Appendix B

Emergency Evacuation Analysis

INTRODUCTION

This supplemental evacuation analysis was prepared in support of the Thousand Oaks General Plan Update. This study is intended to provide Thousand Oaks (the City) with a broad planning level assessment of the capacity of the transportation system during a citywide evacuation event. It identifies residential developments with a single entrance and exit road, and evaluates the potential consequences of large evacuation events on the roadway system under various hazard scenarios in compliance with the following two statutes:

Senate Bill 99 (SB 99) requires that the Safety Element of the General Plan identify any residential developments in any hazard area that does not have at least two evacuation routes. This is a requirement for all safety element updates included upon the revision of the housing element on or after January 1, 2020. Assembly Bill 747 (AB 747) requires that the Safety Element be reviewed and updated to identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios. This will be a requirement for all safety elements or updates to a hazard mitigation plan completed after January of 2022. Since this requirement has recently gone into effect, there is no established standard methodology.

These scenarios are intended to model a potential range of different evacuation scenarios, but not all possible scenarios. Emergency evacuations can occur due to any number of events and at any location, beyond those specifically identified in this report. In addition, emergency movement is unpredictable and the specific conditions of an emergency evacuation could result in evacuation behavior that diverges from the assumptions used in this analysis. This analysis serves only to represent informed estimates of likely potential evacuation scenario footprints and capacity constraints based on available data and does not guarantee that evacuations will follow modeling that is used for analysis purposes. Emergency evacuation assessment is an emerging field and, as noted above, there is no established standard methodology. The methodology utilized in this evaluation is based upon best practices and the professional experience and knowledge of Rincon staff. Rincon is not responsible for any damage to life or property that might occur following the City's emergency evacuation management techniques based on the results of the evacuation analyses herein, and any accompanying recommendations.

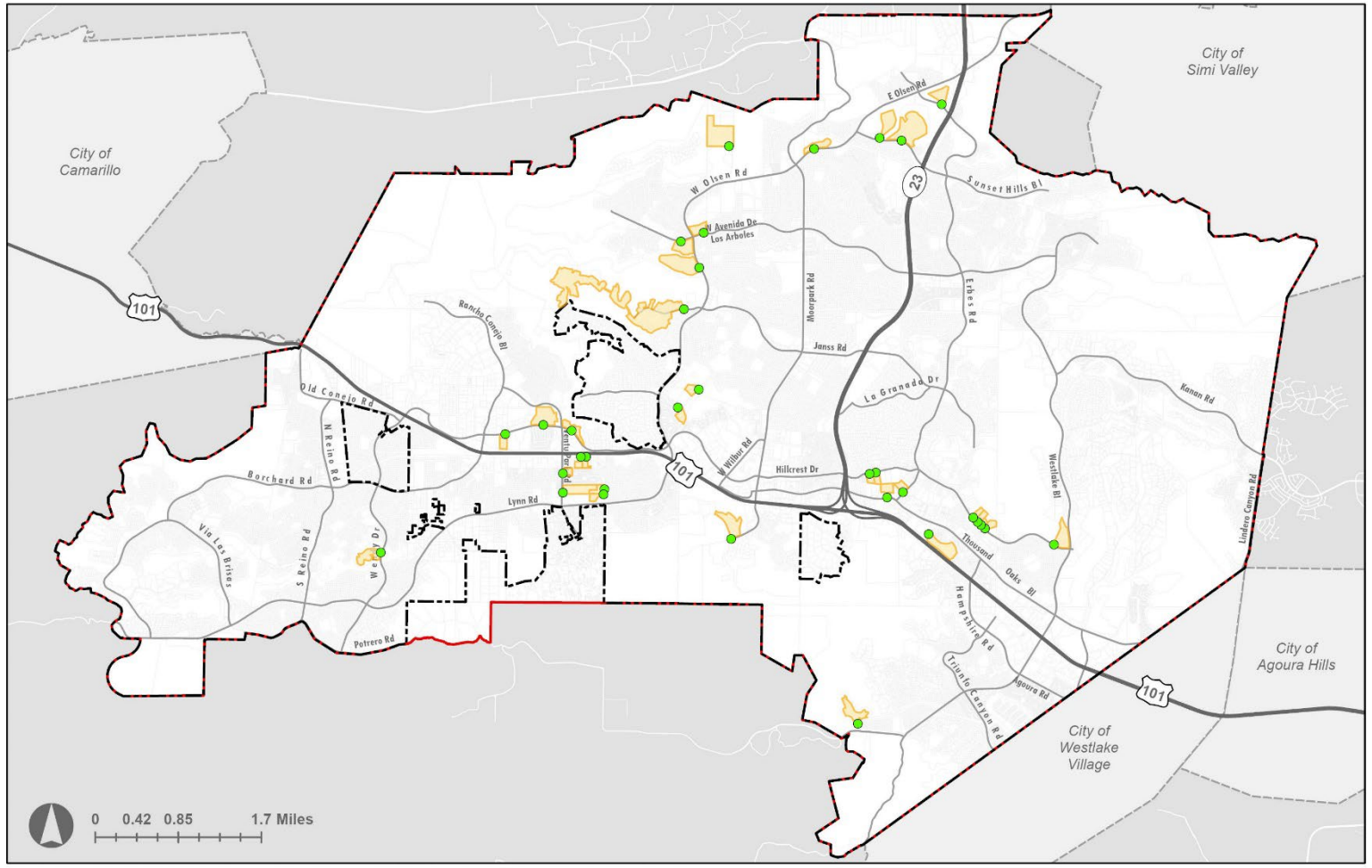
SB 99 Analysis – Single Entrance/Exit Neighborhoods

