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Bus Rapid Transit (BRT) Implementation Study for South Placer County

June 30, 2006

Prepared for:
South Placer Regional Transportation Authority

SA05-0050

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1.0 INTRODUCTION

1.1 STUDY PURPOSE

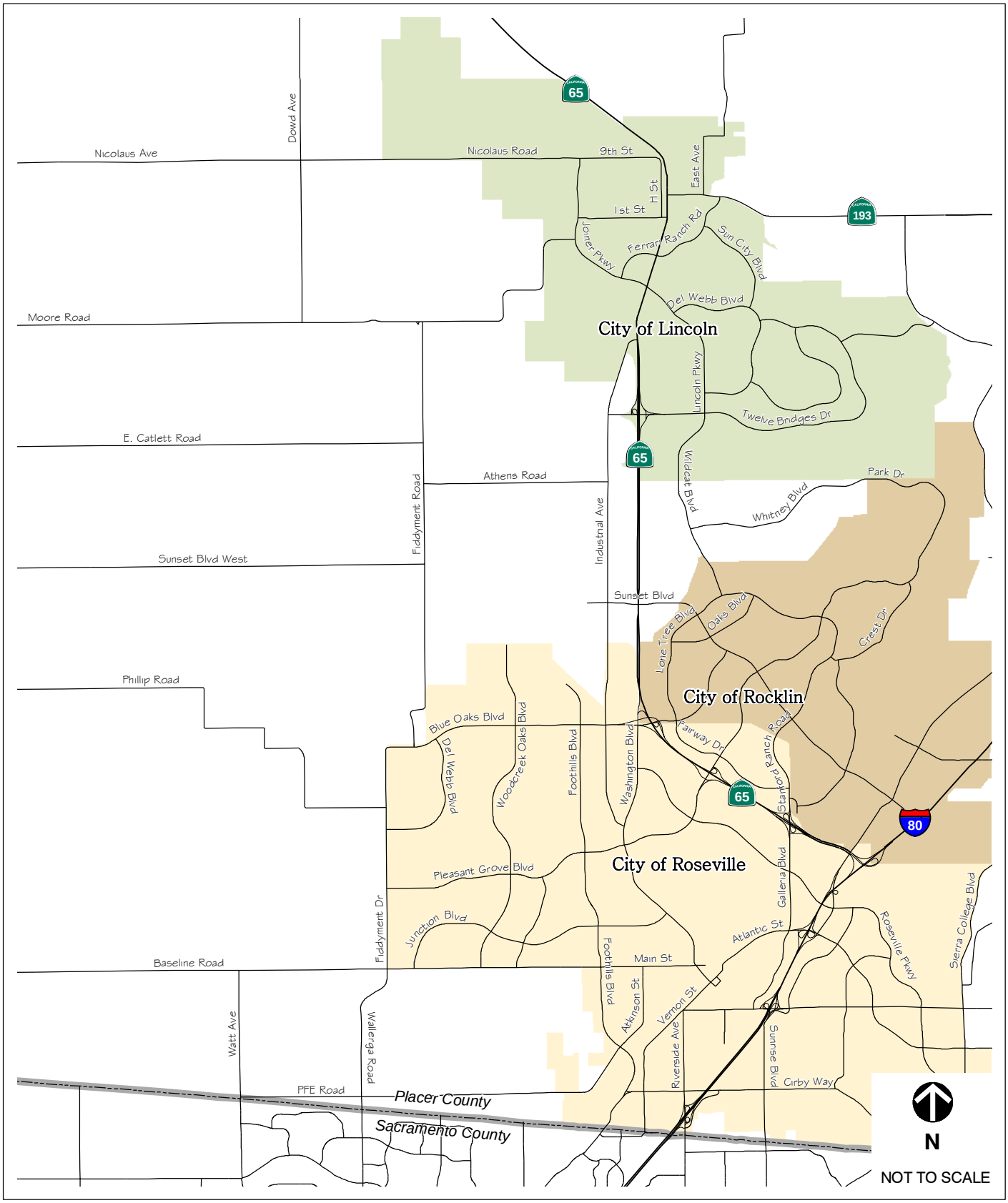
The south Placer Regional Transportation Authority (SPRTA) contracted with Fehr & Peers to develop a Bus Rapid Transit (BRT) Implementation Study for south Placer County. Figure 1 shows the study area of south Placer County. This study builds on the Conceptual BRT Plan for South Placer County (April 11, 2005) prepared for Placer County. The Conceptual BRT Plan was designed to provide guidance to the county and developers about the land use and station requirements for a future BRT system as well as to provide a general conceptual alignment.

The purpose of developing this plan is to provide guidance to agencies and developers about the land use and station requirements for a future BRT system as well as to recommend future BRT routes and stations in rapidly developing areas of south Placer County. Key objectives of this plan are listed below.

- *Identify existing and future regional transit services that should be integrated with a future BRT system in south Placer County*.
- *Review current development plans/proposals and their potential to support BRT service*.
- *Review eight potential transit corridors*.
- *Recommend BRT routes and associated station locations for potential incorporation in the circulation and land use elements of local general plans and relevant specific plans.*
- *Identify candidate transit improvements to the study corridors.*

1.2 STUDY ORGANIZATION

The remainder of this report is organized into four sections. Section 2 describes the basic concepts of BRT. Section 3 describes existing transportation facilities in south Placer County. Section 4 summarizes the potential BRT market in south Placer County. Section 5 provides a review of eight potential BRT corridors. Three candidate BRT routes are identified in Section 6. The final section contains a description of station types and recommended locations.



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STUDY AREA
FIGURE 1

2.0 BASIC CONCEPTS OF BRT

BRT is an elaboration of the express bus concept that incorporates many light-rail transit principles. The Federal Transit Administration (FTA) defines BRT as "a rapid mode of transportation that can provide the quality of rail transit and the flexibility of buses." The Transit Cooperative Research Program (TCRP) has expanded this basic definition to describe BRT as "a flexible, rubber-tired form of rapid transit that combines stations, vehicles, services, running ways, and ITS elements into an integrated system with strong identity.

In many respects, BRT is rubber-tired light rail transit (LRT), but with greater operating flexibility and potentially lower costs. The main features of BRT include dedicated running ways, attractive stations, distinctive and easy-to-board vehicles, off-street fare collections, use of ITS technologies, and frequent all-day service (typically between 5 a.m. and midnight). The discussion below provides details about the FTA definition of these BRT elements. Also, a preliminary evaluation checklist for differentiating BRT service from local, express, or enhanced bus service is provided in Appendix A. This checklist was developed by the Sacramento Regional Transit (RT) District and helps to define why BRT service is different than traditional bus services.

2.1 RUNNING WAYS

As the key element of BRT system, running ways should allow rapid and reliable movement of buses with minimal traffic interference and provide a clear sense of presence and permanence. FTA defines five classifications for running ways in terms of extent of access control as described below in the *Transportation Cooperative Research Program (TCRP) Report 90 – Bus Rapid Transit Volume 2: Implementation Guidelines*, 2003.

Class I running ways provide separate lanes with full access control, allowing uninterrupted flow for the transit vehicles. Examples of Class 1 running ways include bus tunnels, grade-separated busways, and reserved freeway lanes. Separated from congestion in local streets at intersections and adjacent highways, Class I running ways provide the highest travel time savings, the most reliable travel times and highest degree of safety. For this reason, these types of exclusive lanes typically offer the greatest benefits but at the greatest cost.

Class II running ways provide exclusive transit lanes that are separated from the street right-of-way. They provide partial access control, allowing enhanced but not uninterrupted flow for the transit vehicles. An at-grade busway is a typical example of a Class II running way. Because the Class II running ways physically separate BRT vehicles from the general stream of traffic, they can guarantee travel times and reliability. However, Class II running ways have to interact with other traffic at cross streets.

Class III running ways are physically separated lanes within street right-of-way, such as arterial median busways and bus streets. Although median arterial busways are physically segregated from adjacent street traffic lanes, Class III running ways are sometimes used by streetcars and LRT.

Class IV running ways are exclusive or semi-exclusive lanes, such as concurrent and contra flow bus lanes, located within street right-of-way. Class IV running ways are set aside as a designated arterial lane for BRT vehicles only. However, in some cases, specified classes of vehicles are allowed to share the designated lane such as turning vehicles or high-occupancy vehicles.

Class V running ways are characterized by mixed traffic operations, where lanes are shared. The running ways have no control of access, such as mixed traffic lanes. Mixed flow lanes are the most basic form of Class V running way. Most rubber tired urban transit service operates on mixed flow lanes. Because other vehicles share the same lane as BRT vehicles, BRT vehicles face delays due to conflicts with other vehicles.

3.0 EXISTING TRANSPORTATION FACILITIES

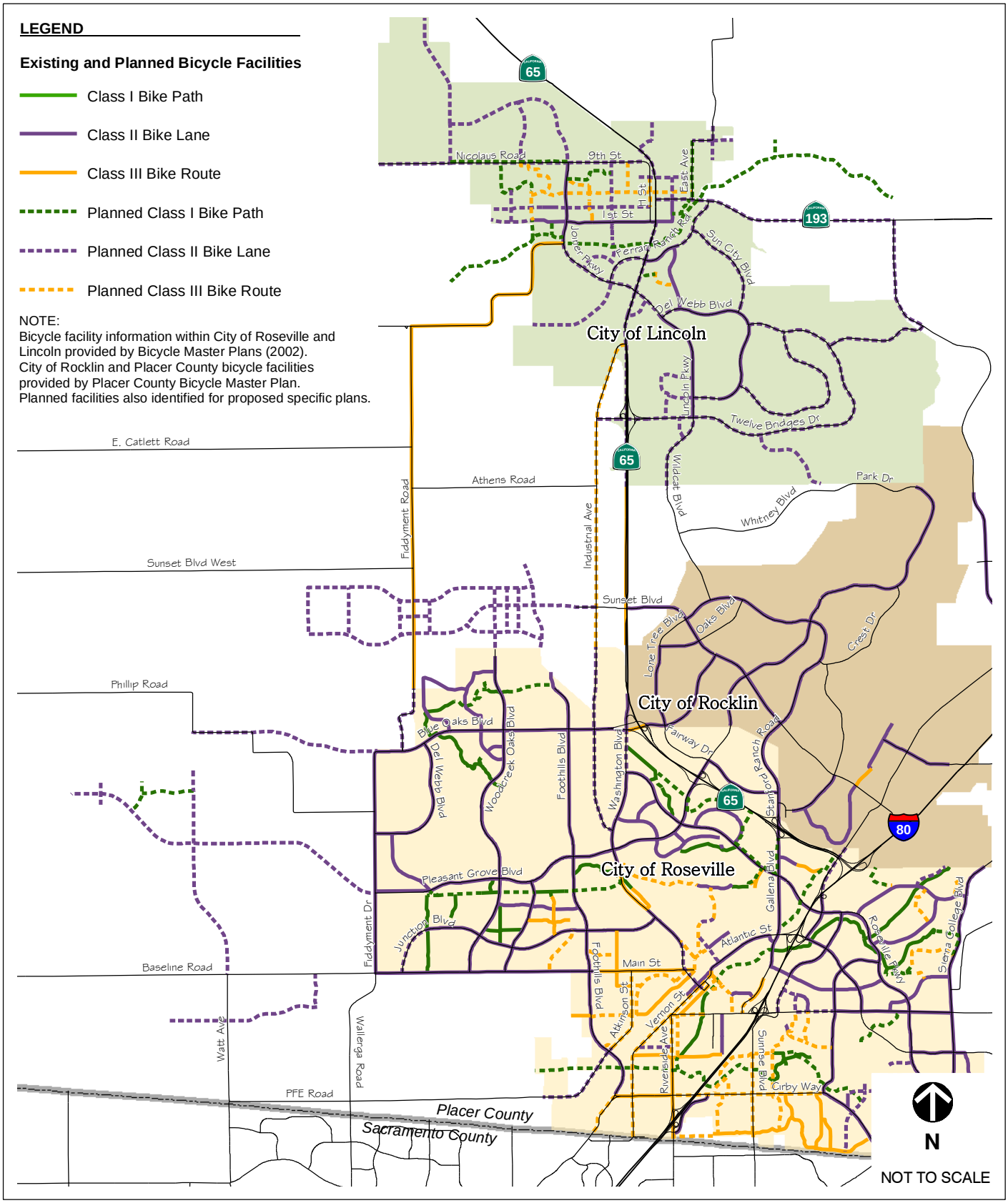
Existing and planned transportation facilities (e.g., bicycle, transit, and roadway) were reviewed and summarized as part of the implementation study process. Figure 2 shows the existing and planned bicycle facilities in the study area. Figure 3 shows existing local bus service, transfer stations, park-and-ride lots, and bus stops Figure 4 shows the existing commuter transit services and facilities.

The key planned roadway improvements in the study area are summarized in Table 1. These improvements are based on the Tier 1 roadway improvements contained in the Metropolitan Transportation Plan (MTP) for 2025 and other funded and development conditioned improvements identified by Placer County and City of Roseville staff.

