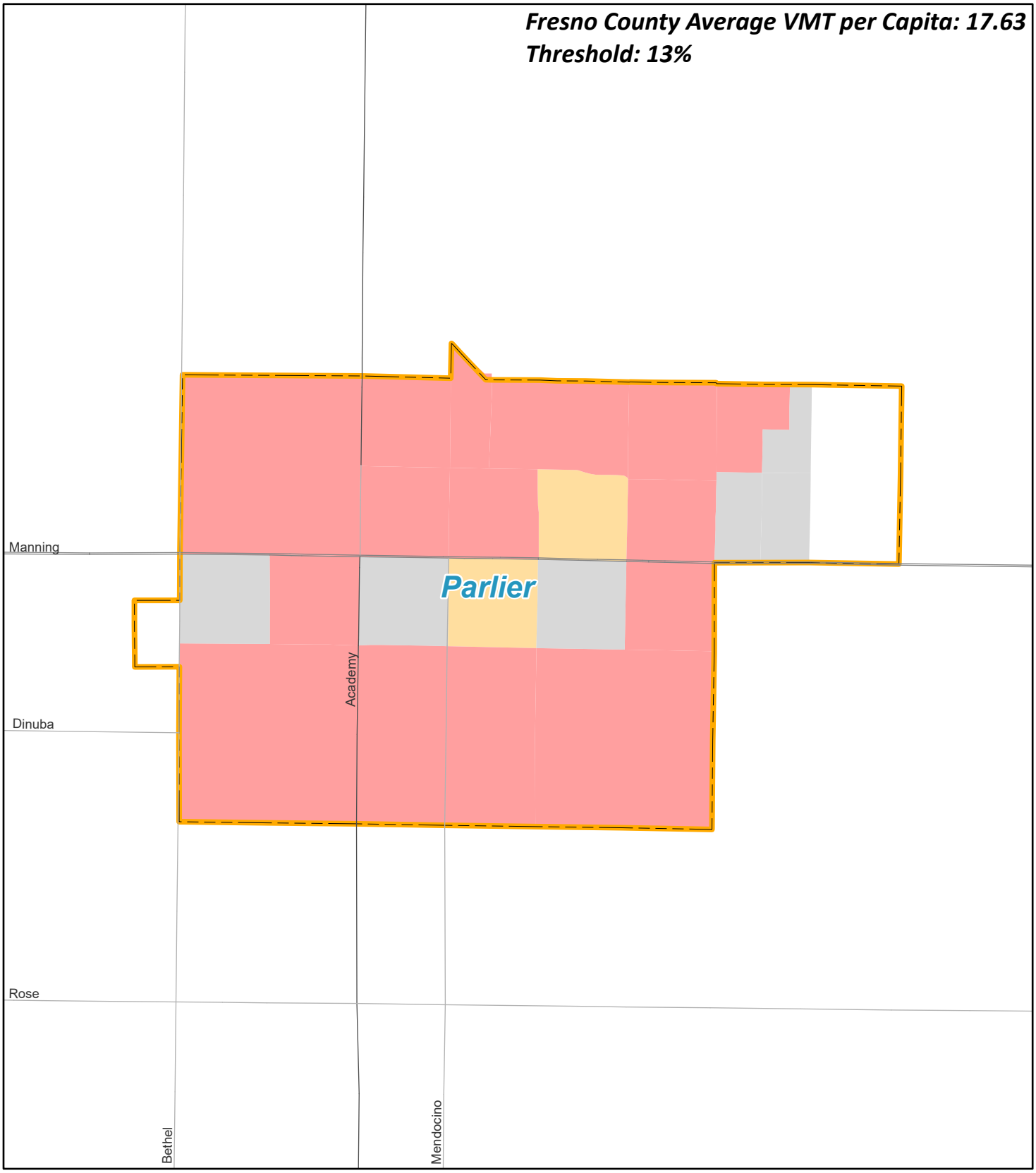
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Orange Cove - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Capita

- Less than 5 Households
- 15.34 - 17.63
- Greater than 17.63

Cities Including Sphere of Influence

Appendix A-11

N

0 2000 4000

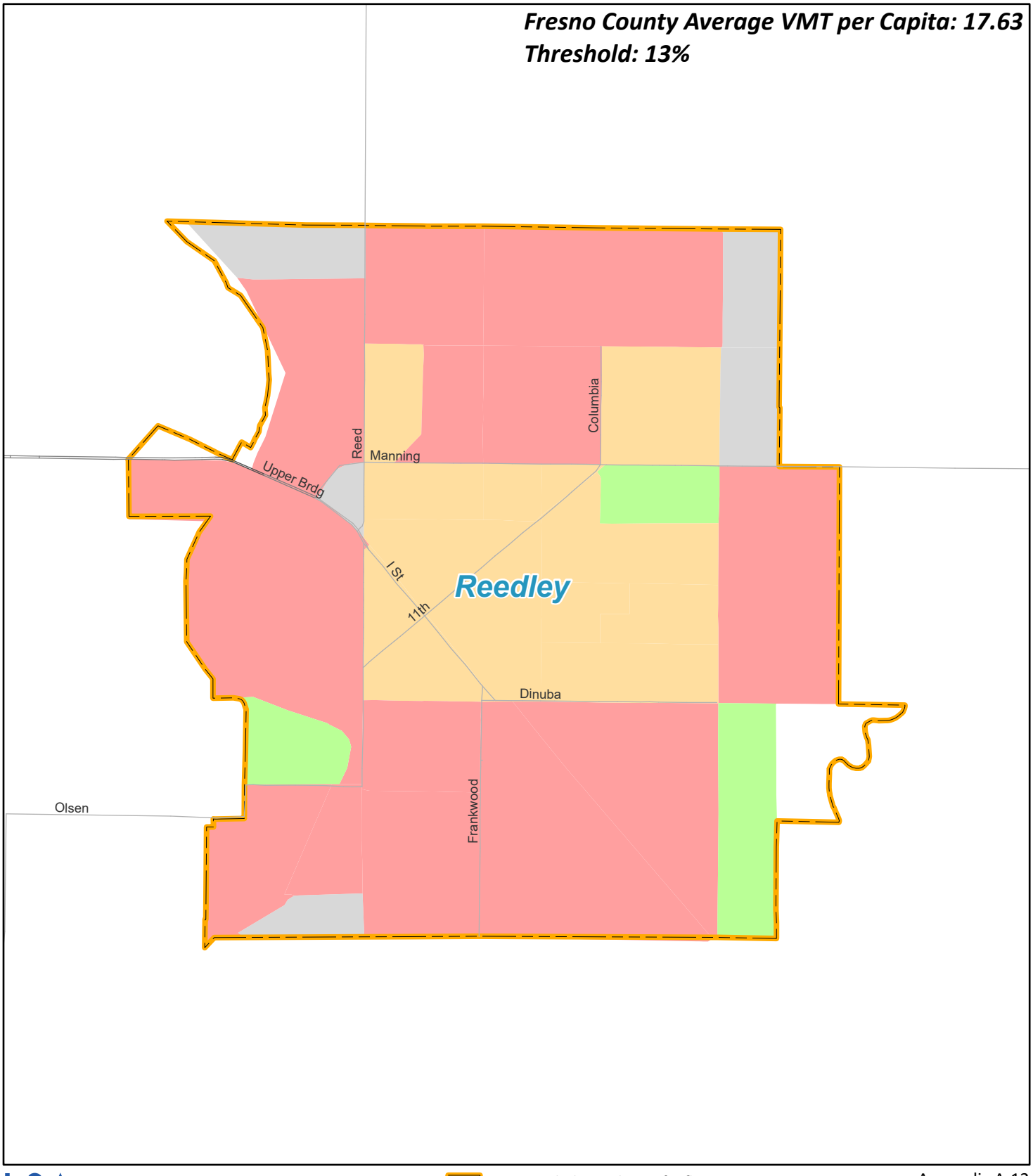
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Parlier - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

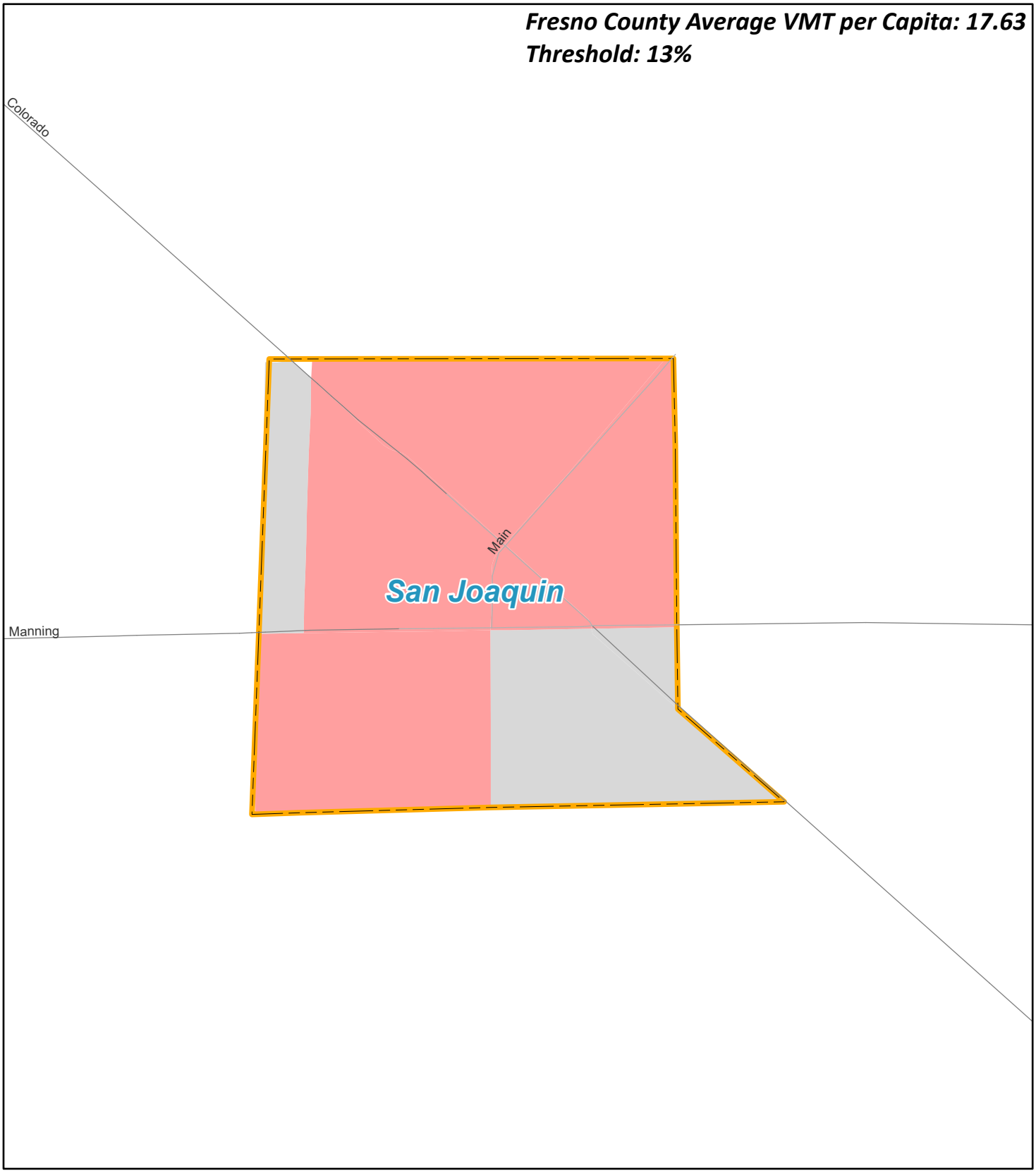
Appendix A-12

Fresno County SB 743 Implementation Regional Guidelines

City of Reedley - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Capita

Less than 5 Households

Greater than 17.63

Cities Including Sphere of Influence

Appendix A-13

N

0 1000 2000

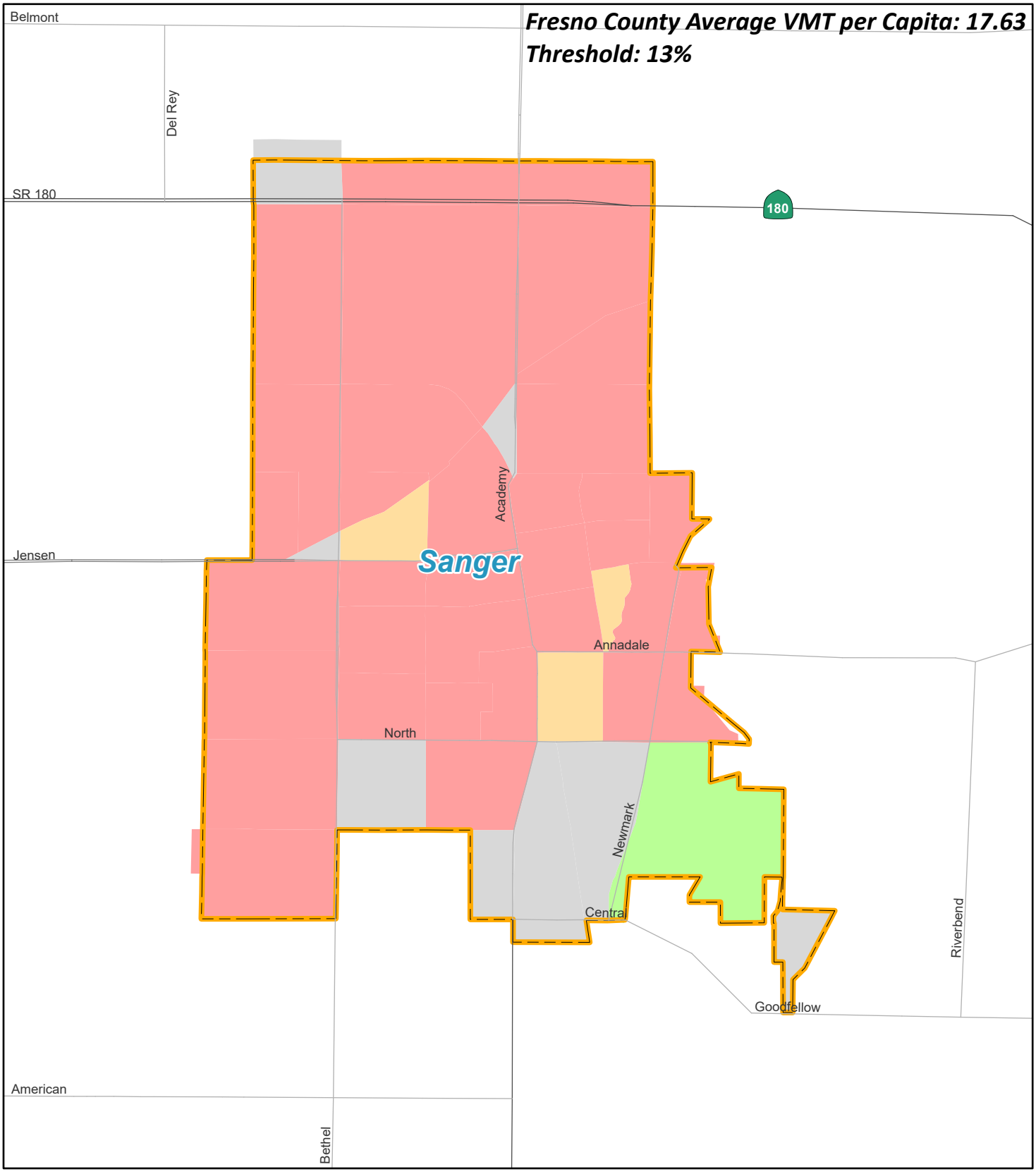
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of San Joaquin - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Capita

- Less than 5 Households
- Less than 15.34
- 15.34 - 17.63
- Greater than 17.63

Cities Including Sphere of Influence

Appendix A-14

N

0 2000 4000

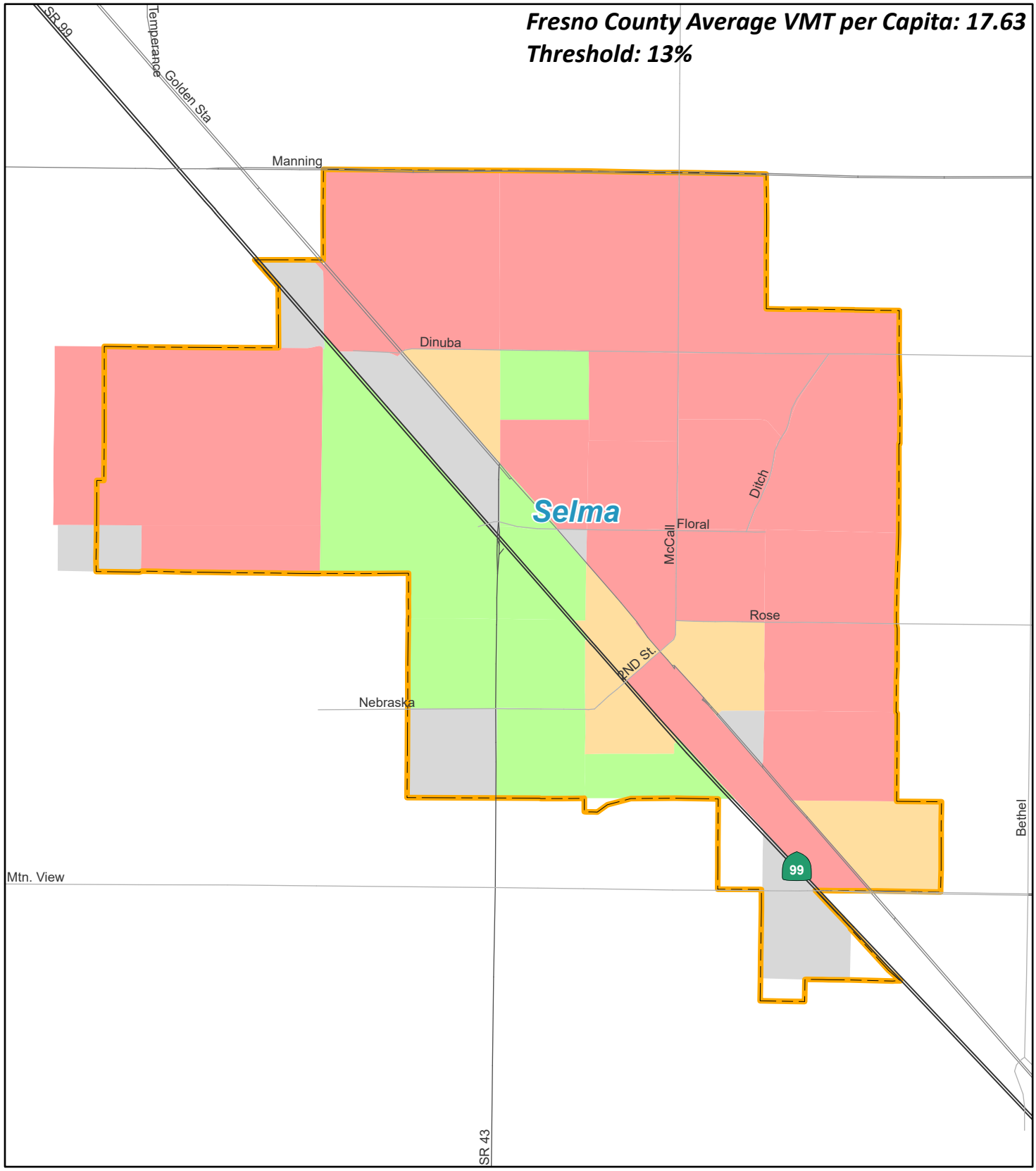
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Sanger - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Capita

- Less than 5 Households
- Less than 15.34
- 15.34 - 17.63
- Greater than 17.63

Cities Including Sphere of Influence

0 2000 4000
FEET

Appendix A-15

Fresno County SB 743 Implementation Regional Guidelines

City of Selma - Existing VMT per Capita

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)

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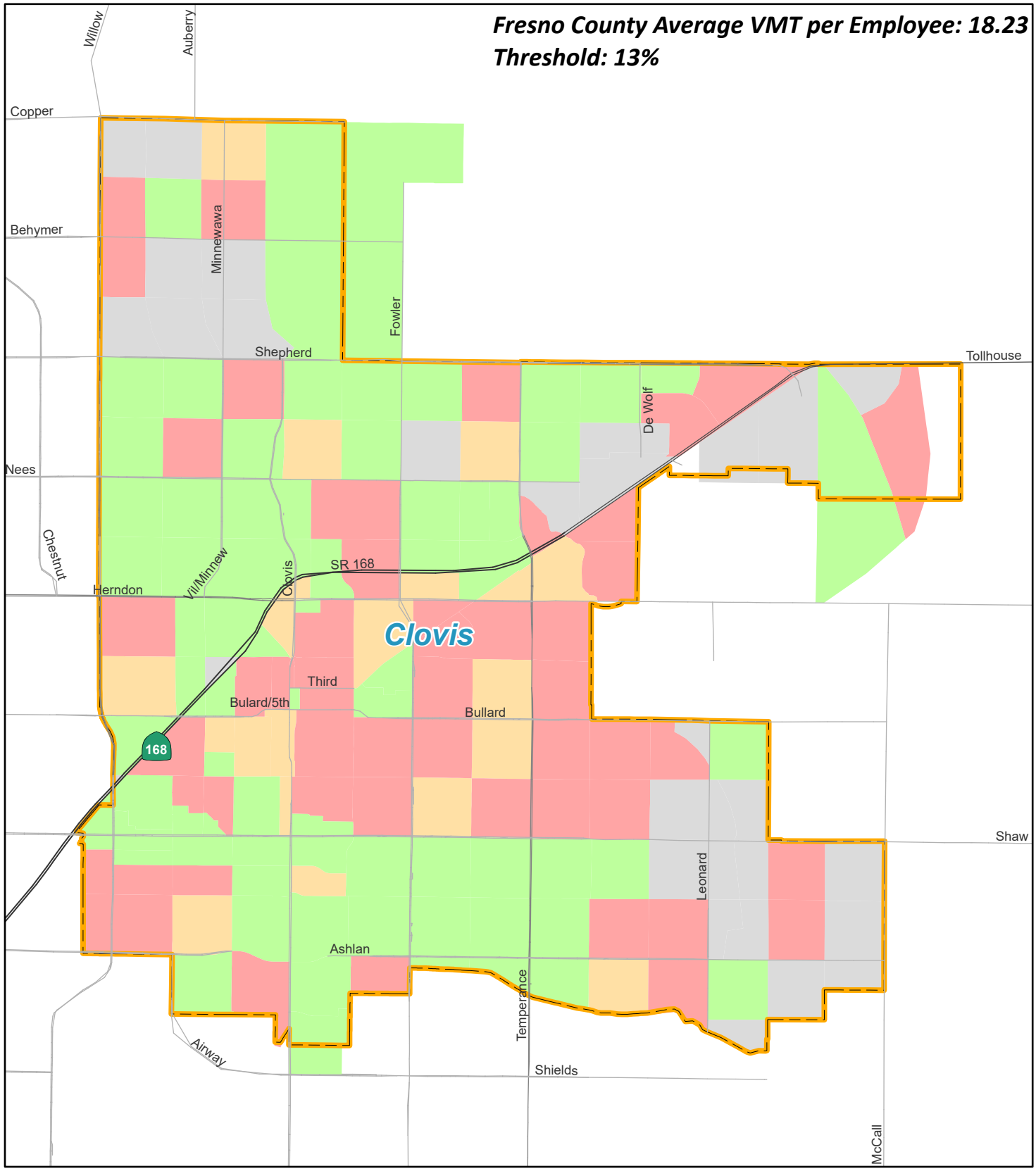
APPENDIX B

VMT PER EMPLOYEE SCREENING MAPS FOR MEMBER JURISDICTIONS



LSA

VMT per Employee

- Less than 5 Employment
- Less than 15.86
- 15.86 - 18.23
- Greater than 18.23

Cities Including Sphere of Influence

Appendix B-1

N

0 3000 6000

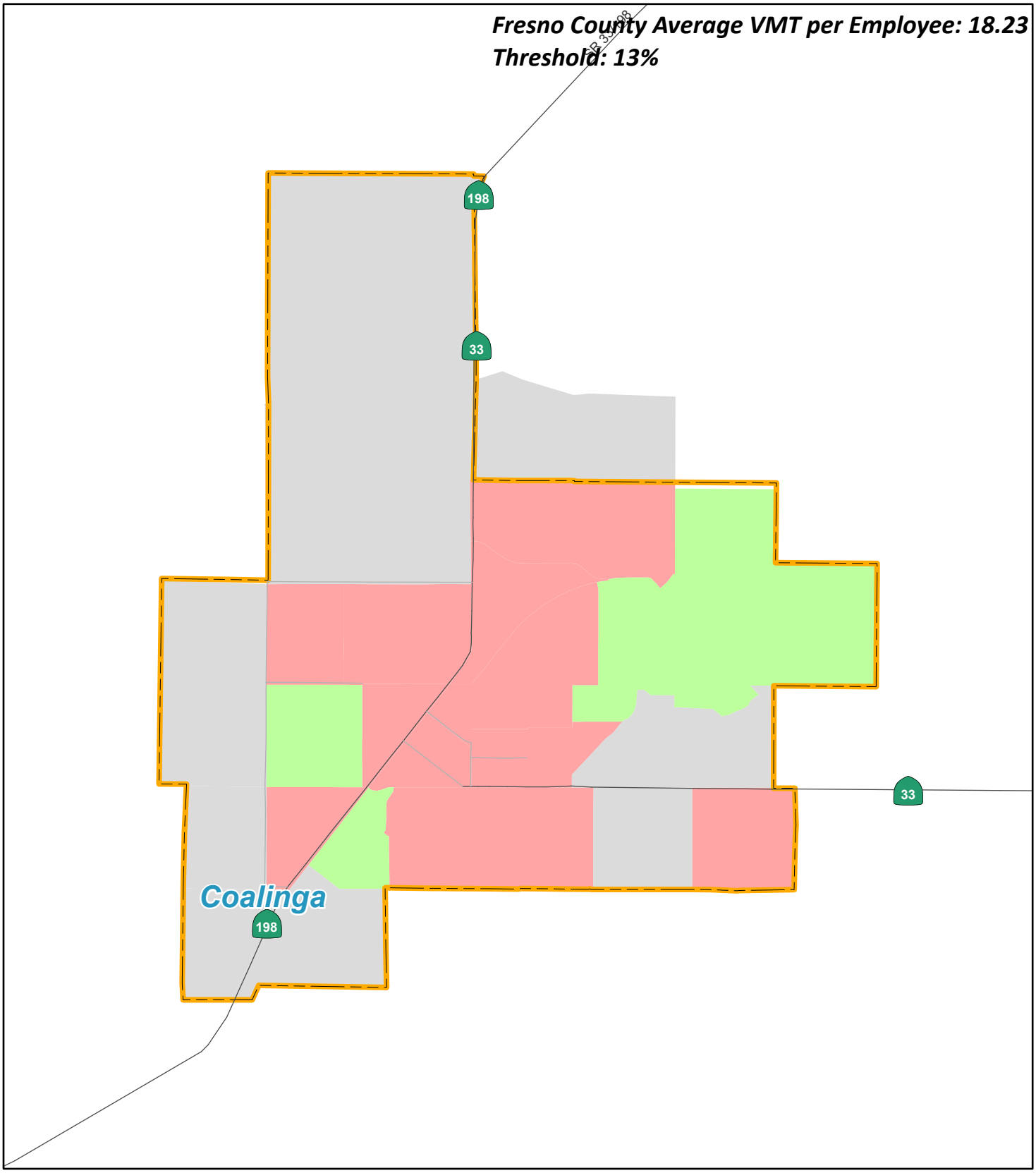
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Clovis - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