Per SB 99, the Safety Element of the General Plan is required to identify neighborhoods in any hazard area that does not have at least two evacuation routes. For this analysis, a neighborhood is defined as 30 or more dwelling units that only have a single route to access a collector or arterial road based on California Fire Code Appendix D107.[1] We have identified 33 neighborhoods in the city

[1] *2019 California Fire Code, Title 24, Part 9 with July 2021 Supplement. Accessed at: https://codes.iccsafe.org/content/CFC2019P4/appendix-d-fire-apparatus-access-roads*

that have a single entry or exit point. See Figure B.1. About half of the neighborhoods are located in the western portion of the city, predominately in the Newbury Park area and along Lynn Road, with the other half of the neighborhoods located in the eastern portion of the city, near Sunset Hills Country Club and areas along Thousand Oaks Boulevard on the eastern side of State Route 23 (SR 23). In the case of an evacuation event, these single entry/exit neighborhoods would likely utilize north/southbound Highway 101 and/or SR 23 to evacuate, depending on the location of the evacuation area. Some neighborhoods could also use alternative evacuation routes, such as Potrero Road and Kanan Road, depending on the severity of traffic congestion on traditional evacuation routes and/or the location of the evacuation area.

Figure B.1 Single Entry/Exit Neighborhoods



AB 747 Analysis – Evacuation Scenarios

In accordance with AB 747, the following analysis and results outline the potential outcomes of a variety of hazard events requiring emergency evacuation.

EVACUATION ASSESSMENT METHODOLOGY

In accordance with AB 747, a range of potential hazard scenarios has been presented in this evacuation analysis. Hazard scenarios were selected through a review of past hazard assessments, and by considering the potential likelihood, magnitude, and spatial extent of various hazards. With nearly all of Thousand Oaks in CAL FIRE's Very high Fire Hazard Severity Zones (VFHSZ), and recent wildfires in Thousand Oaks and Ventura County, hazard scenarios included in this analysis evaluate the potential evacuation effects of three varied wildfire scenarios in addition to a baseline scenario:

1) Baseline – Typical traffic volumes within Thousand Oaks on Monday at 5:00 PM.
2) Wildfire approaching the city from the north, resulting in immediate evacuation southbound on SR 23 towards north/southbound Highway 101.
3) Wildfire approaching the city from the southeast, resulting in immediate evacuation northbound on Highway 101 and/or northbound on SR 23.
4) Wildfire approaching the city from the southwest, resulting in immediate evacuation southbound on Highway 101 and/or northbound on SR 23.

Data Sources and Data Processing

Transportation Network

The transportation network was created using ESRI's StreetMap Premium . StreetMap Premium is a comprehensive dataset that provides enriched network data based on commercial street reference data from leading global and local street data suppliers: HERE and GeoTechnologies, Inc. The dataset includes detailed basemap data and a network dataset for routing, both of which were used in the evacuation analyses. This dataset is well-suited for emergency evacuation analysis because it includes a comprehensive network of roads, baseline traffic data, and is regularly updated to ensure that it remains accurate and current. Further, the network data models the movements of automobiles by obeying one-way roads, speed limits, avoiding illegal turns, and other rules specific to automobiles, and finds solutions that optimize travel time.

Population Modeling

The population of Thousand Oaks was modeled using ESRI's Enrich Layer Tool. The Enrich Layer Tool appends demographic and landscape variables to any input polygon feature class for further analysis, modeling, and reporting. The input polygon layer used for Thousand Oaks was a tessellation of hexagons ¼ mile in diameter that covered the entire city. The Enrich Layer Tool was then used to add daytime population data to the hexagonal tessellation. Daytime population data was taken from

ESRI's daytime population data estimates, which are generated using a mix of inputs from ESRI's U.S. Updated Demographics, the decennial census, the American Community Survey (ACS), and business data from Data Axle, a full-service data provider. ESRI's daytime population is an estimate of the population that includes residents and workers in the city on weekdays during standard workday hours, between 9:00 a.m. and 5:00 p.m. Daytime population was used to best represent the number of individuals in the city at the time of an evacuation scenario, which was 152,397 in each scenario.