TABLE 1. STUDY AREA PLANNED ROADWAY IMPROVEMENTS BY YEAR 2025

Roadway	Improvement	Source
Baseline Rd	Widen from 2 to 4 lanes, from Fiddyment Rd to Brady Ln	MTP
Baseline Rd	Widen from 2 to 6 lanes, from Sutter County Line to Fiddyment Rd	County
Baseline Rd	Widen from 2 to 6 lanes, from Watt Ave to Fiddyment Rd	County
Blue Oaks Blvd	Extend with 4 lanes, from Fiddyment Rd to west side of WRSP	Roseville
Douglas Blvd	Widen from 4 to 6 lanes, from Cavitt Stallman Rd south to Sierra College Blvd	MTP
Fiddyment Rd	Widen to 4 lanes, from Pleasant Grove Blvd to Northern City limits	Roseville
Fiddyment Rd	Widen to 4 lanes, from Baseline Road to north end of WRSP	Roseville
Foothills Blvd	Extend with 2 lanes, from Sunset Blvd to Athens Rd	County
Foothills Blvd	Extend with 2 lanes, from City Limits to Sunset Boulevard	County
Foothills Blvd	Widen from 4 to 6 lanes, from Cirby Way to Pleasant Grove Blvd	MTP
Nelson Rd	Widen from 2 to 4 lanes, from SR 65 Bypass to Nicolaus Rd	MTP
PFE Rd	Widen from 2 to 4 lanes, from North Antelope Rd to Roseville City Limits	MTP
Philip Rd	Realign with 2 lanes, between Blue Oaks Blvd and Bob Doyle Dr	Roseville
Placer Parkway	Construct 4 lanes between SR 65 and Fiddyment Road	County
Placer Parkway	Construct 2 lanes between Fiddyment Road and Pleasant Grove Blvd.	County
Placer Parkway	Construct 4 lanes between Pleasant Grove Blvd. and SR 99	County
Pleasant Grove Blvd	Widen from 4 to 6 lanes, from Foothills Blvd to Woodcreek Oaks Blvd	Roseville
Pleasant Grove Blvd	Widen from 2 to 4 lanes, from Woodcreek Oaks Blvd to Sun City Blvd	MTP
Pleasant Grove Blvd	Extend with 4 lanes, from current terminus to West Side Drive	Roseville
Pleasant Grove Blvd	Extend with 2 lanes, west of West Side Drive	Roseville
Roseville Pkwy	Extend over Union Pacific Rail Road tracks	Roseville
Roseville Pkwy	Construct 4 lanes, from Washington Blvd to Foothills Blvd	Roseville
Roseville Pkwy	Widen from 2 to 4 lanes, from City Limits to Sierra College Blvd	MTP
SR 65	Construct Sunset Blvd interchange	MTP
SR 65	Widen from 2 to 4 lanes, from Gladding to Westlake Blvd	MTP
SR 65	Construct NB slip ramp at Pleasant Grove Blvd. interchange	Roseville
SR 99	Construct Riego Rd interchange	MTP
Sierra College Blvd	Widen from 2 to 4 lanes, from Route 193 to Loomis Town Limits	MTP
Sierra College Blvd	Widen from 2 to 4 lanes, from South Rocklin City Limits to Douglas	MTP
Sierra College Blvd	Widen from 4 to 6 lanes, from Roseville City limits to Sacramento County Line	MTP
Sierra College Blvd	Widen to 6 lanes, from I-80 to South Rocklin City Limits	MTP
Sunset Blvd	Extend with 2 lanes, from Cincinnati Ave to Foothills Blvd	County
Sunset Blvd	Widen from 2 to 4 lanes, from SR 65 to Cincinnati Ave	County
Sunset Blvd	Extend with 2 lanes, from Foothills Blvd to Fiddyment Rd	County
Walerga Rd	Widen from 2 to 4 lanes, from Baseline Rd to Sacramento County Line	MTP
Walerga Rd	Widen bridge at Dry Creek from 2 to 4 lanes	MTP
Watt Ave	Widen from 2 to 4 lanes, from Baseline Rd to Sacramento County Line	MTP
Woodcreek Oaks Blvd	Widen from 2 to 4 lanes, from Junction Blvd to northern city limits	MTP

Notes: WRSP = West Roseville Specific Plan
Source: *SACOG Metropolitan Transportation Plan*, 2005; *Placer County and City of Roseville,* 2004.



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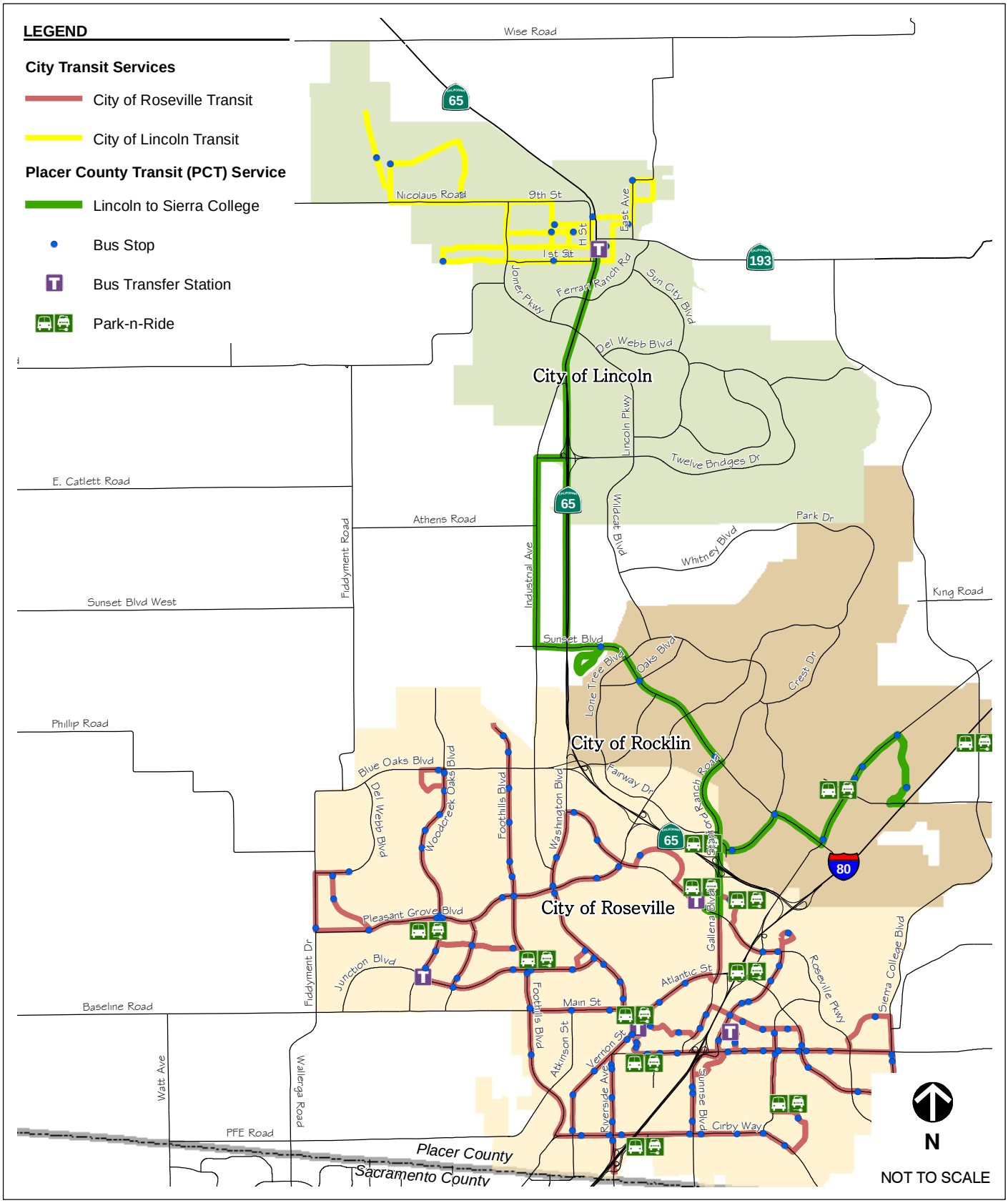
EXISTING AND PLANNED BICYCLE FACILITIES

FIGURE 2



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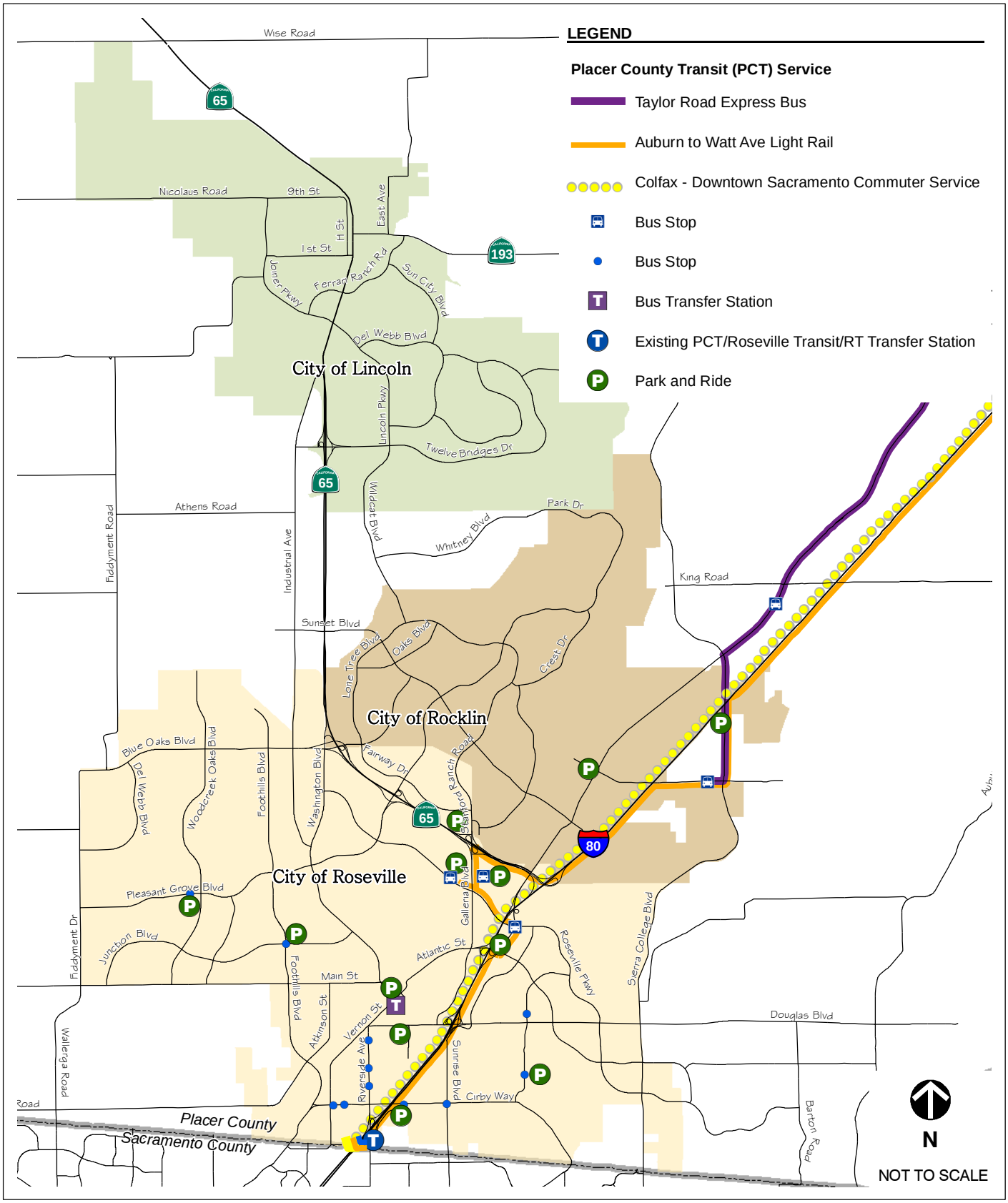
EXISTING LOCAL TRANSIT SERVICES AND FACILITIES

FIGURE 3



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EXISTING COMMUTER TRANSIT SERVICES AND FACILITIES

FIGURE 4

4.0 POTENTIAL BRT MARKET

This section describes the potential BRT market for south Placer County. The market assessment includes a review of potential development projects, future travel demand forecasts, and a summary of a BRT station land use evaluation.

4.1 DEVELOPMENT PROJECT REVIEW

Figure 5 shows potential major transportation and development projects in the study area.

Placer Ranch Specific Plan

The PSRP would be located approximately one mile west of the SR 65 and Sunset Boulevard interchange. It includes 6,758 dwelling units and 10.5 million square feet of non-residential uses on 2,213 acres. The project includes a planned Sacramento State – Placer Campus that would house 25,000 full time equivalent students at build-out on 290 acres. The residential units include 1,740 campus housing units on 46 acres and 5,018 other housing units on 481 acres. The non-residential uses include 2.2 million square feet of office/professional uses, 2.5 million square feet of business park uses, 4.2 million square feet of light industrial uses, 1.2 million square feet of commercial uses, and 0.4 million square feet of public/quasi-public uses.

West Roseville Specific Plan

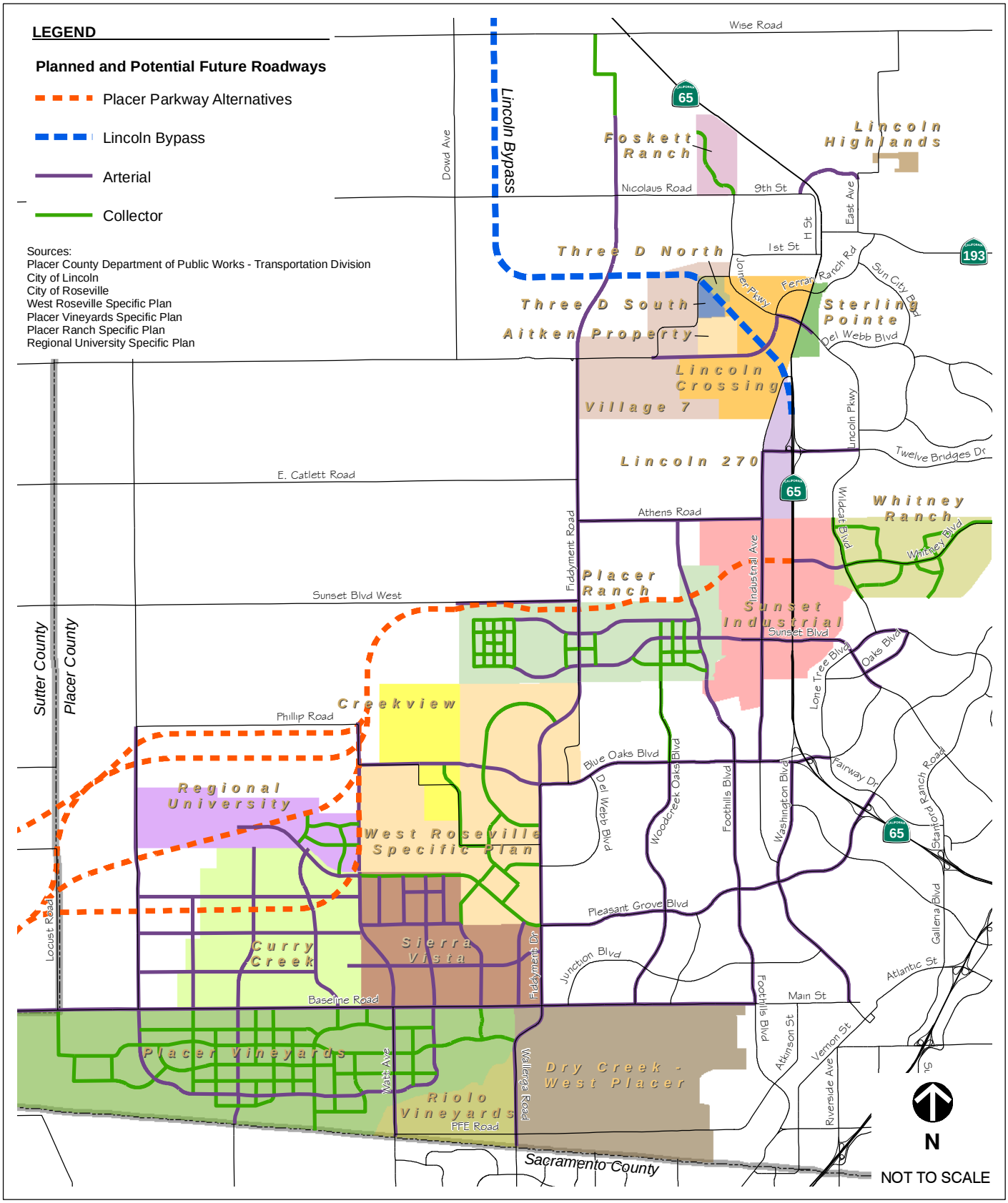
The WRSP is generally located west of Fiddyment Drive and north of Pleasant Grove Boulevard. It includes 8,430 units on 3,162 acres. Approximately 74% of the units are planned as single family residences. The plan includes a village center with 825 medium to high-density units. The plan also includes 34.3 acres of industrial uses, 74.2 acres of light industrial uses, 19.6 acres of business professional uses, and 34.1 acres of community commercial uses.