Less than 15.86

Greater than 18.23

Cities Including Sphere of Influence

Appendix B-2

N

0 1750 3500

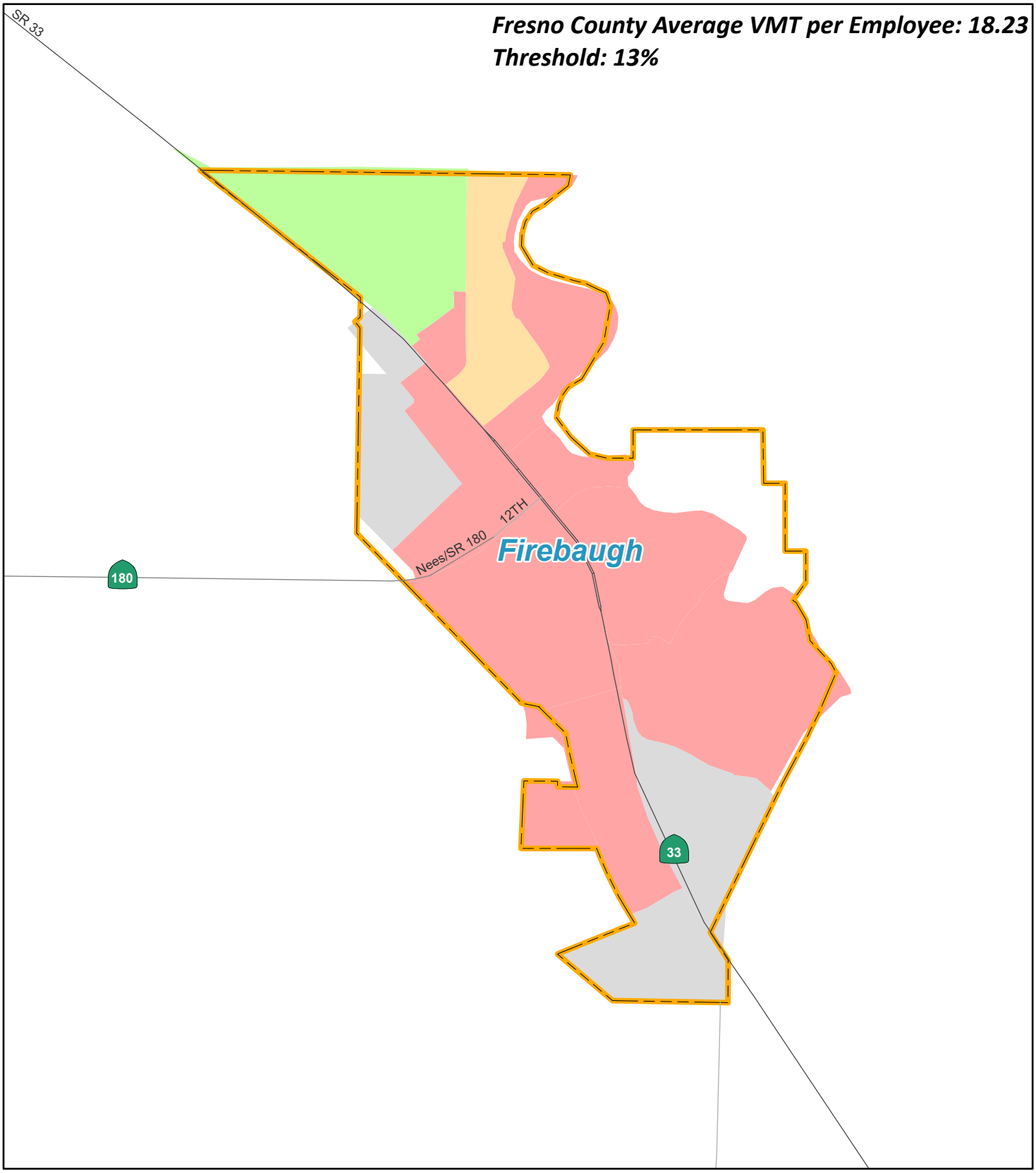
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Coalinga - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

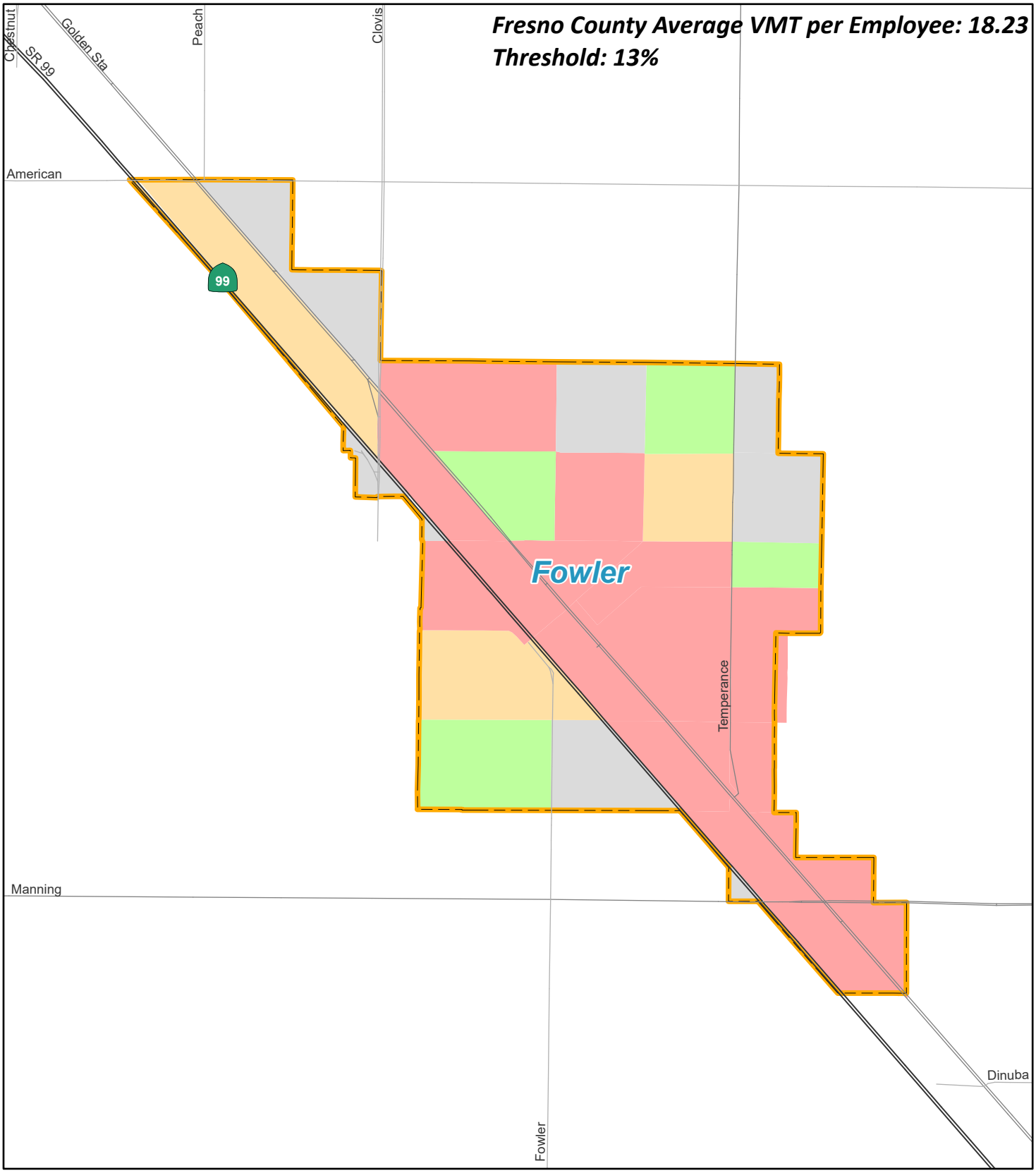
Appendix B-3

Fresno County SB 743 Implementation Regional Guidelines

City of Firebaugh - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

- Less than 5 Employment
- Less than 15.86
- 15.86 - 18.23
- Greater than 18.23

Cities Including Sphere of Influence

Appendix B-4

N

0 2000 4000

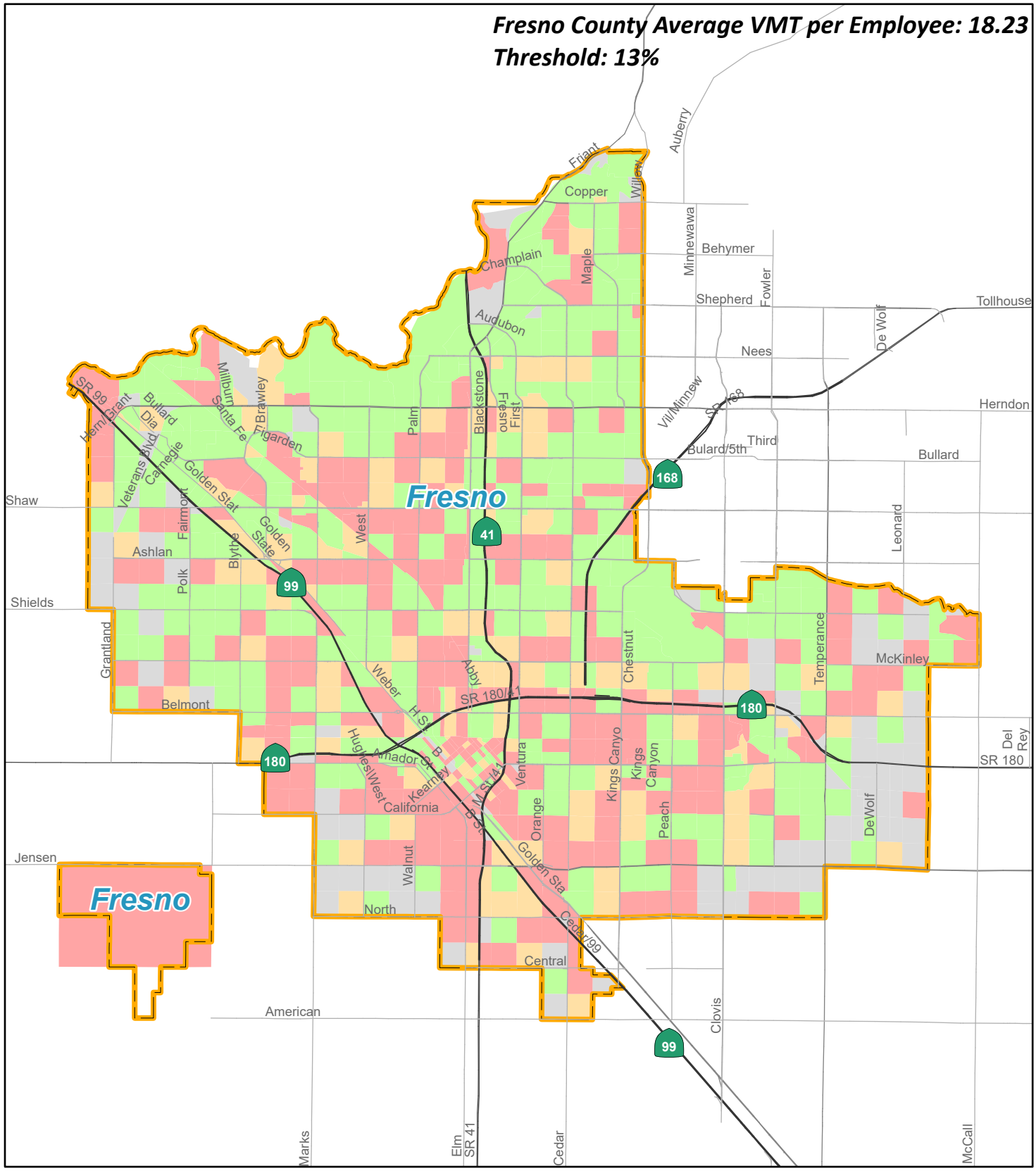
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Fowler - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

- Less than 5 Employment
- Less than 15.86
- 15.86 - 18.23
- Greater than 18.23

Cities Including Sphere of Influence

Appendix B-5

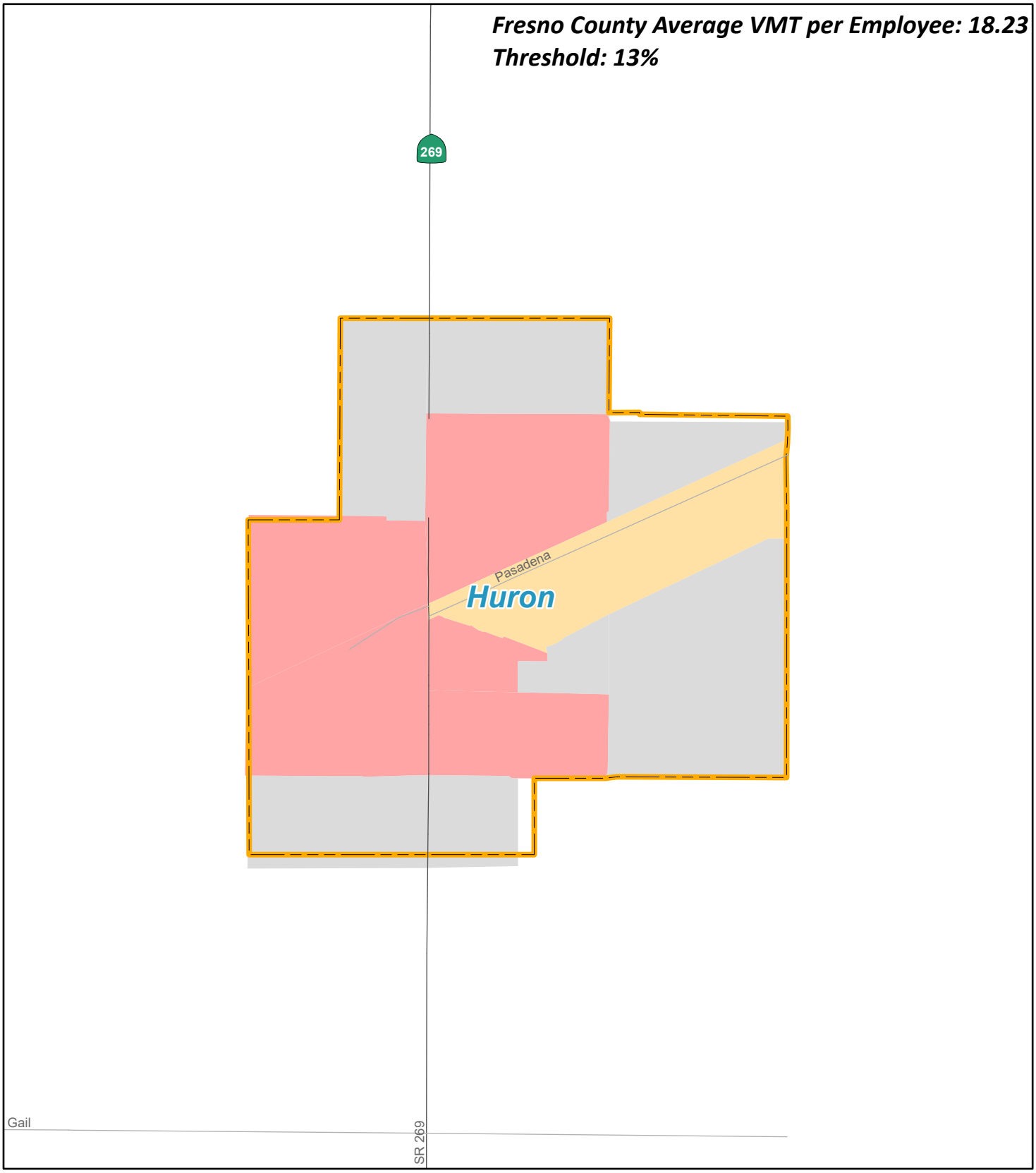
0 7000 14000
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Fresno - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

15.86 - 18.23

Greater than 18.23

Cities Including Sphere of Influence

Appendix B-6

N

0 1000 2000

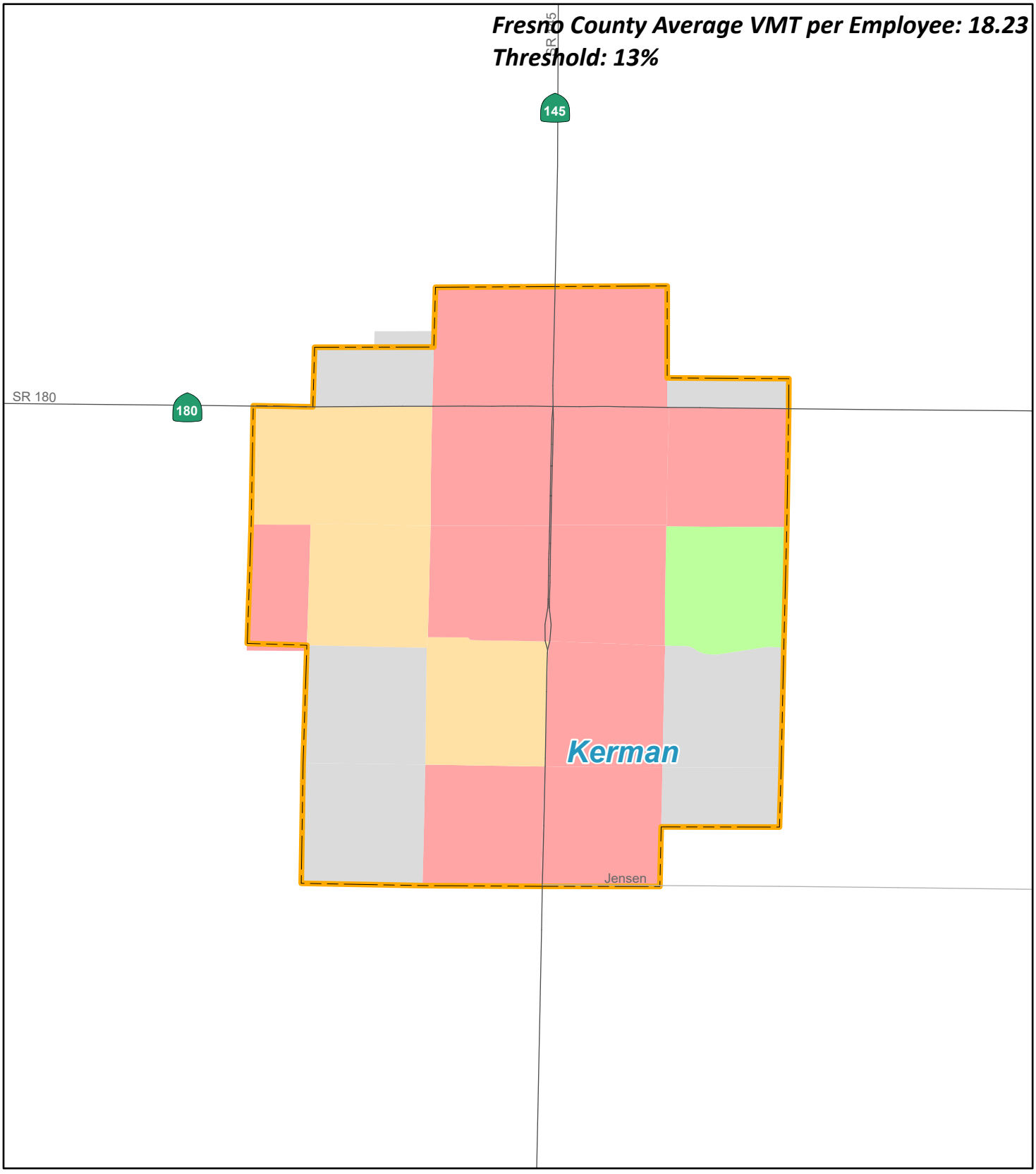
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Huron - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

- Less than 15.86
- 15.86 - 18.23
- Greater than 18.23

Cities Including Sphere of Influence

Appendix B-7

N

0 1500 3000

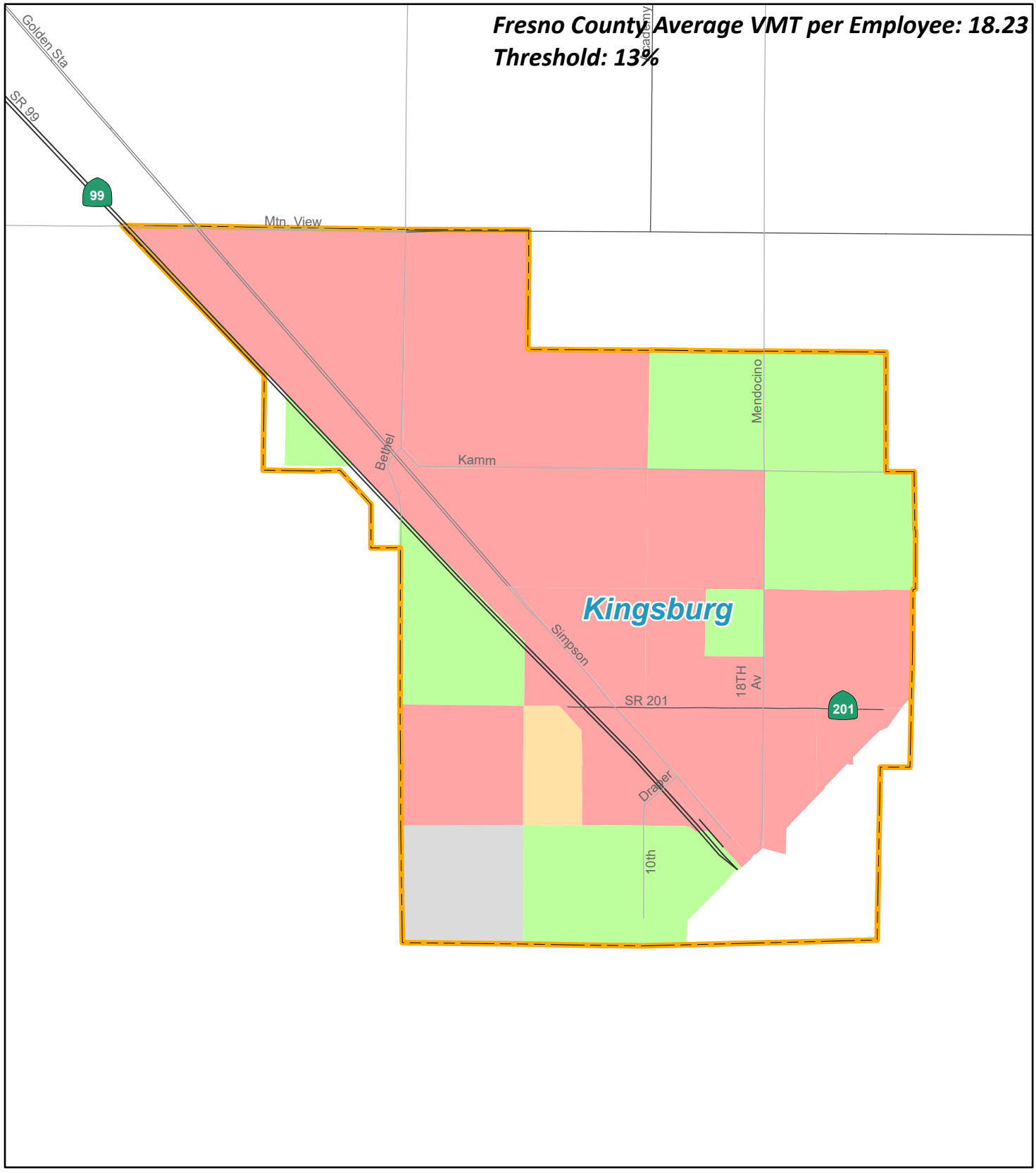
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Kerman - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