After the values of daytime population were assigned to the hexagon tessellation, The City's 2045 General Plan Land Use Update (GPLU) data was used to concentrate the daytime population into places where the population would typically exist. Residential, commercial, industrial, and institutional land uses were selected from the GPLU data. The hexagonal tessellations with the daytime population data were clipped to areas with the previously listed land uses. The total daytime population value from the tessellation was generated into randomly placed points within the selected land use areas for each hexagon. The daytime population points that intersect the evacuation area represent the individuals that are evacuating, and where they start their evacuation from. These points served as evacuation origin points, which change based on the evacuation area used for each scenario.

Evacuation Modeling

Evacuation routes and traffic volumes during an emergency evacuation event were modeled using ArcGIS's Closest Facility tool included in the Network Analyst extension. The Closest Facility tool enables finding the closest facility (e.g., hospital, fire station, or gas station) to a given location or set of locations. The Closest Facility tool can also be customized to include other factors that affect travel time, such as speed limits and road closures. For this evacuation analysis, the "facilities" analyzed were points outside of Thousand Oaks city boundaries located on roads along expected evacuation routes, Highway 101 and SR 23. After distributing the daytime population throughout the city, the evacuation model was run to simulate the level of traffic volumes on roads and major highways during each hazard scenario assuming simultaneous departure of all populations from the evacuation area to the nearest evacuation points within the transportation network.

To depict the level of traffic volumes, average daily traffic (ADT) was assigned to arterial streets and highways within the city. ADT for the streets was provided by the City from their General Plan Traffic Analysis. In a few instances, some roads used in the model did not have ADT values. If a road did not have an ADT value, a value was estimated based on ADT of intersecting roads with ADT values. The number of evacuation routes that traveled along a particular road—moving from the evacuation origin to the nearest evacuation point outside the City Limits—was combined with baseline ADT to depict total traffic volume during an evacuation. For example, SR 23 has an ADT level between 60,001 and 120,000 during the baseline scenario. In the southeastern fire evacuation scenario, additional evacuation routes utilizing SR 23 pushed the SR 23 ADT level to greater than 120,000.

Assumptions and Limitations

The results of this analysis are intended to show roads that could experience increased traffic volumes during an emergency evacuation event. This model assumes that the daytime

population within the evacuation area is going to exit Thousand Oaks city limits at the nearest evacuation point during typical traffic conditions, Monday at 5:00 PM. It is assumed that the locations of the exit points for each scenario change depending on the original direction of the fire, and it is not possible to exit the city where the evacuation area meets the City Limits. While the daytime population was concentrated in residential and industrial/commercial land uses from GPLU data, some individuals may be located in different land use areas.

Evacuation Assessment Results

Baseline

The baseline scenario evaluates typical traffic volumes in the city at 5:00 PM on a Monday. Baseline traffic data, depicted as ADT, was derived from the City's General Plan Traffic Analysis and is used as the basis of comparison for each modeled evacuation scenario. As shown in Figure B.2, the largest traffic volumes, greater than 120,000 ADT, occur along north- and southbound Highway 101. Traffic volumes at levels between 60,001 and 120,000 ADT can be found along SR 23. Smaller traffic volumes below 30,000 ADT—aside from some instances at Highway 101 onramps/offramps —can be found throughout the rest of the city. All expected evacuation routes, Highway 101 and SR 23, are available to individuals for evacuation, with most onramps for each evacuation route showing traffic volumes of less than 30,000 ADT.

Fire from Southeast

This scenario assumes a wildfire southeast of the city. This scenario assumes that exiting the city to the east and southeast using Kanan Road, Westlake Boulevard, Thousand Oaks Boulevard, and southbound Route 101 would not be viable. Consequently, evacuation would need to occur northbound on Highway 101 and northbound on SR 23. Figure B.3 shows the extent of the proposed southeast wildfire evacuation area and expected increased traffic volumes resulting from simultaneous departure throughout various points from the evacuation area. The largest traffic volumes, where traffic levels are expected to be greater than 120,000 ADT, occur along nearly all of northbound Highway 101 and northbound SR 23 as individuals evacuate away from the fire area. Traffic volumes between 30,000 and 60,001 ADT are expected at northbound 101 onramps Westlake Boulevard, Hampshire Road, Moorpark Road, and Lynn Road, as individuals use these connector roads to reach Highway 101 and vacate away from the evacuation area. With few exceptions, it is likely that the northern half of the city would utilize SR 23 to evacuate, and the southern half of the city would utilize Highway 101 to evacuate, because both offer the largest evacuee capacity and are the closest options for their respective (i.e., northern or southern) populations. Consequently, northbound SR 23 onramps Sunset Hills Boulevard and Janss Road, both depicting traffic volumes between 15,001 and 30,000 ADT, and the previously mentioned northbound Highway 101 onramps, would be critical to maintain in this scenario, as these are expected to experience increased traffic volumes. Evacuation responders could consider activating evacuation traffic management at these onramps and contra-flow lane reversal on northbound Highway 101 and northbound SR 23 to allow both lanes to be used for evacuation. Alongside the roads listed above, other roads to consider monitoring in this scenario include Kanan Road, Thousand Oaks Boulevard, and Erbes Road as increased traffic volumes are expected on these connector roads as individuals vacate northbound onto Highway 101 and SR 23.