Sierra Vista Specific Plan

The SVSP would be located north and east of the intersection of Baseline Road and Watt Avenue. It includes 10,000 dwelling units and 1.1 million square feet of non-residential uses. The residential units include 7,500 single family units and 2,500 multi-family units. The non-residential uses include 600,000 square feet of retail uses and 490,000 square feet of office uses.

Regional University Specific Plan

The RUSP would be located to the west of the West Roseville Specific Plan and south of Pleasant Grove Creek. The 1,136 acre plan includes both a university campus and an adjoining mixed-use community. The campus would serve 6,000 students and include 1,155 housing units on 600 acres. The 537 acre mixed-use community includes 3,157 residential units on 317 acres and a 22 acre commercial core.



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PLANNED MAJOR TRANSPORTATION AND DEVELOPMENT PROJECTS

FIGURE 5

Placer Vineyards Specific Plan

The PVSP would be located to the south of Baseline Road and west of Dry Creek Parkway and Walerga Road. The 5,148 acre plan area includes 14,132 dwelling units, 80 acres of commercial development, 160 acres of office and professional development, and 300 acres of professional/light industrial development. The project includes approximately 2,850 proposed high density residential units on 190 acres.

Curry Creek Community Plan

The CCCP would be located to the west of the planned Watt Avenue Extension, between the Regional University Specific Plan area and the Placer Vineyards Specific Plan area. The County is still determining scope/uses. It is expected to include approximately 16,000 residential units and 4 million square feet of non-residential uses on approximately 3,000 acres. Approximately 85 percent of the residential units are anticipated to be single family units. The non-residential uses include approximately 2 million square feet of retail uses and 2 million square feet of office uses.

Riolo Vineyards

The Riolo Vineyards project would be located north of PFE Road, west of Walerga Road and east of Watt Avenue. The 319 acre project includes 805 residential units, 88,000 square feet of retail uses, and neighborhood parks.

Sunset Industrial Area

The Sunset Industrial Area is located both east and west of SR 65, immediately north and south of Sunset Boulevard. The land use designations for the 8,899 acre area includes 3,615 acres of agricultural, 2,819 acres of industrial, 923 acres of business park, 778 acres of public facility, 704 acres of open space, and 60 acres of general commercial. The SR 65 Business Park Area, one of ten planning areas within the Sunset Industrial Area, is located at the junction of SR 65 and Whitney Boulevard.

Whitney Ranch Specific Plan

The Whitney Ranch Specific Plan would be located northeast of the SR 65/Sunset Boulevard interchange. It includes 4,337 units on 1,296 acres. The project also includes a high school, three elementary schools, 33.9 acres of commercial uses, and a 9.6 acres business park. Approximately 73 percent of the residential units are planned as single family residences.

Lincoln 270 Specific Plan

The project would be located between SR 65 and Industrial Avenue, immediately north and south of Twelve Bridges Drive. The 279 acre area includes 58 acres of general commercial, a 48 acre business park, 38 acres of light industrial, a 32 acre medical campus, and 102 acres of open space.

Lincoln Crossing Specific Plan

The LCSP would be located in southwest Lincoln just northeast and west of the junction of SR 65 and the planned Lincoln Bypass. It includes 2,958 units on 1,070 acres. Approximately 80% of the units are planned as single family residences.

Aitken Property

The Aitken property is located in southwest Lincoln just northwest of the junction of SR 65 and the planned Lincoln Bypass. It includes 472 units on 156 acres. All of the units are planned as single family residences.

Three D South

The Three D South project is located in west Lincoln along the west side of the Lincoln Bypass. It includes 185 units on 70 acres. All of the units are planned as single family residences.

Foskett Ranch Specific Plan

The Foskett Ranch is located in north Lincoln on the west side of SR 65. It includes 323 units on 290 acres. Approximately two-thirds of the units are planned as single family residences.

Lincoln Highlands

The Lincoln Highlands project is located in north Lincoln on the east side of SR 65. It includes 196 units on 48 acres. All of the units are planned as single family residences.

Meadowlands

The Meadowlands is located in north Lincoln on the east side of SR 65. It includes 84 units on 20 acres. All of the units are planned as single family residences.

Lincoln SOI

The Lincoln SOI area includes 31,551 dwelling units and 13.6 million square feet of non-residential uses. The non-residential uses include 5.8 million square feet of retail uses, 5.7 million square feet of office uses, and 2.1 million square feet of industrial uses. The SOI is being considered via a comprehensive General Plan Update.

Galleria Expansion

The Galleria Expansion project is located in the City of Roseville south of State Route 65, north of Roseville Parkway, and west of Galleria Boulevard. The existing retail project includes the addition of approximately 487,800 gross square feet of retail uses and new parking structures to the existing 1.28 million square foot Roseville Galleria Mall.

Metro Air Park

Metro Air Park is located in the northern portion of Sacramento County on the east side of Sacramento International Airport and the north side of I-5. The 1,900 acre development includes 8.6 million square feet of industrial and office space, a hotel and a golf course.

South Sutter County Specific Plan

The South Sutter County Specific Plan is located just north of the Sutter County/Sacramento County line and along the State Route 70/99 corridor. The 7,360 acre development includes up to 3,600 acres of business and industrial uses, 17,500 residential units, and 1,000 acres of school, park, retail, and community facility uses.

4.2 FUTURE TRAVEL DEMAND FORECASTS

The landscape of south Placer County will change rather dramatically over the coming years due to planned population and employment growth. Much of this growth will occur in planned developments. Accompanying the growth will be improvements to the transportation system. Land use forecasts and roadway traffic volumes derived from the Placer County "Super Cumulative" travel demand model are used in this study to identify locations that are good candidates for BRT stations and potential BRT routes. The Super Cumulative travel demand model assumes a total level of development that is similar to the Blueprint land use projections adopted by the Sacramento Area Council of Governments, but has a different geographic allocation of development.

The model was calibrated and validated to 2004 conditions in western Placer County and has the ability to forecast daily, AM peak hour, and PM peak hour traffic volumes.

The traffic volume forecasts are based on the land use inputs summarized in Table 2 for the south Placer County area. The land use projections were developed in cooperation with Placer County, City of Roseville, City of Rocklin, City of Lincoln, and Sutter County staff and reflect potential development levels of each development area or project. The amount of development assumed in the Super Cumulative travel model includes anticipated build-out of existing general plans for Placer County, Roseville, Rocklin, and Lincoln plus additional growth beyond existing general plan levels or geographic areas. Additional growth was specifically assumed for Placer Ranch and the Lincoln SOI Expansion Area.

TABLE 2. SUPER CUMULATIVE LAND USE PROJECTIONS

Jurisdiction	New Development Area or Project	Residential Dwelling Units	Employment (1,000 sq. ft.)			College Enrollment
			Retail	Office	Industrial	
Placer Co.	- Placer Vineyards	14,132	1,855	1,764	0	0
	- Placer Ranch	6,758	1,046	5,242	4,186	25,000
	- Sunset Industrial Area[1]	0	357	912	7,851	0
	- Riolo Vineyards	828	88	0	0	0
	- Curry Creek	16,200	2,025	2,124	0	0
	- Regional University[2]	4,387	215	27	0	6,000
Roseville	- General Plan Area	60,002	14,400	15,319	17,401	0
	- MOU Remainder Area	12,600	780	1,020	0	0
Rocklin	- General Plan Area	28,606	4,586	2,848	6,494	23,000
Lincoln	- Existing General Plan Area	22,123	2,948	3,622	8,161	5,000
	- SOI Expansion Area	31,551	5,824	5,663	2,068	0
Sutter Co.	- South Sutter Specific Plan	17,500	2,188	750	1,500	0

Notes: (1) This is the remainder area not included in the Placer Ranch Specific Plan.
(2) The CMU designation of the specific plan allows for office uses.
SOI = Sphere of Influence
Source: DKS Associates, 2005 and Fehr & Peers, 2005

The circulation network needed to serve the proposed developments in south Placer County is currently under development. The Super Cumulative Model is being used by the involved jurisdictions both as a common base to evaluate the environmental impacts of proposed projects as well as to evaluate a series of circulation alternatives with varying roadway alignments and widths in south Placer County. The projected volumes on key arterial streets vary depending on the alignment of individual roadways associated with each of the circulation alternatives. The circulation alternatives that are being studied include the northerly alignment alternative, whose western terminus is a new interchange at SR 65/Sankey Road, for the planned Placer Parkway. The alignment alternatives include a new interchange either at the northern terminus of Watt Avenue or the western terminus of Blue Oaks Boulevard.

The range of daily traffic volumes forecast for segments of the major freeway and roadway facilities in south Placer County, developed by applying the Super Cumulative Model for each of the circulation alternatives, is shown below.

Watt Avenue

- North of Baseline Road: 52,000 – 62,000

Fiddyment Road

- North of Baseline Road: 43,000 – 48,000
- North of Blue Oaks Road: 32,000 – 46,000

Foothills Boulevard

- North of Blue Oaks Road: 46,000 – 47,000

State Route 65

- North of Placer Parkway: 79,000 – 84,000
- South of Blue Oaks Boulevard: 87,000 - 91,000
- North of I-80: 149,000-152,000

Baseline Road

- East of Watt Avenue: 35,000 – 52,000
- East of Fiddyment Drive: 49,000 - 50,000

Pleasant Grove Boulevard

- East of Watt Avenue: 8,000 – 23,000
- East of Fiddyment Drive: 35,000 - 37,000

Blue Oaks Boulevard

- East of Watt Avenue: 29,000 – 32,000
- East of Fiddyment Drive: 40,000 - 42,000
- East of Foothills Road: 58,000 – 59,000

Sunset Road

- East of Watt Avenue: 24,000 – 34,000
- East of Foothills Road: 44,000 – 46,000

Placer Parkway

- East of Watt Avenue: 79,000 – 84,000
- East of Fiddyment Drive: 87,000 - 91,000
- East of Foothills Road: 92,000 – 94,000

4.3 LAND USE THRESHOLDS TO SUPPORT BUS RAPID TRANSIT

Literature review indicates that there are four main land use factors affecting transit use – residential density, employment intensity, land use diversity, and university uses.

Residential Density

At the residential (production) end, the principal land use factors that can promote transit ridership have been aptly summarized as the three Ds: Density, Diversity (land use mixture) and Design (e.g., provision of convenient sidewalks and other pedestrian amenities that encourage walking). A fourth D – accessibility to concentrated regional Destinations (such as downtown Sacramento) is also a key factor in transit use. Of these four D-factors, density in the transit corridor and the intensity of the concentration at the destination end of the corridor are viewed as the most significant quantifiable land use variables.[1]

The effectiveness of increased densities near transit in promoting transit ridership is borne out by an abundance of studies over time. Most of the debate in the literature is not over the efficacy of density in promoting transit use, but over the degree of effectiveness and the means, specific mechanisms and co-factors that induce ridership in higher density settings. A positive correlation between density and transit is not inevitable – high density in an area without transit service, or with transit service that does not meet residents' needs, may have negligible effects on transit use. However, density near transit increases transit patronage by reducing the time and cost of accessing transit and for those within walking distance, eliminating the need for a vehicle to access transit.

Nation-wide Data

An analysis of the 1995 Nationwide Personal Transportation Study (NPTS) found that the public transit share for all trips was as follows.

- 2.9 percent for all densities of between 250 and 1,000 persons per square mile
- 3.1 percent for all densities of between 1,000 and 4,000 persons per square mile
- 3.0 percent for all densities of between 4,000 and 10,000 persons per square mile
- 11 percent for densities above 10,000 per square mile.

[1] Going beyond land use (and the scope of this memo) yet another D, Demographics, is a very significant factor (especially if car ownership is included with income, ethnicity/immigrant status as a demographic variable). For example, Dowell Myers of the School of Policy, Planning and Development, University of Southern California has established that recent immigrants are much more likely to use transit (presentation to the Alameda County CMA on April 27th, 2000). Myers research indicates that immigrants' travel habits converge over time, and there is little difference between the travel patterns of native-born and those of immigrants who have been in the U.S. for several decades.

The significant increase in transit mode share that occurs when densities are greater than 10,000 persons per square mile is related to average residential dwelling unit densities greater than six units per acre. This analysis also showed that bicycle and walk had a larger share than transit at all density levels.

Holtzclaw et al's recent (2002) study confirms numerous studies by Holtzclaw and others that a doubling in density results in a 25 percent reduction in vehicle miles traveled (vmt). Only a fraction of this reduction is due to more transit use and Holtzclaw's principle data source (e.g., Department of Motor Vehicles odometer checks) makes transit's specific contribution difficult to ascertain.

California Specific Data

The 1990 U.S. Census found that 17.8 percent of the total work trips by those living within 1/2 mile of a BART station were made on BART (Cervero, 1993). In a survey of station area adult residents living in 11 multifamily, mainly rental, housing developments near BART (all but three within one-third mile of BART station), Cervero found a higher BART work mode split of 33 percent in the early 1990s.