- Less than 15.86
- 15.86 - 18.23
- Greater than 18.23

Cities Including Sphere of Influence

Appendix B-8

N

0 1500 3000

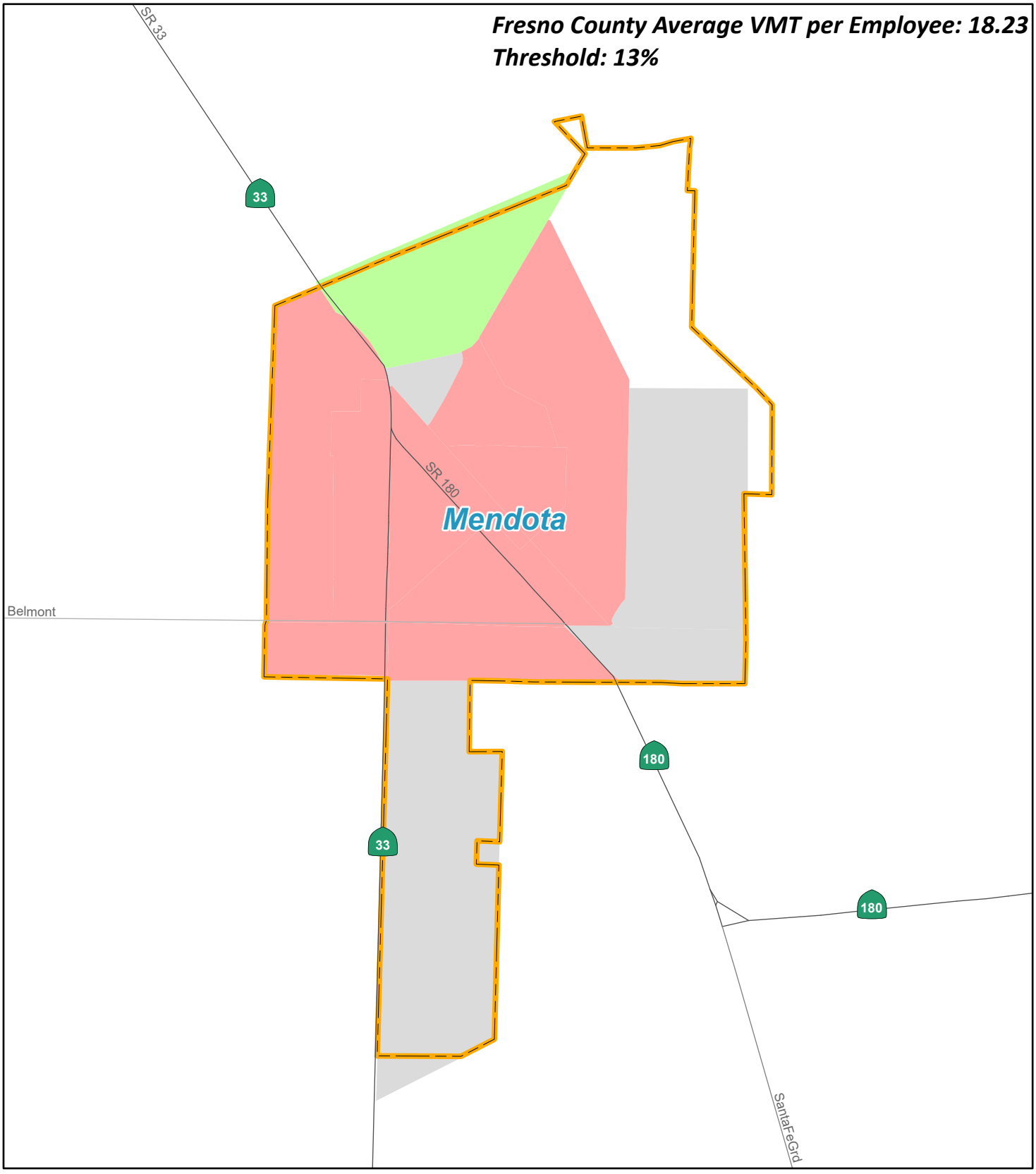
FEET

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

Fresno County SB 743 Implementation Regional Guidelines

City of Kingsburg - Existing VMT per Employee

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

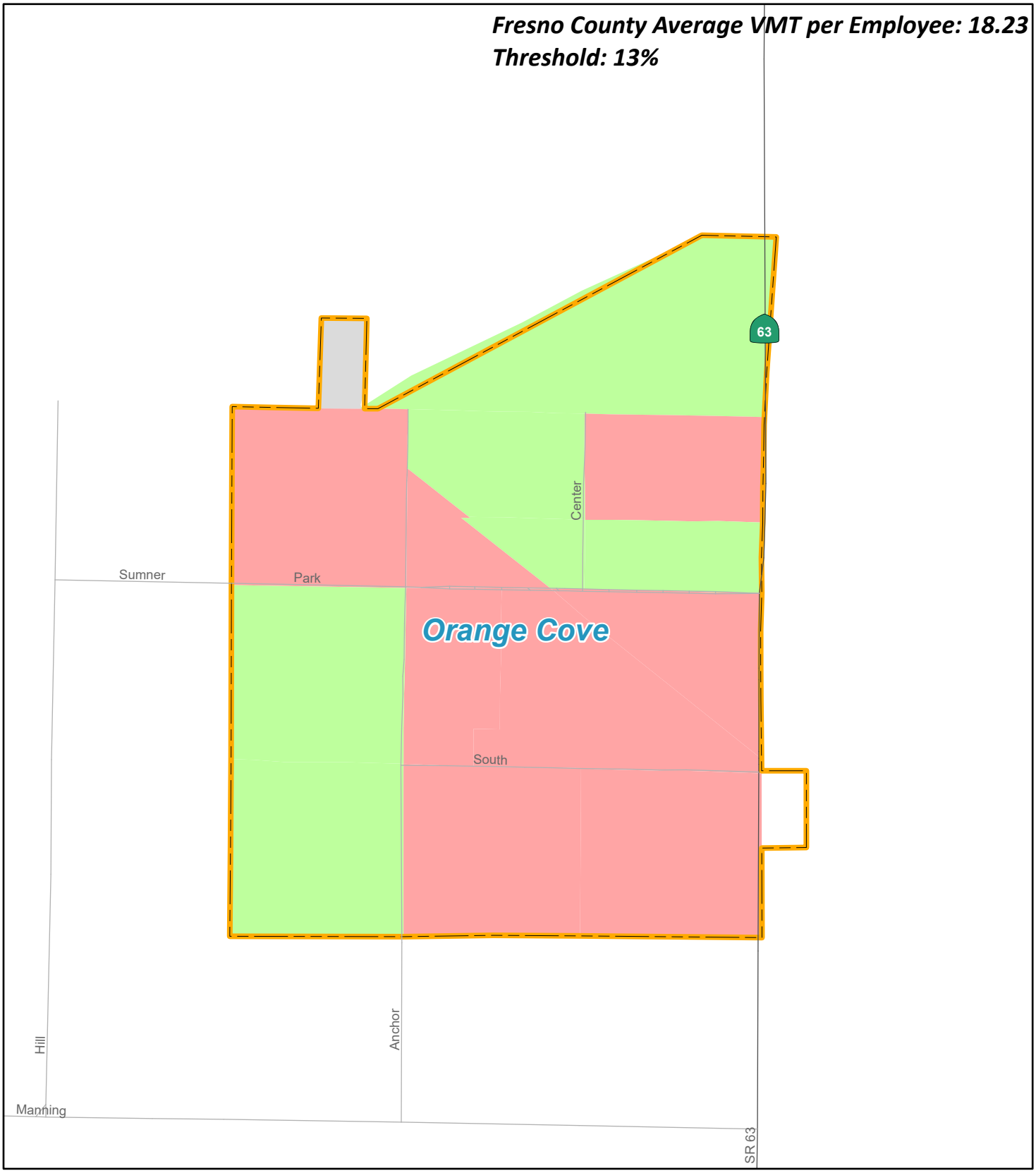
Appendix B-9

Fresno County SB 743 Implementation Regional Guidelines

City of Mendota - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

Less than 15.86

Greater than 18.23

Cities Including Sphere of Influence

Appendix B-10

N

0 1000 2000

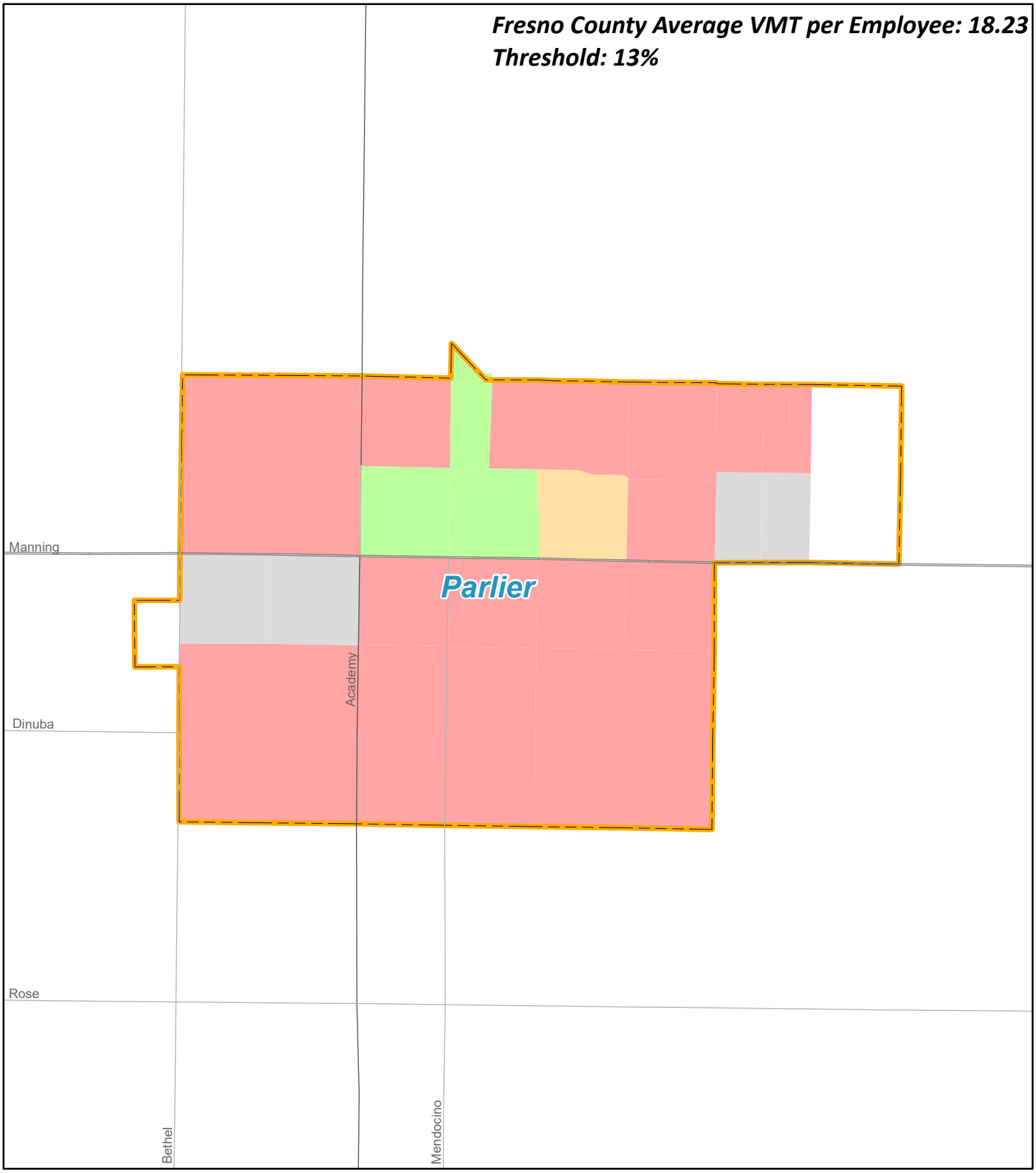
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Orange Cove - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

- Less than 5 Employment
- Less than 15.86
- 15.86 - 18.23
- Greater than 18.23

Cities Including Sphere of Influence

Appendix B-11

0 2000 4000

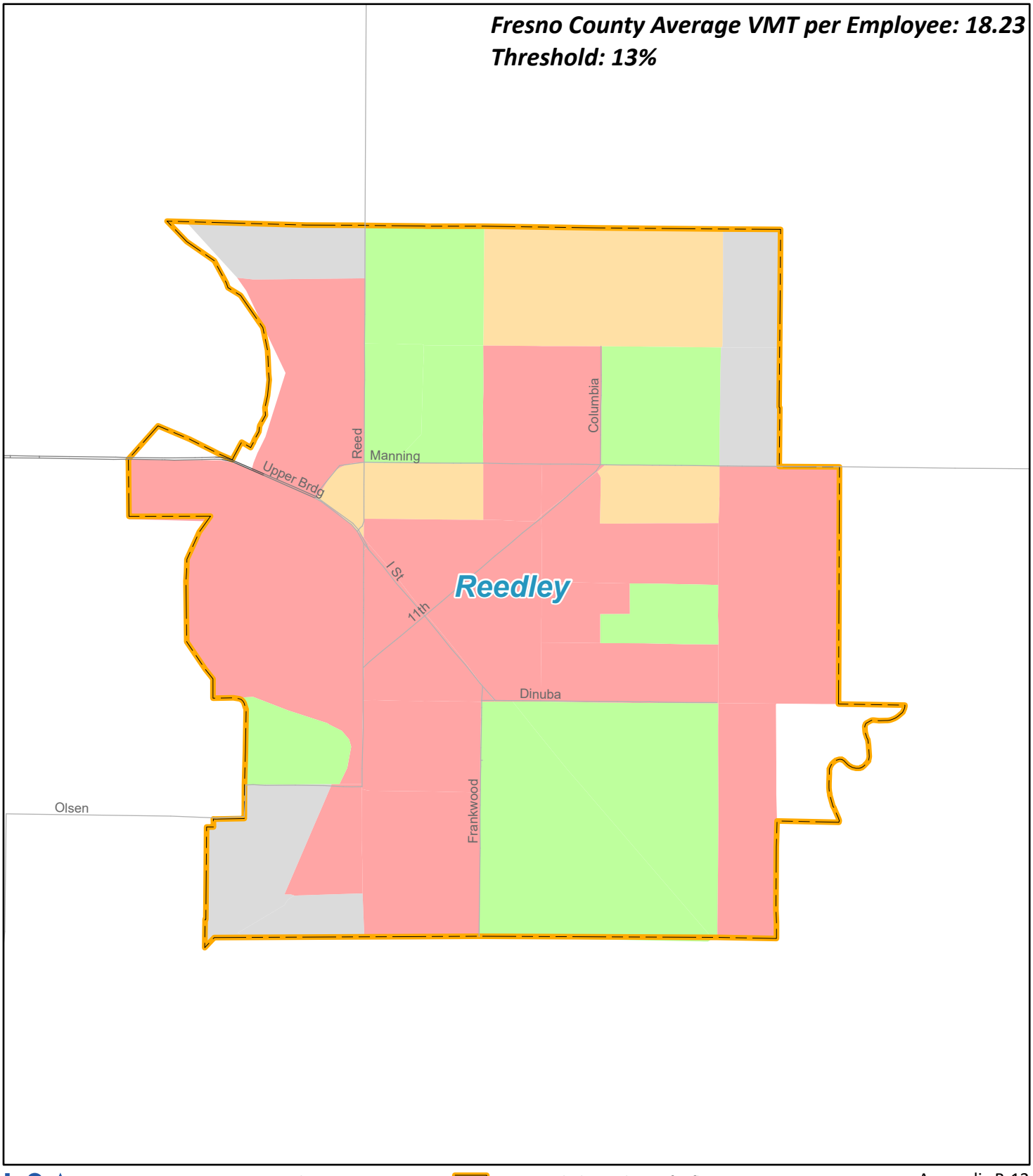
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Parlier - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

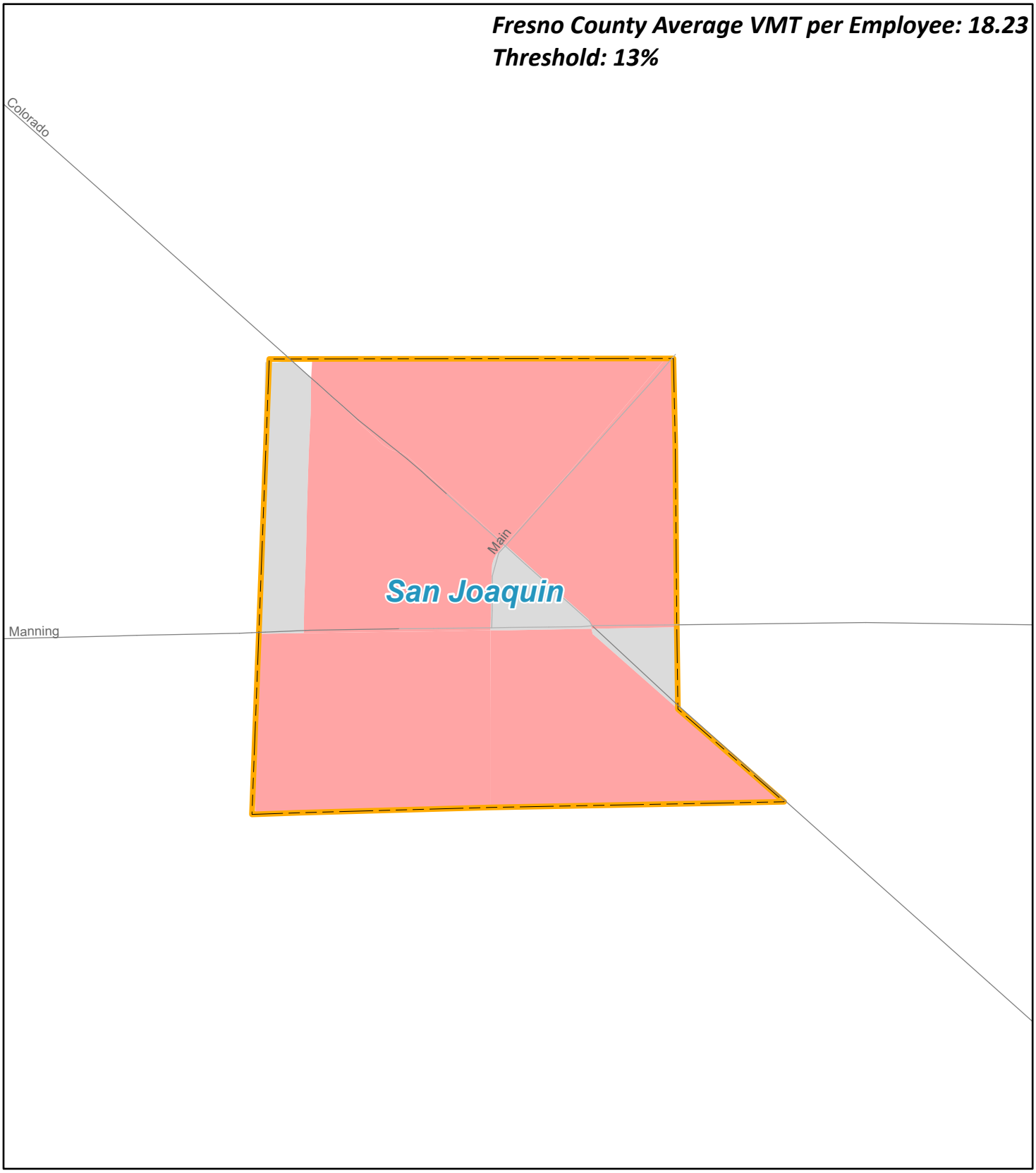
Appendix B-12

Fresno County SB 743 Implementation Regional Guidelines

City of Reedley - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

Less than 5 Employment

Greater than 18.23

Cities Including Sphere of Influence

Appendix B-13

N

0 1000 2000

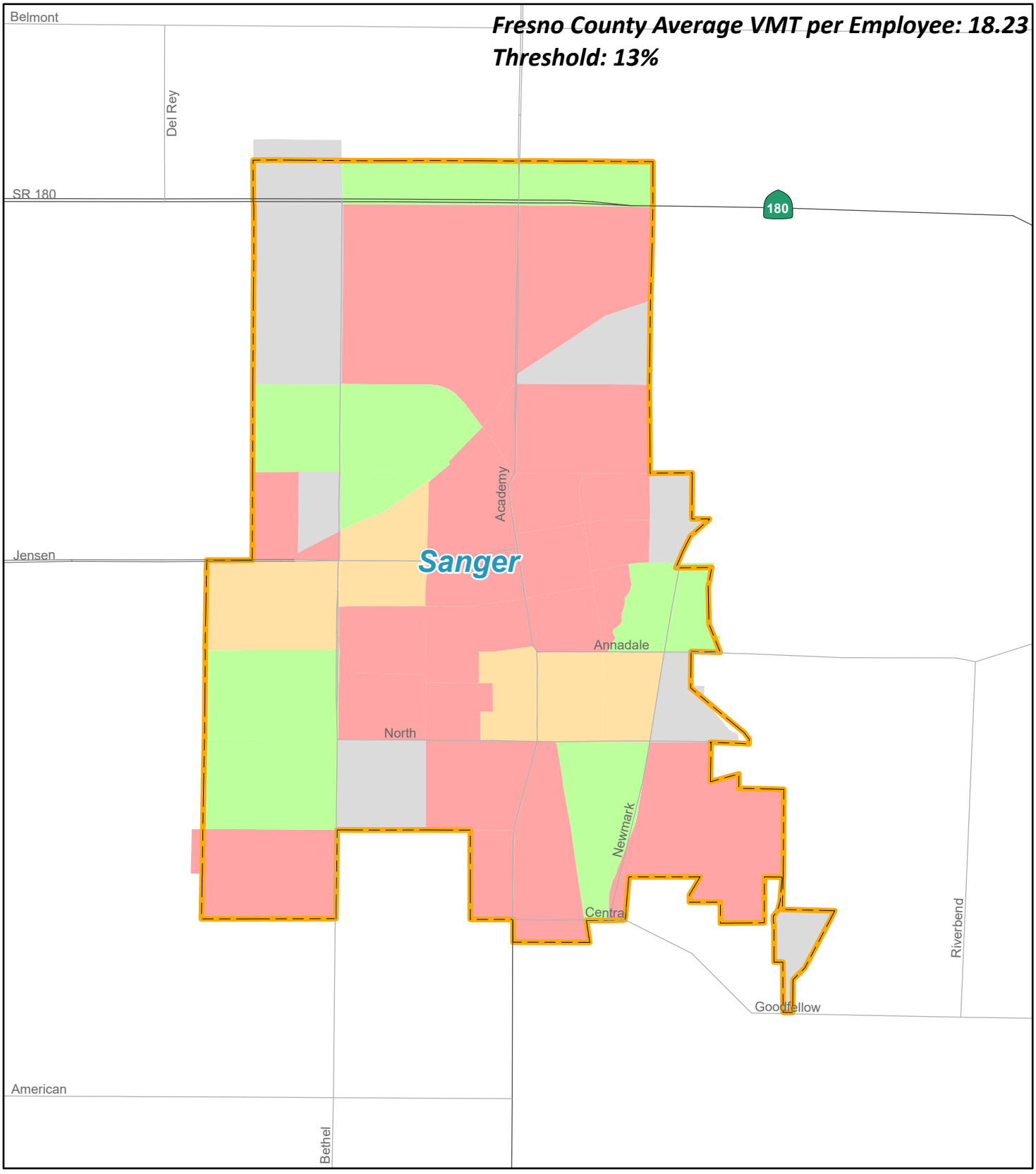
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of San Joaquin - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

Appendix B-14

VMT per Employee

- Greater than 18.23
- Cities Including Sphere of Influence
- Less than 5 Employment
- Less than 5 Employment
- Less than 15.86
- 15.86 - 18.23

N

0 2000 4000

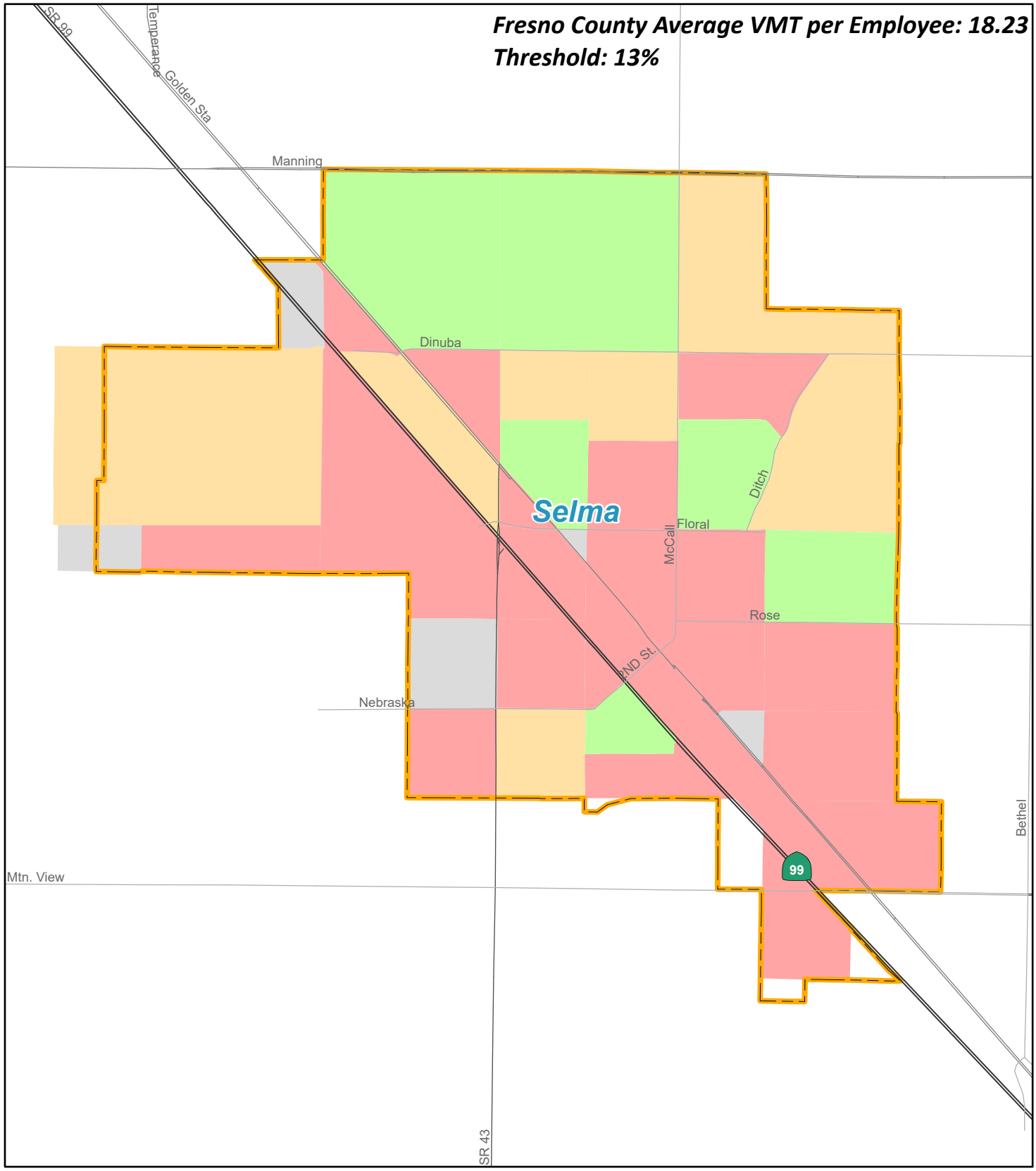
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Sanger - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

VMT per Employee

- Less than 5 Employment
- Less than 15.86
- 15.86 - 18.23
- Greater than 18.23

Cities Including Sphere of Influence

Appendix B-15

N

0 2000 4000

FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Selma - Existing VMT per Employee

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)