Figure B.2 Baseline Traffic Conditions

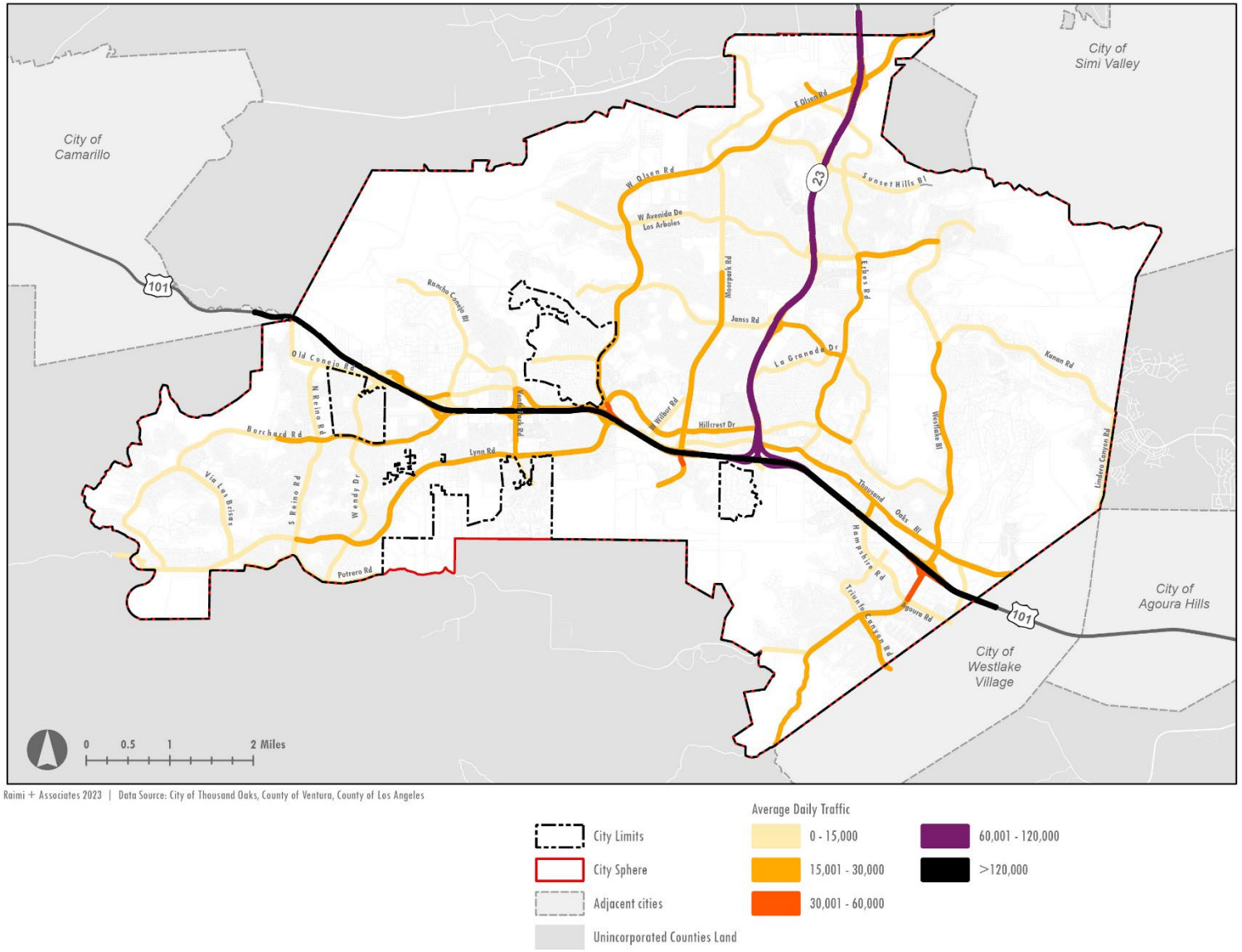