Cervero also studied the effect of proximity to LRT on mode choice in Sacramento. He surveyed residents of four apartment complexes near (generally less than ½ mile walking distance) Sacramento's LRT and found that 12 percent of residents "main trips" (as defined by respondents) were by rail; another 3.2 percent were by bus transit (Cervero, 1993, p. 43). Looking at employment sites in suburban Sacramento that were also within easy walking distance of LRT stations, he found that 6.3 percent of workers arrived by rail and another 5.4 percent by bus (ibid, p. 80). It should be noted that while both the apartments and the worksites studied by Cervero were outside downtown, they were larger and more intensely developed than most suburban developments in the region.

A later study using year 2000 Bay Area Travel Survey (BATS) (Cervero and Duncan 2002, p. 12) found that 19.6 percent of residents living within 1/2 mile of BART commuted via transit in that year. This is slightly higher than the 1990 Census BART mode split for workers within the 1/2-mile radius (17.8 percent). This suggests that the proximity effects of rail are not too different from when Cervero conducted his earlier study.

Employment Intensity

A complementary issue that is often overlooked in studies of the land use and transit connection is that of the commercial densities required to support transit use. Non-residential densities are often referred to as "intensities" and can be expressed in terms of total square footage, total employment, employment density, or floor area ratio (FAR). Frank and Pivo (1995) found employment densities to be as or more important than residential densities. Using Seattle-area data, they found that bus transit ridership to employment centers rises to about 10 percent of all work trips when there are about 100 employees/acre, and exceeds 33 percent when employment densities exceed 200/acre. Dill (2003) studied the land use effects on rail ridership in the Bay Area at the work end using large-scale employer-based surveys conducted in the early 1990s. Data were obtained for BART station area employers as well as Caltrain and Santa Clara light rail (Valley Transit Authority or VTA) station area employers. Employers not near rail serve as a comparison group. The results

indicate that a worksite's proximity to a rail station (particularly within ¼ mile) greatly increases the chances of employees using rail. Proximity to a BART station had a much greater effect than proximity to a Caltrain or VTA station. Outside of San Francisco, Oakland and Berkeley, Dill found that about 5 to 6 percent of all work trips to worksites within ½ mile of rail stations were by rail.

Specific research findings related to employment intensity for potential use in this study are highlighted below.

- The Seattle Metro recommended a minimum concentration of 10,000 employees to support cost-effective bus transit. This same study stated that a density of 50 employees per acre would also be required (Seattle Metro, 1987).

- The City of Portland, adopted a minimum 1.0 FAR for development within identified light rail station areas (City of Portland, 2000).

- Pushkarev and Zupan identified intensities for employment or the destination end of the service (i.e., the CBD). For light rail transit (LRT) this is quantified as 20 – 50 million square feet of non-residential floorspace. (Regional Plan Association, Figure 6.4) This corresponds to 50,000 – 125,000 employees assuming one employee/400 square feet.

- The U.S. DOT/Snohomish County Transit Oriented Development (TOD) Guidelines states that FARs above 2.0 are required to effectively support bus transit. Lower density employment areas may generate enough traffic to clog roads but insufficient riders to sustain effective bus service. By comparison, a typical suburban office complex has an FAR of 0.5 or less (Cervero, 1993b).

Over what area do these densities and intensities need to occur? Cervero and Duncan (2002, p. 14) suggest that a one-mile radius of the destination transit station is relevant. The preponderance of other studies suggest that between one-quarter and one-half mile is the upper limit of what most Americans are willing to walk for transit access purposes. (See Cervero and Seskin, TCRP Research Results Digest, June, 1995, esp. Figures 14-16).

Land Use Diversity

With respect to land use mixture (or Diversity) as a stimulus to transit ridership, the research record is decidedly mixed. A study of the 1985 American Housing Survey, which includes questions about household travel (Cervero 1996 Transportation Research-A), illustrates these mixed results.

- If retail shops are within 300 ft. of the transit station, transit ridership is encouraged.

- If retail is 300 feet to 1 mile away from the station, residents are likely to drive and link a short shop trip onto their journey to work.

This study further finds that mixed land use does seem to encourage non-motorized trips, and is in fact a better predictor of non-motorized trips than is residential density.

On the other hand, the conditions at the employment end may be different. Cervero concluded in another study (1989) that suburban employment centers (SECs) with significant retail exhibited a 3 percent increase in transit/ridesharing use with every 10 percent increase in retail uses in the SEC. The ability to accomplish midday errands and convenience shopping without a car influences some commuters to take transit. (See above for a discussion of employment density and bus/rail ridership).

University Uses

Certain types of land use are "special generators" with respect to producing transit ridership; college and university campuses are excellent examples of a special transit generator. Most university communities have higher transit ridership compared to other land uses and good transit station access by vehicles, bicycles, and pedestrians. A comparison by Balsas (2003) found that the average level of transit use at eight university campuses was more than five times as high as transit ridership in the general population as revealed by the 1995 NPTS.

While high levels of transit use at university campuses has been documented extensively (e.g., Toor and Havlick, 2004), and programs to promote transit at universities have also been closely tracked (e.g., Brown, Hess and Shoup, 2001) few, if any, studies have attempted to directly model the effect of a nearby college campus on LRT or BRT ridership. Fehr & Peers' ongoing research on LRT ridership in Sacramento, Salt Lake City, and elsewhere may provide additional data and tools for estimating the university effect in the near future, but information to date is limited to analogue comparisons.

Land Use Thresholds to Support Transit

A variety of sources recommend residential densities of at least 4 dwelling units per acre or more for minimal (bus) transit service to be viable (Pusharkev & Zupan, 1983; ITE, 1989). Another study stated that 7 to 15 dwelling units per acre can support local bus service (USDOT/Snohomish County Transportation Authority, 1989). Pushkarev and Zupan (1977) examined this question thoroughly in the 1970s; their key conclusions regarding density thresholds for various modes of transit are shown in Table 4. Pushkarev and Zupan's criteria have been used regularly, and have generally been substantiated by other research.

Two important caveats regarding Pushkarev and Zupan study are listed below.

- The study is 25 years old, and much of the data is older.
- Much of Pushkarev and Zupan's data was drawn from the New York region, which, particularly in the 1970s, had a bias toward transit use, while all other factors held equal.

The level of auto-ownership and auto-oriented development in south Placer County in 2004 means that there is considerably less tendency to use transit compared to the New York region. Thus while the land use thresholds for various types of transit developed by Pushkarev and Zupan are still valid, they should generally be viewed as absolute minimum thresholds in auto-oriented regions.

TABLE 3. TRANSIT MODES RELATED TO RESIDENTIAL DENSITY CRITERIA

Mode	Service	Minimum Necessary Residential Density (dwelling units per acre)	Remarks
Dial-a-bus	Many origins to many destinations	6	Only if labor costs are not more than twice those of taxis
	Fixed destinations or subscription service	3.5 to 5	Lower figure if labor costs twice those of taxis; higher if thrice those of taxis
Local bus	"Minimum," ½ mile route spacing, 20 buses per day	4	Average, varies as a function of downtown size and distance from residential area to downtown
	"Intermediate," ½ mile route spacing, 40 buses per day	7	
	"Frequent," ½ mile route spacing, 120 buses per day	15	
Express bus -reached on foot	Five buses during two hour peak period	15 Average density over two square mile tributary area	From 10 to 15 miles away to largest downtowns only
Express bus -reached by auto (Park & Ride)	Five to ten buses during two hour peak period	3 Average density over 20 square mile tributary area	From 10 to 20 miles away to downtowns larger than 20 million square feet of non-residential floor space
Light rail	Five minute headways or better during peak hour	9 Average density for a corridor of 25 to 100 square miles	To downtowns of 20 to 50 million square feet of non-residential floor space
Rapid transit	Five minute headways or better during peak hour	12 Average density for a corridor of 100 to 150 square miles	To downtowns larger than 50 million square feet of nonresidential floor space
Commuter rail	Twenty trains a day	1 to 2	Only to largest downtowns, if rail line exists

Source: Pushkarev and Zupan, 1977.

4.4 BRT STATION LAND USE EVALUATION

The following evaluation was initially prepared for the *Conceptual BRT Plan for south Placer County* (April 11, 2005), prepared by Fehr & Peers for the Placer County Department of Public Works. The station land use evaluation has been updated to reflect new land use data included in the Super Cumulative travel demand model.

As the first step of identifying the potential BRT station, future land uses (i.e., population plus employment) were evaluated within the study area. Based on the station evaluation criteria described above and the land use forecasts, the south Placer area was divided into ½-mile grids using GIS analysis tools and rated according to potential station development levels to identify the best candidate sites for future BRT stations based on current development plans. As shown in Figure 6, 15 initial station locations were identified through this review. Figure 6 shows the station location, station development level, and analogue ridership information for each station development level.

The station development levels measure land use intensity in relation to increasing levels of potential ridership based on empirical data. Fehr & Peers determined a range of potential transit ridership for each development level by identifying actual year 2000 ridership at existing analogous rail stations in Sacramento and San Francisco Bay Area regions. These analogue stations are from a database developed by Fehr & Peers on over 80 rail station sites in northern California. This database includes station ridership as well as station area data on population and employment, transit service levels and other characteristics. Specifically, this database covers 40 BART stations, 33 Caltrain stations, and 11 non-downtown Sacramento LRT stations. Analogue stations for the potential BRT stations in south Placer County were identified primarily on the basis of station area population and employment (focusing on the area within one-half mile of the potential station site). An attempt was made to identify a "lower ridership" and "higher ridership" analogue station from both the Sacramento and Bay Area region. Thus up to four existing analogue stations were identified for each potential BRT station in south Placer County.

The station development level and analogue ridership information on Figure 6 can be used to gauge the potential ridership of identified station locations based on current land use plans and to compare the individual station locations against each other. As shown, there is no ridership data for the low end of Level 1 and high end of Levels 5 and 6 because the analogue stations in Sacramento are not available.

Figure 6 shows that the Placer Ranch Specific Plan area and the Galleria Mall area are two candidate BRT station sites with high ridership potential. To supplement the land use projections described above, additional travel information was developed to assist in identifying potential BRT travel markets and corridors. The projected origins and destinations of travelers from the Placer Ranch and Galleria Mall areas were determined using the Super Cumulative Model. Table 3 shows the projected number of total daily person trips, as aggregated into home-based-work (HBW) trips and non-home-based-work (Non-HBW) trips.

TABLE 4. SELECT ZONE ANALYSIS SUMMARY[1]

Land Use Group	HBW Daily Person-Trips[2]	Non-HBW Daily Person-Trips[2]	Total Daily Person-Trips[2]
Placer Ranch – Residential	16,148	73,172	**89,320**
Placer Ranch – University	7,139	79,849	**86,988**
Placer Ranch – Employment	26,671	65,259	**91,930**
Galleria Area – Retail	16,942	136,634	**153,575**

Notes:

[1] Based on Placer County Supercumulative TDF model.
[2] One-way person-trip.
Source: Fehr & Peers, 2006.

The travel model forecasts that the Placer Ranch residential, university, and employment uses will generate approximately 270,000 daily person trips, while the Galleria area retail uses will generate approximately 150,000 daily person trips. Approximately 84 percent of the person trips generated by uses in these two areas are non-HBW trips.

A review of the assignment of trips from those areas provides the following information on the origins/destinations:

- The most heavily traveled routes for the Placer Ranch uses are listed below.
  - East: Sunset Blvd., Placer Parkway & Blue Oaks to SR 65
  - South: Watt Ave. & Fiddyment Rd. to I-80
  - West: Placer Parkway to SR 70/99 and I-5
  - North: Fiddyment Rd. & SR 65 to Lincoln

- The most heavily traveled routes for the Galleria retail uses are listed below.
  - East: SR 65 to I-80
  - South: Sunrise Blvd. & Hazel Ave. to Highway 50
  - West: I-80
  - North: SR 65 to Lincoln

- Major origins/destinations for the Placer Ranch uses include Sacramento County via either the Watt Avenue/Fiddyment Road corridor or the SR 65/I-80 corridor, Roseville via Fiddyment Road/Rocklin via SR 65, and Lincoln via the Fiddyment Road/SR 65 corridor.

- Major origins/destinations for the Galleria retail uses include Sacramento County via either the I-80 corridor or the Sunrise Boulevard/Hazel Avenue corridor, Roseville/Rocklin via SR 65 or Roseville Parkway, and Lincoln via the SR 65 corridor.

- As expected, HBW trips generally extended further (i.e., have longer trip lengths) than Non-HBW trips. This finding is consistent with the results of the SACOG household travel survey.

- Placer Ranch – Residential:
  - 12 percent of HBW residential person-trips to Sac County
  - 3 percent of Non-HBW residential person-trips to Sac County

- Placer Ranch – University:
  - 21 percent of HBW university trips north from Lincoln
  - 15 percent of HBW trips south from Sac County
  - 13 percent of Non-HBW trips from Lincoln
  - 11 percent of Non-HBW trips from Sac County

- Placer Ranch – Employment:
  - 31 percent of HBW trips north from Lincoln
  - 22 percent of HBW employment trips south from Sac County
  - 17 percent of Non-HBW trips from Lincoln
  - 17 percent of Non-HBW trips from Sac County

- Galleria Area – Retail:
  - 10 percent of Non-HBW south from Sac County
  - 5 percent of Non-HBW north from Lincoln

4.5 SUMMARY OF POTENTIAL BRT MARKET REVIEW

An evaluation of the projected roadway volumes, land use forecasts, and travel patterns described above yields the following conclusions.