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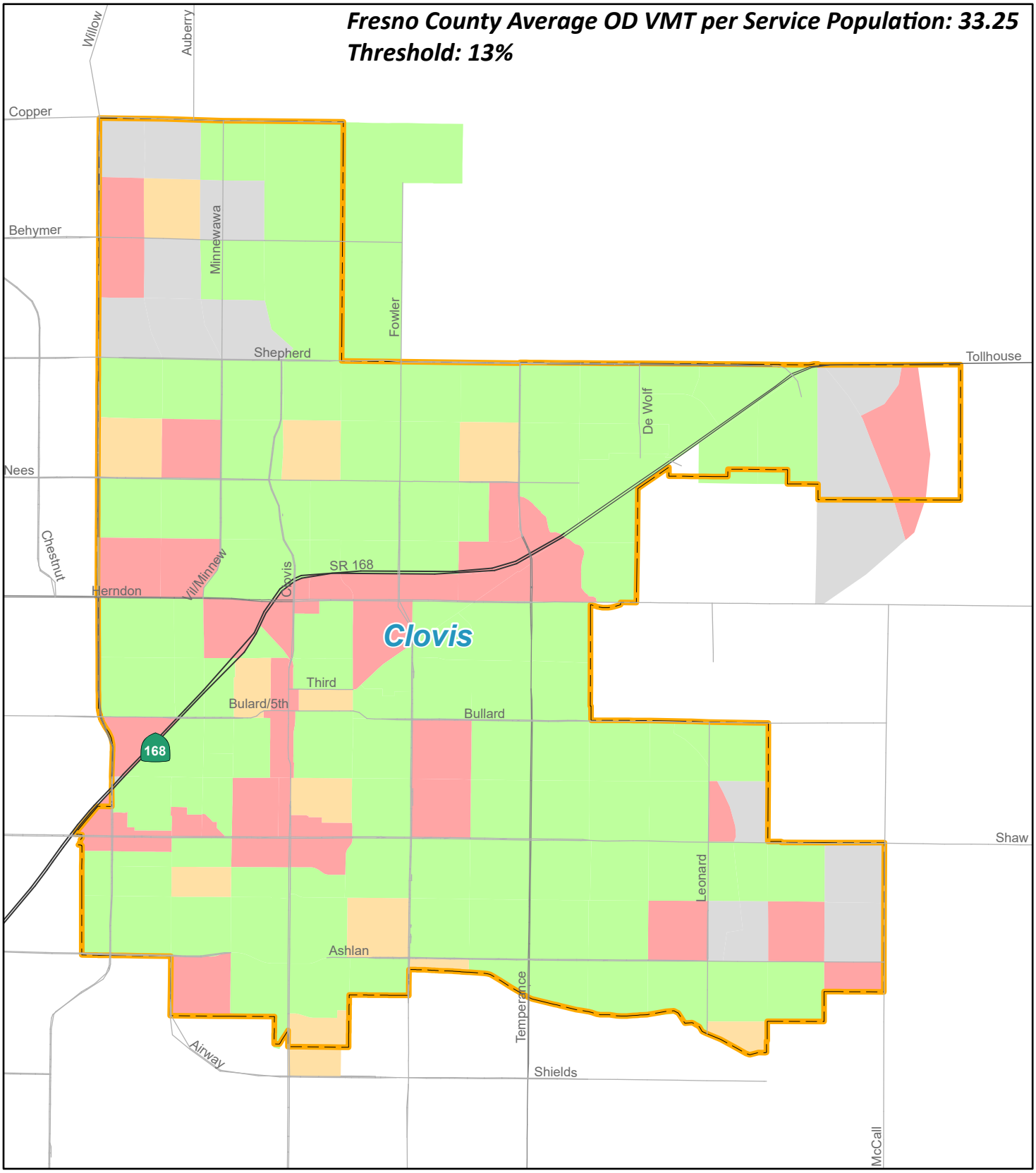
APPENDIX C

VMT PER SERVICE POPULATION SCREENING MAPS FOR MEMBER JURISDICTIONS



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-1

N

0 3000 6000

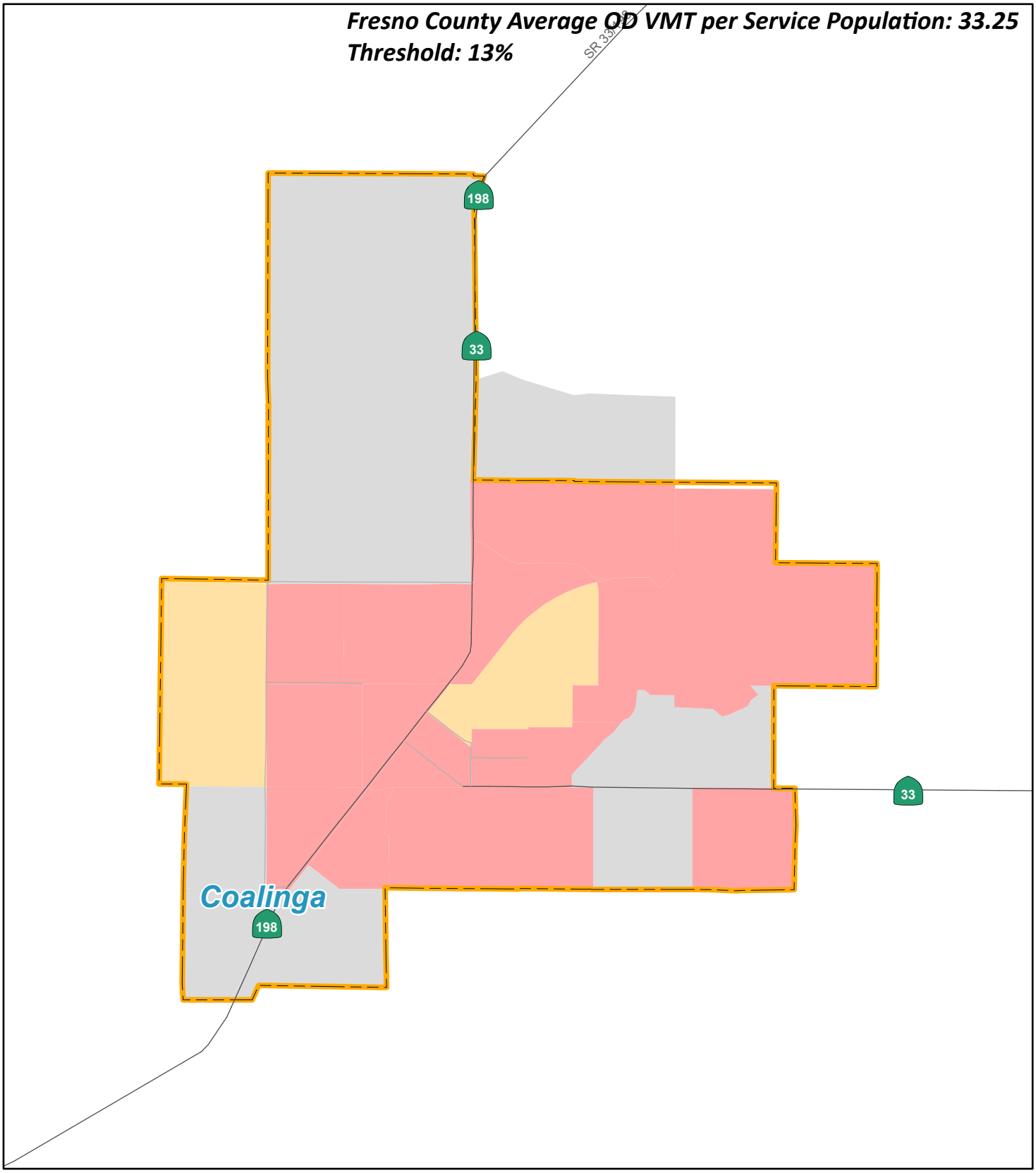
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Clovis - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

Less than 10 Population + Employment

28.93 - 33.25

Greater than 33.25

Cities Including Sphere of Influence

Appendix C-2

N

0 1750 3500

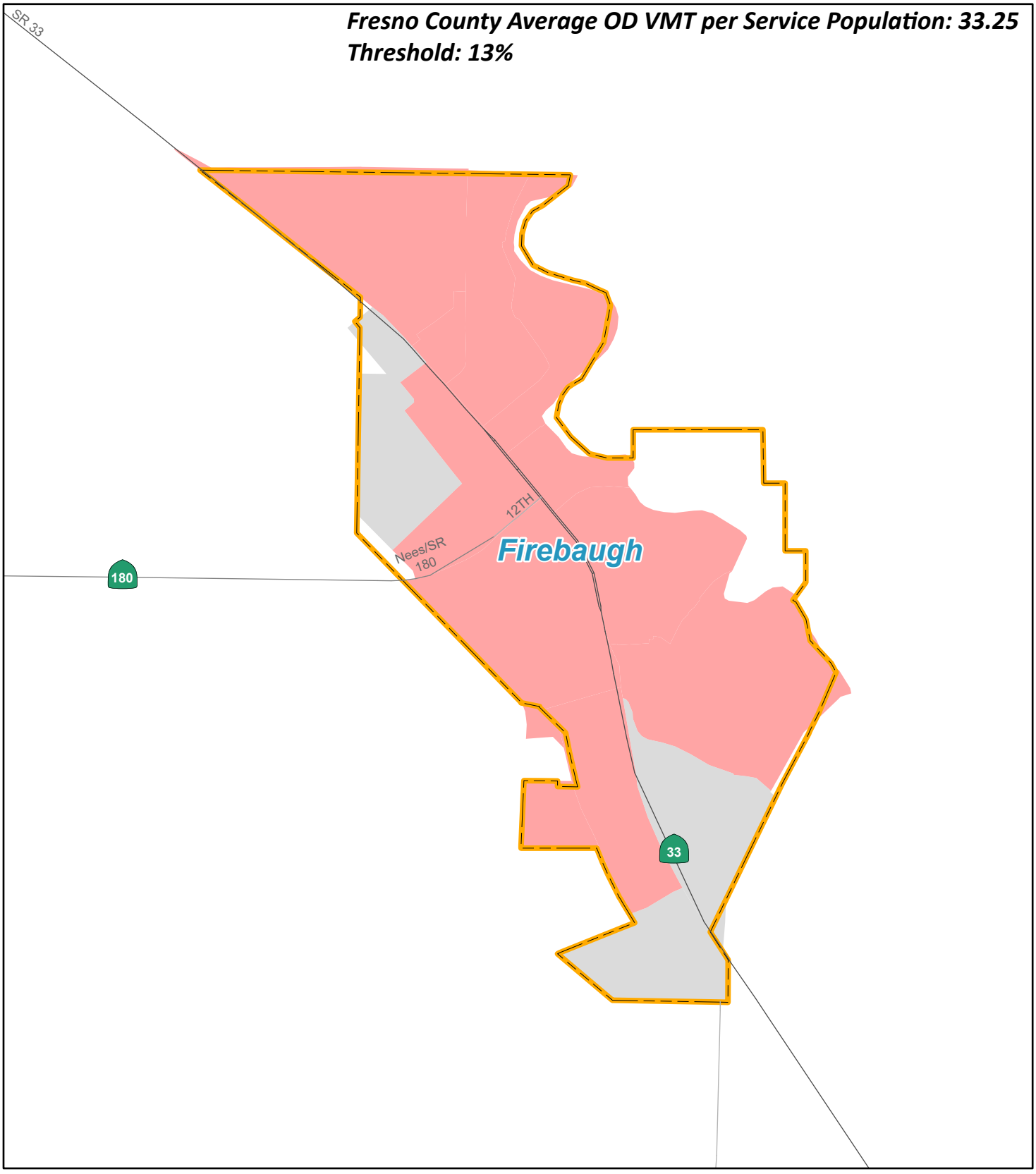
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Coalinga - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

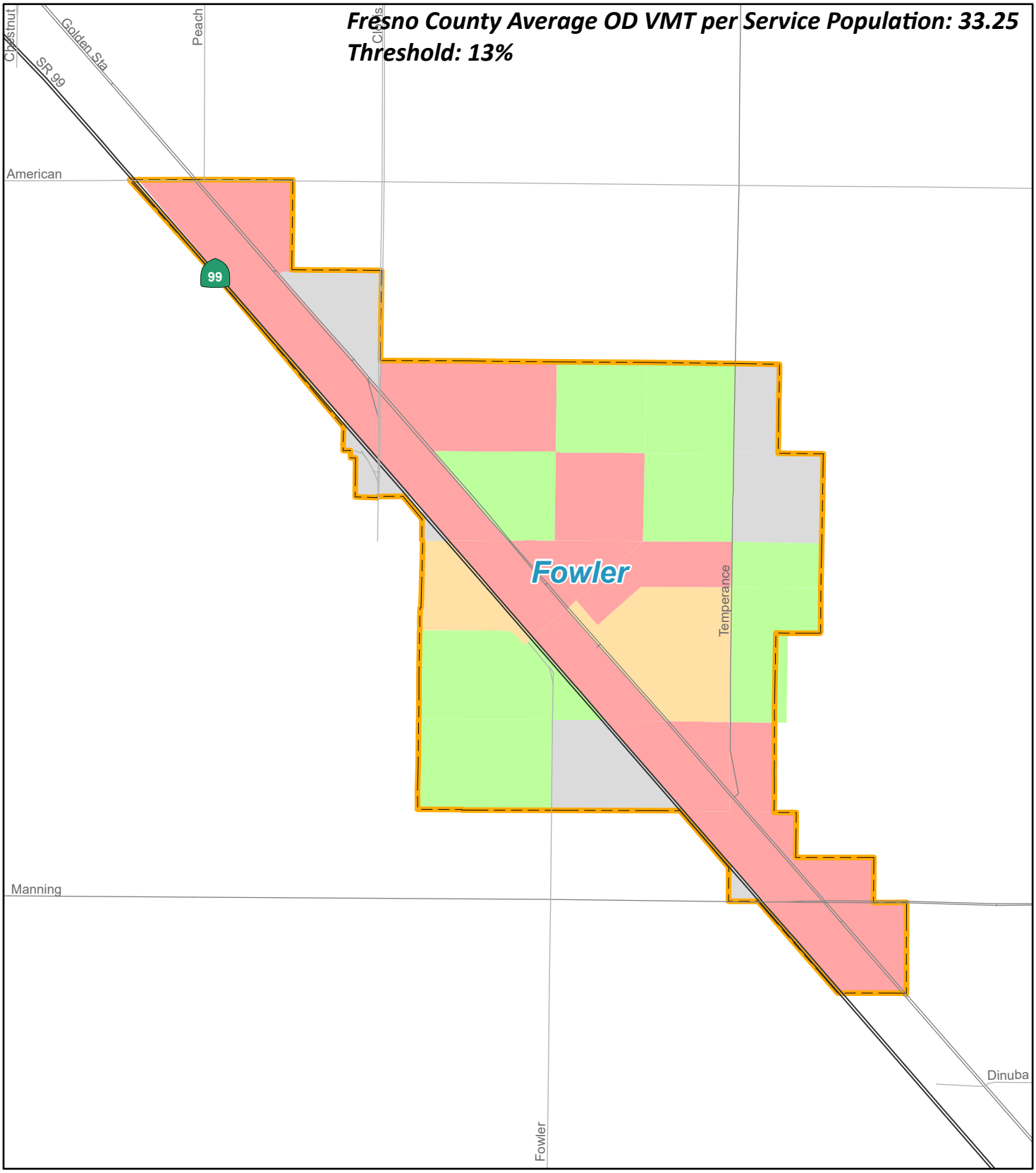
Appendix C-3

Fresno County SB 743 Implementation Regional Guidelines

City of Firebaugh - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

Appendix C-4

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

N

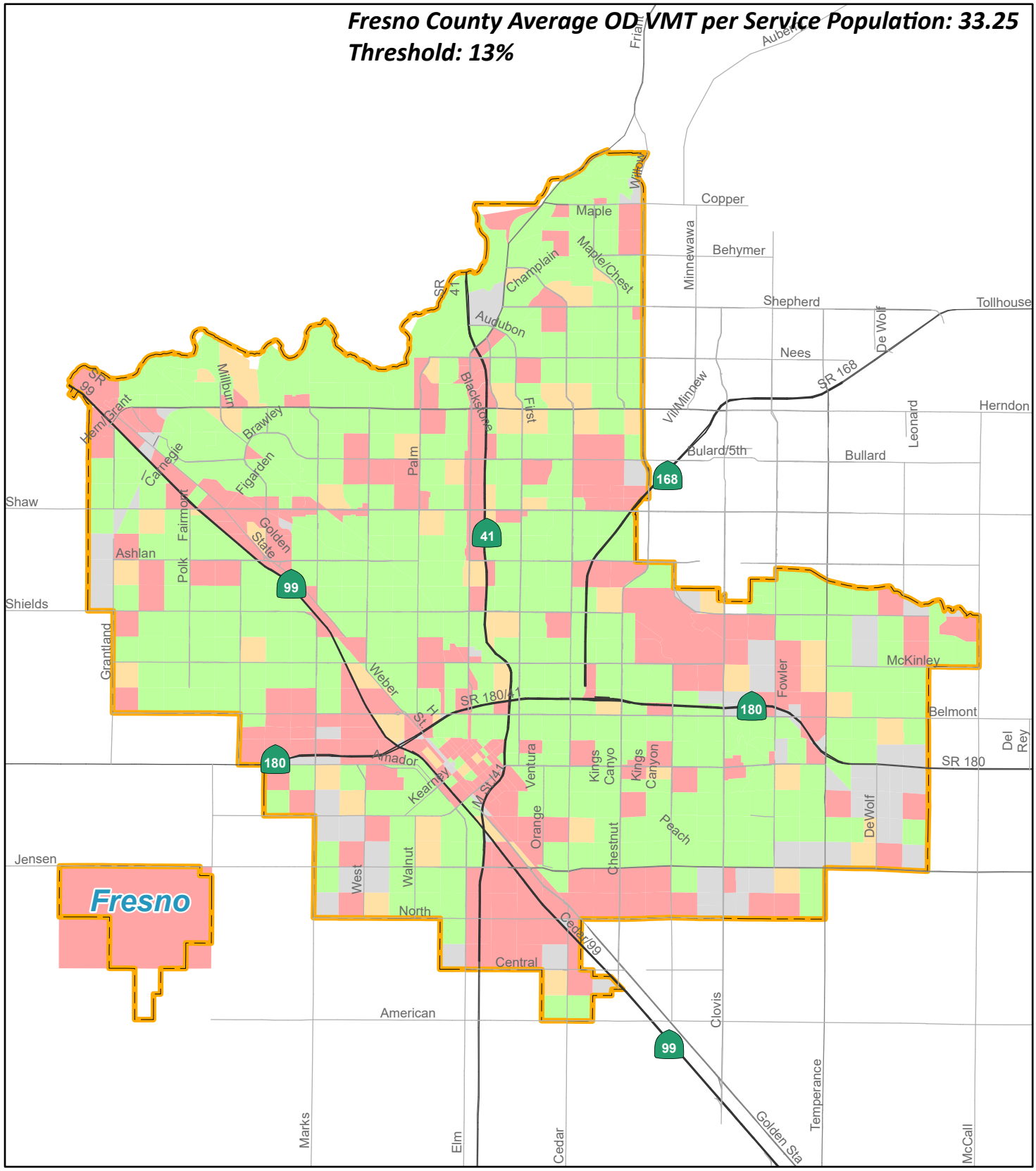
0 2000 4000
FEET

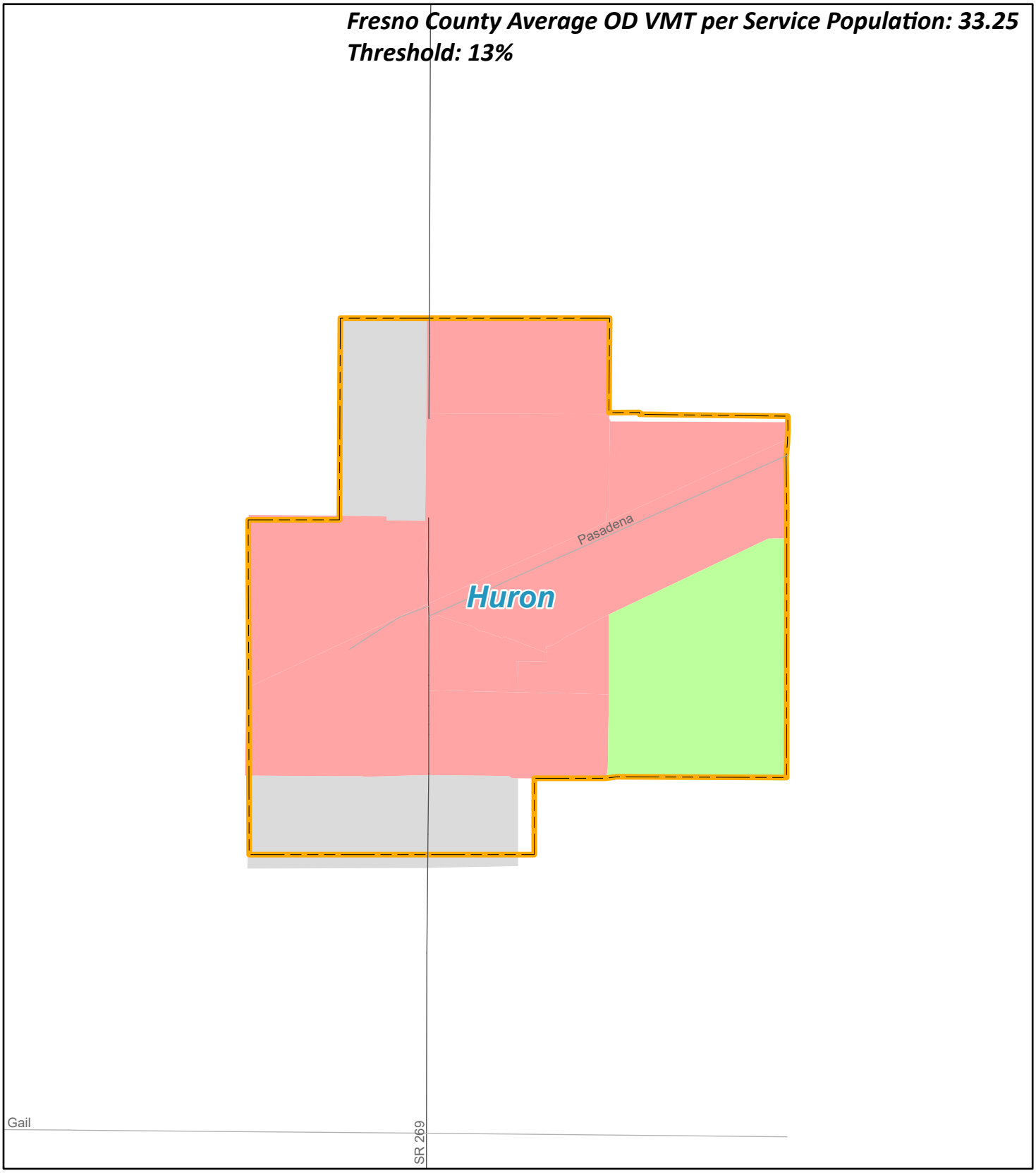
Fresno County SB 743 Implementation Regional Guidelines

City of Fowler - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)


Fresno County Average OD VMT per Service Population: 33.25
Threshold: 13%
Friant
Auberry
Copper
Maple
Maple/Chest
Champlain
Minnewawa
Behymer
SR 41
Audubon
Shepherd
Tollhouse
De Wolf
Nees
SR 168
Millbury
Blackstone
First
Vill/Minnew
Herndon
Leonard
Bullard/5th
Bullard
Brawley
Palm
Carnegie
Figarden
Fairmont
Golden State
Shaw
Ashlan
Polk
Shields
Grantland
Weber
SR 180/41
Fowler
McKinley
Belmont
Del Rey
SR 180
Amador
Kearney
M St/41
Ventura
Kings Canyo
Kings Canyon
Orange
Chestnut
Peach
DeWolf
Jensen
Fresno
West
Walnut
North
Central
Cedar/99
American
Clovis
Temperance
Golden Sta
McCall
Marks
Elm
Cedar
168
41
99
180
OD VMT per Service Population
Less than 10 Population + Employment
Less than 28.93
28.93 - 33.25
Greater than 33.25
Cities Including Sphere of Influence
0
7000
14000
FEET
LSA
Appendix C-5
Fresno County SB 743 Implementation Regional Guidelines
City of Fresno - Existing VMT per Service Population
SOURCE: Fresno COG Activity Based Travel Demand Model (2019)
P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-6

N

0 1000 2000

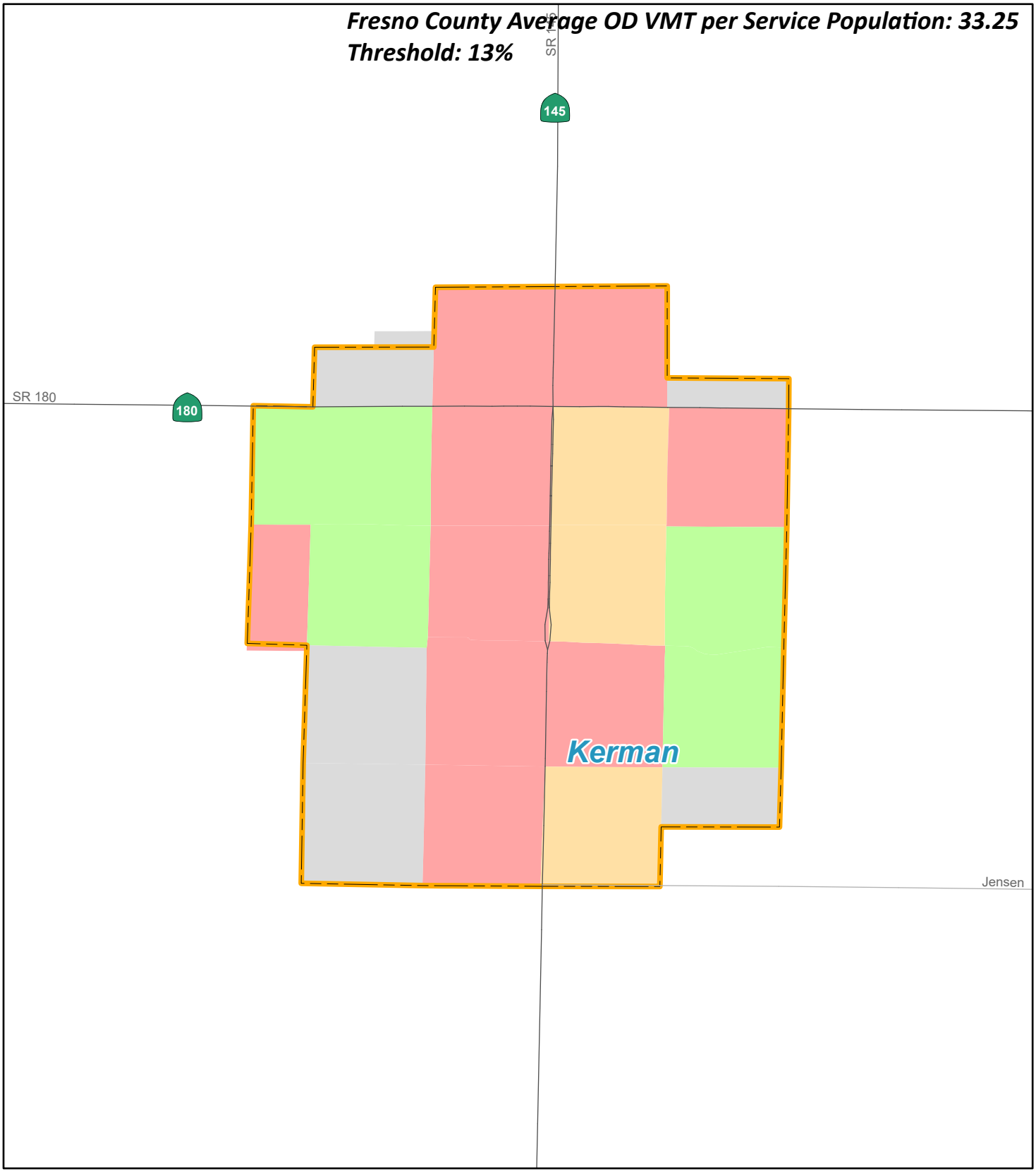
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Huron - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-7