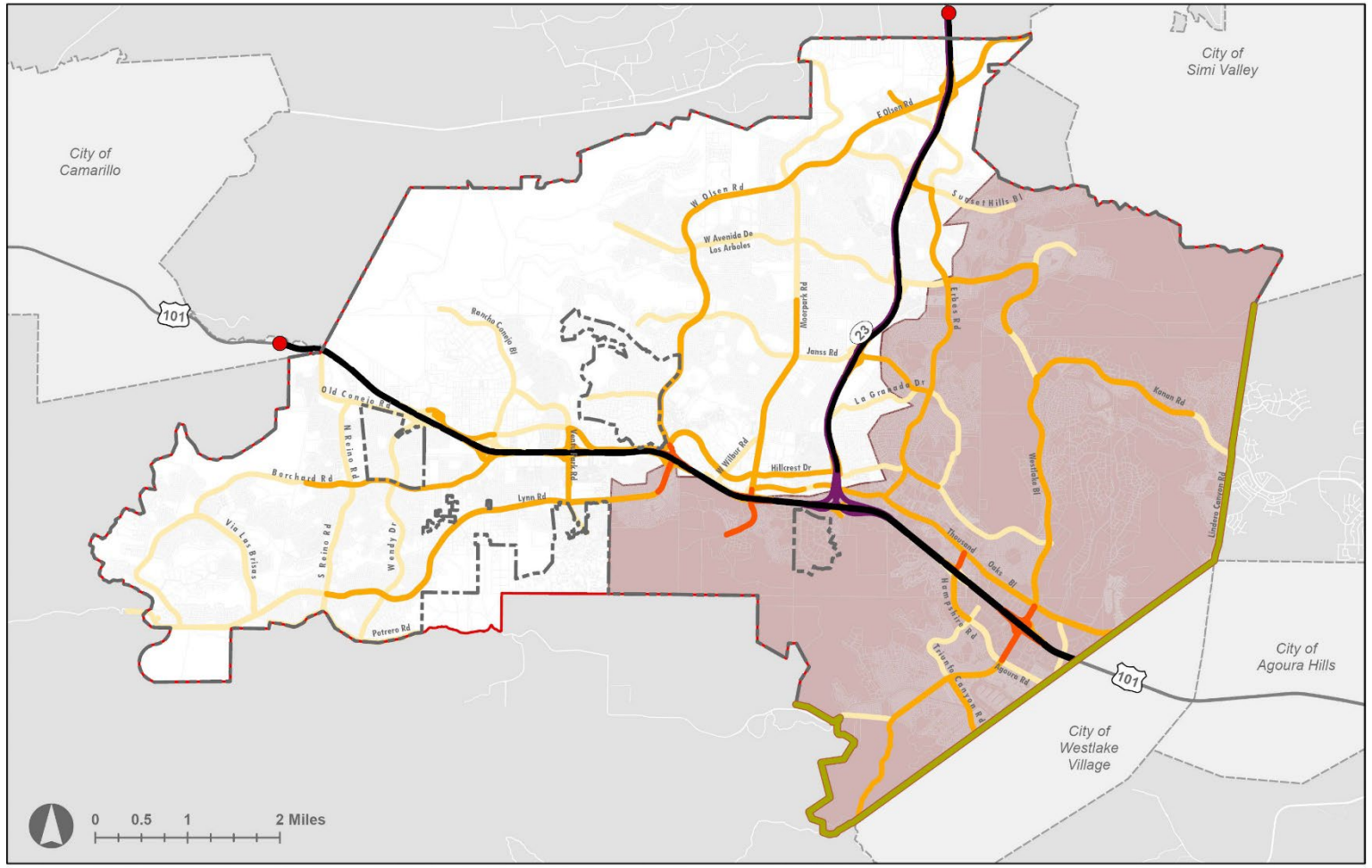


