



FEHR & PEERS
TRANSPORTATION CONSULTANTS



CONCEPTUAL BUS RAPID TRANSIT (BRT) PLAN FOR SOUTH PLACER COUNTY

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PREPARED FOR:
PLACER COUNTY

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1.0 BACKGROUND OVERVIEW

1.1 STUDY PURPOSE

Placer County Department of Public Works contracted with Fehr & Peers to develop a conceptual Bus Rapid Transit (BRT) plan for south Placer County. The purpose of developing this plan is 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. 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.*
- *Identify potential BRT stations in south Placer County based on current development applications, likely future development trends, and potential alignments of new roadways such as Placer Parkway.*
- *Provide transit-oriented land use development criteria for the ½ mile radius surrounding potential BRT stations.*
- *Evaluate current development plans against the transit-oriented land use development criteria.*
- *Determine which potential stations have the greatest opportunity to have transit-oriented land use development.*
- *Develop BRT alignment options that connect the potential stations with the greatest opportunity for transit-oriented development.*
- *Recommend a conceptual BRT alignment and associated station locations for potential incorporation in the circulation and land use elements of the general plan and relevant specific plans.*

1.2 ORGANIZATION OF THE REPORT

The remainder of this report is organized into four sections. Section 2 describes the basic concepts of BRT. Section 3 describes the results of a literature review on the topic of BRT station land use development criteria. Section 4 contains an evaluation the potential BRT stations for south Placer County while the final section discusses a conceptual BRT system alignment for south Placer County.

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 minimum 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 allow uninterrupted flow by providing full control of access, such as bus tunnel, grade-separated busway, 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 partial control of access, such as at-grade busway. 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 across 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. 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 have no control of access, such as mixed traffic lanes. Mixed flow lanes are the most basic form of BRT running way. Most rubber tired urban transit service operates on mixed flow lanes. However, because other vehicles share the same lane as BRT vehicles, BRT vehicles face delays due to conflicts with other vehicles.



2.2 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 a 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. 10% to 15% 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.

2.3 BRT Vehicles

BRT vehicle design has an important impact on variety aspects of BRT system performance such as revenue speed, reliability, capacity, and maintenance cost. The vehicle configuration is the primary vehicle planning/design parameter for BRT systems and it is a function of the combination of size, floor height, and body type. In United States, BRT vehicles range from low-floor two-axle 40- or 45-foot units to three-axle 60-foot articulated buses in five vehicle configurations. The characteristics and range of costs for the five vehicle

configurations are described below according to the *Characteristics of Bus Rapid Transit for Decision-Making* (FTA, 2004)

Conventional Standard vehicles have a conventional boxy body with a full length of 40-45 feet. The partial low-floor variety contains internal floors that are significantly lower than high-floor buses. This type typically has at least two doors and a rapidly deployable ramp for wheelchairs. A 40-foot vehicle can accommodate 35-44 seated passengers and 50-60 seated/standing patrons. A 45-foot vehicle can accommodate 35-52 seated passengers and 60-70 seated/standing patrons. The cost of a conventional standard vehicle ranges from \$300,000 to \$350,000.



Stylized Standard vehicles have all the features of conventional type and additionally incorporate slight body modification to make the body more modern and attractive. The capacity of this type is similar to a conventional standard vehicle. The cost of a stylized standard vehicle ranges from \$300,000 to \$370,000.



Conventional Articulated vehicles have a longer body with approximately 50% more carrying capacity than standard vehicles. Its seating capacity varies between 31 (four wide doors) and 65 (2 doors) depending on the number and location of doors, while its total seating/standing capacity is about 80-90 patrons. The cost of a conventional articulated vehicle ranges from \$500,000 to \$645,000.



Stylized Articulated vehicles are more modern, attractive and comfortable to meet BRT communities' desire. It has at least three doors with 2 double stream and quickly-deployed ramps to shorten dwelling time. The capacity of this type is similar to a conventional articulated vehicle. The cost of a stylized articulated vehicle ranges from \$630,000 to \$950,000.



Specialized BRT Vehicles Vehicles have a modern and aerodynamic body similar to a rail vehicle. It also includes advanced propulsion and ITS guidance systems. The capacity of this type is similar to a conventional articulated vehicle. The cost of a specialized BRT vehicle ranges from \$950,000 to \$1,600,000.



2.4 Fare Collection

Fare collection is an important factor to the BRT operating system, and it includes two primary aspects – fare structure and fare collection approach. Descriptions of these aspects according to TCRP Report 90 are provided below.

Fare Structure

There are two types of fare structure concepts – same fare and premium fare. Under same fare structure, BRT fares are same as other bus service, and the unified structure can provide easy understanding for riders and facilitated transfers between BRT and feeder bus services. Premium fare structure establishes a surcharge for BRT service. It has been commonly used for express bus service in cities like New York City and Houston, and may be appropriate for BRT service on grade-separated busways.

Fare Collection Approach

The basic objective of fare collection process is to maximize passenger convenience and minimize station dwelling time. Existing fare collection approaches vary widely worldwide but overall, there are two types of fare collection approach.

Off-board Collection Passengers can pay fares before boarding and thereby this approach can reduce passenger service times, station dwelling times, and overall vehicle travel times. Off-board fares can be collected through a variety of ways including prepayment, platform collection, vending machines, proof of payment, and free-fare zones.

On-board Collection Passengers pay fares on vehicles and this approach is commonly used at low-demand stations, during off-peak periods, or for special fare collection capital reduction considerations. On-board fares can be collected through a variety of ways including single-door entry collection, pay enter inbound and pay leave outbound, passes, and smart cards.

2.5 ITS Applications

Intelligent Transportation Systems (ITS) have played an important role to help transit agencies increase safety, operational efficiency and quality of 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

2.6 BRT Service Plans

As a critical factor to affect passenger's perception of BRT service, BRT service plans need to be frequent, direct, easy-to-understand, comfortable, reliable, operationally efficient, and above all, rapid. The general guidelines for BRT service plan are shown below (TCRP Report 90).

- BRT service plans generally prefer to have few high-frequency BRT routes than more routes with long headways.
- Through service, at least for basic all-stop routes, is desirable when the round trip can be made in 2 hours (3 hours maximum).
- Busway route structure should include basic all-stop service complemented by express (or limited-stop), feeder, and connector service.
- The basic all-stop service should run all-day, from about 6 a.m. to midnight, 7 days a week; and the express service should operate weekdays throughout the day or just during peak hours.
- The basic BRT service should operate at an interval of 5-10 minutes during peak hours, and 12-15 minutes at other times.

3.0 BRT STATION DEVELOPMENT CRITERIA LITERATURE REVIEW

BRT planning in south Placer County should be consistent with the guidelines and criteria set forth by FTA. For the purpose of this conceptual plan, the primary factor to the BRT planning process is the intensity and growth prospects and patterns of south Placer area. As a first step in evaluating potential Bus Rapid Transit (BRT) service in south Placer County, a literature review was conducted regarding the influence of urban form (i.e., land use development density and intensity) on potential transit use.