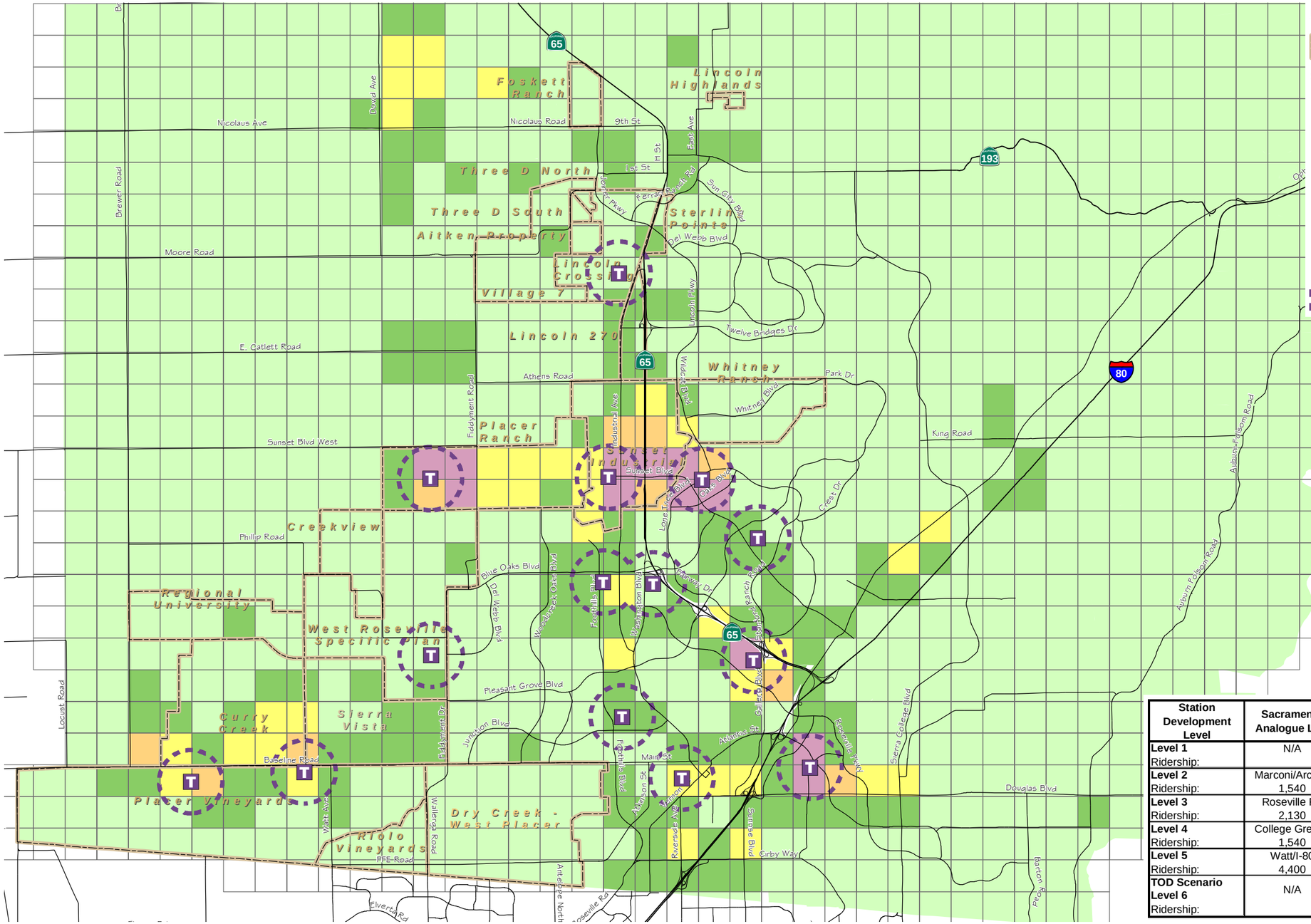
- The type, mix and density of uses planned for the Placer Ranch Specific Plan area make it the candidate BRT station site with the highest ridership potential.

- The existing and planned uses in the Galleria Mall area make it a candidate BRT station site with high ridership potential.

- The existing and planned uses in the H-P Campus area make it a candidate BRT station site with high ridership potential.

- The uses planned for the following locations make them good candidate BRT station sites.
  - West Roseville Specific Plan Town Center
  - Placer Vineyards Center at Watt Avenue
  - Planned Corporate Center at SR 65/Blue Oaks Boulevard

- The existing Taylor park-and-ride lots is a good candidate BRT station site, given its location (i.e., proximity to I-80) and its planned expansion.



Station Development Level	Sacramento Analogue Low	Sacramento Analogue High	Bay Area Analogue Low	Bay Area Analogue High (Adjusted Ridership)
Level 1 Ridership:	N/A	Marconi/Arcade 1,540	San Martin 370	Orinda 1,770
Level 2 Ridership:	Marconi/Arcade 1,540	Roseville Rd 2,130	Atherton 490	N. Concord/Martinez 2,450
Level 3 Ridership:	Roseville Rd 2,130	65th St 3,620	Morgan Hill 720	Dublin/Pleasanton 8,550
Level 4 Ridership:	College Greens 1,540	Watt/I-80 4,400	Millbrae 1,610	El Cerrito Del Norte 9,950
Level 5 Ridership:	Watt/I-80 4,400	N/A	San Mateo 2,220	Balboa Park 11,000
TOD Scenario Level 6 Ridership:	N/A	N/A	Palo Alto 3,940	Berkeley 13,600

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POTENTIAL BRT STATION AREA EVALUATIONS - BASED ON PLACER COUNTY SUPERCUMULATIVE MODEL

FIGURE 6

5.0 REVIEW OF POTENTIAL TRANSIT CORRIDORS

This section provides a review of nine potential transit corridors in south Placer County. Figure 7 shows the location of the corridors.

5.1 WATT AVENUE CORRIDOR

Current Conditions

The northern terminus of Watt Avenue is at Baseline Road in south Placer County. South of Baseline Road, Watt Avenue is two lanes wide until it reaches Elverta Road, where it becomes a four-lane to six-lane road between Elverta Road and I-80.

Facility Plans

The extension of Watt Avenue, north from Baseline Road to the Placer Parkway corridor, is planned to serve the proposed Regional University Specific Plan area and the future Curry Creek development. The Placer County General Plan designates Watt Avenue as an arterial transit corridor. The transit corridor designation is intended to facilitate the development of land use and design standards that promote the viability of high-capacity transit in those corridors where there is a significant amount of undeveloped land. The arterial transit corridors would have transit access almost continuously along the corridor where development is present.

The Sacramento County General Plan calls for Watt Avenue, north to the Sacramento/Placer county line, to be a six-lane thoroughfare and feeder transit line network transportation corridor (i.e., designed to provide higher speed transit service that feed major transit lines such as light rail transit along the I-80 corridor). SACOG's Metropolitan Transportation Plan for 2025 included a BRT project along Watt Avenue, with a project cost of $20 million. The Sacramento Regional Transit District (RT) 20-year Vision includes BRT on Watt Avenue from Bond Road in Elk Grove north to Elverta Road.

Opportunities & Constraints

A number of opportunities make Watt Avenue a strong candidate for future BRT service. This includes the existing Watt/I-80 light rail station, the emerging job center at McClellan Business Park, and the identification of Watt Avenue as a BRT corridor in the plans described above. The primary constraints include the projected congestion levels on Watt Avenue and residential development that borders one or both sides of the roadway in Sacramento County. The Mobility Strategies for County Corridors, a report prepared for Sacramento County (September, 2004) identified a major transitway alternative that would provide an eight-lane couplet between Antelope Road and James Way. The couplet would provide three mixed flow lanes and an exclusive HOV/BRT lane in this segment.

5.2 PLEASANT GROVE BOULEVARD CORRIDOR

Current Conditions

Pleasant Grove Boulevard links Fiddyment Road at its western terminus to SR 65. It ranges from a two-lane to four-lane section between its western terminus at Fiddyment Road and Foothills Boulevard, to six lanes between Foothills Boulevard and SR 65.

Facility Plans

Conceptual plans being developed call for Pleasant Grove Boulevard to be six lanes from Foothills Boulevard west to Woodcreek Oaks Boulevard, and four lanes from Woodcreek Oaks Boulevard west to the Regional University Specific Plan.

Opportunities & Constraints

Much of Pleasant Grove Boulevard, east of Fiddyment Road, has been developed as relatively low density housing that would not support BRT service levels.

5.3 BLUE OAKS BOULEVARD CORRIDOR

Current Conditions

Blue Oaks Boulevard links Fiddyment Road at its western terminus to SR 65. It ranges from a two-lane section at its western terminus to four lanes at SR 65.

Facility Plans

Right-of-way is dedicated along Blue Oaks Boulevard for an eight-lane facility. Conceptual plans call for Blue Oaks Boulevard to be six lanes from SR 65 west to Placer Parkway. The Placer County General Plan designates Blue Oaks Boulevard as an arterial transit corridor. The transit corridor designation is intended to facilitate the development of land use and design standards that promote the viability of high-capacity transit in those corridors where there is a significant amount of undeveloped land. The arterial transit corridors would have transit access almost continuously along the corridor where development is present.

Opportunities & Constraints

A number of opportunities make Blue Oaks Boulevard a strong candidate for future BRT service. This includes the eight-lane right-of-way that is being preserved, its designation as an arterial transit corridor, its central east-west location, and access to both the existing H-P campus area and the planned corporate center at SR 65 and Blue Oaks Boulevard. There are presently no significant constraints on the development of potential transit service along Blue Oaks Boulevard.

5.4 PLACER PARKWAY CORRIDOR

Facility Plans

The objective of the Placer Parkway Corridor Preservation project is to identify and preserve an approximate 15-mile corridor, between SR 65 and SR 70/99, ranging in width from 500 to 1,000 feet. The corridor width will vary among three segments:

- East – 500 ft. wide from SR 65 to Fiddyment Rd.
- Central -- 1,000 ft. wide from Fiddyment Rd. to Pleasant Grove Rd.
- West -- 500 ft. wide from Pleasant Grove Rd. to SR 70/99

The future four-to six-lane roadway will have up to seven interchanges:

- SR 65 @ Whitney Ranch Parkway
- Foothills Boulevard
- Fiddyment Rd.
- Watt Ave./Blue Oaks Blvd.
- Up to two in Sutter County's future South Sutter Co. Specific Plan area
- SR 70/99 (between Riego Rd. and Sankey Rd.)

Opportunities & Constraints

The Placer Parkway would provide a continuous median with a minimum width of 100 feet. This median could be used for future transit service. The Placer Parkway project includes a "no-development buffer" that would prohibit development on either side of the facility through the implementation of conservation easements. There is the potential to develop express bus service along the corridor with park-and-ride lots at the interchanges. Future bus service along the corridor could link South Placer County with future development at Metro Air Park and/or the South Sutter Specific Plan area. Since there would be no development within 500-1,000 feet of the corridor right-of-way boundary, access to any future stations at the interchanges would likely be primarily by auto, local bus, or bicycle. There are presently no significant constraints on the development of potential transit service along Placer Parkway.

5.5 STATE ROUTE 65 CORRIDOR

Current Conditions

SR 65 is currently a four-lane freeway from I-80 north past Blue Oaks Boulevard.

Facility Plans

The Transportation Concept Report (July, 2001) for SR 65 calls for the segment between I-80 and the Blue Oaks Boulevard interchange to be a six-lane freeway for the twenty-year planning horizon and an eight-lane freeway for ultimate planning purposes. The segment between the Blue Oaks Boulevard interchange and Industrial Avenue is planned to be a four-lane freeway for the twenty-year planning horizon and a six-lane freeway for ultimate planning purposes.

Opportunities & Constraints

The existing right-of-way width of SR 65 may be a constraint for the development of potential transit service along SR 65, given the need for the facility to be six to eight lanes wide. There are opportunities to provide HOV lanes on SR 65 and a direct HOV connector with I-80. There is the potential to develop BRT, enhanced bus, and/or express bus service along the corridor with park-and-ride lots at the interchanges.

5.6 INTERSTATE 80 CORRIDOR

Current Conditions

Interstate 80 is currently eight lanes from SR 65 to Eureka Road and six lanes west to Douglas Boulevard.

Facility Plans

The Interstate 80 (I-80) project will widen the freeway from the Placer/Sacramento County line (approximately Riverside Ave/Auburn Blvd) all the way to SR 65. The existing carpool lanes in Sacramento County will be extended to SR 65 in both the eastbound and westbound directions, and auxiliary lanes will be added between the interchanges. The Transportation Concept Report (January, 2001) for I-80 calls for the segment between the Sacramento/Placer County Line and the Sierra College Boulevard interchange to be an eight-lane freeway with HOV lanes for the twenty-year planning horizon and a ten lane freeway with HOV lanes for ultimate planning purposes. Auxiliary lanes are also identified between Riverside and SR 65.

Opportunities & Constraints

There are presently no significant constraints on the development of potential transit service along I-80. There are opportunities to provide HOV lanes on I-80 and a direct HOV connector with SR 65. There is the potential to develop BRT, enhanced bus, and/or expanded express bus service along the corridor with park-and-ride lots at the interchanges.

5.7 ROSEVILLE PARKWAY CORRIDOR

Current Conditions

Roseville Parkway is a six-lane roadway from Washington Boulevard to Douglas Boulevard.

Facility Plans

The Roseville General Plan shows no plan to widen Roseville Parkway.

Opportunities & Constraints

Roseville Parkway is largely developed, both in terms of the roadway facility and adjacent property. There are limited opportunities to provide exclusive transit lanes and/or queue bypass lanes without significant right-of-way acquisition and cost.

5.8 DOUGLAS BOULEVARD CORRIDOR

Current Conditions

Douglas Boulevard ranges from a two-lane roadway at its western terminus at Vernon Street, to a six-lane roadway east of I-80. The I-80/Douglas Boulevard interchange was recently reconstructed.

Facility Plans

The Roseville General Plan shows no plan to widen Douglas Boulevard between Vernon Street and Eureka Road.

Opportunities & Constraints

Douglas Boulevard is largely developed, both in terms of the roadway facility and adjacent property. There are limited opportunities to provide exclusive transit lanes and/or queue bypass lanes without significant right-of-way acquisition and cost.

5.9 EUREKA ROAD CORRIDOR

Current Conditions

Eureka Road is a six-lane roadway from I-80 to Douglas Boulevard.

Facility Plans

The Roseville General Plan calls for Eureka Road to be seven lanes between Taylor Road and a point mid-way between N. Sunrise Avenue and Rocky Ridge Drive and six lanes for the remaining segment to Douglas Boulevard.

Opportunities & Constraints

Eureka Road is largely developed, both in terms of the roadway facility and adjacent property. There are limited opportunities to provide exclusive transit lanes and/or queue bypass lanes without significant right-of-way acquisition and cost.

5.10 SUMMARY OF POTENTIAL BRT CORRIDOR REVIEW

An evaluation of the opportunities and constraints presented above, as well as projected roadway volumes and land use forecasts presented in the previous section, yields the following conclusions.