Figure B.3 Fire from the Southeast Evacuation Results



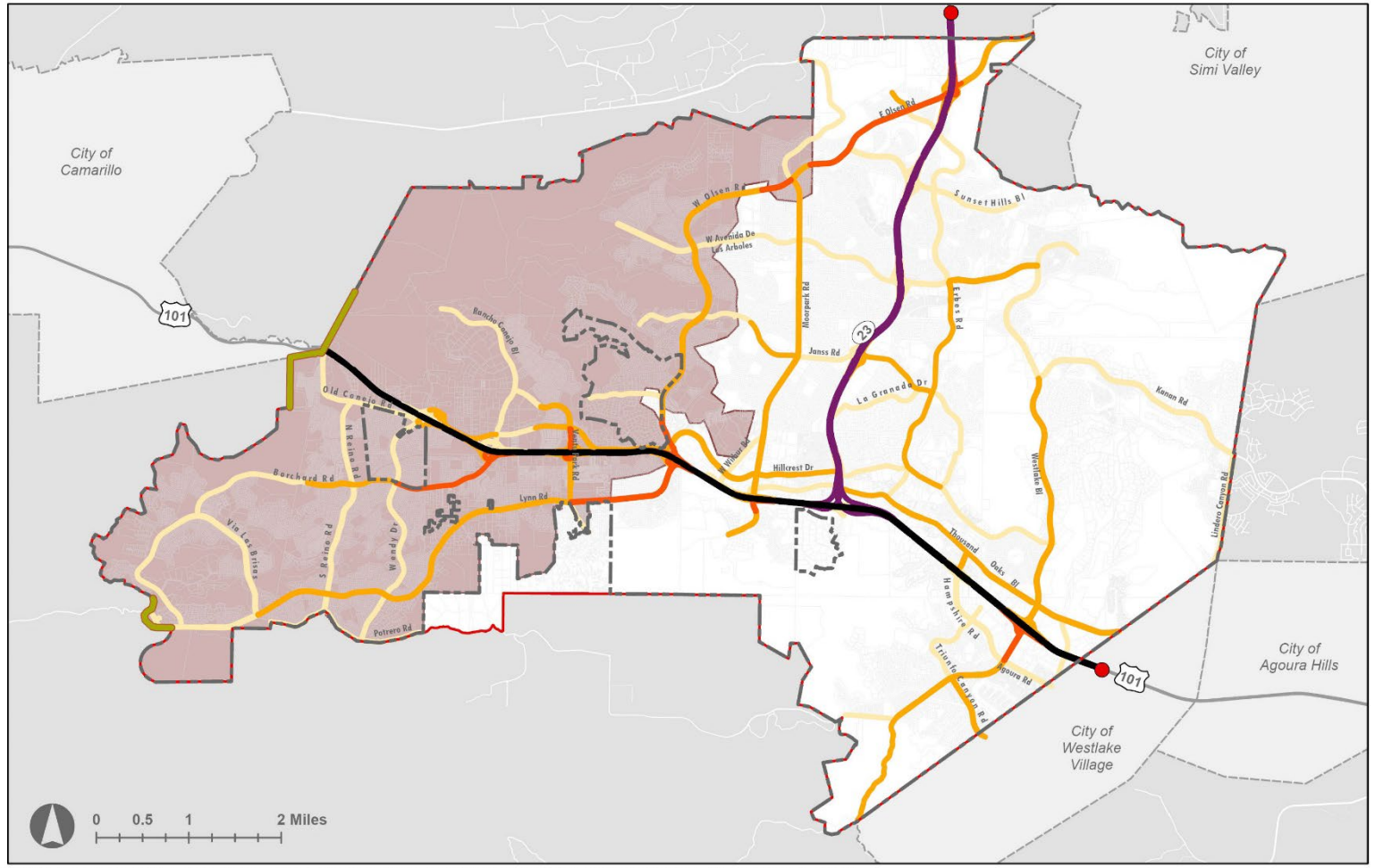
Fire from the Southwest

This scenario assumes a wildfire southwest of the city. This scenario assumes that exiting the city to the west and southwest using northbound Highway 101 and Potrero Road are not viable. Figure B.4 shows the extent of the proposed southwest wildfire evacuation area and expected increased traffic volumes resulting from simultaneous departure throughout various points from the evacuation area. The largest traffic volumes, where traffic levels are expected to be greater than 120,000 ADT, occur along all of southbound Highway 101. Traffic volumes between 60,001 and 120,000 ADT can be expected along northbound SR 23 as some individuals in the northern part of the city vacate using northbound SR 23. Roads and their associated highway onramps exhibiting between 30,001 and 60,000 ADT include Borchard Road, Lynn Road, Ventu Park Road, Olsen Road, Moorpark Road, and Westlake Boulevard. The critical areas to maintain in this scenario would include previously listed connector roads/highway onramps in the fire evacuation area to ensure evacuees coming from the westernmost portion of the city can quickly and safely access the major evacuation routes. Similar to the previous scenario, evacuation responders could consider activating evacuation traffic management at these highway onramps/connector roads and contra-flow lane reversal on southbound Highway 101 to allow both lanes to be used for evacuation if necessary.

Fire from the North

This scenario assumes a wildfire north of the city. This scenario assumes that exiting the city on northbound SR 23 is not viable. Figure B.5 shows the extent of the proposed north wildfire evacuation area and expected increased traffic volumes resulting from simultaneous departure throughout various points from the evacuation area. The largest traffic volumes, where traffic levels are expected to be greater than 120,000 ADT, occur along Highway 101 as individuals evacuate north- and southbound away from the fire evacuation area. Traffic volumes between 60,001 and 120,000 ADT can be expected along southbound SR 23 as individuals proceed towards Highway 101. Increased traffic volumes, exhibiting ADT levels between 15,001-30,000 ADT, can be found on portions of Erbes Road, Janss Road, and E. Avenida de Los Arboles, Olsen Road, and Moorpark Road. The critical areas to maintain in this scenario would include the southbound SR 23 onramps within the fire evacuation zone, southbound SR 23 as it merges with Highway 101, and previously listed connector roads as they feed individuals onto SR 23 or directly onto Highway 101. Like the previous scenarios, evacuation responders could consider activating evacuation traffic management at these onramps and contra-flow lane reversal on southbound SR 23 to allow both lanes to be used for evacuation if necessary.