This section summarizes the results of a literature review regarding the impact of land use and urban form factors on transit use. This literature review covers a variety of sources and authors, focusing on the past 10 years, but also covering important earlier studies such as Public Transportation and Land Use Policy, Indiana University Press, 1977 and A Guide to Land Use and Public Transportation, U.S. DOT, 1989, whose findings have been borne out and elaborated by subsequent investigations.

The literature review included review of three fairly recent and very comprehensive literature reviews by Cervero and Seskin (1995) and Cervero and Ewing (1998:2002). This was supplemented by a search of the Bureau of Transportation Statistics TRIS online database for literature published between 1998 and May 1, 2003, and a search of UC Berkeley's Harmer E. Davis Transportation Library's databases. To glean the results of completed studies not yet published in journals, a similar search was conducted of the nearly 1,400 technical papers presented at the 82nd Transportation Research Board Annual Meeting in January 2003.

The following five specific questions guided the literature review.

- What land use factors contribute to increased transit ridership?
- What specific empirical evidence about transit proximity and ridership exists (for example what percent of people within 1/2 mile of transit use it)?
- Is there evidence of specific California relationships between land use and transit ridership?
- What other station area characteristics support or enhance transit ridership?
- What land use density or intensity thresholds apply for supporting different transit modes?

3.1 LAND USE CHARACTERISTICS

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.

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.

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.

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 1/2 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 1/4 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 at 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 attached (Table 1). 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 many of the data are older still.
- 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, 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 1. 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.

3.2 STATION AREA DESIGN CHARACTERISTICS

Design that minimizes walk times by providing sidewalks and walkways that are complete and direct can increase walking as well as walking access to transit. A variety of studies (e.g. Cervero 1993, Cervero and Gorham, 1995, Dill 2003) have found that design matters for transit access. There are upper limits to what design can do to encourage walking: Untermann (1984) and others suggest that one-half mile is the most Americans can be expected to walk under ideal circumstances.

The exact effect of such design features is not easily isolated, but most researchers have concluded that the effect of design alone is much less than that of density, and that design changes are most effective in conjunction with higher densities. Using regression analysis to compare existing neighborhoods that were transit oriented to demographically comparable auto-oriented neighborhoods in the Los Angeles area, Cervero and Gorham (1995) found that density had more than twice as much impact as neighborhood design.

4.0 POTENTIAL BRT STATION EVALUATION FOR SOUTH PLACER COUNTY

This section describes the BRT station development criteria for south Placer County followed by a discussion of the land use evaluation used to identify potential BRT stations in south Placer County. Figure 1 shows the study area of south Placer County.

4.1 POTENTIAL BRT STATION EVALUATION CRITERIA

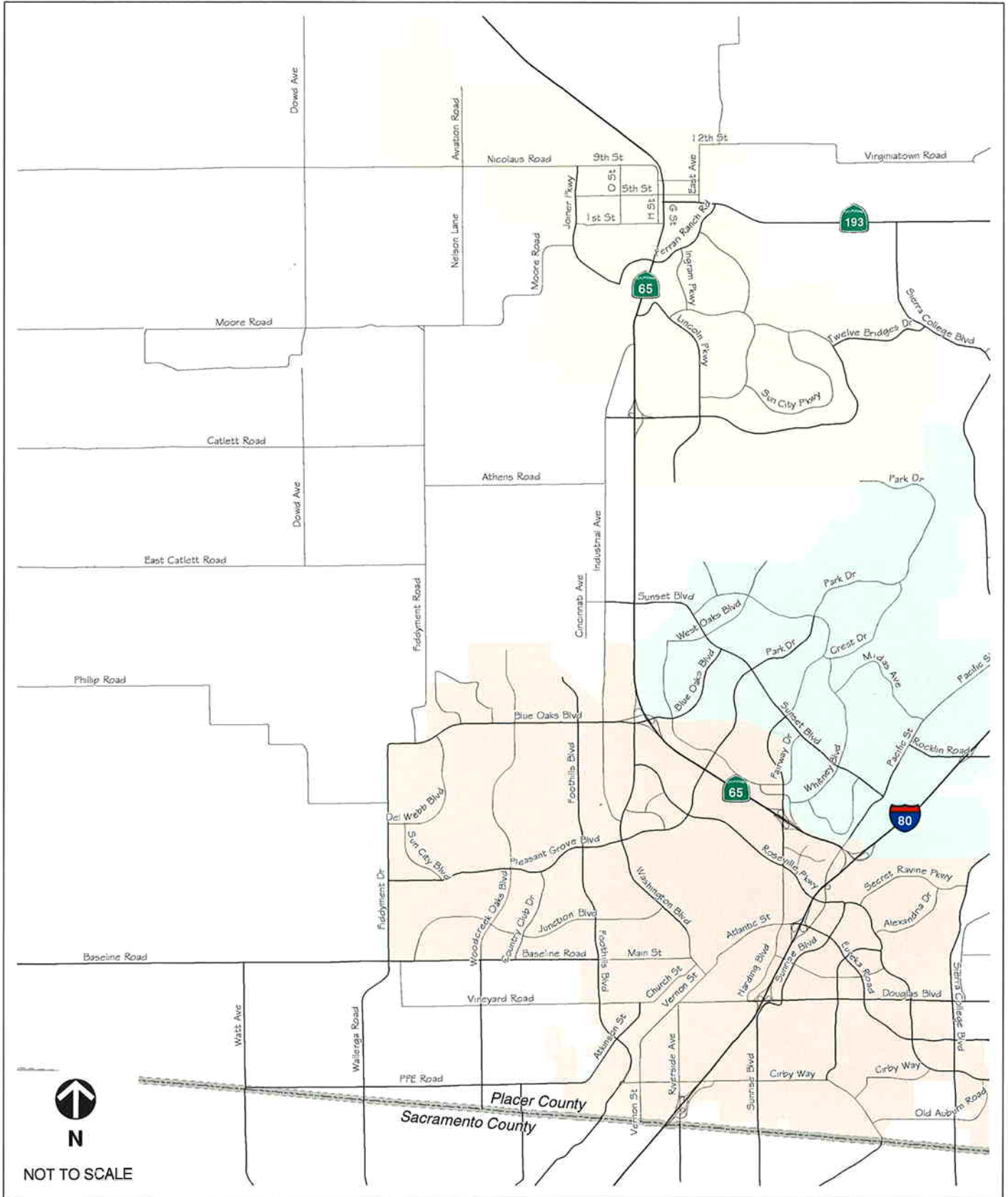
According to TCRP Report 90, one of the key conditions for developing an effective BRT system is that the proposed location be an urbanized area with a strong central business district or activity centers with dense patterns that facilitate transit use. To make transit effective, the land use patterns should be complementary, meaning high residential densities and concentrated employment near stations. A key question related to this condition is what minimum density or intensity of land use is required to facilitate transit use. Based on the literature discussed above, the following criteria are recommended for use in this study when evaluating potential BRT station locations in south Placer County.

- Minimum residential density of 9 dwelling units per acre (within ½ mile of station)
- Minimum non-residential FAR of 1.0 (within ½ mile of station)

While lower density and intensity levels may be able to support express bus or BRT service, these criteria are considered to be thresholds at which an effective express bus or BRT service could be implemented within the generally auto-oriented development patterns of the study area.