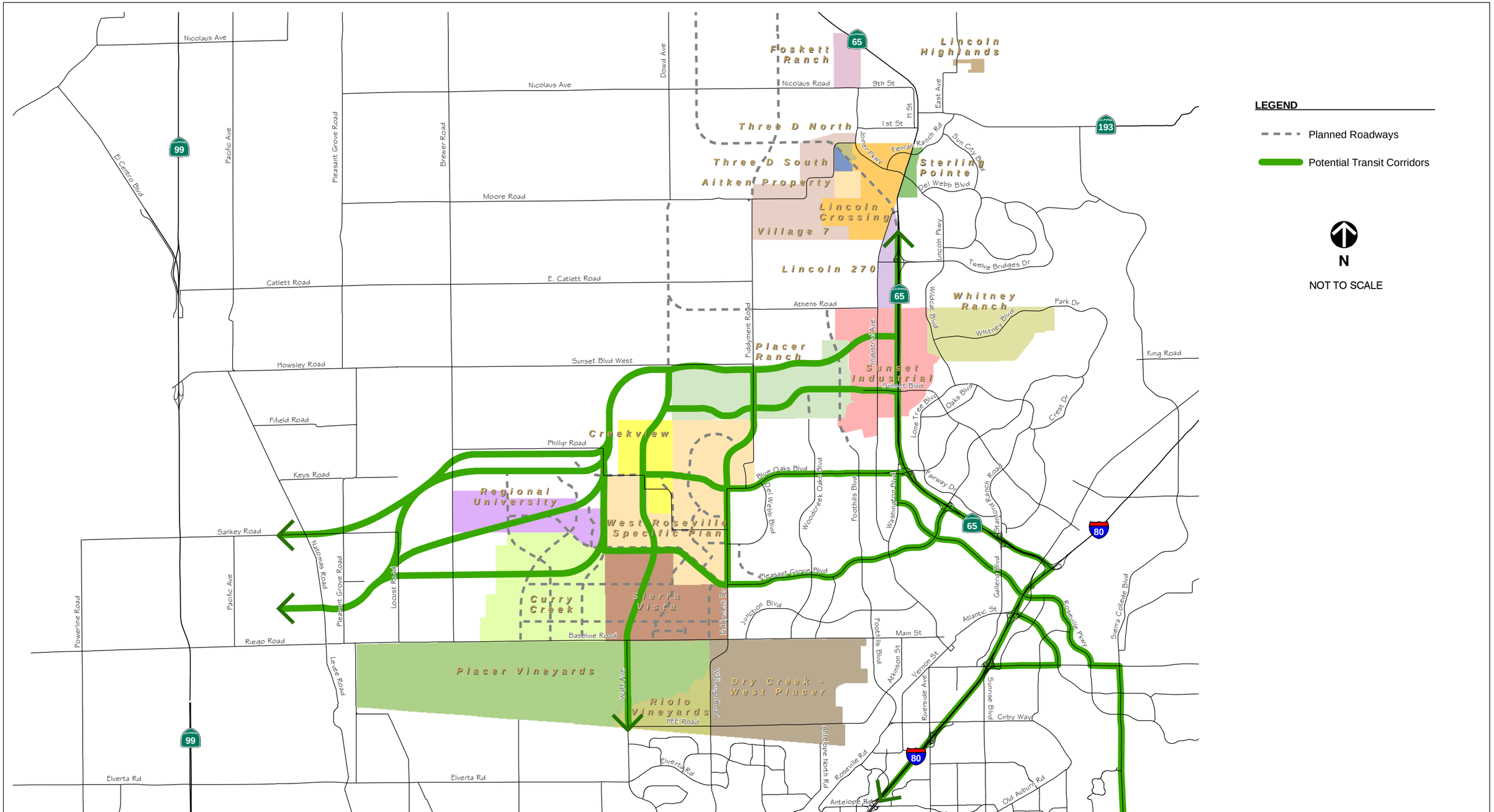
- Watt Avenue is an ideal corridor to provide BRT service for the following reasons.
  - Designation as a transit corridor in the Placer County General Plan
  - Designation as a feeder transit corridor in the Sacramento County General Plan
  - Ability to establish a right-of-way that can support transit
  - Plans to provide BRT service along Watt Avenue in Sacramento County portion of the corridor

- Blue Oaks Boulevard is an ideal corridor to provide BRT service for the following reasons.
  - Designation as a transit corridor in the Placer County General Plan
  - Eight-lane right-of-way allows for development of transit lanes
  - Central location of this east-west route in south Placer County

- I-80 is a good corridor to provide BRT service, to link the south Placer area to the I-80/Watt light rail station or to downtown Sacramento, given the planned HOV lanes both in Placer County and in Sacramento County.

- SR 65 would be a good corridor to provide BRT service if HOV lanes were developed to provide competitive travel times for transit.

- Roseville Parkway is a good corridor to provide BRT service because it links several potential BRT station locations including the Galleria Mall area and the Taylor park-and-ride lot.



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POTENTIAL TRANSIT CORRIDORS
FIGURE 7

6.0 BRT ROUTE PLAN

This section identifies three potential BRT routes for south Placer County.

6.1 BACKGROUND

There are a limited number of developed areas within south Placer County that have population and/or employment densities that can presently support BRT service. The potential BRT routes are thus designed to serve developing areas in south Placer County that are being planned for higher densities. The BRT routes would provide connections from these new developing areas to existing major commercial centers in south Placer County, to major transit routes (i.e., light rail lines) in Sacramento County, and/or to major park-and-ride lots.

The Placer Ranch Specific Plan area shows the greatest potential as a major transit hub, based on the Draft Specific Plan that plans for a Sacramento State-Placer Campus that would serve up to 25,000 students. Two of the three candidate BRT routes identified below would have a transit center at the planned CSUS-Placer Campus serving as the northern terminal. The Placer Vineyards and West Roseville Specific Plan areas have planned land uses that would support a transit center or station on one of the BRT routes. The Galleria, the H-P Campus, and the Taylor park-and-ride lots are existing developed areas that would support a BRT transit station.

Implementation of any of the three candidate BRT routes requires that the following actions be accomplished:

- Specific Plans for new development are approved with population and employment densities that would support BRT.
  - Minimum residential density of 9 dwelling units per acres (within ½ mile of station)
  - Minimum non-residential FAR of 1.0 (within ½ mile of station)
- Right-of-way for improvements along the BRT routes and at BRT stations is preserved and/or acquired both in new development areas and in areas that have existing development.
- The land use programs in the Specific Plans, particularly those areas that have higher population and employment densities that would be served by BRT, are developed as planned and approved.
- A funding mechanism is adopted for capital as well as operating & maintenance costs for the BRT routes.
- Coordination efforts with multiple jurisdictions and transit agencies occur to establish management, operational, and funding mechanisms and protocols for the routes.

6.2 CANDIDATE BRT ROUTES

Figure 8 shows three candidate BRT routes for south Placer County. BRT Route 1 would link the Sacramento State-Placer Campus (Placer Ranch Specific Plan), the H-P campus, the planned corporate center at Blue Oaks Boulevard and Washington Boulevard, the Galleria area, and the Watt/I-80 light rail station via SR 65 and the planned I-80 HOV lanes.

BRT Route 2 would link the Sacramento State-Placer Campus (Placer Ranch Specific Plan), the West Roseville Specific Plan town center, and the Placer Vineyards Specific Plan with the planned BRT extension along Fiddyment Road, local streets in the West Roseville and Sierra Vista developments, and Watt Avenue to Elverta Road.

BRT Route 3 would link the Galleria area and the Taylor park-and-ride lot with the Hazel and Sunrise light rail stations. The route would utilize Roseville Parkway, a short portion of Douglas Boulevard, Sierra College Boulevard, Hazel Avenue, and Folsom Boulevard.

All of the BRT routes could be phased in over time, with initial service provided either as enhanced bus and/or express bus type service. Implementation considerations that are specific to the three routes are summarized below.

- § BRT Route 1 (CSUS-Placer Campus to Galleria to Watt/I-80 LRT Station via I-80)
  - Initial phases of the CSUS-Placer Campus would need to be in place.
  - Coordination with RT on bus platform use at the Watt/I-80 LRT station.

- § BRT Route 2 (CSUS-Placer Campus to Placer Vineyards to Watt/I-80 LRT Station via Watt Ave.)
  - Initial phases of the CSUS-Placer Campus would need to be in place.
  - The West Roseville Specific Plan town center would need to be in place.
  - The planned Watt Avenue BRT line in Sacramento County would have to be in place.
  - Coordination with RT on bus platform use at the Watt/I-80 LRT station.

- § BRT Route 3 (Galleria to Hazel & Sunrise LRT stations via Sierra College Blvd./Hazel Ave.)
  - Coordination with RT on bus drop-off area use at the Hazel and Sunrise LRT stations.

It is anticipated that BRT Route 1 might be implemented first because it would serve several existing activity centers and Placer County jurisdictions would control the implementation of needed route improvements. Implementation of BRT Route 2 would require that Regional Transit implement BRT service in Sacramento County between I-80 and Sacramento County/Placer County line first, as it would not be cost-effective for Placer County to fund the operating costs for both the Sacramento County and Placer County portions of a BRT route serving the Watt Avenue corridor. As noted above, express bus service could be provided in the Watt Avenue corridor as an interim service, prior to BRT service being implemented in Sacramento County by RT.

6.3 RECOMMENDED CORRIDOR IMPROVEMENTS

Recommended improvements for the three BRT routes are shown in Figures 9-11 and are described below. Section 7 provides recommendations for station locations.

BRT Route 1

- Provision of dedicated HOV lanes on SR 65 (or HOT lanes) with a direct HOV connector from SR 65 to/from I-80
- Provision of HOV drop ramps from Roseville Parkway to and from the west via I-80
- Provision of a dedicated Arterial HOV/Transit lane on Blue Oaks Boulevard (i.e., six mixed flow lanes and two exclusive HOV/BRT lanes) from Fiddyment Road to Washington Boulevard
- Provision of a dedicated Arterial HOV/Transit lane on Fiddyment Road (i.e., four mixed flow lanes and two exclusive HOV/BRT lanes) from Sunset Boulevard to Blue Oaks Boulevard
- Provision of queue jump lanes at the intersections of Blue Oaks Boulevard/Washington Boulevard, Roseville Parkway/Washington Boulevard, and Roseville Parkway/Galleria Boulevard
- Provision of transit signal priority from the Sacramento State – Placer Campus station to the SR 65/Galleria Boulevard interchange

BRT Route 2

- Provision of a dedicated Arterial HOV/Transit lane on Fiddyment Road (i.e., four mixed flow lanes and two exclusive HOV/BRT lanes) from Sunset Boulevard to Del Webb Boulevard
- Provision of a dedicated Arterial HOV/Transit lane on Watt Avenue (i.e., four mixed flow lanes and two exclusive HOV/BRT lanes) from Sacramento/Placer County line to Pleasant Grove Boulevard
- Provision of transit signal priority along Fiddyment Road and Watt Avenue

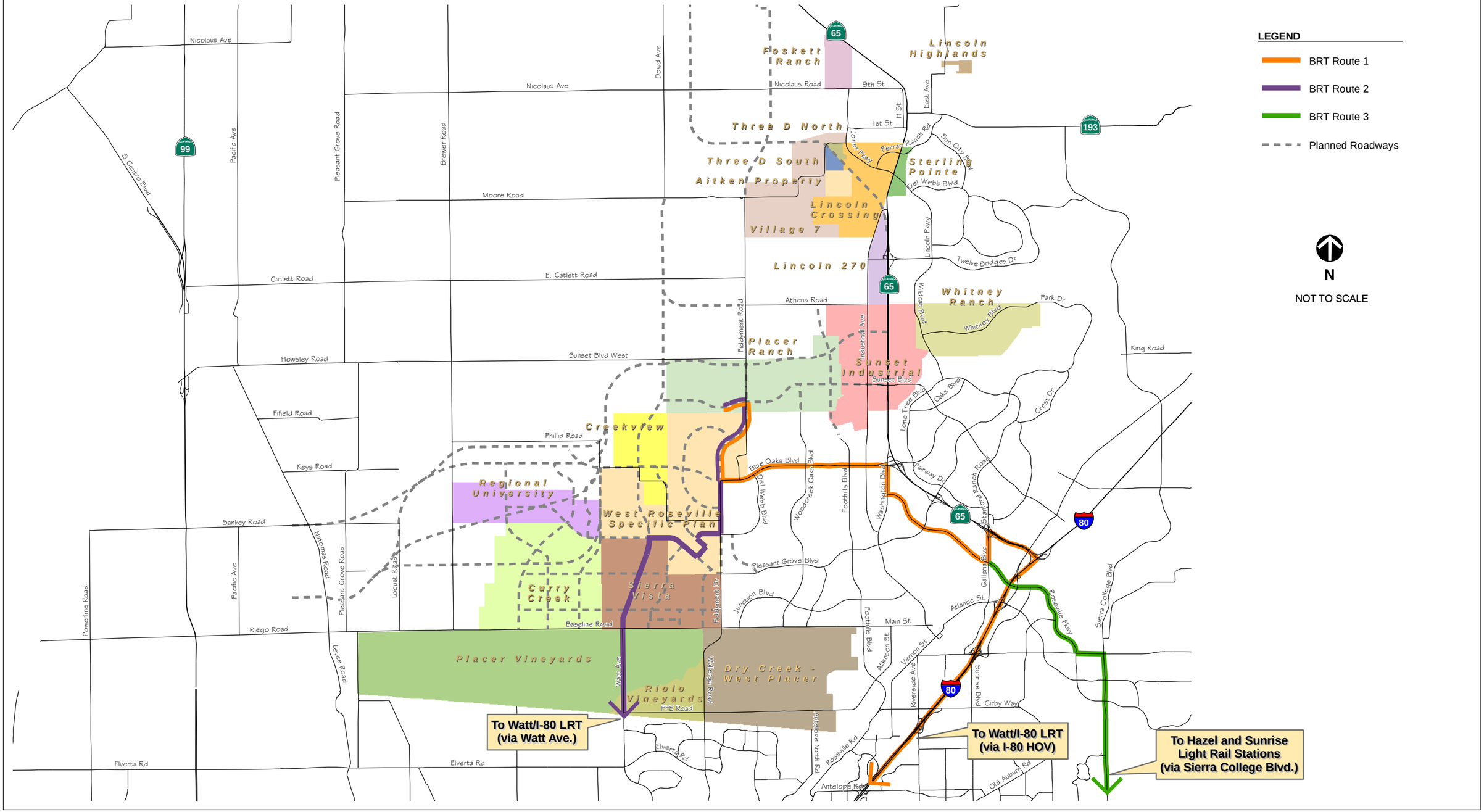
BRT Route 3

- Provision of queue jump lanes at the intersections of Roseville Parkway/Galleria Boulevard and Douglas Boulevard/Sierra College Boulevard
- Provision of transit signal priority along Roseville Parkway, Douglas Boulevard, and Sierra College Boulevard

Intelligent Transportation Systems (ITS) have played an important role to help transit agencies increase safety, operational efficiency and quality of BRT service. ITS applications are also fundamental to greatly enhancing BRT operations and achieving BRT system objectives including safety, reliability, efficiency, and passenger information availability. The main ITS elements for BRT include the following (TCRP Report 90):

- Automatic Vehicle Location and Control (AVLC)
- Passenger Information System
- Traffic Signal Priorities
- Automated Passenger Counting
- Electronic Fare Collection
- Vehicle Guidance and Control

According to TCRP Report 90, bus delays at traffic signal account for 10 to 20 percent of overall bus travel times and 50 percent or more of all delays. Traffic signal controls for BRT pre-emption as well as a range of priorities (i.e., passive, active, and real-time). Pre-emption is the highest level of control as it results in changes to the normal signal phasing and sequencing; it has had limited use, though, given its impact on signal coordination and pedestrians. The implementation of real-time signal priorities, which consider both auto and bus arrivals when making adjustments to the traffic signal, have been somewhat limited given the need for specialized equipment. The most frequently applied signal priorities are active or passive signal priority, which improve BRT speeds by modifying existing signal operations.