N

0 1500 3000

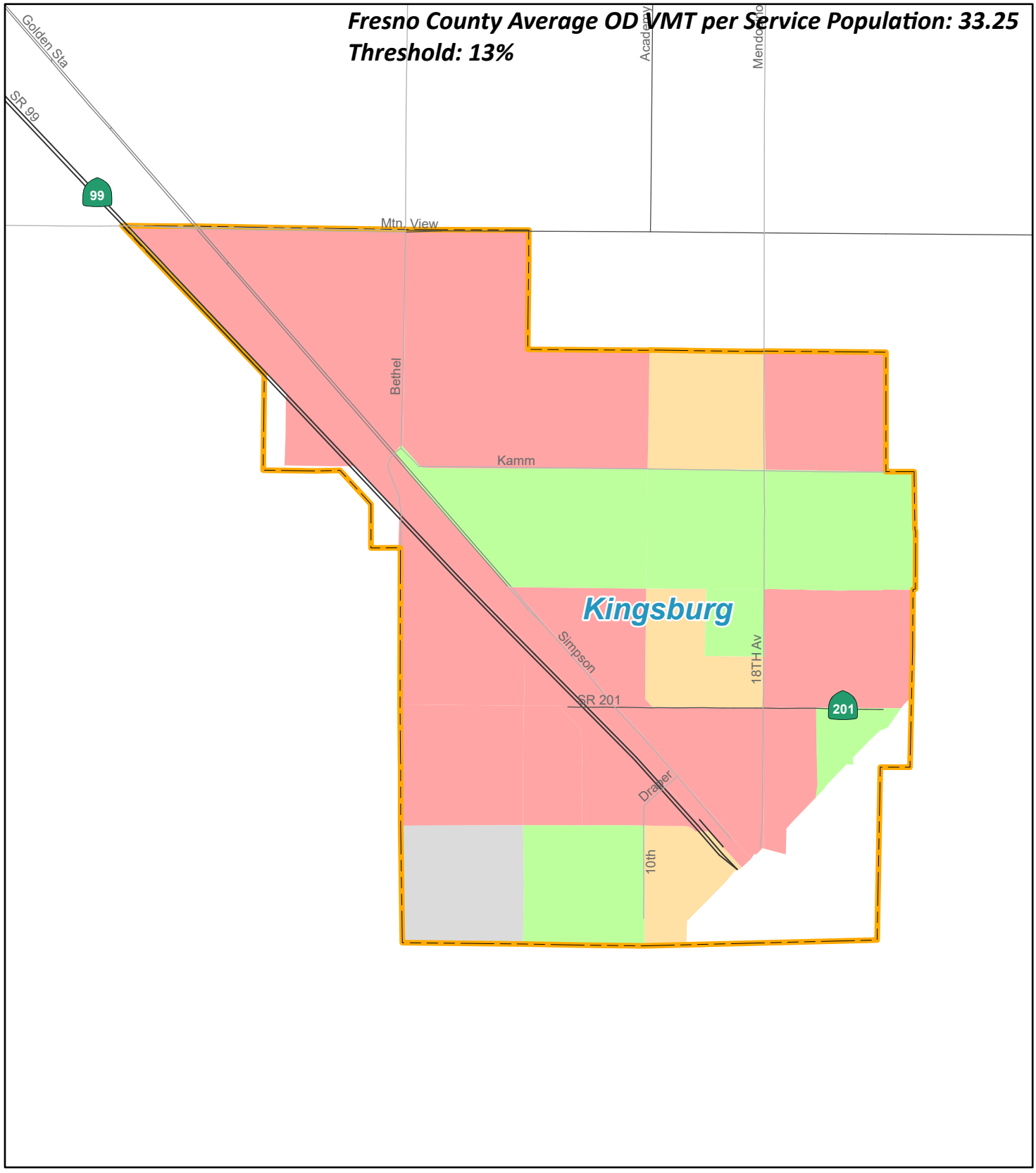
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Kerman - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-8

N

0 1500 3000

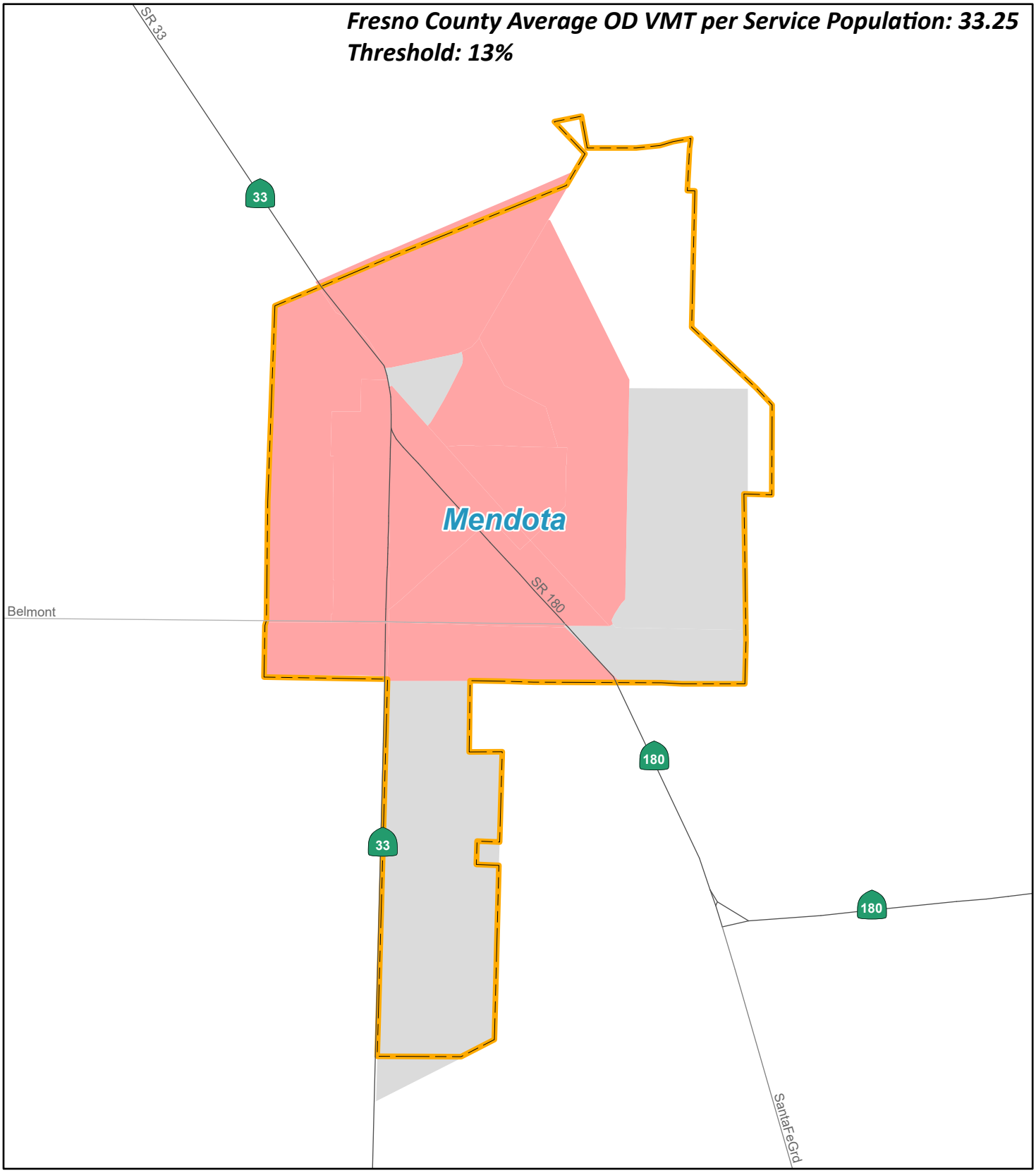
FEET

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

Fresno County SB 743 Implementation Regional Guidelines

City of Kingsburg - Existing VMT per Service Population

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

Less than 10 Population + Employment

Greater than 33.25

Cities Including Sphere of Influence

Appendix C-9

N

0 1500 3000

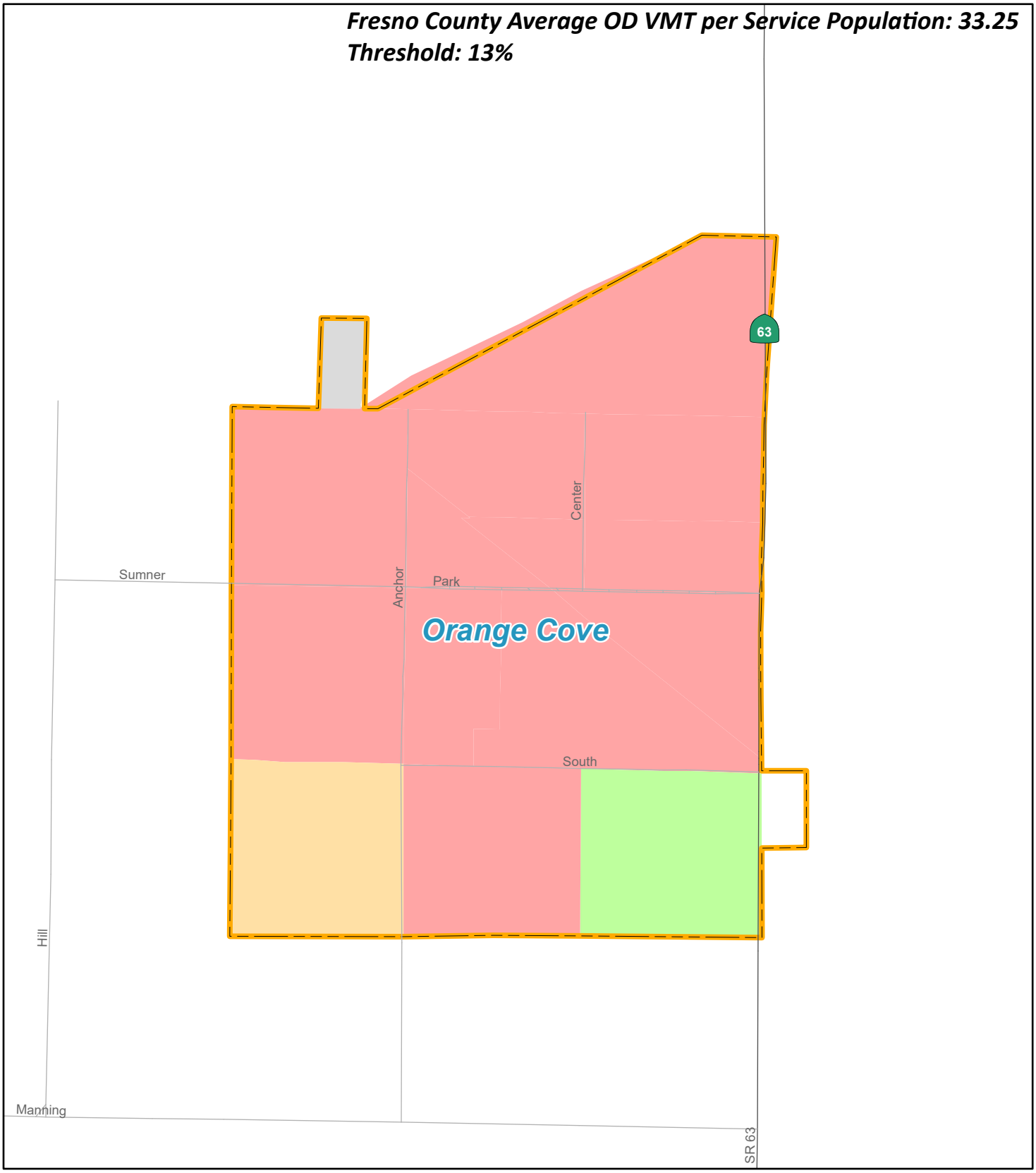
FEET

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

Fresno County SB 743 Implementation Regional Guidelines

City of Mendota - Existing VMT per Service Population

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-10

N

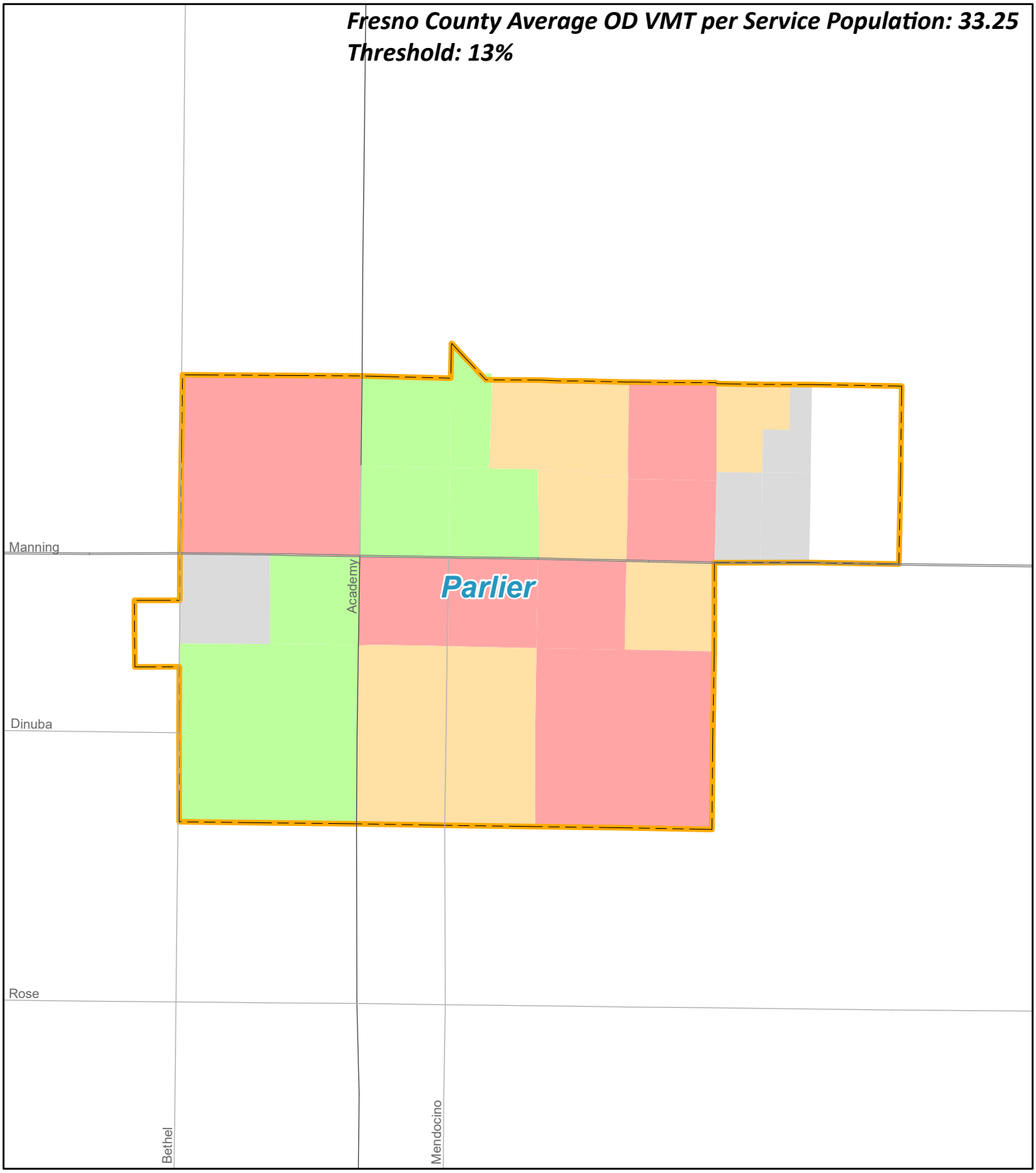
0 1000 2000
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Orange Cove - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-11

N

0 2000 4000

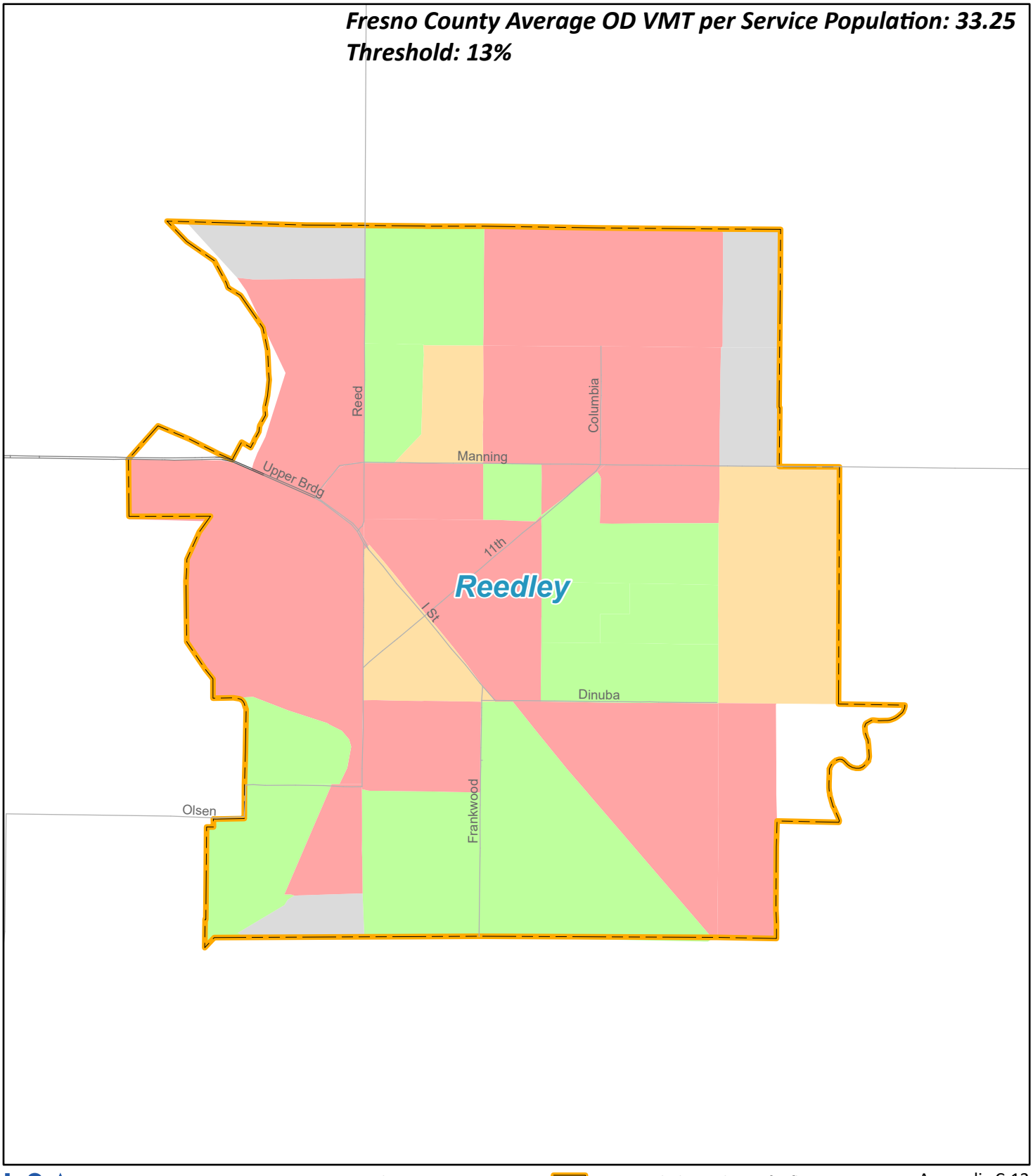
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Parlier - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-12

N

0 1500 3000

FEET

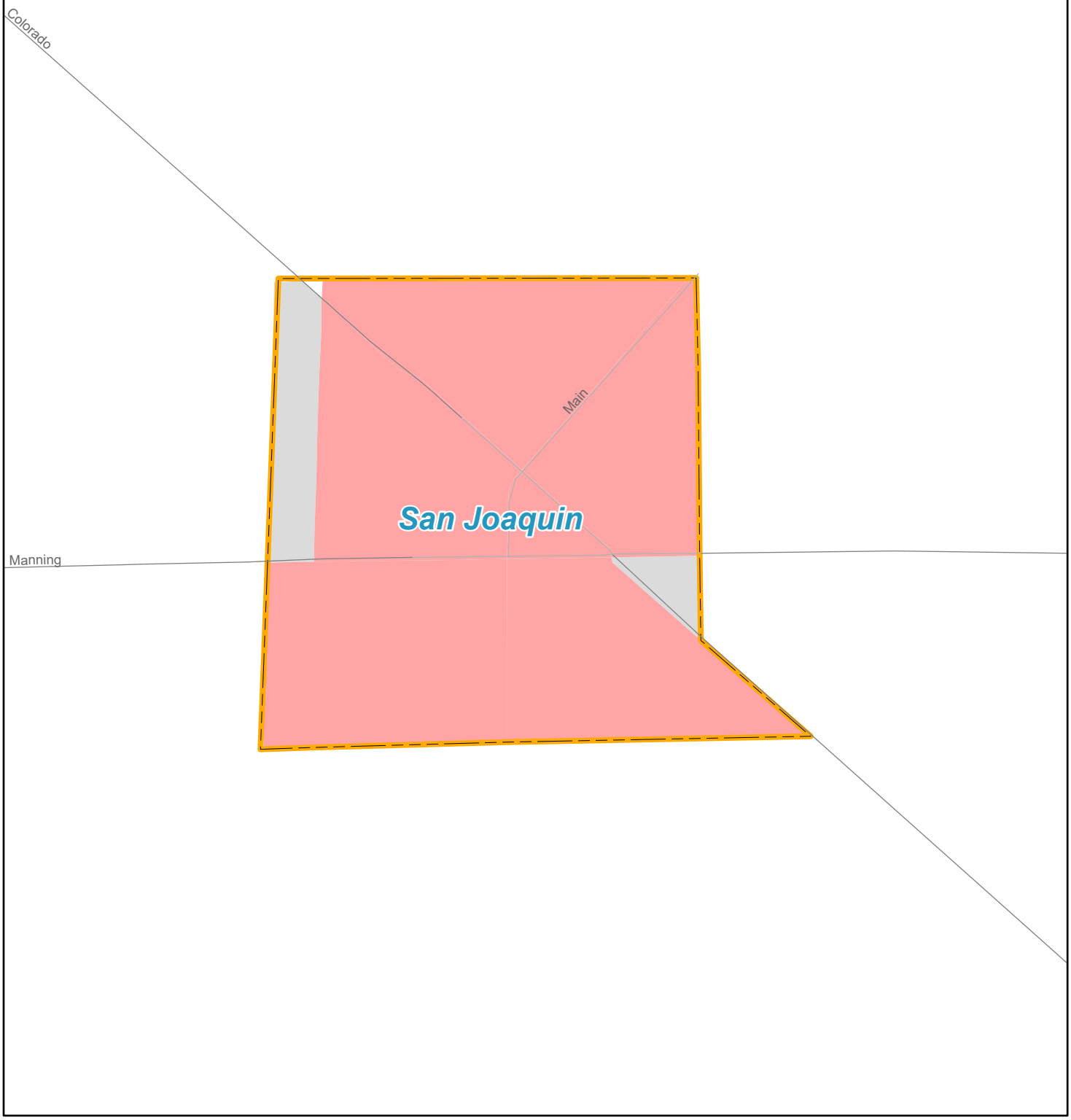
Fresno County SB 743 Implementation Regional Guidelines

City of Reedley - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)