Given the small number of studies quantifying the effect of a nearby college campus on LRT or BRT ridership, we recommend treating Full-Time Equivalent students as full-time employees for purposes of ridership evaluation in this study. Students take transit more often than the general population, but even full-time students do not commute to the university every day. This method would thus effectively assume that students' higher propensity to ride transit is effectively offset by their less than five-day-a-week commute pattern. This is likely to provide a somewhat conservative assumption (i.e., tending to underestimate student ridership) but will result in a superior forecast than if students are left out of the analysis altogether.

In addition to these criteria, potential station locations will be evaluated for their connectivity to surrounding land uses by walking, bicycling, and driving. While it is difficult to quantify the connectivity of a potential station, existing and planned roadway, bicycle, and pedestrian facilities within the study area were mapped and reviewed during the station evaluation process to evaluate whether good access between potential stations and nearby land uses, especially universities, is provided or planned for all support modes.



4.2 TRANSPORTATION FACILITIES AND DEVELOPMENT PROJECT REVIEW

Existing and planned transportation facilities (e.g., bicycle, transit, and roadway) and planned development projects within the study area were reviewed and summarized as part of station evaluation process. Figure 2 shows the existing and planned bicycle facilities in the study area while Figures 3 and 4 show the existing local and commuter transit services and facilities, respectively. The key planned roadway improvements in the study area are summarized in Table 2. 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.

In addition, the following major development projects are planned in the study area based on the inputs from County and city staff.

- Placer Ranch Specific Plan
- West Roseville Specific Plan
- Placer Vineyards Specific Plan
- De La Salle Specific Plan
- Sunset Industrial Specific Plan
- Sunset Ranchos Specific Plan
- Lincoln 270 Specific Plan
- Lincoln Crossing Specific Plan
- Sterling Pointe Specific Plan
- Aiken Property
- Three D South
- Three D North
- Foskett Ranch Specific Plan
- Lincoln Highlands
- Meadowlands

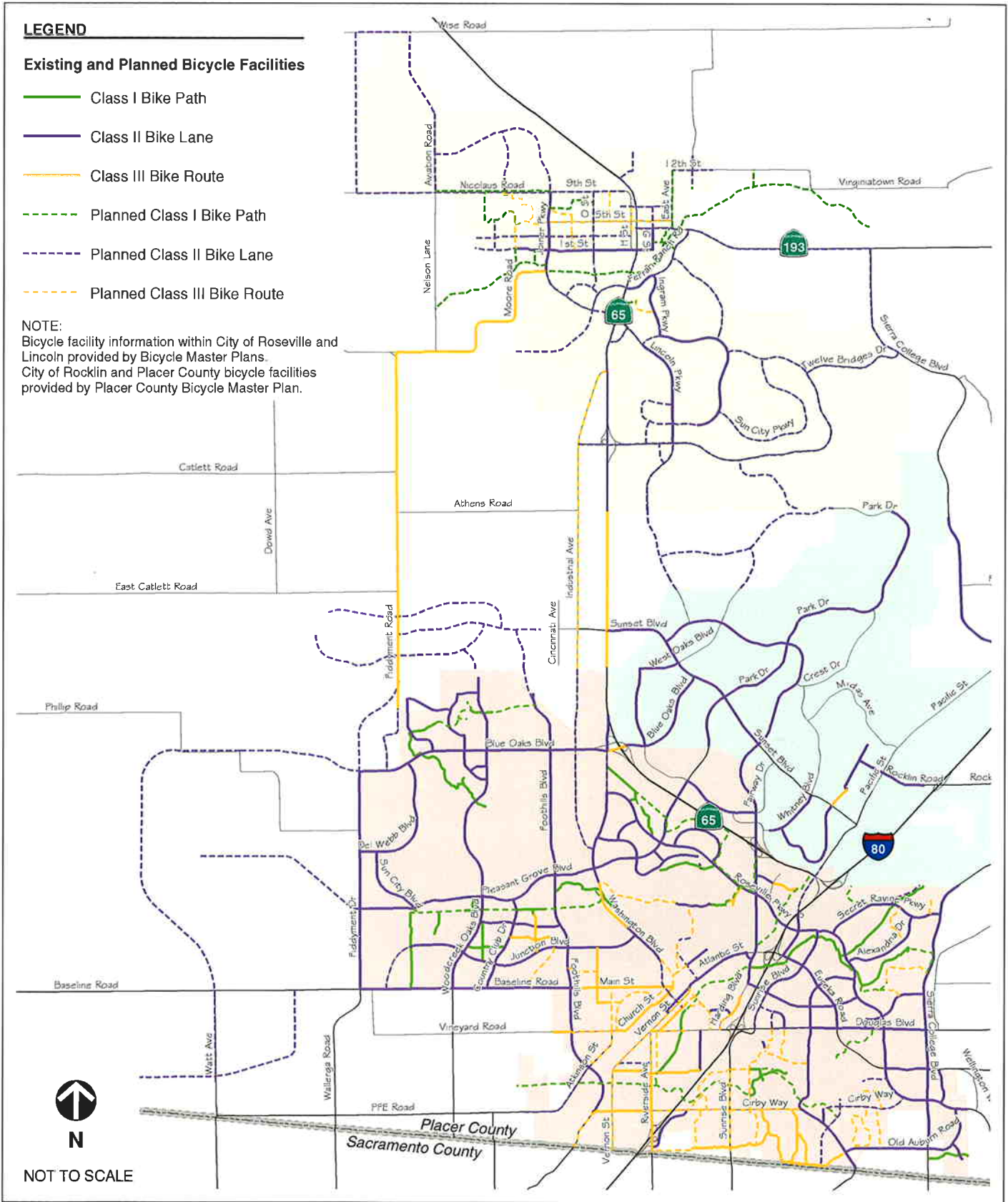
Figure 5 shows the planned major transportation and development projects in the project vicinity.