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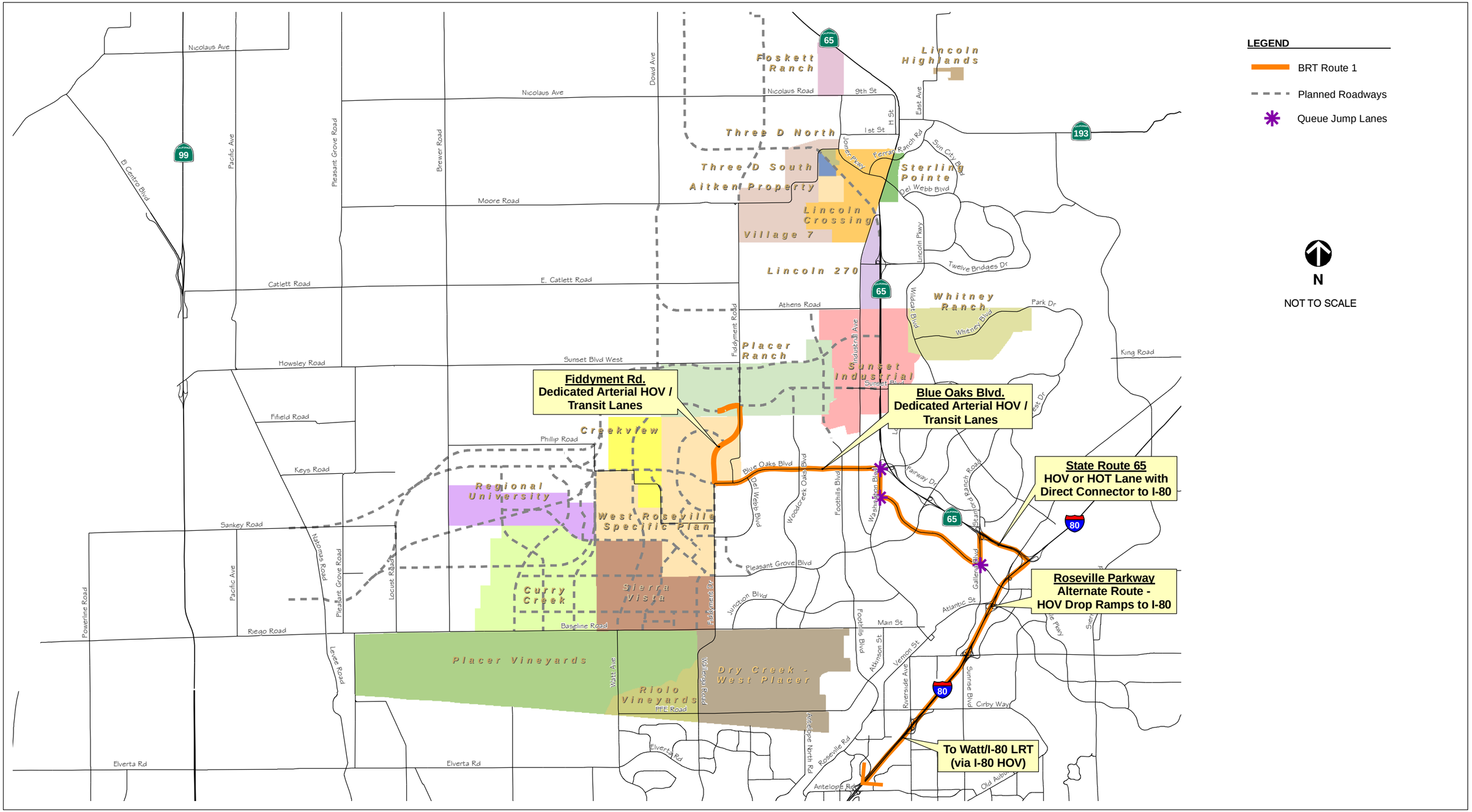
BRT ROUTES
FIGURE 8



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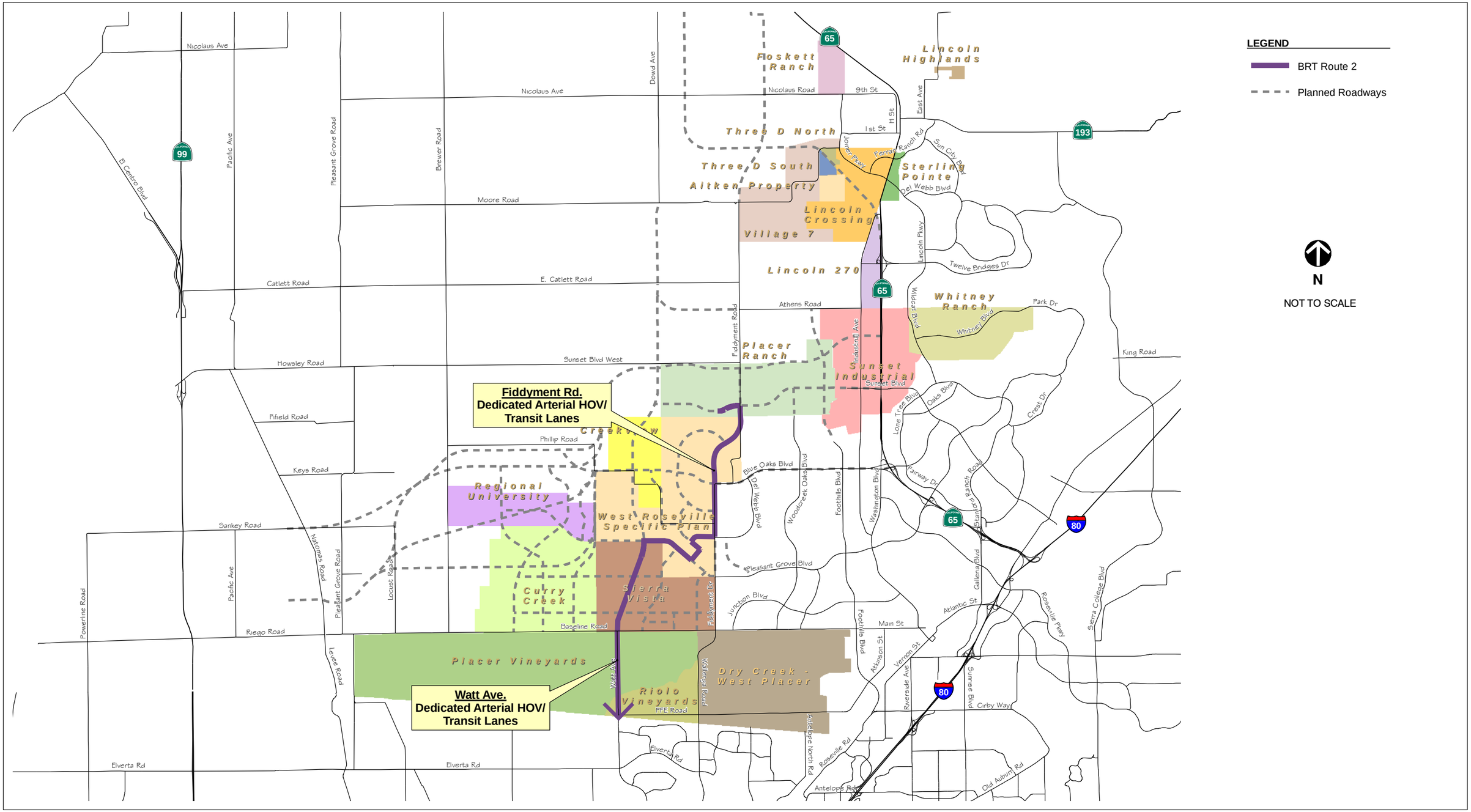
CANDIDATE BRT ROUTE 1 IMPROVEMENTS
FIGURE 9



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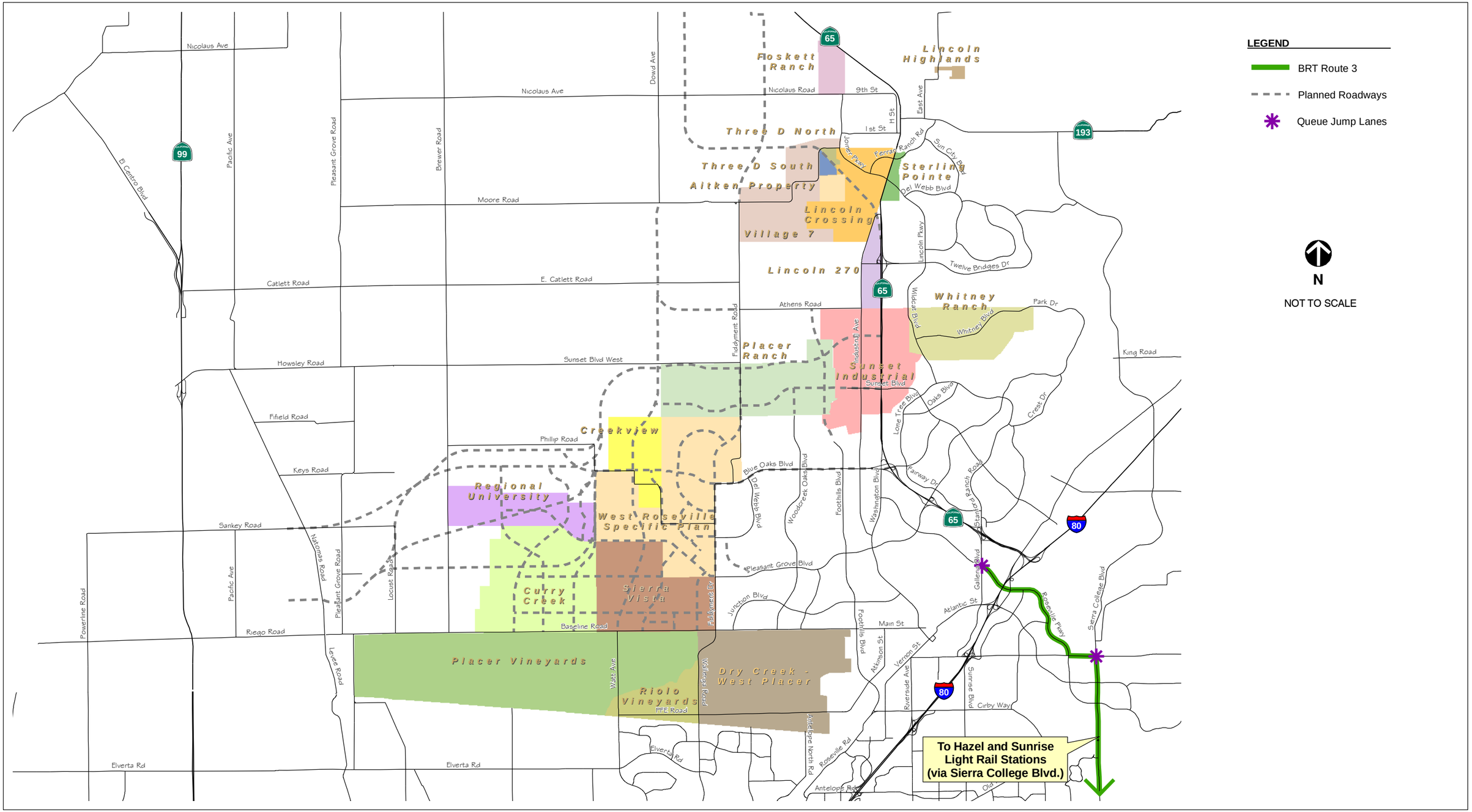
CANDIDATE BRT ROUTE 2 IMPROVEMENTS
FIGURE 10



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CANDIDATE BRT ROUTE 3 IMPROVEMENTS

FIGURE 11

7.0 BRT STATION PLAN

This section identifies candidate BRT station locations and types for south Placer County.

7.1 BRT STATIONS

According to the TCRP Report 90, BRT stations build the critical link between the BRT system, passengers, and other public transit services provided in the region. Different from a typical local bus station, BRT stations have their special role to support a strong and consistent identity for BRT in the community while respecting and enhancing the surrounding urban context. Generally, BRT stations present the following key features (TCRP Report 90):

- Provide high-quality design with passenger amenities (such as shelters, seating, and lighting) to support a positive public perception of BRT service.
- Respect the unique character of neighborhoods and districts and provide the appropriate balance between system continuity and contextual design.
- Integrate with the current and future land use to generate greater patronage and develop design concepts cooperatively with the surrounding community.
- Support an integrated system identity by keeping the transit service visible and recognizable to the community.
- Provide an opportunity to improve streetscapes by incorporating new amenities such as landscaping and recreational trails.

BRT Station Type

According to the *Characteristics of Bus Rapid Transit for Decision-Making* (FTA, 2004), current BRT systems have the following four station types with certain characteristics and range of costs.

Simple Stops consist of a transit stop with simple shelter to protect waiting passengers from the weather. In general, this type has the lowest capital cost that ranges from $15,000 to $20,000 per shelter (does not include cost of platform or soft-costs).

Enhanced Stops provide additional BRT station features such as weather protection and lighting. It also incorporates additional design treatments including walls, high-quality material finishes, and passenger amenities such as benches, pay phones, or trash cans. In general, the cost of an enhanced stop ranges from $25,000 to $35,000 per shelter (does not include cost of platform or soft-costs).

Designated Stations provide more complex BRT station features such as level passenger boarding and alighting, separate connection between platforms or between platform and passenger amenities. In general, the cost of a designated station ranges from $150,000 to $2.5 million per station (does not include cost of parking facilities or soft-costs).