Figure B.4 Fire from the Southwest Evacuation Results



Raimi + Associates 2023 | Data Source: City of Thousand Oaks, County of Ventura, County of Los Angeles, CAL FIRE, Esri, HERE

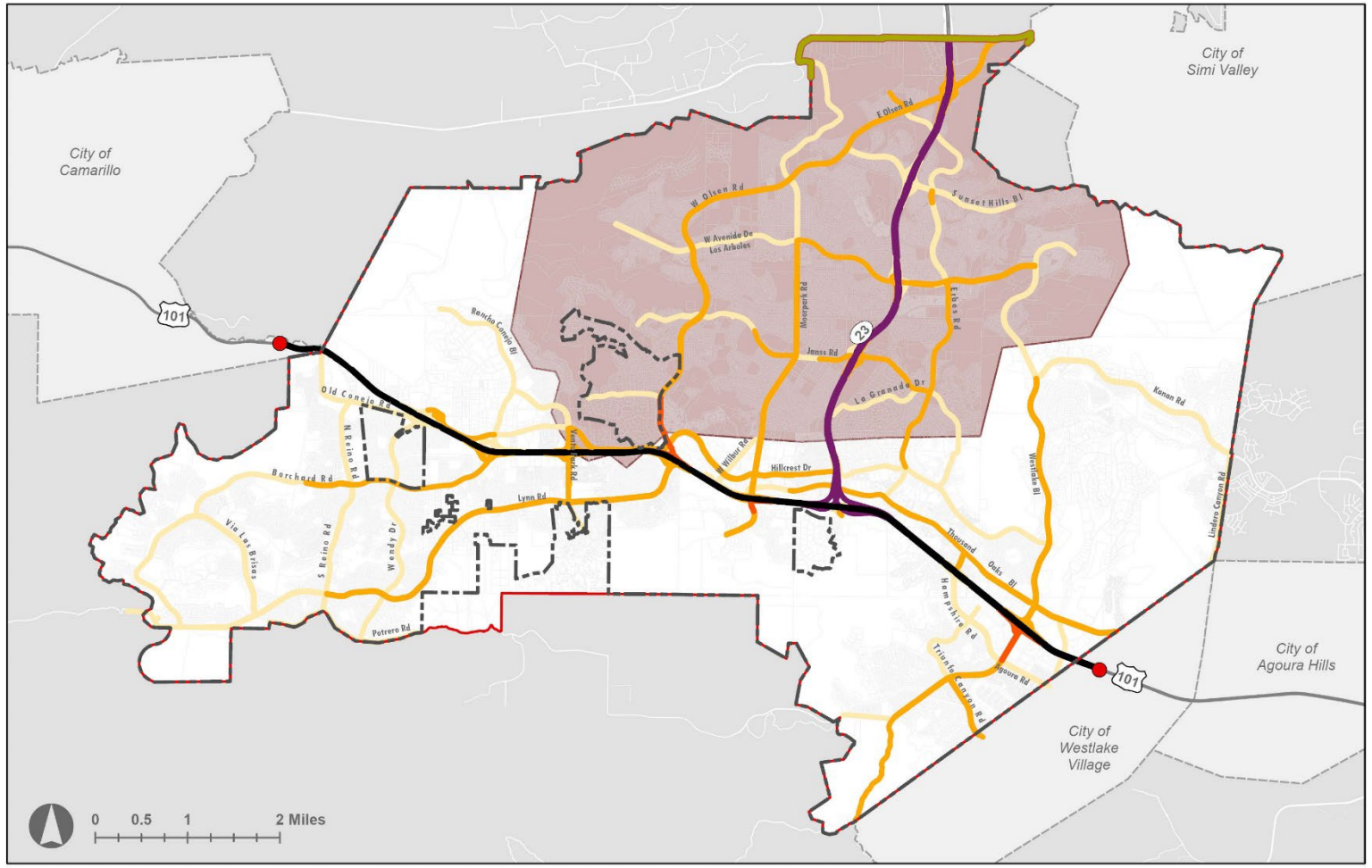
City Limits
City Sphere
Unincorporated County Land
Adjacent cities

Fire Evacuation Area
Closed Exit Route
Evacuation Point

Combined Average Daily Traffic (ADT) and Evacuation Traffic

0 - 15,000
15,001 - 30,000
30,001 - 60,000
60,001 - 120,000
>120,000

Figure B.5 Fire from the North Evacuation Results



Evacuation Strategies

The following lists evacuation strategies that city may consider to improve future evacuation events. Ventura County conducted The Hill & Woolsey Fires Emergency Response After-Action Review[2] in January 2020, which also details the County's recommended solutions to challenges that occurred during those events.