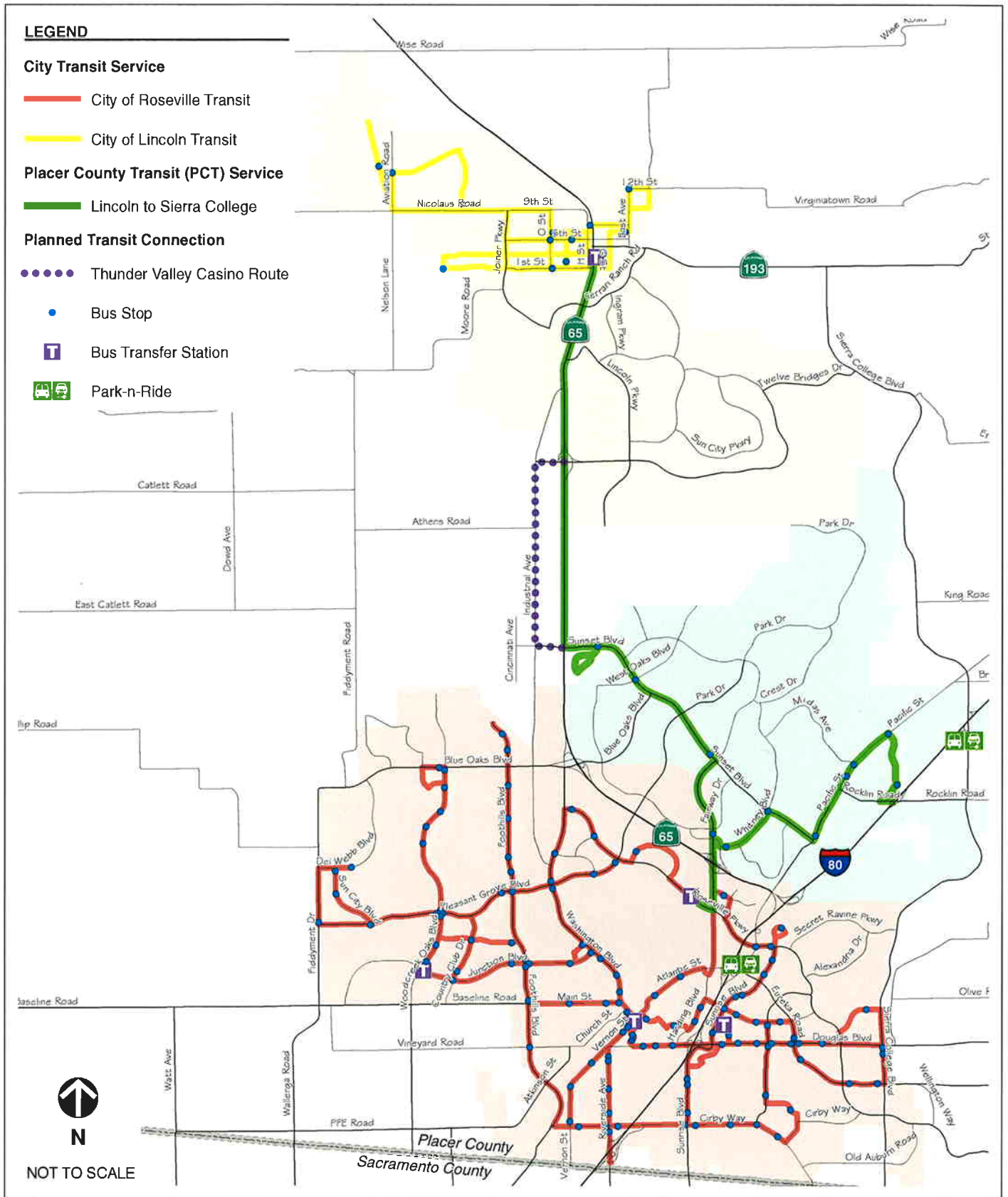
LEGEND

Existing and Planned Bicycle Facilities

- Class I Bike Path
- Class II Bike Lane
- Class III Bike Route
- - - Planned Class I Bike Path
- - - Planned Class II Bike Lane
- - - Planned Class III Bike Route

NOTE:
 Bicycle facility information within City of Roseville and Lincoln provided by Bicycle Master Plans.
 City of Rocklin and Placer County bicycle facilities provided by Placer County Bicycle Master Plan.