Intermodal Terminal or Transit Center It is the most complex and costly type among the current BRT stations. It usually consists of level passenger boarding, a host of amenities, and transfer facilities between BRT service and other public transit modes (e.g., local bus and rail transit). In general, the cost of this type ranges from $5 to $20 million (or higher) per facility (does not include soft-costs).

Station Location and Spacing

BRT station location and spacing are critical factors to affect patronage and operating speeds. TCRP Report 90 defines the following principles to be considered to determine the BRT station location and spacing.

- BRT station should be located at major passenger concentrations (e.g., high-density residential areas, high-density employment areas, universities and high schools, and recreational centers).
- BRT station should be located near major bus routes and major arterial roadways.
- BRT station should be placed as far apart as possible and the recommended guidelines for BRT station spacing by arrival mode are show below.

- 0.25 – 0.33 miles for pedestrians
- 0.5 – 1.0 miles for bus
- 2.0 miles for automobile

Park-and-Ride Facilities

Park-and-ride facilities should be provided at BRT stations if a large number of potential riders are located beyond the appropriate walking distance or connecting bus service area. Generally, park-and-ride facilities are located in suburban areas mainly serving commuters. According to TCRP Report 90, the planning and design of park-and-ride facilities need to consider the following issues:

- Park-and-ride facilities should be located at a place with good road accessibility, potential expansion ability, and minimized backtracking for patrons.
- Park-and-ride facilities should be provided for every 1.2 to 5.0 boarding BRT passengers per parking space, depending on the number of feeder bus service. Ten to fifteen percent more spaces are desirable to ensure space availability.
- Park-and-ride facilities should have direct and convenient pedestrian access to BRT station. Separate access points for buses and automobiles are desirable when parking spaces exceed 500 or when parking fees are charged.

7.2 RECOMMENDED BRT TRANSIT CENTERS

BRT transit centers are recommended at the following locations based on the candidate BRT routes, a review of proposed development plans in south Placer County, and a review of super cumulative model data. The transit centers are anticipated to have higher ridership levels than the stations identified in the next section, given the type and density of adjacent land uses near the centers. Transit centers would provide more bus bays to facilitate higher level of connecting service from other transit lines. Figure 9 shows the location of the recommended transit centers.

BRT Route 1

- Placer Ranch: CSUS – Placer Campus
- Galleria Area

BRT Route 2

- Placer Ranch: CSUS – Placer Campus

BRT Route 3

- Galleria Area

- Hazel light rail station
- Sunrise light rail station

Table 5 provides a summary of suggested elements for each of the transit centers.

TABLE 5. SUGGESTED BRT TRANSIT CENTER ELEMENTS

BRT Transit Center	Bus Platform Layout	Park-and-ride Spaces	Station Access
BRT Route 1 – CSUS-Placer Campus	Two vehicles	300	FIddyment Road
BRT Route 1 – Galleria	Single vehicle	100	Roseville Parkway
BRT Route 2 – CSUS-Placer Campus	Two vehicles	300	Fiddyment Road
BRT Route 3 – Galleria	Single vehicle	100	Roseville Parkway
BRT Route 3 – Hazel LRT Station	n/a	n/a	Folsom Boulevard
BRT Route 3 – Sunrise LRT Station	n/a	n/a	Sunrise Boulevard

Source: Fehr & Peers, 2006.

The CSUS-Placer Campus transit center would be a new facility that would be constructed with the Placer Ranch Specific Plan development. The Galleria transit center is envisioned as a significant upgrade of the existing transit station that is currently accessed via Roseville Parkway, with ultimate costs in the $5 to $10 million range, to provide for structured parking and improved access. Construction of the Galleria transit center would likely be phased, with interim access and park-and-ride improvements. The Hazel and Sunrise stations, along Folsom Boulevard, are existing light rail stations that will ultimately have a total of 919 park-and-ride spaces. The Sunrise station also serves as a bus terminal.

7.3 RECOMMENDED BRT STATIONS

BRT stations are recommended at the following locations based on the candidate BRT routes, a review of proposed development plans in south Placer County, and a review of super cumulative model data. Figure 12 shows the location of the recommended stations.

BRT Route 1

- H-P Campus Area
- SR 65/Blue Oaks Boulevard: Planned Corporate Center

BRT Route 2

- West Roseville Specific Plan town center
- Placer Vineyards: East Transit Center Drive/16th Avenue

BRT Route 3

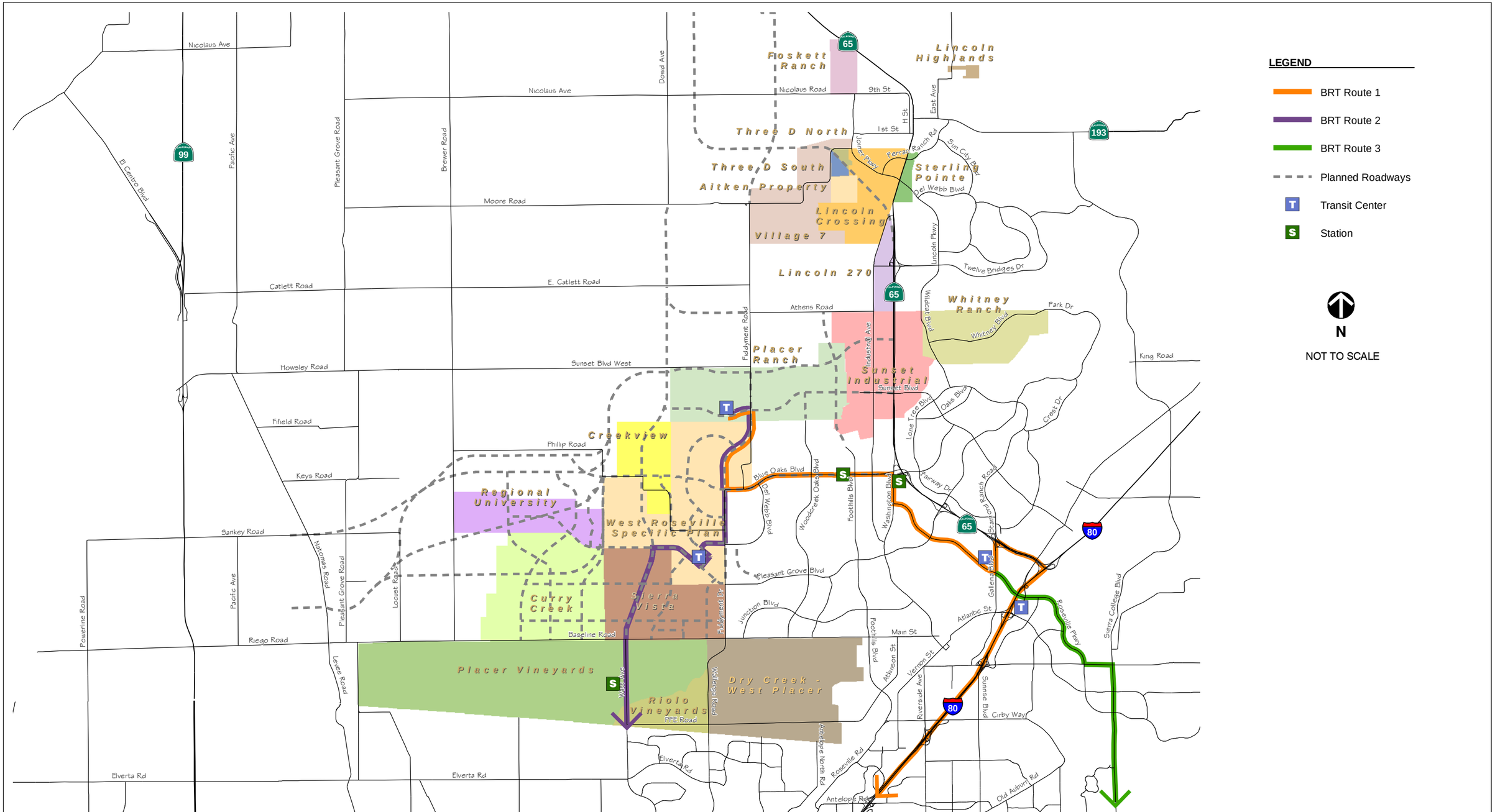
- Taylor park-and-ride lot

Table 6 provides a summary of suggested elements for each of the BRT stations.

TABLE 6. SUGGESTED BRT STATION ELEMENTS

BRT Station	Bus Platform Layout	Park-and-ride Spaces	Station Access
BRT Route 1 – H-P Campus	Single vehicle	100	Blue Oaks Boulevard
BRT Route 1 – Planned Corporate Center	Single vehicle	200	Washington Boulevard
BRT Route 2 – West Roseville Town Center	Single vehicle	50	Pleasant Grove Boulevard
BRT Route 2 – Placer Vineyards Center	Single vehicle	200	Watt Avenue
BRT Route 3 – Taylor park-and-ride lot	n/a	n/a	Taylor Road

Source: Fehr & Peers, 2006.



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BRT STATIONS
FIGURE 12

APPENDIX A – REGIONAL TRANSIT (RT) BUS SERVICE EVALUATION GUIDELINES

DEFINITIONS FOR
SACRAMENTO REGIONAL TRANSIT (RT) FIXED-ROUTE BUS SERVICES

SERVICE	CHARACTERISTICS
LOCAL BUS	• Less than 25% of bus stops are spaced greater than ½ miles apart. • Average headway 20 minutes or more; may have peak-hour service only; routes may have major direction changes, bends and loops. • Less than 25% of route has Traffic Signal Priority; buses may have real-time passenger information. • Typically, no special branding of vehicles or stops. • Uses Mixed-Flow Traffic Lanes (some intersections may have queue jumps). • Conventional 40 foot buses, may include Neighborhood Ride Buses. • Passengers pay on-board or display passes to the operator/inspector. • This service operates at low average route speeds (6-11 mph).
EXPRESS (COMMUTER) BUS	• Between 25-75% of stops spaced greater than ½ mile apart. • Average headway peak-hour service only; generally straight-line routes, some bends and loops. • Less than 25% of route has Traffic Signal Priority; some stations and buses may have real-time passenger information. • Typically, no special branding of vehicles or stops. • Uses Mixed-Flow Traffic Lanes (some intersections may have queue jumps); uses at-grade designated transit/HOV lanes. • Stylized or specially upgraded buses (40ft. or 60ft.) • Passengers pay on-board or display passes to the operator/inspector. • This service operates with a higher average route speed than local bus service.
ENHANCED BUS (E-Bus)	• Between 25-75% of stations spaced grater than ½ mile apart; station platform height allows level entry into vehicles. • Average headway 15 minutes or less; straight route with few bends and loops. • Between 25-75% of route has Traffic Signal Priority; coordinated traffic signal timing for transit service; some stations and buses may have real time passenger information. • Vehicles and stations have special color and appearance; stations are specially signed, illuminated with amenities. • Uses Mixed-Flow Traffic Lanes (some may have queue jumps); and, at-grade designated transit lanes/HOV lanes. • Stylized or specially upgraded buses (40ft or 60ft). • Pay on-bard or show pass/transfer to operator; passengers may possess proof-of-payment, display on demand. • This service operates with a higher average route speed than local bus service, But is slower than BRT.
BUS RAPID TRANSIT (BRT)	• More than 75% of stations are spaced greater than ½ miles apart; station platform height allows level entry into vehicles. • Average headway 15 minutes or less; straight-line route with few bends and loops. • Coordinated traffic signal timing for transit service; more than 75% of route has Traffic Signal Priority; more than 75% of stations have real-time passenger information; buses have real-time passenger information. • Vehicles and stations have special color and appearance; stations are specially signed illuminated with amenities. • Over 50% of the route uses grade-separated exclusive lanes (transitways); and/or designated transit/HOV lanes; may incorporate lane assist and precision docking guidance technology. • Specialized BRT vehicles (40ft, 60ft or 80ft. long); stylized or specially upgraded buses (40ft or 60ft). • Pay on-bard or show pass/transfer to operator; passengers may possess proof-of-payment, display on demand. • This service achieves high average route speeds (20 mph or greater off-peak, 15 mph or greater during peak periods).

SACRAMENTO REGIONAL TRANST (RT) BUS SERVICE EVALUATION CHECKLIST

ELEMENT	CRITERIA	Local Bus	Express Bus	Enhanced Bus	Bus Rapid Transit
Stations	More than 75% of stations spaced greater than ½ mile apart.				X
	Between 25-75% of stations spaced greater than ½ mile apart.		X	X	
	Less than 25% of stops spaced greater than ½ mile apart.	X			
	Station platform height allows level entry into vehicles			X	X
Service & Operating Plan	Average headway 15 minutes or less			X	X
	Average headway 20 minutes or more	X			
	Average headway Peak Hour Service Only	X	X		
	Straight-line route with few bends or direction changes			X	X
	Generally straight-line route, some bends and loops		X		
	Major direction changes, bends, neighborhood loops	X			
Intelligent Transportation Systems (ITS)	Coordinated traffic signal timing for transit service			X	X
	More than 75% of route has Transit Signal Priority				X
	Between 25-75 % of route has Transit Signal Priority			X	
	Less than 25% of route has Transit Signal Priority	X	X		
	More than 75% of stations have real-time passenger information				X
	Some stations have real time passenger information		X	X	
	Buses have real-time passenger information	X	X	X	X
Special Branding Identification	Vehicles have special color and appearance			X	X
	Stations have special color and appearance, are specially signed, illuminated, with amenities			X	X
Running Ways	Over 50% of the route is grade-separated exclusive lanes (transitway)				X
	At-grade designated transit lanes/HOV lanes		X	X	X
	Mixed flow lanes with queue jumps at intersections	X	X	X	
	Lane-assist and precision-docking guidance technology				X
Vehicles	Specialized BRT vehicles (40ft, 60ft, or 80ft)				X
	Stylized or specially upgraded buses (40ft or 60ft)		X	X	X
	Conventional 40ft buses, may include Neighborhood Ride Buses	X			
Fare Collection	Pay on-board or show pass/transfer to the operator	X	X	X	X
	Possess proof-of-payment, display on demand of inspector			X	X
*FOR THE ROUTE, SUM UP THE NUMBER OF (**X**) IN EACH COLUMN AND DIVIDE BY THE FACTOR SHOWN (PLACE ANSWER BELOW)*		÷ 9	÷ 10	÷ 15	÷ 17
RESULTANT PROPORTION OF EACH BUS SERVICE TYPE REPRESENTED					