Fresno County Average OD VMT per Service Population: 33.25
Threshold: 13%



LSA

OD VMT per Service Population

Less than 10 Population + Employment

Greater than 33.25

Cities Including Sphere of Influence

Appendix C-13

N

0 1000 2000

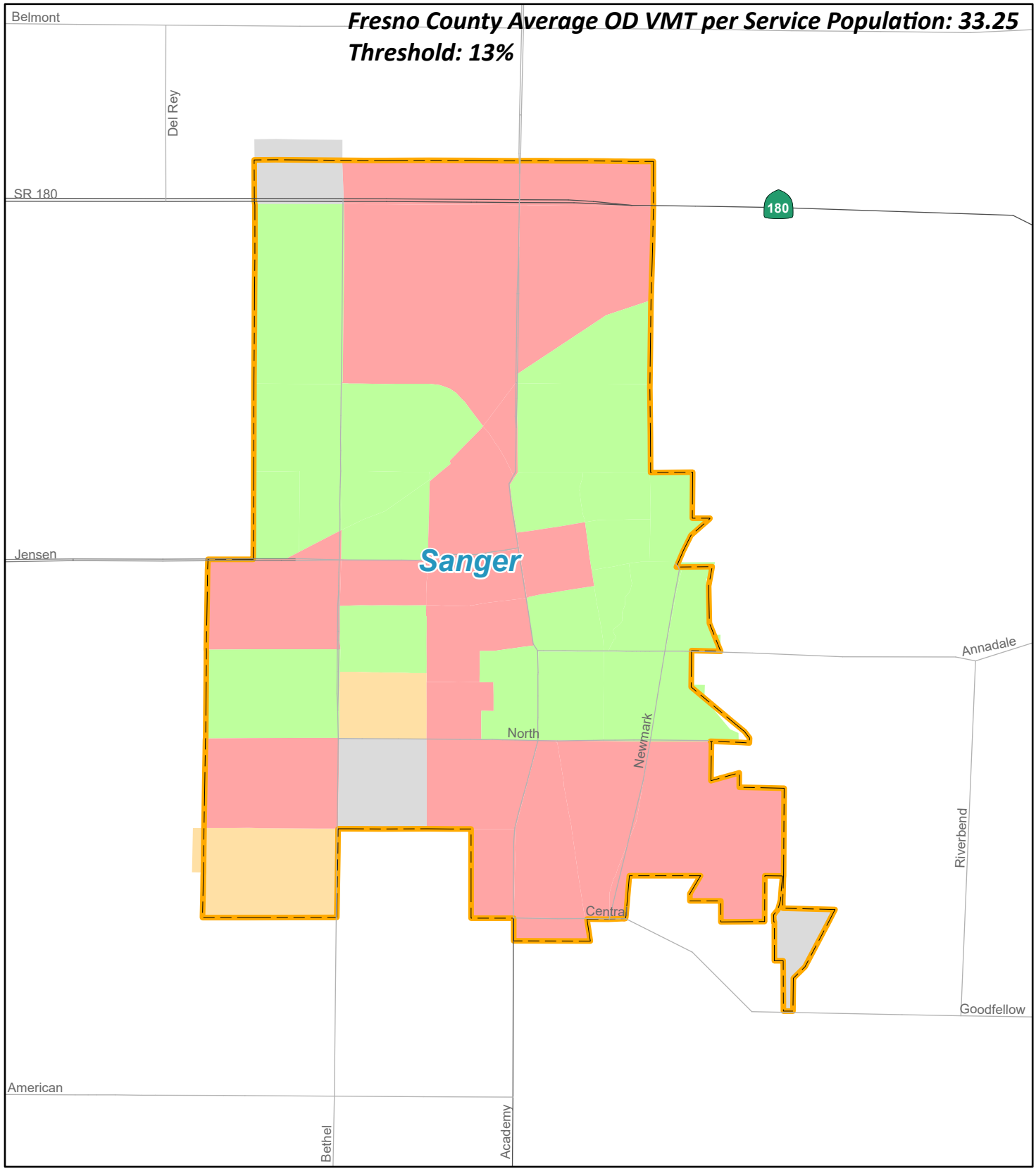
FEET

Fresno County SB 743 Implementation Regional Guidelines

City of San Joaquin - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-14

N

0 2000 4000

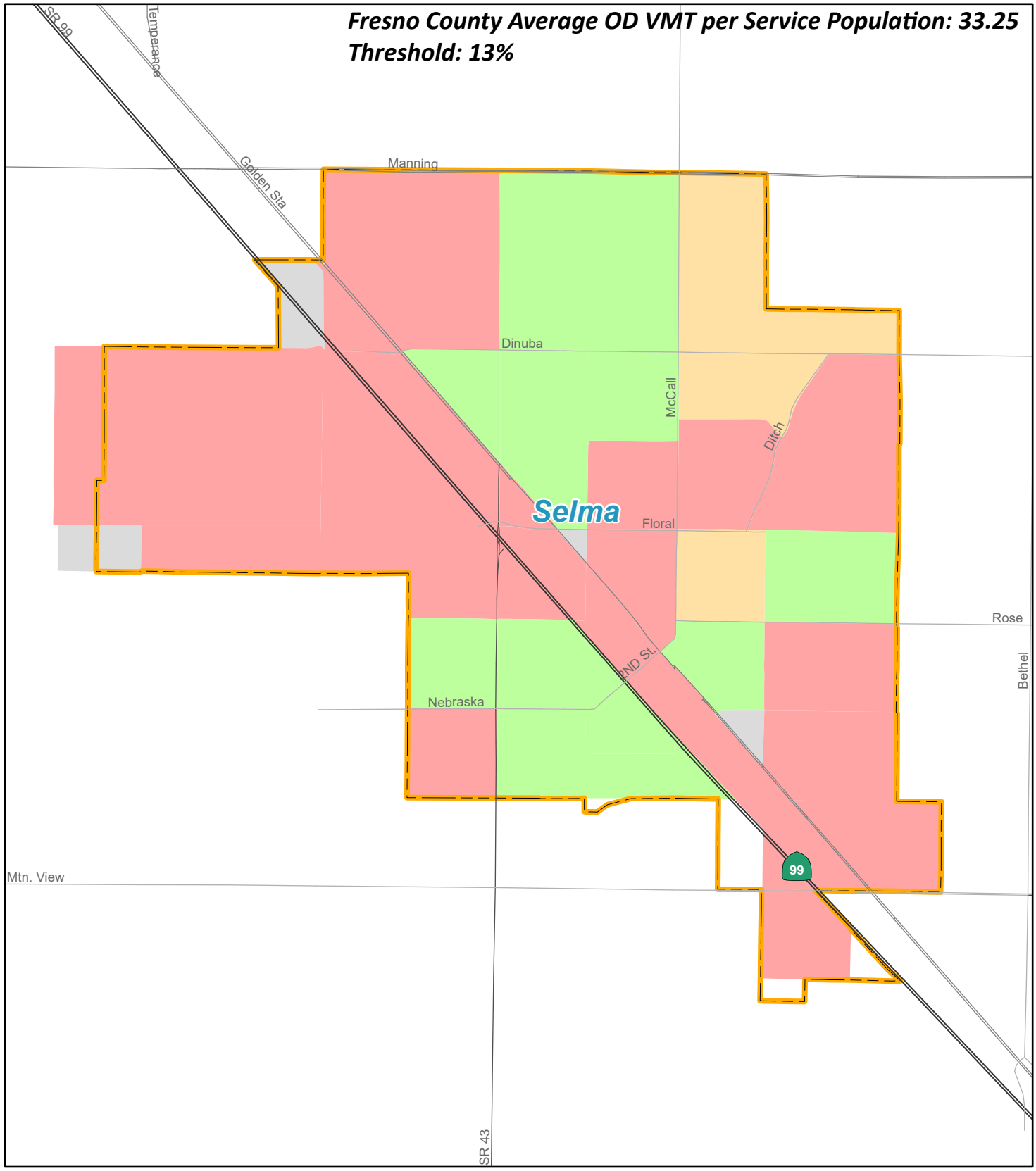
FEET

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

Fresno County SB 743 Implementation Regional Guidelines

City of Sanger - Existing VMT per Service Population

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)



LSA

OD VMT per Service Population

- Less than 10 Population + Employment
- Less than 28.93
- 28.93 - 33.25
- Greater than 33.25

Cities Including Sphere of Influence

Appendix C-15

N

0 2000 4000

FEET

Fresno County SB 743 Implementation Regional Guidelines

City of Selma - Existing VMT per Service Population

SOURCE: Fresno COG Activity Based Travel Demand Model (2019)

P:\F-L\FCG1901 FresnoCOG VMT\GIS\VMT_Maps_05-13-2025\ArcPro\Fresno County SB 743 Implementation Regional Guidelines.aprx (5/20/2025)

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APPENDIX D

INTEGRATED PROCESS FOR ESTIMATING INDUCED VMT

Appendix D: Estimating Induced Demand for Roadway Capacity Projects

Short Term Induced Demand

Increasing roadway capacity is primarily aimed at decreasing auto travel times, either by adding capacity to existing facilities or by providing a more direct travel route between origins and destinations. The term 'induced demand' is used to describe an economic concept where increased supply (in this case, road capacity) results in an increase in demand. In transportation, increased demand can be measured a number of ways. In cases where capacity is added to an existing facility, volume can be compared before and after the capacity increase. However, this is not a useful measure in cases where a new facility is added to the system. Therefore, total vehicle miles of travel is often used as a systemwide measure of induced demand.

In his seminal book Stuck In Traffic (Brookings Institution Press, 1992), economist Anthony Downs describes a concept termed "Triple Convergence". This refers to the idea that if roadway capacity is added to a new road overnight, the next day there would be much less congestion on the road. But over time, the road would fill back up with traffic and the travel time would be close to or as congested as it was before capacity was added. The reason for this is because of three behavioral responses; travelers who were taking alternative routes would switch to the new road (route switching), travelers who were traveling in off-peak time periods would switch to peak periods (time-of-day switching), and travelers who were traveling by alternative modes would switch to auto (mode switching).

There are actually two other effects that Downs doesn't consider: travelers could select new destinations in the corridor if faster travel times make more destinations accessible to activities, and travelers could travel more frequently in total if faster travel times made time available for new activities that were not possible before. For example, people going to work instead of telecommuting or people going to a movie instead of watching one at home.

The Fresno activity-based model (FresnoABM) comprises of demand and network models that fully cover the above described behavior. DaySim is the activity-based model component. It consists of a series of sub-models including long-term choices such as work and school location choice, and auto ownership, and short-term choices such as tour and stop generation, tour and stop time-of-day choice, tour and stop mode choice, and other choices – see Figure 1. The result of the activity-based model is travel demand for the residents of Fresno County. These models are sensitive to accessibilities (e.g. travel time) throughout the model system. Therefore, changes in travel times affect all of the model components.

Once travel demand is generated, auto trips are assigned to the auto network using Cube software. Level-of-service skims are built based on the congested travel times in the network and used for the next iteration of demand. . In total, the model is run three times to achieve convergence, where the travel times input to the model are consistent with the travel times generated by the demand in the model. This can be thought of as an equilibrium solution between supply and demand. Iteration is also

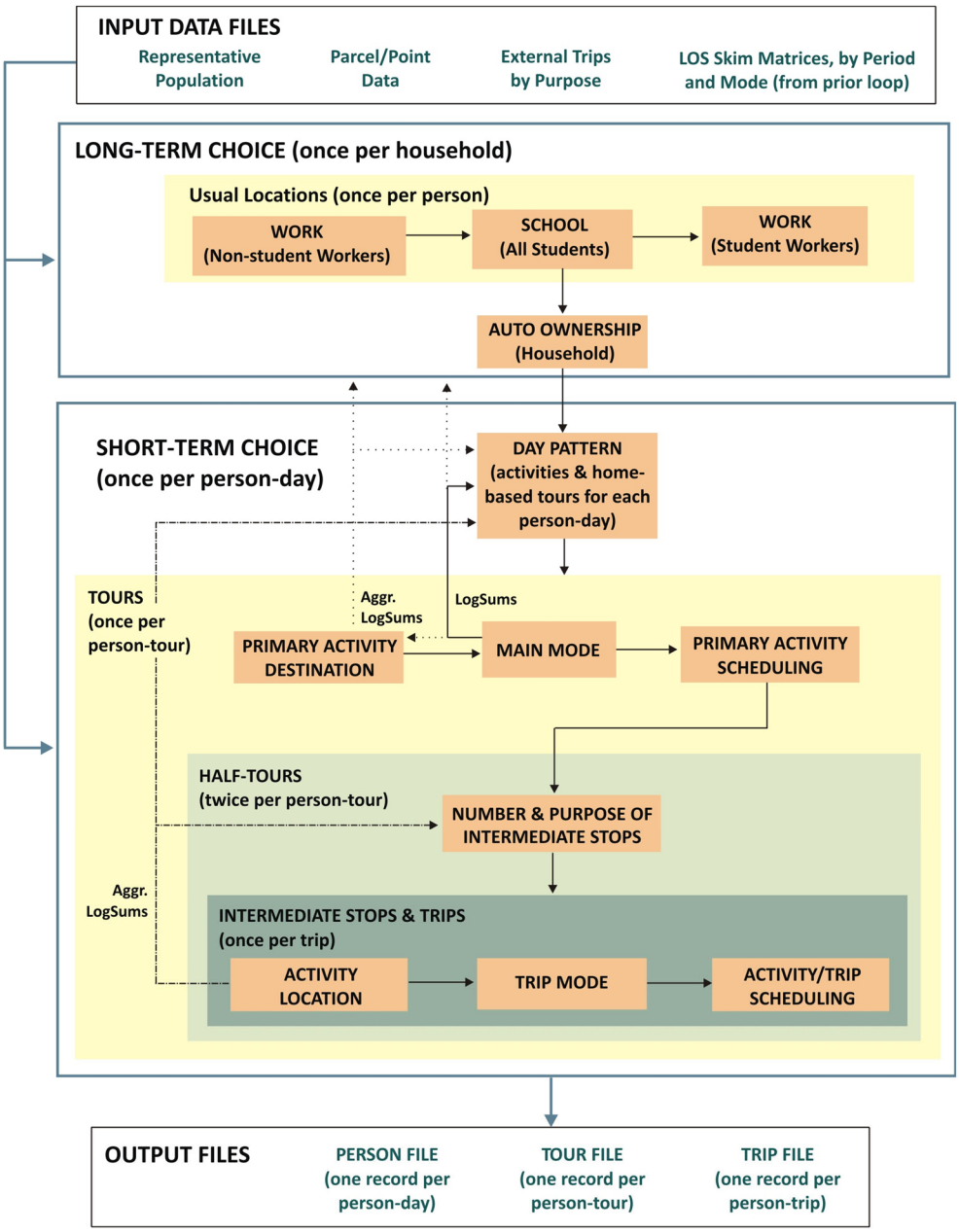

FIGURE 1: DAYSIM SUB-MODELS

used within the traffic assignment step itself, according to a process that seeks to find a condition known as 'Wardrop's User Equilibrium' where, given fixed demand (from the last iteration of the travel model) no user can switch their route and find a lower cost path. This process accounts for the effects of congestion on route choice. The other aspects of changes of travel behavior referred to above (time of day switching, mode switching, destination switching, and frequency of travel) are considered explicitly by DaySim.

It should also be pointed out that because equilibrium is achieved both in traffic assignment and in global feedback loops, the result of the model is one in which travelers may be switching multiple times in multiple directions to achieve equilibrium. What we observe at the end of the process is what Downs

observes after capacity increases over time; the roadway capacity increase may lead to increased volumes, which results in increased congestion which could be close to or the same as the congestion before the roadway capacity increase, albeit with more vehicles and an overall increase in utility.

In 2008, Sacramento Area Council of Government (SACOG) performed several tests using DaySim to examine sensitivity to induced travel. The results were documented in a report (https://www.sacog.org/sites/main/files/file-attachments/appendix_c-4_travel_model_documentation.pdf) and also published in a scientific journal paper (https://www.sciencedirect.com/science/article/pii/S1755534513700277).

Long Term Induced Demand

According to many studies and literatures such as Fundamental Law of Road Congestion: Evidence from US Cities (Duranton and Turner, 2011), and Impact of Highway Capacity and Induced Travel on Passenger vehicle Use and Greenhouse Gas Emissions Policy Brief (Handy and Boarnet, 2014), transportation capacity projects also have long term impacts on vehicle miles traveled. One of the long term impacts from capacity improvement is land use changes, which may include more dispersed development in remote areas if no proper land use control policy is in place. Such more dispersed development in remote areas will lead to additional VMT should it be allowed to happen without any mitigation. Since most travel demand models, including ABMs, have a separate land use modeling process, the land use changes generated by the new capacity improvements are generally not reflected in the traditional travel demand forecasting process. In order to address the long term VMT impacts from land use changes generated by capacity improvement projects, Fresno COG, in collaboration with RSG Inc., developed an integrated process to estimate both the short term and long term VMT impacts from new capacity improvement.

The following methodology is employed to estimate the effect of induced VMT from new land uses generated due to transportation capacity improvement projects. This process provides iterative and incremental feedback between the activity-based travel-demand model (ABM) and the land-use growth allocation model such that changes in the traffic network are incorporated into land-use allocation, and vice-versa.

Step 1: Base Year Model Run

A full ABM run is performed with base year network and socioeconomic data.

Step 2: Incremental Land-Use Allocation

An increment period is determined for the land-use allocation (e.g. 3 years). Growth targets are established for the new year at the zone, jurisdiction, and regional level. Planned transportation improvements for the new target year are incorporated into the model network.

For each incremental target year, skim results from the previous target year's ABM run are analyzed and fed into the land-use allocation model. The skims essentially indicate the accessibility of each zone by mode, i.e. a time-weighted aggregation of housing and services reachable by that zone using the coded traffic network. This takes into account both the relative location of each zone to destinations in other zones, as well as the nature and quality of the transportation choices available to that zone to reach those destinations.

The base parcel fabric is then analyzed for development attractiveness, including factors such as existing development characteristics, planned land-use characteristics, proximity to high-quality transit, intersection with conservation zones, etc. Also considered are the skim results from the previous run, making parcels in zones with high accessibility to jobs and housing via the previous model network (including transportation improvements) more attractive to new development. In this way, the transportation projects reflected in the previous run contribute to the accessibility of each zone and, consequently, the attractiveness of parcels for new development.

Each of the factors considered above are weighted and aggregated to create a total development score for each parcel in the planning area, where higher scores denote parcels that are more likely to attract future development.

Finally, development is assigned beginning with the highest-scoring parcels until growth targets are achieved – first at the zone level, then at the jurisdictional and regional levels. The character and intensity of each parcel's development is consistent with the planned land use designated to that parcel by the applicable jurisdiction's general and/or specific plans. The new land-use pattern (along with the improved model network) is then run through the ABM process again, and the procedure repeats for the next increment period. This iterative process continues until the horizon year is met.

Land-Use Allocation Tool

The land-use allocation tool has the following parameters:

Data Inputs

- **Base Year Socioeconomic Data.** This includes population, housing, and employment data at the parcel, microzone (MAZ) and traffic analysis zone (TAZ) levels.
- **Demographic Forecast.** Detailed growth forecast data providing jurisdiction-level (i.e. spheres of influence) growth targets.
- **ABM Skim Results.** The allocation model incorporates ABM skim results for the following modes: bike (MAZ-level), transit (TAZ-level), and SOV (TAZ-level).
- **Development Type Data.** Future growth is allocated by using archetypal development types that are designed to be reflective of the land-use designations described in the general and specific plans of the jurisdictions in the region. Each parcel eligible for future growth is assigned development types that represent, respectively, low-intensity, moderate-intensity, and high-intensity development.
- **Cube Land Model Results (optional).** The land-use allocation model supports the incorporation of TAZ-level growth targets from a Cube Land run, controlled to a user-provided level of confidence.

Input Parameters

- **Target Year**
- **Parameter Weights.** The user can indicate the weight of each of the following parameters when determining a parcel's development attractiveness score:
    - **Infill Weight.** Parcels closer to city limits or the geographic center of an unincorporated community have a higher infill score.

    - **Conservation Weight.** Parcels are given conservation scores based on the percentage of their area that does not intersect with any conservation resources (e.g. important farmland).
    - **TOD Weight.** Parcels closer to high-quality transit can be given a higher weight.
    - **DT Weight.** Parcels located in the downtown region of the FMCA can be given a higher weight.
    - **Bike Weight.** Parcels in zones with more favorable bike skim results have a higher bike score.
    - **Transit Weight.** Parcels in zones with more favorable transit skim results have a higher transit score.
    - **SOV Weight.** Parcels in zones with more favorable SOV skim results have a higher SOV score.
    - **Density Weight.** Parcels whose development types have higher net density are given higher density scores. Used to calibrate region-wide density measures.
    - **Single-Family Weight.** Parcels with single-family units in their development types are given higher SF scores. Used to calibrate region-wide housing mix measures.
    - **Mixed-Use Weight.** Parcels with mixed-use development in their development types are given higher MU scores. Used to calibrate region-wide housing mix measures.
    - **Infill Penalty.** The total score of parcels within city limits can be penalized. Used to calibrate regional infill goals.
    - **Redevelopment Penalty.** The total score of parcels with existing development can be penalized. Used to calibrate regional redevelopment goals.
- **Forecast Adjustments.** The following adjustments can be made if the user wishes to deviate from the demographic forecast:
    - **Population Adjustment.** The region-wide population growth target can be increased or decreased.
    - **Employment Adjustment.** The region-wide employment growth target can be increased or decreased.
    - **Vacancy Rate Adjustment.** The region-wide vacancy rate can be increased or decreased.
    - **Urban Adjustment.** The region-wide share of population and employment growth allocated to the urban area can be increased or decreased.
- **Redevelopment Minimum Density.** The minimum net density increase (combined housing and employment) can be set to screen out developed parcels that are unlikely to be redeveloped.
- **Cube Factor.** The TAZ-level growth controls from the Cube Land run, if any, are scaled to match the jurisdiction-level forecast data and then adjusted by this factor. This allows the user to control how much confidence is to be given to the Cube Land results and, alternately, how much influence and flexibility should be given to the land-use allocation model.

Output Parameters

- **Socioeconomic Data** for target year (parcel level)
- **Performance Metric Report**
- **PopulationSim Input Files:**
    - mazData.csv
    - gq_maz.csv

- countyData.csv
- **ABM Input Files:**
  - maz_parks.csv
  - se_detail.csv

Figure 2 below is a flowchart that demonstrates how the iterative modeling process will be conducted.

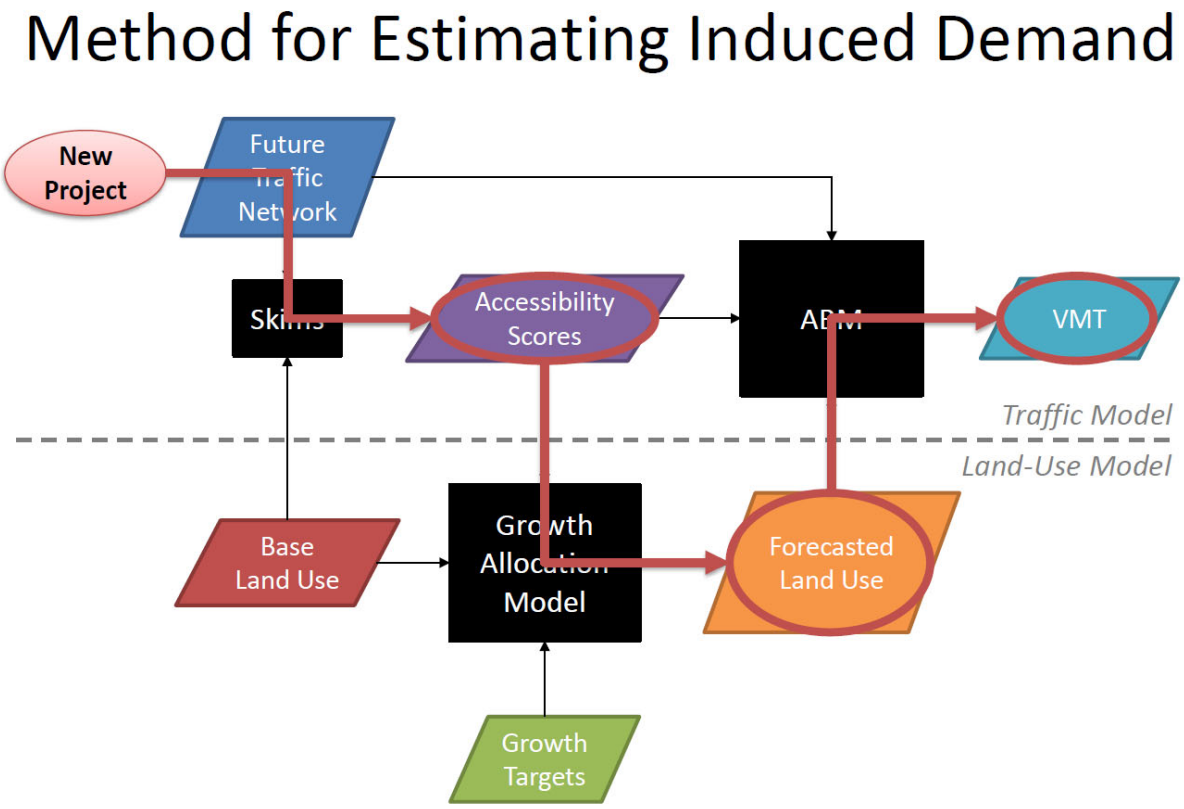

FIGURE 2 INTEGRATED INDUCED DEMAND MODELING PROCESS

Calibration and Validation

While calibrating what weight should be given to accessibility results across the various travel modes presents myriad challenges, including a lack of literature on the subject, Fresno COG will perform calibration runs and sensitivity analyses to ensure that the land-use allocation model is sensitive to these factors in intuitive and appropriate ways, using detailed land-use data for the Fresno County region from 2014 and 2019 to compare projected results from the allocation model to known data.