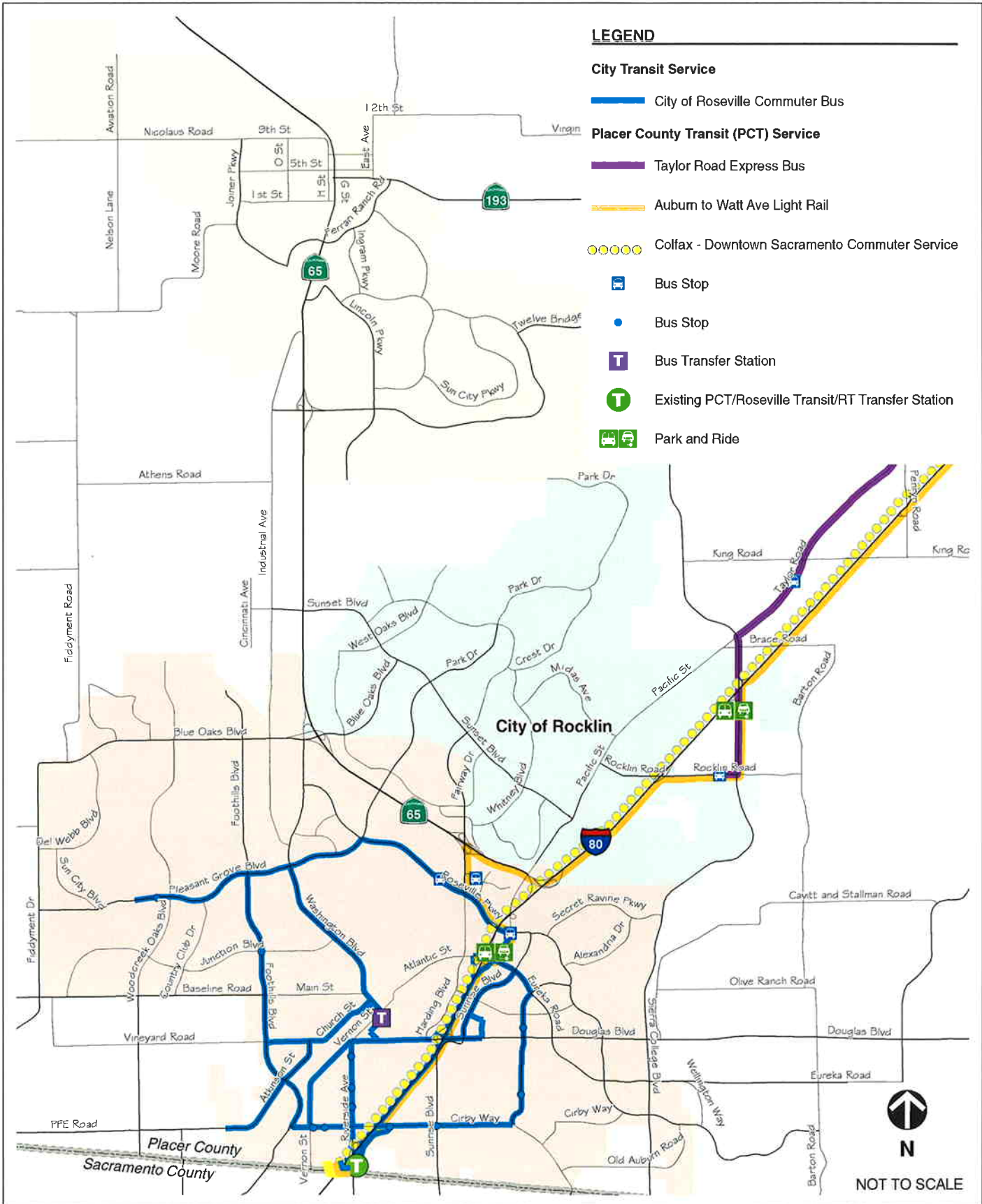


TABLE 2. STUDY AREA PLANNED ROADWAY IMPROVEMENTS BY YEAR 2025

Roadway	Improvement	Source	Year
Baseline Rd	Widen from 2 to 4 lanes, from Fiddymnt Rd to Brady Ln	MTP	2008
Baseline Rd	Widen from 2 to 6 lanes, from Sutter County Line to Fiddymnt Rd	County	B 2025
Baseline Rd	Widen from 2 to 6 lanes, from Watt Ave to Fiddymnt Rd	County	B 2015
Blue Oaks Blvd	Extend with 4 lanes, from Fiddymnt Rd to west side of WRSP	Roseville	2015
Douglas Blvd	Widen from 4 to 6 lanes, from Cavitt Stallman Rd south to Sierra College Blvd	MTP	2010
Fiddymnt Rd	Widen to 4 lanes, from Pleasant Grove Blvd to Northern City limits	Roseville	2012
Fiddymnt Rd	Widen to 4 lanes, from Baseline Road to north end of WRSP	Roseville	2020
Foothills Blvd	Extend with 2 lanes, from Sunset Blvd to Athens Rd	County	2005
Foothills Blvd	Extend with 2 lanes, from City Limits to Sunset Boulevard	County	2005
Foothills Blvd	Widen from 4 to 6 lanes, from Cirby Way to Pleasant Grove Blvd	MTP	2019
Nelson Rd	Widen from 2 to 4 lanes, from Route 65 Bypass to Nicolaus Rd	MTP	2014
PFE Rd	Widen from 2 to 4 lanes, from North Antelope Rd to Roseville City Limits	MTP	2010
Philip Rd	Realign with 2 lanes, between Blue Oaks Blvd and Bob Doyle Dr	Roseville	2010
Placer Parkway	Construct 4 lanes between SR 65 and Fiddymnt Road	County	2025
Placer Parkway	Construct 2 lanes between Fiddymnt Road and Pleasant Grove Road	County	2016
Placer Parkway	Construct 4 lanes between Pleasant Grove Road and SR 99	County	2025
Pleasant Grove Blvd	Widen from 4 to 6 lanes, from Foothills Blvd to Woodcreek Oaks Blvd	Roseville	2010
Pleasant Grove Blvd	Widen from 2 to 4 lanes, from Woodcreek Oaks Blvd to Sun City Blvd	MTP	2006
Pleasant Grove Blvd	Extend with 4 lanes, from current terminus to West Side Drive	Roseville	2012
Pleasant Grove Blvd	Extend with 2 lanes, west of West Side Drive	Roseville	2012
Roseville Pkwy	Extend over Union Pacific Rail Road tracks	Roseville	2015
Roseville Pkwy	Construct 4 lanes, from Washington Blvd to Foothills Blvd	Roseville	2015
Roseville Pkwy	Widen from 2 to 4 lanes, from City Limits to Sierra College Blvd	MTP	2022
Route 65	Construct Sunset Blvd interchange	MTP	2008
Route 65	Widen from 2 to 4 lanes, from Gladding to Westlake Blvd	MTP	2007
Sierra College Blvd	Widen from 2 to 4 lanes, from Route 193 to Loomis Town Limits	MTP	2012
Sierra College Blvd	Widen from 2 to 4 lanes, from South Rocklin City Limits to Douglas	MTP	2010
Sierra College Blvd	Widen from 4 to 6 lanes, from Roseville City limits to Sacramento County Line	MTP	2016
Sierra College Blvd	Widen to 6 lanes, from I-80 to South Rocklin City Limits	MTP	2010
Sunset Blvd	Extend with 2 lanes, from Cincinnati Ave to Foothills Blvd	County	2005
Sunset Blvd	Widen from 2 to 4 lanes, from SR 65 to Cincinnati Ave	County	2005
Sunset Blvd	Extend with 2 lanes, from Foothills Blvd to Fiddymnt Rd	County	2012
Walerga Rd	Widen from 2 to 4 lanes, from Baseline Rd to Sacramento County Line	MTP	2004
Walerga Rd	Widen bridge at Dry Creek from 2 to 4 lanes	MTP	2009
Watt Ave	Widen from 2 to 4 lanes, from Baseline Rd to Sacramento County Line	MTP	2018
Woodcreek Oaks Blvd	Widen from 2 to 4 lanes, from Junction Blvd to northern city limits	MTP	2020





Notes: B 2020 = Before Year 2020; WRSP = West Roseville Specific Plan

Placer Parkway has four alignment alternatives.

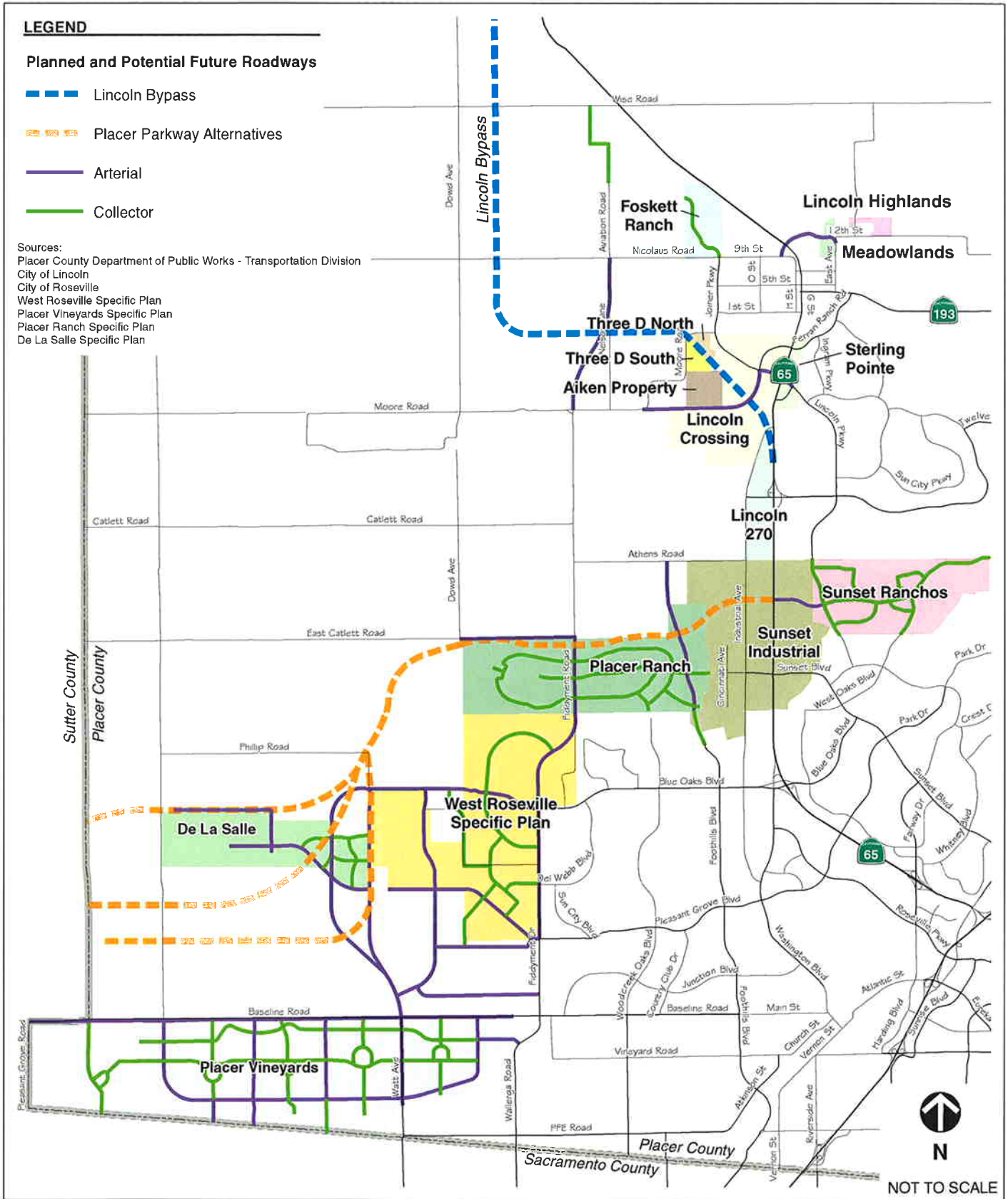
Source: Placer County and City of Roseville, 2004.