TRAFFIC MANAGEMENT

- Reverse one or more lanes of a highway (SR 23 or Highway 101) to accommodate an increased flow of traffic in one direction.
- Redirect all lanes of a designated evacuation route to accommodate rapid evacuation from a city or region.
- Temporarily close inbound travel lanes on selected unlimited access arterials (such as parkways and boulevards) to allow outbound traffic to utilize these lanes during evacuation.
- Close inbound lanes on highways (SR 23 or Highway 101) utilized for evacuation routes to prevent drivers on these routes from entering the city while evacuation is underway.
- Minimize left-turn movements along evacuation routes and on roads leading to evacuation routes.
- Signage: Use variable message board equipment and targeted installation of permanent dynamic message signs on evacuation routes to improve communication and reduce public confusion.
- Consider how to stage tow trucks at key bottleneck locations along evacuation routes to help detect and clear minor crashes and maintain traffic flow.
- Increase the green time and/or progression band for through movements leading out of an evacuation zone.
- Install signal battery backups in case signal operations need to be maintained during a power outage. Consider using channeling devices, static signs, and coning strategies to manage intersection flow during power outage if the signals lack power.
- Identify and communicate with communities that have at least two access points. Prioritize adding additional access to communities which are currently served by only one or two access points.
- Develop transportation solutions such as the use of a bus system for evacuating individuals with special needs (such as those with mobility limitations).
- Establish traffic control points (i.e., locations along designated evacuation routes with emergency management personnel) to maintain a greater degree of evacuation management. These locations could enhance the efficiency of an evacuation, reduce public confusion, and allow increased operational flexibility during an evacuation.

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[2] *http://vcportal.ventura.org/BOS/District2/Hill_Woolsey_Fires_Emergency_Response_After_Action_Review_01.21.2020.PDF*

COMMUNICATIONS

- Strengthen and maintain communication among coordinating emergency event agencies. This could be achieved through systems such as the Public Information Emergency System and Emergency Satellite Communications.
- Implement a traffic control center to coordinate all evacuation activities. This center would have up to the minute reports on traffic patterns and can communicate directly with the broadcast media to let drivers know about roadway congestion and conditions and direct them to alternate routes.
- Install counters and/or CCTV cameras to assess traffic flow, volume of vehicles evacuating, and monitor incidents.
- Develop communication plan to provide information regarding primary and secondary evacuation routes and incidents to the public.

VULNERABLE POPULATIONS

- Understand if there are areas in the city with a greater percentage of senior adults, disabled people, mobility impaired, visually impaired, people with medical conditions, and people without vehicles with of objective of identifying areas that should be prioritized by first responders during an evacuation.
- Develop system to ensure hearing impaired receive evacuation warnings.
- Provide special assistance to mobility impaired, visually impaired, people with medical conditions, and people without vehicles such as paratransit.
- Translated materials should be prepared to support communication to non-English speaking populations including during evacuation.
- Evacuation centers should provide dialysis machine or other life-sustaining equipment.
- Provide resources for free to unhoused populations during evacuation.

Conclusion

Thousand Oaks' transportation network allows for evacuation north, west, and east during a disaster. However, due to the population density, an evacuation event could still put a burden on the transportation network. In compliance with SB 99, we have identified 33 neighborhoods that have a single entry or exit point throughout the city. The analysis according to AB 747 shows that in the case of a large wildfire, large portions of the City's evacuation network could become unviable. Depending on the direction of the wildfire, northbound/southbound Highway 101 and SR 23 could become affected thus prompting emergency traffic management and the use of alternative evacuation routes. Implementing traffic management strategies will aid in efficient and expeditious flow of evacuation traffic, which is the most critical and challenging element in a successful evacuation. Communication during an evacuation event is found to be an extreme challenge due to the coordination between agencies responsible for communication. Improved training, procedures, platforms, and public educations are all strategies that can occur pre-emptively to improve communication among entities

involved in the management of response, and communication between the City and the general public. Vulnerability of residents should be considered in determining which areas may need to be prioritized by first responders during an evacuation. Areas within the city with a greater percentage of elderly people, disabled people, households that do not own vehicles (i.e., transit dependent populations), and institutionalized populations require a greater amount of support during an evacuation. Other vulnerable groups should be evaluated relative to evacuation route vulnerability.

It is recommended that the results of these analyses be considered to frame supportive policies for the Safety Element Update. These policies can be used to identify potential evacuation capacity and resiliency improvements throughout the city.