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APPENDIX E

VEHICLE MILES TRAVELED MITIGATION MEASURES FOR LAND USE DEVELOPMENT PROJECTS (CAPCOA)

LSA

Appendix E - Vehicle Miles Traveled Mitigation Measures for Land Development Projects

No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
1	T-1	Increase Residential Density	This measure accounts for the vehicle miles traveled (VMT) reduction achieved by a project that is designed with a higher density of dwelling units (DU) compared to the average residential density in the U.S. Increased densities affect the distance people travel and provide greater options for the mode of travel they choose. Increasing residential density results in shorter and fewer trips by single-occupancy vehicles and thus a reduction in GHG emissions. This measure is best quantified when applied to larger developments and developments where the density is somewhat similar to the surrounding area due to the underlying research being founded in data from the neighborhood level.	Urban, Suburban	Project/Site	This measure is most accurately quantified when applied to larger developments and/or developments where the density is somewhat similar to the surrounding neighborhood.	When paired with Measure T-2, Increase Job Density, the cumulative densification from these measures can result in a highly walkable and bikeable area, yielding increased co-benefits in VMT reductions, improved public health, and social equity.	Refer to California Air Pollution Control Officers Association (CAPCOA) report Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity (CAPCOA Manual), Final Draft, December 2021, page 71.	Up to 30.0 percent project VMT in the study area
2	T-2	Increase Job Density	This measure accounts for the VMT reduction achieved by a project that is designed with a higher density of jobs compared to the average job density in the U.S. Increased densities affect the distance people travel and provide greater options for the mode of travel they choose. Increasing job density results in shorter and fewer trips by single-occupancy vehicles and thus a reduction in GHG emissions.	Urban, suburban	Project/Site	This measure is most accurately quantified when applied to larger developments and/or developments where the density is somewhat similar to the surrounding neighborhood.	When paired with Measure T-1, Increase Residential Density, the cumulative densification from these measures can result in a highly walkable and bikeable area, yielding increased co-benefits in VMT reductions, improved public health, and social equity.	Refer to CAPCOA Manual, page 74.	Up to 30.0 percent project VMT in the study area
3	T-3	Provide Transit-Oriented Development	This measure would reduce project VMT in the study area relative to the same project sited in a non-transit-oriented development (TOD) location. TOD refers to projects built in compact, walkable areas that have easy access to public transit, ideally in a location with a mix of uses, including housing, retail offices, and community facilities. Project site residents, employees, and visitors would have easy access to high-quality public transit, thereby encouraging transit ridership and reducing the number of single-occupancy vehicle trips and associated GHG emissions.	Urban, suburban. Rural only if adjacent to commuter rail station with convenient rail service to a major employment center.	Project/Site	To qualify as a TOD, the development must be a residential or office project that is within a 10-minute walk (0.5 mile) of a high frequency transit station (either rail, or bus rapid transit with headways less than 15 minutes). Ideally, the distance should be no more than 0.25 to 0.3 of a mile but could be up to 0.5 mile if the walking route to station can be accessed by pedestrian-friendly routes. Users should confirm “unmitigated” or “baseline” VMT does not already account for reductions from transit proximity.	When building TOD, a best practice is to incorporate bike and pedestrian access into the larger network to increase the likelihood of transit use.	Refer to CAPCOA Manual, page 77.	Up to 31.0 percent project VMT in the study area
4	T-4	Integrate Affordable and Below Market Rate Housing	This measure requires below market rate (BMR) housing. BMR housing provides greater opportunity for lower income families to live closer to job centers and achieve a jobs/housing match near transit. It is also an important strategy to address the limited availability of affordable housing that might force residents to live far away from jobs or school, requiring longer commutes. The quantification method for this measure accounts for VMT reductions achieved for multifamily residential projects that are deed restricted or otherwise permanently dedicated as affordable housing.	Urban, suburban	Project/Site	Multifamily residential units must be permanently dedicated as affordable for lower income families. The California Department of Housing and Community Development (2021) defines lower-income as 80 percent of area median income or below, and affordable housing as costing 30 percent of gross household income or less.	Pair with Measure T-1, Increase Residential Density, and Measure T-2, Increase Job Density, to achieve greater population and employment diversity.	Refer to CAPCOA Manual, page 81.	Up to 28.6 percent project/site multifamily residential VMT
5	T-5	Implement Commute Trip Reduction Program (Voluntary)	This measure will implement a voluntary commute trip reduction (CTR) program with employers. CTR programs discourage single-occupancy vehicle trips and encourage alternative modes of transportation such as carpooling, taking transit, walking, and biking, thereby reducing VMT and GHG emissions. Voluntary implementation elements are described in this measure.	Urban, suburban	Project/Site	Voluntary CTR programs must include the following elements to apply the VMT reductions reported in literature. • Employer-provided services, infrastructure, and incentives for alternative modes such as ridesharing (Measure T-8), discounted transit (Measure T-9), bicycling (Measure T-10), vanpool (Measure T-11), and guaranteed ride home. • Information, coordination, and marketing for said services, infrastructure, and incentives (Measure T-7).	Other strategies may also be included as part of a voluntary CTR program, though they are not included in the VMT reductions reported by literature and thus are not incorporated in the VMT reductions for this measure. This program typically serves as a complement to the more effective workplace CTR measures such as pricing workplace parking (Measure T-12) or implementing employee parking “cash-out” (Measure T-13).	Refer to CAPCOA Manual, page 84.	Up to 4.0 percent project/site employee commute VMT

Appendix E - Vehicle Miles Traveled Mitigation Measures for Land Development Projects

No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
6	T-6	Implement Commute Trip Reduction Program (Mandatory Implementation and Monitoring)	This measure will implement a mandatory CTR program with employers. CTR programs discourage single-occupancy vehicle trips and encourage alternative modes of transportation such as carpooling, taking transit, walking, and biking, thereby reducing VMT and GHG emissions.	Urban, suburban	Project/Site	The mandatory CTR program must include all other elements (i.e., Measures T-7 through T-11) described for the voluntary program (Measure T-5) plus include mandatory trip reduction requirements (including penalties for non-compliance) and regular monitoring and reporting to ensure the calculated VMT reduction matches the observed VMT reduction.	This program typically serves as a complement to the more effective workplace CTR measures, such as pricing workplace parking (Measure T-12) or implementing employee parking "cash-out" (Measure T-13).	Refer to CAPCOA Manual, page 87.	Up to 26.0 percent project/site employee commute VMT
7	T-7	Implement Commute Trip Reduction Marketing	This measure will implement a marketing strategy to promote the project site employer's CTR program. Information sharing and marketing promote and educate employees about their travel choices to the employment location beyond driving such as carpooling, taking transit, walking, and biking, thereby reducing VMT and GHG emissions.	Urban, suburban	Project/Site	The following features (or similar alternatives) of the marketing strategy are essential for effectiveness. • Onsite or online commuter information services. • Employee transportation coordinators. • Onsite or online transit pass sales. • Guaranteed ride home service.	This measure could be packaged with other commute trip reduction measures (Measures T-8 through T-13) as a comprehensive CTR program (Measure T-5 or T-6).	Refer to CAPCOA Manual, page 90.	Up to 4.0 percent project/site employee commute VMT
8	T-8	Provide Ridesharing Program	This measure will implement a ridesharing program and establish a permanent transportation management association with funding requirements for employers. Ridesharing encourages carpooled vehicle trips in place of single-occupied vehicle trips, thereby reducing the number of trips, VMT, and GHG emissions.	Urban, suburban	Project/Site	Ridesharing must be promoted through a multifaceted approach. Examples include the following. • Designating a certain percentage of desirable parking spaces for ridesharing vehicles. • Designating adequate passenger loading and unloading and waiting areas for ridesharing vehicles. • Providing an app or website for coordinating rides.	When providing a ridesharing program, a best practice is to establish funding by a non-revocable funding mechanism for employer-provided subsidies. In addition, encourage use of low-emission ridesharing vehicles (e.g., shared Uber Green). This measure could be paired with any combination of the other commute trip reduction strategies (Measures T-7 through T-13) for increased reductions.	Refer to CAPCOA Manual, page 93.	Up to 8.0 percent project/site employee commute VMT
9	T-9	Implement Subsidized or Discounted Transit Program	This measure will provide subsidized or discounted, or free transit passes for employees and/or residents. Reducing the out-of-pocket cost for choosing transit improves the competitiveness of transit against driving, increasing the total number of transit trips and decreasing vehicle trips. This decrease in vehicle trips results in reduced VMT and thus a reduction in GHG emissions.	Urban, suburban	Project/Site	The project should be accessible either within 1 mile of high-quality transit service (rail or bus with headways of less than 15 minutes), 0.5 mile of local or less frequent transit service, or along a designated shuttle route providing last-mile connections to rail service. If a well-established bikeshare service (Measure T-22-A) is available, the site may be located up to 2 miles from a high-quality transit service. If more than one transit agency serves the site, subsidies should be provided that can be applied to each of the services available. If subsidies are applied for only one service, all variable inputs below should also pertain only to the service that is subsidized.	This measure could be paired with any combination of the other commute trip reduction strategies (Measures T-7 through T-13) for increased reductions.	Refer to CAPCOA Manual, page 96.	Up to 5.5 percent from employee/resident vehicles accessing the site
10	T-10	Provide End-of-Trip Bicycle Facilities	This measure will install and maintain end-of-trip facilities for employee use. End-of-trip facilities include bike parking, bike lockers, showers, and personal lockers. The provision and maintenance of secure bike parking and related facilities encourages commuting by bicycle, thereby reducing VMT and GHG emissions.	Urban, suburban	Project/Site	End-of-trip facilities should be installed at a size proportional to the number of commuting bicyclists and regularly maintained.	Best practice is to include an onsite bicycle repair station and post signage on or near secure parking and personal lockers with information about how to reserve or obtain access to these amenities. This measure could be paired with any combination of the other commute trip reduction strategies (Measures T-7 through T-13) for increased reductions.	Refer to CAPCOA Manual, page 101.	Up to 4.4 percent project/site employee commute VMT

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No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
11	T-11	Provide Employer-Sponsored Vanpool	This measure will implement an employer-sponsored vanpool service. Vanpooling is a flexible form of public transportation that provides groups of 5 to 15 people with a cost-effective and convenient rideshare option for commuting. The mode shift from long-distance, single-occupied vehicles to shared vehicles reduces overall commute VMT, thereby reducing GHG emissions.	Urban, suburban, rural	Project/Site	Vanpool programs are more appropriate for the building occupant or tenant (i.e., employer) to implement and monitor than the building owner or developer.	When implementing a vanpool service, best practice is to subsidize the cost for employees that have a similar origin and destination and provide priority parking for employees that vanpool. This measure could be paired with any combination of the other commute trip reduction strategies (Measures T-7 through T-13) for increased reductions.	Refer to CAPCOA Manual, page 105.	Up to 20.4 percent project/site employee commute VMT
12	T-12	Price Workplace Parking	This measure will price onsite parking at workplaces. Because free employee parking is a common benefit, charging employees to park onsite increases the cost of choosing to drive to work. This is expected to reduce single-occupancy vehicle commute trips, resulting in decreased VMT, thereby reducing associated GHG emissions.	Urban, suburban	Project/Site	Implementation may include the following. • Explicitly charging for employee parking. • Implementing above-market rate pricing. • Validating parking only for invited guests (or not providing parking validation at all). • Not providing employee parking and transportation allowances. In addition, this measure should include marketing and education regarding available alternatives to driving.	Best practice is to ensure that other transportation options are available, convenient, and have competitive travel times (i.e., transit service near the project site, shuttle service, or a complete active transportation network serving the site and surrounding community), and that there is not alternative free parking available nearby (such as on-street). This measure is substantially less effective in environments that do not have other modes available or where unrestricted street parking or other offsite parking is available nearby and has adequate capacity to accommodate project-related vehicle parking demand.	Refer to CAPCOA Manual, page 110.	Up to 20.0 percent project/site employee commute VMT
13	T-13	Implement Employee Parking Cash-Out	This measure will require project employers to offer employee parking cash-out. Cash-out is when employers provide employees with a choice of forgoing their current subsidized/free parking for a cash payment equivalent to or greater than the cost of the parking space. This encourages employees to use other modes of travel instead of single occupancy vehicles. This mode shift results in people driving less and thereby reduces VMT and GHG emissions.	Urban, suburban	Project/Site	To prevent spill-over parking and continued use of single occupancy vehicles, residential parking in the surrounding area must be permitted, and public on-street parking must be market rate.	This measure could be paired with many other commute trip reduction strategies (Measures T-7 through T-11) for increased reductions.	Refer to CAPCOA Manual, page 114.	Up to 12.0 percent project/site employee commute VMT
14	T-14	Provide Electric Vehicle Charging Infrastructure	Install onsite electric vehicle chargers in an amount beyond what is required by the 2019 California Green Building Standards (CALGreen) at buildings with designated parking areas (e.g., commercial, educational, retail, multifamily). This will enable drivers of plug-in hybrid electric vehicles (PHEVs) to drive a larger share of miles in electric mode (eVMT), as opposed to gasoline-powered mode, thereby displacing GHG emissions from gasoline consumption with a lesser amount of indirect emissions from electricity. Most PHEVs owners charge their vehicles at home overnight. When making trips during the day, the vehicle will switch to gasoline mode if/when it reaches its maximum all-electric range.	Urban, suburban, rural	Project/Site	Parking at the chargers must be limited to electric vehicles.	In addition to increasing the percentage of electric miles for PHEVs, the increased availability of chargers from implementation of this measure could mitigate consumer “range anxiety” concerns and increase the adoption and use of battery electric vehicles (BEVs), but this potential effect is not included in the calculations as a conservative assumption. Expanded mitigation could include quantification of the effect of this measure on BEV use.	-	-
15	T-15	Limit Residential Parking Supply	This measure will reduce the total parking supply available at a residential project or site. Limiting the amount of parking available creates scarcity and adds additional time and inconvenience to trips made by private auto, thus disincentivizing driving as a mode of travel. Reducing the convenience of driving results in a shift to other modes and decreased VMT and thus a reduction in GHG emissions. Evidence of the effects of reduced parking supply is strongest for residential developments.	Urban, suburban	Project/Site	This measure is ineffective in locations where unrestricted street parking or other offsite parking is available nearby and has adequate capacity to accommodate project-related vehicle parking demand.	When limiting parking supply, a best practice is to do so at sites that are located near high quality alternative modes of travel (such as a rail station, frequent bus line, or in a higher density area with multiple walkable locations nearby). Limiting parking supply may also allow for more active uses on any given lot, which may support Measures T-1 and T-2 by allowing for higher density construction.	Refer to CAPCOA Manual, page 123.	Up to 13.7 percent from resident vehicles accessing the site

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No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
16	T-16	Unbundle Residential Parking Costs from Property Cost	This measure will unbundle, or separate, a residential project's parking costs from property costs, requiring those who wish to purchase parking spaces to do so at an additional cost. On the assumption that parking costs are passed through to the vehicle owners/drivers utilizing the parking spaces, this measure results in decreased vehicle ownership and, therefore, a reduction in VMT and GHG emissions. Unbundling may not be available to all residential developments, depending on funding sources.	Urban, suburban	Project/Site	Parking costs must be passed through to the vehicle owners/drivers utilizing the parking spaces for this measure to result in decreased vehicle ownership.	Pair with Measure T-19-A or T-19-B to ensure that residents who eliminate their vehicle and shift to a bicycle can safely access the area's bikeway network.	Refer to CAPCOA Manual, page 127.	Up to 15.7 percent project VMT in the study area
17	T-17	Improve Street Connectivity	This measure accounts for the VMT reduction achieved by a project that is designed with a higher density of vehicle intersections compared to the average intersection density in the U.S. Increased vehicle intersection density is a proxy for street connectivity improvements, which help to facilitate a greater number of shorter trips and thus a reduction in GHG emissions.	Urban, suburban	Plan/Community	Projects that increase intersection density would be building a new street network in a subdivision or retrofitting an existing street network to improve connectivity (e.g., converting cul-de-sacs or dead-end streets to grid streets).	Pair with Measure T-18, Provide Pedestrian Network Improvement, to best support use of the local pedestrian network.	Refer to CAPCOA Manual, page 131.	Up to 30.0 percent from vehicle travel in the plan/community
18	T-18	Provide Pedestrian Network Improvement	This measure will increase the sidewalk coverage to improve pedestrian access. Providing sidewalks and an enhanced pedestrian network encourages people to walk instead of drive. This mode shift results in a reduction in VMT and GHG emissions.	Urban, suburban, rural	Plan/Community	The GHG reduction of this measure is based on the VMT reduction associated with expansion of sidewalk coverage expansion, which includes not only building of new sidewalks but also improving degraded or substandard sidewalk (e.g., damaged from street tree roots). However, pedestrian network enhancements with non-quantifiable GHG reductions are encouraged to be implemented, as discussed under Expanded Mitigation Options.	When improving sidewalks, a best practice is to ensure they are contiguous and link externally with existing and planned pedestrian facilities. Barriers to pedestrian access and interconnectivity, such as walls, landscaping buffers, slopes, and unprotected crossings should be minimized. Other best practice features could include high-visibility crosswalks, pedestrian hybrid beacons, and other pedestrian signals, mid-block crossing walks, pedestrian refuge islands, speed tables, bulb-outs (curb extensions), curb ramps, signage, pavement markings, pedestrian-only connections and districts, landscaping, and other improvements to pedestrian safety (see Measure T-35, Provide Traffic Calming Measures).	Refer to CAPCOA Manual, page 134.	Up to 6.4 percent from vehicle travel in the plan/community
19	T-19-A	Construct or Improve Bike Facility	This measure will construct or improve a single bicycle lane facility (only Class I, II, or IV) that connects to a larger existing bikeway network. Providing bicycle infrastructure helps to improve biking conditions within an area. This encourages a mode shift on the roadway parallel to the bicycle facility from vehicles to bicycles, displacing VMT and thus reducing GHG emissions. When constructing or improving a bicycle facility, a best practice is to consider local or state bike lane width standards. A variation of this measure is provided as T-19-B, Construct or Improve Bike Boulevard.	Urban, suburban	Plan/Community. This measure reduces VMT on the roadway segment parallel to the bicycle facility (i.e., the corridor). An adjustment factor is included in the formula to scale the VMT reduction from the corridor level to the plan/community level.	The bicycle lane facility must be either Class I, II, or IV. Class I bike paths are physically separated from motor vehicle traffic. Class IV bikeways are protected on-street bikeways, also called cycle tracks. Class II bike lanes are striped bicycle lanes that provide exclusive use to bicycles on a roadway.	Implement alongside Measures T-22-A, T-22-B, and/or T-22-C to ensure that micromobility users can ride safely along bicycle lane facilities and not have to ride along pedestrian infrastructure, which is a risk to pedestrian safety.	Refer to CAPCOA Manual, page 138.	Up to 0.8 percent from vehicles on parallel roadways

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No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
20	T-19-B	Construct or Improve Bike Boulevard	Construct or improve a single bicycle boulevard that connects to a larger existing bikeway network. Bicycle boulevards are a designation within Class III Bikeway that create safe, low-stress connections for people biking and walking on streets. This encourages a mode shift from vehicles to bicycles, displacing VMT and thus reducing GHG emissions. A variation of this measure is provided as T-19-A, Construct or Improve Bike Facility, which is for Class I, II, or IV bicycle infrastructure.	Urban, suburban	Plan/Community. This measure reduces VMT on the roadway segment parallel to the bicycle facility (i.e., the corridor). An adjustment factor is included in the formula to scale the VMT reduction from the corridor level to the plan/community level.	The following roadway conditions must be met. • Functional classification: local and collector if there is no more than a single general-purpose travel lane in each direction. • Design speed: <= 25 miles per hour. • Design volume <= 5,000 average daily traffic. • Treatments at major intersections: both directions have traffic signals (or an effective control device that prioritizes pedestrian and bicycle access such as rapid flashing beacons, pedestrian hybrid beacons, high-intensity activated crosswalks, TOUCANs), bike route signs, “sharrowed” roadway markings, and pedestrian crosswalks.	Construct boulevards with forced turns for vehicles every few blocks to minimize through traffic while ensuring that speed and volume metrics are met. Implement alongside Measures T-22-A, T-22-B, and/or T-22-C to ensure that micromobility users can ride safely along bicycle lane facilities and not pedestrian infrastructure, which is a risk to pedestrian safety.	Refer to CAPCOA Manual, page 143.	Up to 0.2 percent from vehicles on roadways
22	T-20	Expand Bikeway Network	This measure will increase the length of a city or community bikeway network. A bicycle network is an interconnected system of bike lanes, bike paths, bike routes, and cycle tracks. Providing bicycle infrastructure with markings and signage on appropriately sized roads with vehicle traffic traveling at safe speeds helps to improve biking conditions (e.g., safety and convenience). In addition, expanded bikeway networks can increase access to and from transit hubs, thereby expanding the “catchment area” of the transit stop or station and increasing ridership. This encourages a mode shift from vehicles to bicycles, displacing VMT and thus reducing GHG emissions. When expanding a bicycle network, a best practice is to consider bike lane width standards from local agencies, state agencies, or the National Association of City Transportation Officials’ Urban Bikeway Design Guide.	Urban, suburban	Plan/Community	The bikeway network must consist of either Class I, II, or IV infrastructure.	As networks expand, ensure safe, secure, and weather-protected bicycle parking facilities at origins and destinations. Also, implement alongside T-22-A, T-22-B, and/or T-22-C to ensure that micromobility options can ride safely along bicycle lane facilities and not have to ride along pedestrian infrastructure, which is a risk to pedestrian safety.	Refer to CAPCOA Manual, page 147.	Up to 0.5 percent from vehicle travel in the plan/community
23	T-21-A	Implement Conventional Carshare Program	This measure will increase carshare access in the user’s community by deploying conventional carshare vehicles. Carsharing offers people convenient access to a vehicle for personal or commuting purposes. This helps encourage transportation alternatives and reduces vehicle ownership, thereby avoiding VMT and associated GHG emissions. A variation of this measure, electric carsharing, is described in Measure T-21-B, Implement Electric Carshare Program.	Urban, suburban	Plan/Community	The GHG mitigation potential is based, in part, on literature analyzing one-way carsharing service with a free-floating operational model. This measure should be applied with caution if using a different form of carsharing (e.g., roundtrip, peer-to-peer, fractional).	When implementing a carshare program, best practice is to discount carshare membership and provide priority parking for carshare vehicles to encourage use of the service.	Refer to CAPCOA Manual, page 151.	Up to 0.15 percent from vehicle travel in the plan/community

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No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
24	T-21-B	Implement Electric Carshare Program	This measure will increase carshare access in the user's community by deploying electric carshare vehicles. Carsharing offers people convenient access to a vehicle for personal or commuting purposes. This helps encourage transportation alternatives and reduces vehicle ownership, thereby avoiding VMT and associated GHG emissions. This also encourages a mode shift from internal combustion engine vehicles to electric vehicles, displacing the emissions-intensive fossil fuel energy with less emissions-intensive electricity. Electric carshare vehicles require more staffing support compared to conventional carshare programs for shuttling electric vehicles to and from charging points. A variation of this measure, conventional carsharing, is described in Measure T-21-A, Implement Conventional Carshare Program.	Urban, suburban	Plan/Community	The GHG mitigation potential is based, in part, on literature analyzing one-way carsharing service with a free-floating operational model. This measure should be applied with caution if using a different form of carsharing (e.g., roundtrip, peer-to-peer, fractional).	When implementing a carshare program, best practice is to discount carshare membership and provide priority parking for carshare vehicles to encourage use of the service.	Refer to CAPCOA Manual, page 158.	Up to 0.18 percent GHG reduction from vehicle travel in the plan/community. Please refer to VMT reduction formula on CAPCOA Manual, page 158.
25	T-22-A	Implement Pedal (Non-Electric) Bikeshare Program	This measure will establish a bikeshare program. Bikeshare programs provide users with on-demand access to bikes for short-term rentals. This encourages a mode shift from vehicles to bicycles, displacing VMT and thus reducing GHG emissions. Variations of this measure are described in Measure T-22-B, Implement Electric Bikeshare Program, and Measure T-22-C, Implement Scootershare Program.	Urban, suburban	Plan/Community	The GHG mitigation potential is based, in part, on literature analyzing docked (i.e., station-based) bikeshare programs. This measure should be applied with caution if using dockless (free-floating) bikeshare.	Best practice is to discount bikeshare membership and dedicate bikeshare parking to encourage use of the service. Also consider including space on the vehicle to store personal items while traveling, such as a basket.	Refer to CAPCOA Manual, page 160.	Up to 0.02 percent from vehicle travel in the plan/community
26	T-22-B	Implement Electric Bikeshare Program	This measure will establish an electric bikeshare program. Electric bikeshare programs provide users with on-demand access to electric pedal assist bikes for short-term rentals. This encourages a mode shift from vehicles to electric bicycles, displacing VMT and reducing GHG emissions. Variations of this measure are described in Measure T-22-A, Implement Pedal (Non-Electric) Bikeshare Program, and Measure T-22-C, Implement Scootershare Program.	Urban, suburban	Plan/Community	The GHG mitigation potential is based, in part, on literature analyzing docked (i.e., station-based) bikeshare programs. This measure should be applied with caution if using dockless (free-floating) bikeshare.	Best practice is to discount electric bikeshare membership and dedicate electric bikeshare parking to encourage use of the service. Consider also including space on the vehicle to store personal items while traveling, such as a basket.	Refer to CAPCOA Manual, page 164.	Up to 0.06 percent from vehicle travel in the plan/community. This quantification methodology does not account for the miles traveled from vehicle travel of program employees picking up and dropping off bikes.
27	T-22-C	Implement Scootershare Program	This measure will establish a scootershare program. Scootershare programs provide users with on-demand access to electric scooters for short-term rentals. This encourages a mode shift from vehicles to scooters, displacing VMT and thus reducing GHG emissions. Variations of this measure are described in Measure T-22-A, Implement Pedal (Non-Electric) Bikeshare Program, and Measure T-22-B, Implement Electric Bikeshare Program.	Urban, suburban	Plan/Community	The GHG mitigation potential is based, in part, on literature analyzing docked (i.e., station-based) bikeshare programs. This measure should be applied with caution given the likely higher popularity of scootershare compared to bikeshare.	Best practice is to discount scootershare membership and dedicate scootershare parking to encourage use of the service. Consider also including space on the vehicle to store personal items while traveling, such as a basket.	Refer to CAPCOA Manual, page 168.	Up to 0.07 percent from vehicle travel in the plan/community. This quantification methodology does not account for the miles traveled from vehicle travel of program employees picking up and dropping off scooters.
28	T-23	Provide Community-Based Travel Planning	This measure will target residences in the plan/community with community-based travel planning (CBTP). CBTP is a residential-based approach to outreach that provides households with customized information, incentives, and support to encourage the use of transportation alternatives in place of single occupancy vehicles, thereby reducing household VMT and associated GHG emissions.	Urban, suburban	Plan/Community	CBTP involves teams of trained travel advisors visiting all households within a targeted geographic area, having tailored conversations about residents' travel needs, and educating residents about the various transportation options available to them. Due to the personalized outreach method, communities are typically targeted in phases.	Pair with any of the Measures from T-17 through T-22-C to ensure that residents that are targeted by CBTP who want to use alternative transportation have the infrastructure and technology to do so.	Refer to CAPCOA Manual, page 172.	Up to 2.3 percent from vehicle travel in the plan/community

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No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
29	T-24	Implement Market Price Public Parking (On-Street)	This measure will price all on-street parking in a given community, with a focus on parking near central business districts, employment centers, and retail centers. Increasing the cost of parking increases the total cost of driving to a location, incentivizing shifts to other modes and thus decreasing total VMT to and from the priced areas. This VMT reduction results in a corresponding reduction in GHG emissions.	Urban, suburban	Plan/Community	When pricing on-street parking, best practice is to allow for dynamic adjustment of prices to ensure approximately 85 percent occupancy, which helps prevent induced VMT due to circling behaviors as individuals search for a vacant parking space. In addition, this method should primarily be implemented in areas with available alternatives to driving, such as transit availability within 0.5. mile or areas of high residential density nearby (allowing for increased walking/biking). If the measure is implemented in a small area, residential parking permit programs should be considered to prevent parking intrusion on nearby streets in residential areas without priced parking.	Pricing on-street parking also helps support individual projects with priced onsite parking by removing potential alternative parking locations.	Refer to CAPCOA Manual, page 175.	Up to 30.0 percent from vehicle travel in the plan/community
30	T-25	Extend Transit Network Coverage or Hours	This measure will expand the local transit network by either adding or modifying existing transit service or extending the operation hours to enhance the service near the project site. Starting services earlier in the morning and/or extending services to late-night hours can accommodate the commuting times of alternative-shift workers. This will encourage the use of transit and therefore reduce VMT and associated GHG emissions.	Urban, suburban	Plan/Community	There are two primary means of expanding the transit network: by increasing the frequency of service, thereby reducing average wait times and increasing convenience, or by extending service to cover new areas and times.	This measure is focused on providing additional transit network coverage, with no changes to transit frequency. This measure can be paired with Measure T-26, Increase Transit Service Frequency, which is focused on increasing transit service frequency, for increased reductions.	Refer to CAPCOA Manual, page 179.	Up to 4.6 percent from vehicle travel in the plan/community
31	T-26	Increase Transit Service Frequency	This measure will increase transit frequency on one or more transit lines serving the plan/community. Increased transit frequency reduces waiting and overall travel times, which improves the user experience and increases the attractiveness of transit service. This results in a mode shift from single occupancy vehicles to transit, which reduces VMT and associated GHG emissions.	Urban, suburban	Plan/Community	Refer to measure description.	This measure is focused on providing increased transit frequency, with no changes to transit network coverage. This measure can be paired with Measure T-25, Extend Transit Network Coverage or Hours, which is focused on increasing transit network coverage, for increased reductions.	Refer to CAPCOA Manual, page 185.	Up to 11.3 percent GHG reduction from vehicle travel in the plan/community. Please refer to VMT reduction formula on CAPCOA Manual, page 185.