LEGEND

Planned and Potential Future Roadways

-  Lincoln Bypass
-  Placer Parkway Alternatives
-  Arterial
-  Collector

Sources:
 Placer County Department of Public Works - Transportation Division
 City of Lincoln
 City of Roseville
 West Roseville Specific Plan
 Placer Vineyards Specific Plan
 Placer Ranch Specific Plan
 De La Salle Specific Plan



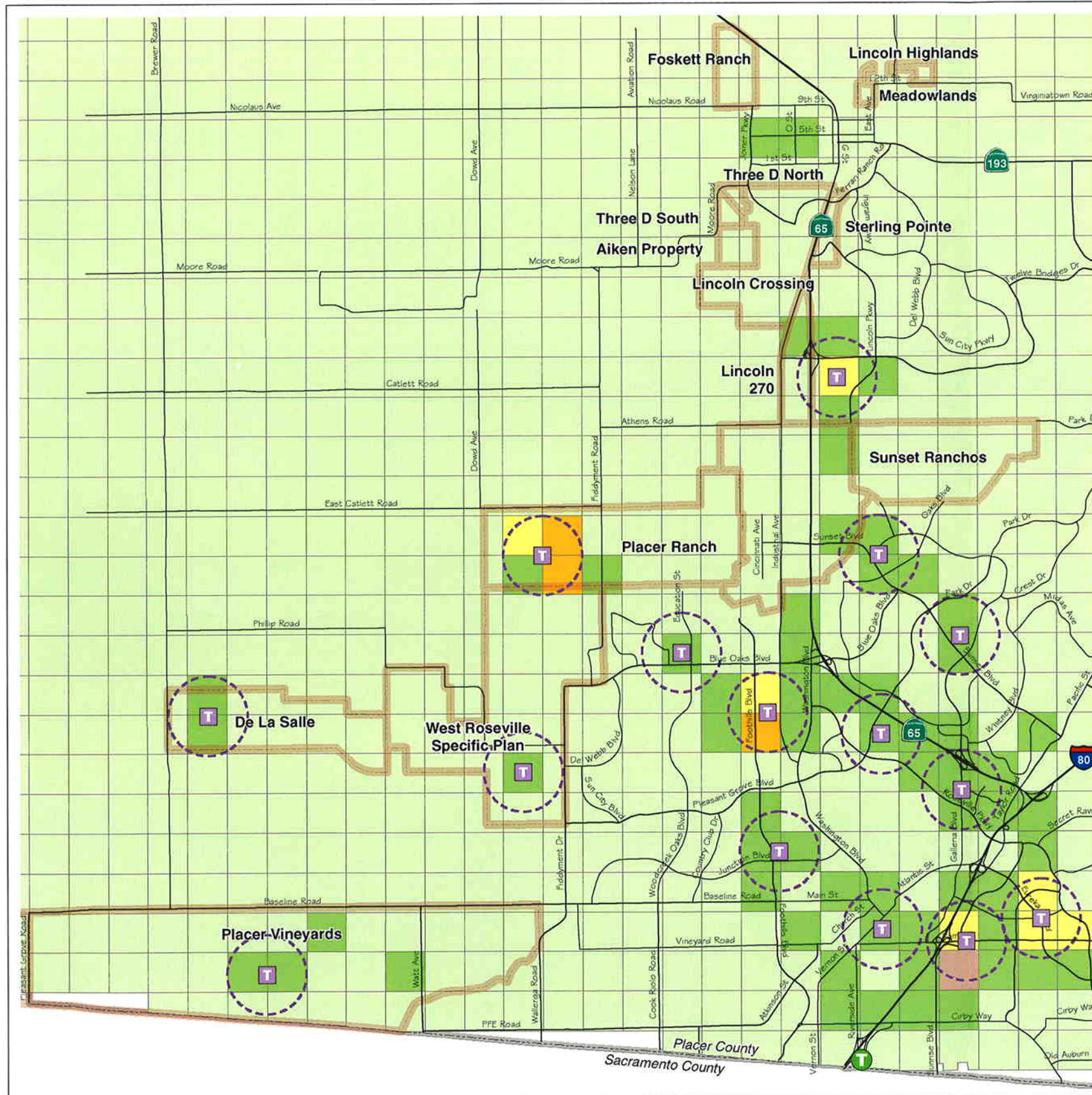
4.3 POTENTIAL BRT STATION LAND USE EVALUATION

As the first step of identifying the potential BRT station, land uses (i.e., population plus employment) were evaluated for each TAZ contained in the 2025 Placer Parkway Model within the study area. Two land use scenarios were provided by Placer County. Scenario "A" assumes that future development will be concentrated along Placer Parkway and Scenario "B" assumes that development projects would be more widespread. Per the discussion with County staff, Scenario "A" was used to identify potential BRT stations and to identify a conceptual BRT alignment.

Based on the station evaluation criteria described above and the traffic analysis zone (TAZ) 2025 land use information from the Placer Parkway model, 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 on 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 on over 80 rail station sites in northern California developed by Fehr & Peers. 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.



LEGEND

- Planned Development
- Station Development Level (Population + Employment + Student)**
- 1 (0 - 2,000)
- 2 (2,000 - 4,000)
- 3 (4,000 - 6,000)
- 4 (6,000 - 8,000)
- 5 (8,000 - 11,000)
- 6 (>11,000)
- 1/2 Mile Buffer
- Potential Station Location
- Existing PCT/Roseville Transit/RT Transfer Station



NOT TO SCALE

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

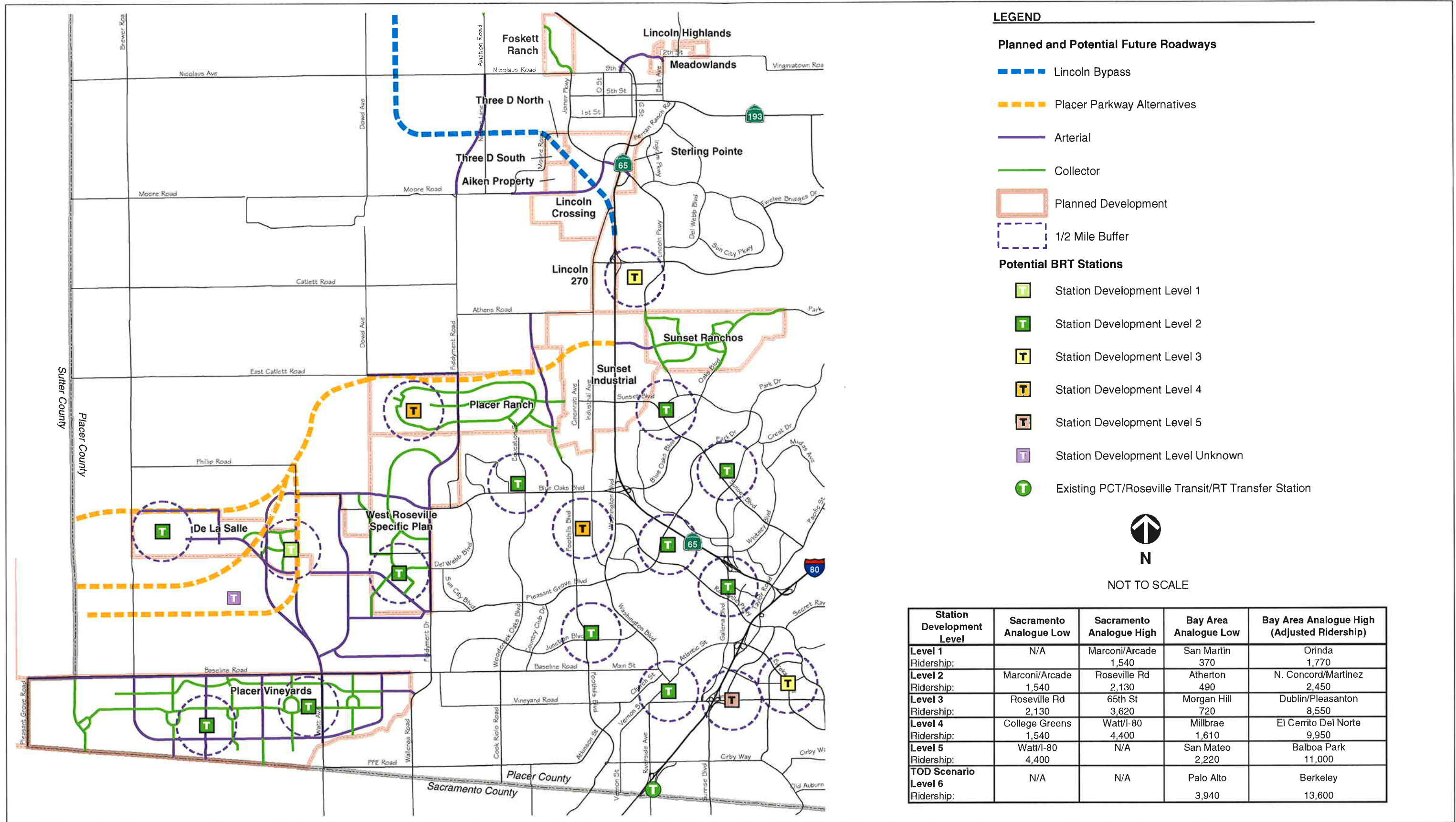
4.4 RECOMMENDED POTENTIAL BRT STATIONS

The initial 15 BRT station locations were reviewed with County staff, City of Roseville staff, Sacramento County staff, and affected developers. The outcome of this review was the identification of three additional stations locations. One of the new locations is within the Curry Creek community plan area between the De La Salle and Placer Vineyards specific plan areas. The County is developing a new community plan for this area and may include a potential BRT station in the plan area. The other two new station locations are within the De La Salle and Placer Vineyards specific plans. The De La Salle specific plan currently has a private college on the west end of the site and major commercial uses on the east end of the site adjacent to the proposed Watt Avenue extension. The BRT alignment could likely serve one of these locations, but not both. Ideally, the major commercial uses and university would be located together along the BRT alignment to create a single station location with higher ridership potential. The final extra station was added in the Placer Vineyards specific plan area along Watt Avenue. This addition was to reflect the potential for BRT service to be extended along the Watt Avenue corridor in Sacramento County. Figure 7 shows the recommended potential 18 BRT stations along with the currently planned roadway system within the study area.

4.5 POTENTIAL BRT ALIGNMENT EVALUATION CRITERIA

The potential BRT alignment is an important factor for ridership and operating performance. Based on TCRP Report 90, the following criteria should generally be followed when evaluating alignment options.

- BRT alignment should reflect city structure, potential major travel markets, and available resources.
- BRT alignment should serve three basic service components including CBD distribution, line haul, and neighborhood collection.
- BRT alignment generally should be radial, connecting the city center with outlying residential and commercial areas.
- BRT alignment should follow freeways and major arterials that are relatively free flowing.
- BRT alignment should support few high-frequency BRT routes rather than more low-frequency routes.