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No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
32	T-27	Implement Transit-Supportive Roadway Treatments	This measure will implement transit-supportive treatments on the transit routes serving the plan/community. Transit-supportive treatments incorporate a mix of roadway infrastructure improvements and/or traffic signal modifications to improve transit travel times and reliability. This results in a mode shift from single occupancy vehicles to transit, which reduces VMT and the associated GHG emissions.	Urban, suburban	Plan/Community	Treatments can include transit signal priority, bus-only signal phases, queue jumps, curb extensions to speed passenger loading, and dedicated bus lanes.	This measure could be paired with other Transit subsector strategies (Measure T-25 and Measure T-29) for increased reductions.	Refer to CAPCOA Manual, page 189.	Up to 0.6 percent from vehicle travel in the plan/community
33	T-28	Provide Bus Rapid Transit	This measure will convert an existing bus route to a bus rapid transit (BRT) system. BRT includes the following additional components, compared to traditional bus service: exclusive right-of-way (e.g., busways, queue jumping lanes) at congested intersections, increased limited-stop service (e.g., express service), intelligent transportation technology (e.g., transit signal priority, automatic vehicle location systems), advanced technology vehicles (e.g., articulated buses, low-floor buses), enhanced station design, efficient fare-payment smart cards or smartphone apps, branding of the system, and use of vehicle guidance systems. BRT can increase the transit mode share in a community due to improved travel times, service frequencies, and the unique components of the BRT system. This mode shift reduces VMT and the associated GHG emissions.	Urban, suburban	Plan/Community	The measure quantification methodology accounts for the increase in ridership from (1) improved travel times from transit signal prioritization, (2) increased service frequency, and (3) the unique ridership increase associated with a full-featured BRT service operating on a fully segregated running way with specialized (or stylized) vehicles, attractive stations, and efficient fare collection practices. To take credit for the estimated emissions reduction, the user should implement, at minimum, these components.	This measure could be paired with Measure T-25, Extend Transit Network Coverage or Hours, and Measure T-29, Reduce Transit Fares, for increased reductions.	Refer to CAPCOA Manual, page 193.	Up to 13.8 percent from vehicle travel in the plan/community. Please refer to VMT reduction formula on CAPCOA Manual, page 195.
34	T-29	Reduce Transit Fares	This measure will reduce transit fares on the transit lines serving the plan/community. A reduction in transit fares creates incentives to shift travel to transit from single-occupancy vehicles and other traveling modes, which reduces VMT and associated GHG emissions. This measure differs from Measure T-8, Implement Subsidized or Discounted Transit Program, which can be offered through employer-based benefits programs in which the employer fully or partially pays the employee's cost of transit.	Urban, suburban	Plan/Community	Transit fare reductions can be implemented systemwide or in specific fare-free or reduced-fare zones.	This measure could be paired with other Transit subsector strategies (Measure T-25, Extend Transit Network Coverage or Hours, and Measure T-26, Increase Transit Service Frequency) for increased reductions.	Refer to CAPCOA Manual, page 200.	Up to 1.2 percent from vehicle travel in the plan/community

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No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
35	T-30	Use Cleaner-Fuel Vehicles	This measure requires use of cleaner-fuel vehicles in lieu of similar vehicles powered by gasoline or diesel fuel. Cleaner-fuel vehicles addressed in this measure include electric vehicles, natural gas and propane vehicles, and vehicles powered by biofuels such as composite diesel (blend of renewable diesel, biodiesel, and conventional fossil diesel), ethanol, and renewable natural gas. The full GHG emissions impact of cleaner fuels depends on the emissions from the vehicle's tailpipe as well as the emissions associated with production of the fuel (sometimes termed "upstream" emissions). For example, tailpipe GHG emissions from renewable natural gas are identical to tailpipe GHG emissions from conventional natural gas; the GHG benefits of renewable natural gas come from the fact that it is produced from biomass. Similarly, BEVs have zero tailpipe emissions, but properly accounting for their GHG impacts requires quantifying the emissions associated with the electricity generation needed to charge the vehicle's batteries.	Not-applicable	Project/Site or Plan/Community	-	If using electric vehicles, pair with Measure T-14 to ensure that electric vehicles have sufficient access to charging infrastructure.	-	-
36	T-31-A	Locate Project in Area with High Destination Accessibility	The measure requires development in an area with high accessibility to destinations. Destination accessibility is measured in terms of the number of jobs or other attractions (e.g., schools, supermarkets, and health care services) that are reachable within a given travel time or travel distance, and tends to be highest at central locations and lowest at peripheral ones. When destinations are nearby, the travel time between them is less, thus increasing the potential for people to walk and bike to those destinations and, therefore, reducing the VMT and associated GHG emissions. As an implementation consideration, projects should consider accessibility by people of all functional abilities and incorporate design principles such as Universal Design.	Urban, suburban	Project/Site	-	This is a variation of measure T-31-B.	-	-
37	T-31-B	Improve Destination Accessibility in Undeserved Areas	This measure accounts for the VMT reduction that would be achieved by constructing job centers or other attractions (e.g., schools, supermarkets, and health care services) for residents in underserved areas (e.g., food deserts). When destinations are nearby, the travel time between them is less, thus increasing the potential for people to walk and bike to those destinations, reducing VMT and associated GHG emissions. As an implementation consideration, projects should consider accessibility by people of all functional abilities and incorporate design principles such as Universal Design.	Urban, suburban	Plan/Community	-	This is a variation of measure T-31-A.	-	-
38	T-32	Orient Project Toward Transit, Bicycle, or Pedestrian Facility	This measure requires projects to minimize setback distance between the project and planned or existing transit, bicycle, or pedestrian corridors. A project that is designed around an existing or planned transit, bicycle, or pedestrian corridor encourages sustainable mode use. As an implementation consideration, projects should consider accessibility by people of all functional abilities and incorporate design principles such as Universal Design.	Urban, suburban, rural	Project/Site	-	-	-	-
39	T-33	Locate Project near Bike Path/Bike Lane	This measure requires projects to be located within 0.5-mile bicycling distance to an existing Class I or IV path or Class II bike lane. A project that is designed around an existing or planned bicycle facility encourages sustainable mode use. The project design should include a comparable network that connects the project uses to the existing off-site facilities that connect to work/retail destinations. As an implementation consideration, projects should provide sufficient and convenient bicycle parking and long-term storage, ideally near the bike lane itself, for residents, employees, and visitors, and a bicycle repair station with tools and equipment.	Urban, suburban	Project/Site	-	This measure can be implemented with Measure T-9.	-	-

Appendix E - Vehicle Miles Traveled Mitigation Measures for Land Development Projects

No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
40	T-34	Provide Bike Parking	This measure requires projects provide short-term and long-term bicycle parking facilities to meet peak season maximum demand. Parking can be provided in designated areas or added within rights-of-way, including by replacing parking spaces with bike parking corrals. Ensure that bike parking can be accessed by all, not just project employees or residents.	Urban, suburban, rural	Project/Site or Plan/Community	-	-	-	-
41	T-35	Provide Traffic Calming Measures	This measure requires projects to include pedestrian/bicycle safety and traffic calming measures above jurisdictional requirements. Roadways should also be designed to reduce motor vehicle speeds and encourage pedestrian and bicycle trips with traffic calming features. Traffic calming features may include marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, raised intersections, median islands, tight corner radii, roundabouts or mini-circles, on-street parking, planter strips with street trees, chicanes/chokers, and others. Providing traffic calming measures encourages people to walk or bike instead of using a vehicle. This mode shift will result in a decrease in vehicle miles traveled. Traffic calming also promotes active transportation, which improves physical health.	Urban, suburban, rural	Plan/Community	-	-	-	-
42	T-36	Create Urban Non-Motorized Zones	The measure requires projects to convert a percentage of its roadway miles to transit malls, linear parks, or other non-motorized zones. These features encourage non-motorized travel and thus a reduction in vehicle miles traveled. This measure is only applicable to projects located in urban environments. Consider access issues for paratransit users and those with mobility impairments.	Urban	Plan/Community	-	-	-	-
43	T-37	Dedicate Land for Bike Trails	This measure requires projects to provide for, contribute to, or dedicate land for the provision of off-site bicycle trails linking the project to designated bicycle commuting routes in accordance with an adopted citywide or countywide bikeway plan. Existing desire paths can make good locations, as it represents a community-identified transportation need.	Urban, suburban, rural	Plan/Community	-	-	-	-

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Appendix E - Vehicle Miles Traveled Mitigation Measures for Land Development Projects

No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
44	T-38	Provide First and Last Mile TNC Incentives	This measure requires a first-last mile partnership between a municipality/transit agency and a transportation network company (TNC) for subsidized, shared TNC rides to or from the local transit station within a specific geographic area. This measure encourages a shift to transit mode for longer trips. Consider providing inclusive mechanisms so people without bank accounts, credit cards, or smart phones can access the incentives.	Urban, suburban, rural (only if the project is adjacent to a commuter rail station with convenient rail service to a major employment center)	Plan/Community	-	-	-	-
45	T-39	Implement Preferential Parking Permit Program	This measure requires projects provide preferential parking in terms of free or reduced parking fees, priority parking, or reserved parking in convenient locations (such as near public transportation or building entrances) for commuters who carpool, vanpool, ride-share or use sustainably fueled vehicles. Projects should also provide wide parking spaces to accommodate vanpool vehicles. Commercial preferential parking can accommodate workers who work non-standard hours by providing opportunities to participate. Residential preferential parking can consider an equitable distribution of permits, giving priority to owners of sustainably fueled vehicles.	Urban, suburban	Project/Site	-	-	-	-
46	T-40	Implement School Bus Program	This measure will provide school bus service transporting students to a school project. A school bus service can reduce the number of private vehicle trips to drop-off or pick-up students, thereby reducing VMT and associated GHG emissions, as well as onsite air pollution emissions, especially if the bus is zero emissions. Best practices include concentrating service for students who live further away from schools, providing service both before and after school, and encouraging parents to utilize the service. This measure is more effective at schools that draw students from a larger enrollment area, such as high schools or private schools.	Urban, suburban, rural	Project/Site	-	-	-	-
47	T-41	Implement a School Pool Program	This measure requires projects create a ridesharing program for school children. Most school districts provide bussing services to public schools only. School pool helps match parents to transport students to private schools, or to schools where students cannot walk or bike but do not meet the requirements for bussing. A school pool program can help reduce onsite air pollutant emissions at the school by reducing private vehicle trips, especially if the pool vehicle is zero emissions.	Urban, suburban, rural	Project/Site	-	-	-	-

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Appendix E - Vehicle Miles Traveled Mitigation Measures for Land Development Projects

No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
48	T-42	Implement Telecommute and/or Alternative Work Schedule Program	This measure requires projects to permit employee telecommuting and/or alternative work schedules and monitor employee involvement to ensure forecasted participation matches observed participation. While this measure certainly reduces commute-related VMT, recent research has shown that total VMT from telecommuters can exceed VMT from non-telecommuters. In addition, telecommuting affects commercial and residential electricity use, complicating the calculation of the net effect and attribution of emissions. More specifically, an office with fewer employees could result in a decrease in the project's energy used to operate equipment and provide space heating and air conditioning. Conversely, an increase in telecommuters using their private homes as workspaces could result in a residential increase in energy for those same end uses and appliances. While this measure is currently not quantified and, according to some studies, could result in total VMT increases and other disbenefits, it is recommended that users review the most recent literature at the time of their project initiation to see if new findings more conclusively support a quantifiable emissions reduction.	Urban, suburban, rural	Project/Site	-	-	-	-
49	T-43	Provide Real-Time Transit Information	This measure requires projects provide real-time bus/train/ferry arrival time, travel time, alternative routings, or other transit information via electronic message signs, dedicated monitor or interactive electronic displays, websites, or mobile apps. This makes transit service more convenient and may result in a mode shift from auto to transit, which reduces VMT.	Urban, suburban, rural	Plan/Community	-	-	-	-
50	T-44	Provide Shuttles (Gas or Electric)	This measure will provide local shuttle service through coordination with the local transit operator or private contractor. The shuttles will provide service to and from commercial centers to nearby transit centers to help with first and last mile connectivity, thereby incentivizing a shift from private vehicles to transit, reducing associated GHG emissions. Electric shuttle vehicles provide a marginally more effective reduction to GHG emissions compared to gas- or diesel-fueled shuttles due to their use of less emissions-intensive electric power. Shuttles that serve only the project residents and/or employees may be seen as increasing gentrification and exclusionary. Consider allowing all people to use the shuttle, regardless of status. Note that this measure can also be implemented at the Project/Site scale by a large employer as part of a Trip Reduction Program.	Urban, suburban	Project/Site	-	-	-	-

Appendix E - Vehicle Miles Traveled Mitigation Measures for Land Development Projects

No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
51	T-45	Provide On-Demand Microtransit	This measure will provide small-scale, on-demand public transit services that can offer fixed routes and schedules or flexible routes and on-demand scheduling (e.g., Metro Micro) through coordination with the local transit operator or private contractor. Microtransit aims to offer shorter wait times and improved reliability compared to the bus and rail system to further incentivize alternative transportation modes that are less emissions-intensive than private vehicle trips. On-demand rides can be booked using smartphone applications or call centers. Note that this measure may also be applicable at the Project/Site scale for a large employer (e.g., Google's Via2G pilot) as part of a Trip Reduction Program.	Urban, suburban	Project/Site or Plan/Community	-	-	-	-
52	T-46	Improve Transit Access, Safety, and Comfort	This measure requires projects improve transit access and safety through sidewalk/crosswalk safety enhancements, bus shelter improvements, improved lighting, and other features. Work with the community to determine barriers to use, most desired improvements, and other access challenges.	Urban, suburban, rural (only if the project is adjacent to a commuter rail station with convenient rail service to a major employment center, or if there is available transit and the project is close to jobs/services)	Plan/Community	-	-	-	-
52	T-47	Provide Bike Parking Near Transit	This measure requires the project to provide short-term and long-term bicycle parking near rail stations, transit stops, and freeway access points where there are commuter or rapid bus lines. Include locations for shared micromobility devices as well as higher-security parking for personal bicycles.	Urban, suburban	Plan/Community	-	-	-	-

Appendix E - Vehicle Miles Traveled Mitigation Measures for Land Development Projects

No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
53	T-48	Implement Area or Cordon Pricing	This measure requires projects implement a cordon pricing scheme. The pricing scheme will set a cordon (boundary) around a specified area to charge a toll to enter the area by vehicle. The cordon location is usually the boundary of a central business district or urban center but could also apply to substantial development projects with limited points of access. The toll price can be based on a fixed schedule or be dynamic, responding to real-time congestion levels. It is critical to have an existing, high quality transit infrastructure for the implementation of this strategy to reach a significant level of effectiveness. The pricing signals will only cause mode shifts if alternative modes of travel are available and reliable. This measure should provide an exception for low-income residents or workers within the pricing zone.	Urban	Plan/Community	-	-	-	-
54	T-49	Replace Traffic Controls with Roundabout	This measure requires projects install a roundabout as a traffic control device to smooth traffic flow, reduce idling, eliminate bottlenecks, and manage speed. In some cases, roundabouts can improve traffic flow and reduce emissions. The emission reduction depends heavily on what the roundabout is compared to (e.g., uncontrolled intersection, stop sign, traffic signal). Design roundabout so cyclists have the option to join traffic or bypass the roundabout with an adjacent path.	Urban, suburban, rural	Plan/Community	-	-	-	-
55	T-50	Required Project Contributions to Transportation Infrastructure Improvement	This measure requires projects contribute to traffic-flow improvements or other multi-modal infrastructure projects that reduce emissions and are not considered as substantially growth inducing. The local transportation agency should be consulted for specific needs. Larger projects may be required to contribute a proportionate share to the development and/or continuation of a regional transit system. Contributions may consist of dedicated right-of-way, capital improvements, or easements. Ensure the jurisdictional fee system does not disadvantage infill projects over greenfield projects.	Urban, suburban, rural	Plan/Community	-	-	-	-
56	T-51	Install Park-and-Ride Lots	This measure requires projects install park-and-ride lots near transit stops and high occupancy vehicle lanes. Park-and-ride lots also facilitate car- and vanpooling. Parking lots can also incorporate cool pavements, tree canopy, or solar photovoltaic shade canopies to reduce the urban heat island effect as well as evaporative emissions from parked vehicles and dedicated electric vehicle parking spots and/or charging infrastructure.	Suburban, rural	Plan/Community	-	-	-	-
57	T-52	Designate Zero Emissions Delivery Zones	This measure requires the municipality to designate certain curbside locations as commercial loading zones exclusively available for zero-emission commercial delivery vehicles. Doing so replaces tailpipe diesel emissions from last-mile delivery vehicles as well as heavy duty drayage trucks moving goods with less emissions-intensive electric vehicles and potentially micromobility for food and parcel delivery. Locations should be prioritized based on land use density and existing exposure from air pollution.	Urban	Plan/Community	-	-	-	-

Appendix E - Vehicle Miles Traveled Mitigation Measures for Land Development Projects

No.	CAPCOA Mitigation Measure No.	Mitigation Measure	Measure Description	Locational Context	Scale of Application	Implementation Requirements	Expanded Mitigation Options	Formula	VMT Reduction
58	T-53	Electrify Loading Docks	This measure will require that Transport Refrigeration Units and auxiliary power units (APUs) be plugged into the electric grid at the loading dock instead of running on diesel. The indirect GHG emission from electricity generation can partially offset the emissions reduction from fuel reductions. Electrifying loading docks can reduce exposure to air pollutants for workers and drivers.	Urban, suburban, rural	Project/Site	-	-	-	-
59	T-54	Install Hydrogen Fueling Infrastructure	The measure requires projects to implement accessible hydrogen fuel cell fueling infrastructure. Drivers of fuel cell electric vehicles (FCEV), from individual passenger vehicles to haul truck fleets, will be able to refuel using this infrastructure. The expansion of hydrogen fueling locations indirectly supports the uptake of FCEV in place of the typical internal combustion engine vehicle fueled by carbon-emitting gasoline and diesel.	-	Project/Site or Plan/Community	-	-	-	-
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Source: *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity,* Final Draft, by the California Air Pollution Control Officers Association, December 2021.

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APPENDIX F

VEHICLE MILES TRAVELED MITIGATION MEASURES FOR LAND USE DEVELOPMENT PROJECTS (CARB PAPERS)

LSA

Table C- Vehicle Miles Traveled Mitigation Measures for Land Development Projects (CARB Papers)[1]

#	Mitigation Measure	VMT Reduction[2]	Local VMT Reduction Calculations (Local Data/Fresno COG ABM)[3]	Notes
1	Provide Bicycling Network Improvements	No effect on VMT	Information included in the Fresno County SB 743 Implementation Regional Guidelines - Technical Documentation	
2	Implement Transit Improvements	No effect on VMT	Information included in the Fresno County SB 743 Implementation Regional Guidelines - Technical Documentation	
3	Improve or increase access to transit	1.3% - 5.8%	N/A	Variable: Various factors associated with proximity to transit stop (please refer to *How do Local Actions Affect CMT? A Critical Review of the Empirical Evidence* (Salon, D., Boarnet, M.G., Handy, S., Spears, S., and Tal, G.)
4	Land Use Mix	Elasticity: 0.02 - 0.10	N/A	Variable: Entropy - variety and balance of land-use types within a neighborhood
5	Regional Accessibility	Elasticity: 0.05 - 0.25	N/A	Variable: Various factors associated with job accessibility and distance to CBD (please refer to *How do Local Actions Affect CMT? A Critical Review of the Empirical Evidence* (Salon, D., Boarnet, M.G., Handy, S., Spears, S., and Tal, G.)
6	Job-Housing Balance	Elasticity: 0.06 - 0.31 for commute VMT	N/A	Variable: Various factors associated with job accessibility (please refer to *How do Local Actions Affect CMT? A Critical Review of the Empirical Evidence* (Salon, D., Boarnet, M.G., Handy, S., Spears, S., and Tal, G.)
7	Provide Pedestrian Network Improvements	Elasticity: 0.00 - 0.02 for sidewalk length, 0.19 for Pedestrian Environment Factor	N/A	
8	Voluntary Travel Behavior Change (VTBC) Program	5% - 12%	N/A	
9	Implement Employer-Based Trip Reduction (EBTR) Program	1.33% - 6% of commute VMT	N/A	
10	Provide telecommuting options	Home-based telecommuting: 48.1% for household VMT, 66.5% - 76.6% for all personal VMT, and 90.3% for commute VMT only; Center-based telecommuting: 53.7% - 64.8% for all personal VMT and 62.0% - 77.2% for commute VMT only	N/A	
11	Increase Project/Development Density	Elasticity: <=0.07 - 0.19	N/A	Variable: residential density
12	Improve network connectivity and/or increase intersection density on the project site	Elasticity: -0.46 - 0.59	N/A	Variable: Various factors associated with intersection or street density (please refer to *How do Local Actions Affect CMT? A Critical Review of the Empirical Evidence* (Salon, D., Boarnet, M.G., Handy, S., Spears, S., and Tal, G.)
13	Implement Parking Cash-out Programs or Workplace Parking Pricing	12% of commute VMT (parking cash out); 2.3% - 2.9% for $3 per day workplace parking price; 2.8% for price increase equivalent to 60% hourly value of commuter travel time cost	N/A	

Notes:

VMT = Vehicle Miles Traveled

[1] All mitigation measures have been obtained from *How do Local Actions Affect CMT? A Critical Review of the Empirical Evidence* (Salon, D., Boarnet, M.G., Handy, S., Spears, S., and Tal, G.).

[2] All VMT reduction numbers have been obtained from *How do Local Actions Affect CMT? A Critical Review of the Empirical Evidence* (Salon, D., Boarnet, M.G., Handy, S., Spears, S., and Tal, G.).

[3] Fresno COG VMT reduction recommendation for these measures obtained based on analysis conducted by Fresno COG staff and LSA using local data and/or the COG's Activity Based Model. Details are provided in the *Fresno County SB 743 Implementation Regional Guidelines - Technical Documentation.*

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APPENDIX G

VEHICLE MILES TRAVELED MITIGATION MEASURES FOR COMMUNITY PLANS AND GENERAL PLANS

LSA

Table F - Vehicle Miles Traveled Mitigation Measures for Community Plans and General Plans[1]

#	Mitigation Measure	CAPCOA VMT Reduction	Local VMT Reduction Calculations (Local Data/Fresno COG ABM)[2]
1	Shift single occupancy vehicle trips to carpooling or vanpooling by providing ride-matching services or shuttle services	0.30% - 13.40% commute VMT reduction (for CAPCOA TRT-11: (Provide Employer-Sponsored Vanpool/Shuttle)); Grouped strategy (for CAPCOA TST-6 (Provide Local Shuttles))	Information included in the Fresno County SB 743 Implementation Regional Guidelines - Technical Documentation
2	Provide enhanced bicycle and/or pedestrian facilities	0.00% - 2.00% (for pedestrian network improvements); Multiple measures for bike facilities, refer to Table A for VMT reduction percentages	Information included in the Fresno County SB 743 Implementation Regional Guidelines - Technical Documentation
3	Provide incentives or subsidies that increase the use of modes other than a single-occupancy vehicle	0.30% - 13.40% commute VMT reduction (for CAPCOA TRT-11: (Provide Employer-Sponsored Vanpool/Shuttle)); Grouped strategy (for CAPCOA TST-6 (Provide Local Shuttles)); 0.30% - 20.00% commute VMT reduction (for CAPCOA TRT-4 (Implement Subsidized or Discounted Transit Program))	N/A
4	Modify land use plan to increase development in areas with low VMT/capita characteristics and/or decrease development in areas with high VMT/capita characteristics	Not quantified in CAPCOA	N/A
5	Add roadways to the street network if those roadways would provide shorter travel paths for existing and/or future trips	Not quantified in CAPCOA	N/A
6	Improve or increase access to transit	CAPCOA TST-2 (Implement transit access improvements): Not quantified alone, grouped strategy with TST-3 (Expand transit network) and TST-4 (Increase transit service frequency/speed); CAPCOA LUT-5 (Increase transit accessibility): 0.50% - 24.60%	N/A
7	Increase access to common goods and services, such as groceries, schools, and daycare	Similar to CAPCOA LUT-3 (Increase Diversity of Urban and Suburban Developments (Mixed Use)): 9.00% - 30.00% VMT reduction and CAPCOA LUT-4 (Increase Destination Accessibility): 6.70% - 20.00% VMT reduction	N/A
8	Incorporate a neighborhood electric vehicle network	0.50% - 12.70%	N/A
9	Provide traffic calming	0.25% – 1.00%	N/A
10	Limit or eliminate parking supply	5.00% - 12.50%	N/A

LSA

Table F - Vehicle Miles Traveled Mitigation Measures for Community Plans and General Plans[1]

#	Mitigation Measure	CAPCOA VMT Reduction	Local VMT Reduction Calculations (Local Data/Fresno COG ABM)[2]
11	Implement or provide access to a commute reduction program - Voluntary	1.00% - 6.20% commute VMT	N/A
12	Provide car-sharing, bike sharing, and ride-sharing programs	0.40% - 0.70% VMT reduction (for car sharing); 1.00% - 15.00% commute VMT reduction (for ride-sharing); a 135% - 300% increase in biking (of which roughly 7% are shifting from vehicle travel) results in a negligible impact (around 0.03% VMT reduction)	N/A
13	Provide partially or fully subsidized transit passes	Similar to CAPCOA TRT-4 [Implement Subsidized or Discounted Transit Program]; for TRT-4, commute VMT reduction is 0.30% - 20.00%	N/A
14	Provide telework options	0.07% - 5.50% commute VMT	N/A
15	Provide employee transportation coordinators at employment sites	Not quantified in CAPCOA	N/A
16	Provide a guaranteed ride home service to users of non-auto modes	Not quantified in CAPCOA	N/A

Notes:

VMT = Vehicle Miles Traveled; Fresno COG = Fresno Council of Governments; ABM = Activity-Based Model; CAPCOA = California Air Pollution Control Officers Association

CAPCOA Transportation Mitigation Categories (LU = Land Use/Location, SD = Neighborhood/Site Enhancements, PD = Parking Policy/Pricing, TR = Commute Trip Reduction Programs, TS = Transit System Improvements, RP = Road Pricing/Management; V = Vehicles)

[1] All mitigation measures have been obtained from the *Guidelines for Transportation Impact Studies in the San Diego Region* developed by San Diego Section of the Institute of Transportation Engineers (ITE) and the San Diego Traffic Engineers Council (SANTEC) in January 2019.

[2] Fresno COG VMT reduction recommendation for these measures obtained based on analysis conducted by Fresno COG staff and LSA using local data and/or the COG's Activity Based Model. Details are provided in the *Fresno County SB 743 Implementation Regional Guidelines - Technical Documentation.*

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