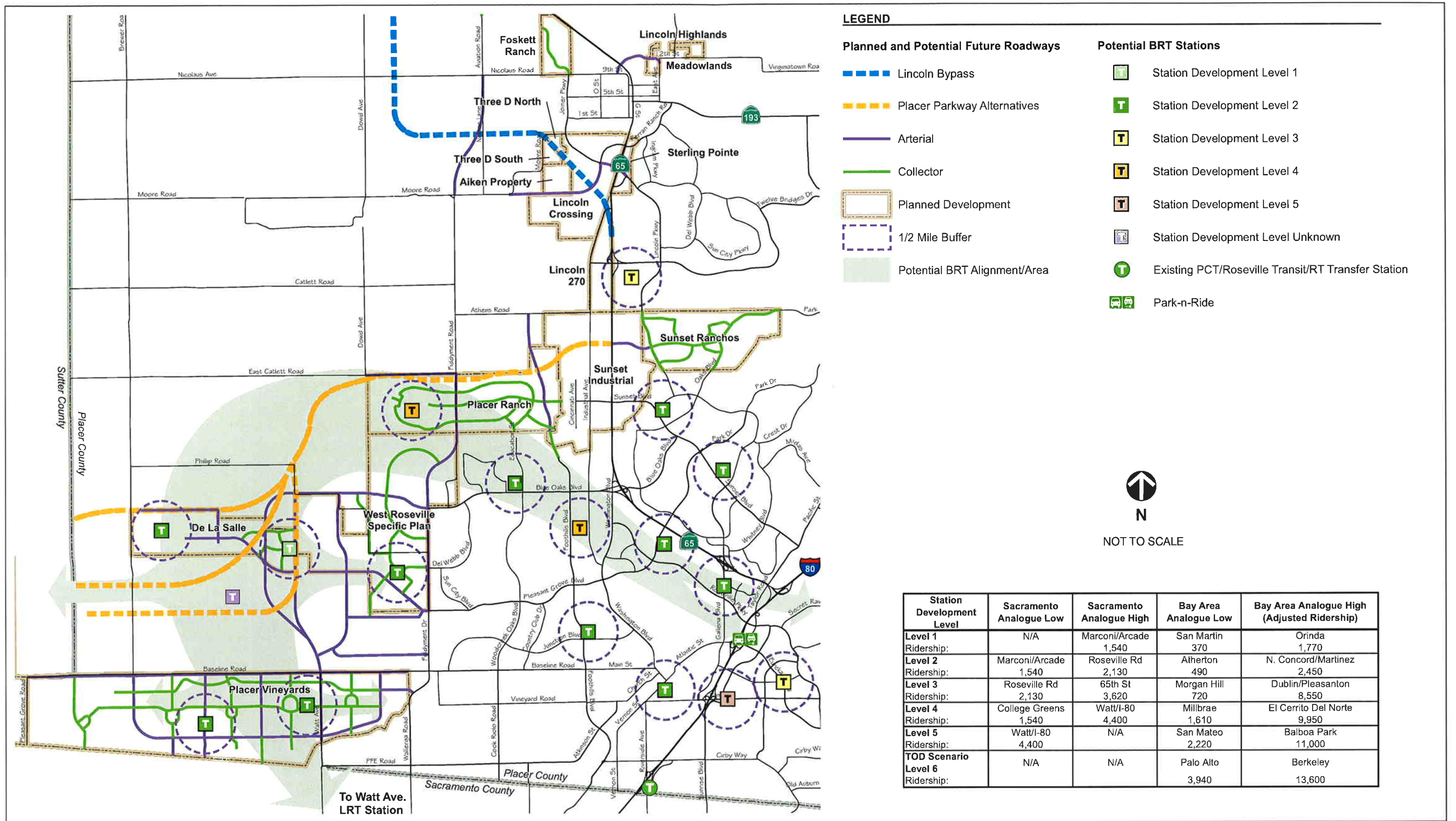
4.6 POTENTIAL BRT ALIGNMENT

The potential BRT alignment in south Placer County was determined based on the criteria described above and discussions with County staff, City of Roseville staff, Sacramento County staff, and affected developers. As shown in Figure 8, the potential BRT alignment is intended to connect with future BRT or other bus service in the Watt Avenue corridor that would provide direct access to the Watt Avenue LRT station in Sacramento County. This connection is important to provide high quality public transit access to regional destinations such as downtown Sacramento. The alignment would extend northward from the Sacramento County line and attempt to provide connections to the planned growth areas within Placer Vineyards, Curry Creek, De La Salle, and Placer Ranch before turning south towards the Galleria Mall and the Placer County park-and-ride lot and transit station at Taylor Road and Interstate 80. The alignment could continue further east to provide regional access to Folsom, Rancho Cordova, and the Highway 50 corridor.

The alignment could take advantage of existing and planned major arterials such as Watt Avenue, Blue Oaks Boulevard, and Placer Parkway or use exclusive running ways. At a minimum, the County may want to consider reserving sufficient right-of-way along existing and planned arterials to provide for Class IV running ways as detailed in section 4.7 below. More detailed analysis of alignment options is necessary as development plans are finalized and future roadway alignments are decided.

4.7 POTENTIAL BRT ALIGNMENT DESIGN OPTIONS

As mentioned in Section 1, a variety of running ways can be considered for the future BRT system in south Placer County. Based on the existing BRT practice in the United States, roadway right-of-way (ROW) is one of the primary factors to affect the decision-makings on types of running ways. Table 3 shows the ROW requirements for different types of running ways based on the existing BRT systems.



LEGEND

Planned and Potential Future Roadways

- ▬▬▬ Lincoln Bypass
- ▬▬▬ Placer Parkway Alternatives
- ▬ Arterial
- ▬ Collector
- Planned Development
- 1/2 Mile Buffer
- Potential BRT Alignment/Area

Potential BRT Stations

- T Station Development Level 1
- T Station Development Level 2
- T Station Development Level 3
- T Station Development Level 4
- T Station Development Level 5
- T Station Development Level Unknown
- T Existing PCT/Roseville Transit/RT Transfer Station
- T Park-n-Ride



NOT TO SCALE

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

TABLE 3. RIGHT-OF-WAY (ROW) REQUIREMENTS FOR RUNNING WAYS

Class	Type of Running Ways	ROW Requirements
Class I - Full Access Control	Reserved Freeway Lanes	28-32 feet including shoulder (desirable) 20 feet including shoulder (reduced)
	Two-way Freeway Median Busway	42 feet including median (desirable) 38 feet including median (reduced) 28 feet without median (minimum)
	Grade-Separated Busway	42-47 feet including shoulder (Typical) 30-36 feet including shoulder (Special-Elevated) 31-32 feet including shoulder (Special-Tunnel)
Class II – Partial Access Control	At-Grade Busway	26-36 feet including shoulder (Typical) 30 feet including shoulder (Special-Elevated) 31-32 feet including shoulder (Special-Tunnel)
Class III – Physically Separated Lanes within Street ROW	Arterial Median Busway	Total 64-68 feet no left turn no parking for 2 traffic lanes (minimal) Total 68-74 feet no left turn with parking for 2 traffic lanes (minimal) Total 74-78 feet with left turn no parking for 2 traffic lanes (minimal) Total 78-84 feet with left turn no parking for 2 traffic lanes (minimal) Total 76-84 feet no left turn for 4 traffic lanes (minimal) Total 86-90 feet with left turn for 4 traffic lanes (minimal)
	Bus Streets	Total 66 feet minimum (including three 11-foot vehicle lanes, two-way 22-foot bus street, and 11-foot bus station)
Class IV – Exclusive / Semi-Exclusive Lanes	Concurrent Flow Bus Lanes	Total 42-48 feet no left turn for 2 traffic lanes (two-way) Total 52-60 feet with left turn for 2 traffic lanes (two-way) Total 62-66 feet no left turn for 4 traffic lanes (two-way) Total 76-80 feet with left turn for 4 traffic lanes (two-way)
	Contra Flow Bus Lanes	32 feet no left turn for 2 traffic lanes (one-way total) 45 feet no left turn for 3 traffic lanes (one-way total) 55 feet with left turn for 3 traffic lanes (one-way total) 60 feet with left turn with continuous off-peak loading zone for 3 traffic lanes (one-way total)
Class V – Mixed Traffic Lanes	Bus Bulbs	No additional ROW required

Source: TCRP Report 90, Bus Rapid Transit, Volume 2: Implementation Guidelines, (Transportation Research Board, 2003).

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

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

SERVICE	CHARACTERISTICS
LOCAL BUS	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Between 25-75% of stations spaced greater 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-board 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)	<ul style="list-style-type: none"> • 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-board 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	X
	Between 25-75% of stations spaced greater than ½ mile apart.		X		
	Less than 25% of stops spaced greater than ½ mile apart.	X		X	X
Service & Operating Plan	Station platform height allows level entry into vehicles			X	X
	Average headway 15 minutes or less			X	X
	Average headway 20 minutes or more	X			
Intelligent Transportation Systems (ITS)	Average headway Peak Hour Service Only	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			
	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			
	More than 75% of stations have real-time passenger information		X	X	
	Some stations have real time passenger information		X	X	X
Special Branding Identification	Buses have real-time passenger information	X		X	X
	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	
Vehicles	Lane-assist and precision-docking guidance technology				X
	Specialized BRT vehicles (40ft, 60ft, or 80ft)		X	X	X
	Stylized or specially upgraded buses (40ft or 60ft)		X		X
Fare Collection	Conventional 40ft buses, may include Neighborhood Ride Buses	X			
	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					

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