



BAY AREA RAPID TRANSIT

eBART Next Segment Study

2014

Bay Area Rapid Transit
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Oakland CA 94604-2688

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Project Partners:





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Chapter 1

Introduction and Summary

Project Background and History

The eBART Project represents an expansion of rail service into Eastern Contra Costa County. The eBART Project provides a cost-effective way to bring BART service to Antioch, and the rest of east Contra Costa County. eBART will provide East County with frequent, reliable, and high quality rail service that will connect the growing region of East Contra Costa County with areas already served by BART.

eBART (which stands for East Contra Costa County BART) has evolved as part of a long term effort to extend rail transit service into Eastern Contra Costa County. The concept of eBART was developed in 2001-2002 as part of the State Route 4 East Corridor Transit Study. In 2004 voters approved Regional Measure 2 which included \$96 million for eBART. In the same year Contra Costa County voters approved Measure J which provided \$150 million for eBART.

The original eBART concept envisioned a rail service extending into Eastern Contra County as far to the southeast as the Byron/Discovery Bay area, nearly 23 miles in length. Environmental studies and engineering began in 2005 and in 2009 project development was completed for Phase I of the project. Construction of Phase I began in 2011 and is scheduled for completion in 2018.

The Phase I eBART project, currently under construction, involves a ten mile extension of BART service into Eastern Contra Costa County. The extension will use Diesel Multiple Unit (DMU) rail technology to extend eastward from the existing BART system at the Pittsburg/Bay Point BART Station in the median of State Route 4 to Antioch, with the Antioch Station at Hillcrest Avenue and a future infill station at Railroad Avenue in Pittsburg called Pittsburg Center Station.

Study Purpose and Scope

The Next Segment Study explored the options for an extension of the eBART project beyond the Phase I terminus Antioch Station at Hillcrest Avenue. The goal of the study was to identify the most suitable alignment for the extension and the location of the next terminus or end of the line station. The options were evaluated with the purpose of selecting a single station option for recommendation. Initially two options were considered for the alignment of the next segment of eBART:

1. The median of State Route 4 (also known as the SR-4 Bypass south of its junction with SR-160)
2. The Union Pacific Railroad's Mococo Line corridor

A meeting with officials of the Union Pacific Railroad held at the onset of the study determined that the Mococo Line corridor was not available for acquisition any time in the foreseeable future. This finding narrowed the alignment consideration strictly to the median of State Route 4.

Given this, it was then determined that the study would consider an extension from the Antioch Station to a new station at five alternative locations along State Route 4. During the study process an additional sixth potential station site emerged as a result of the meetings with the cities and the stakeholder outreach. This station site which is called the Mokelumne Station is located between the Lone Tree Station and the Sand Creek Station sites.

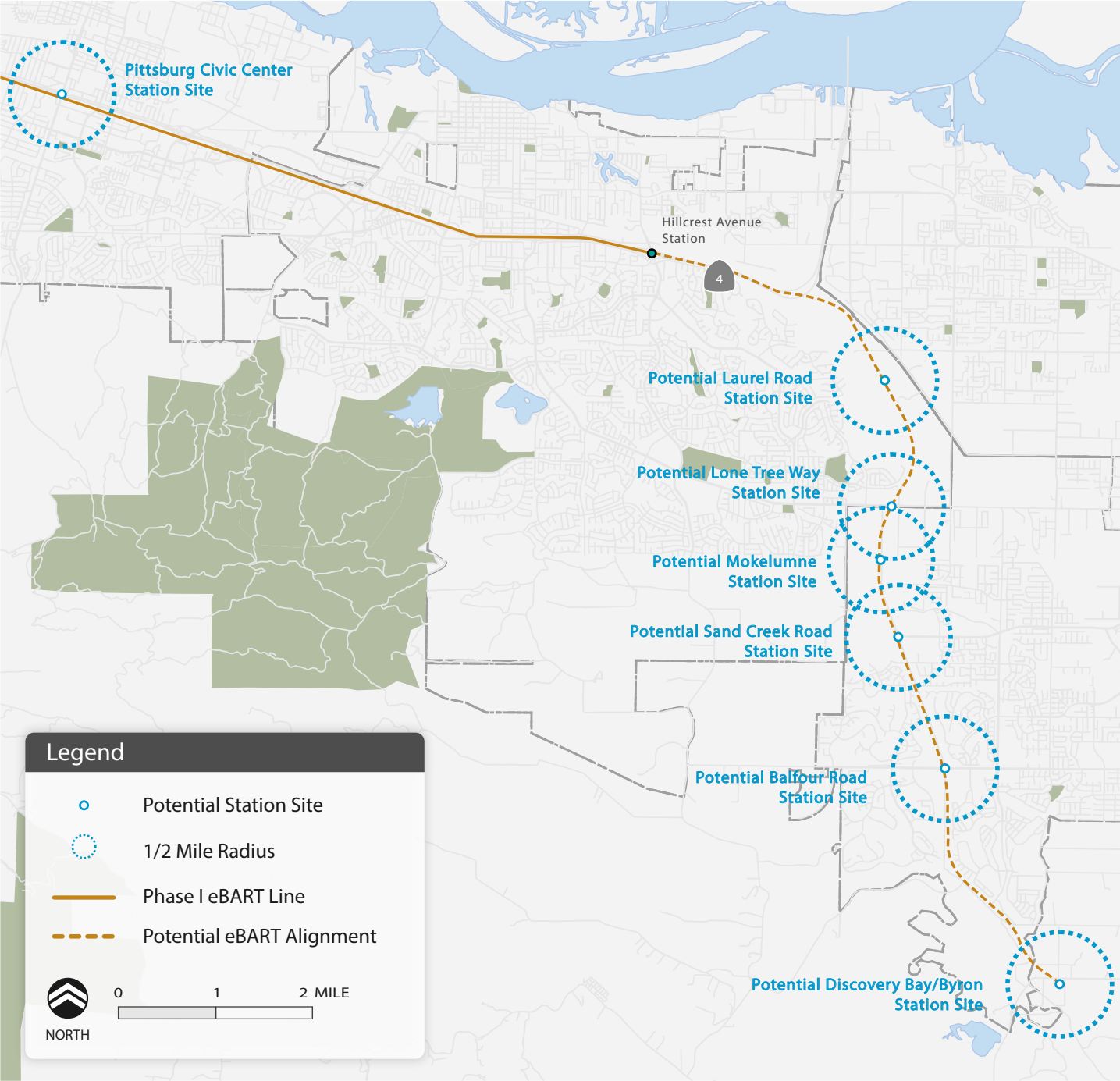
- Laurel Road, about 3 miles from the Antioch Station
- Lone Tree Way, about 4 miles from the Antioch Station
- Mokelumne Trail, about 4.5 miles from the Antioch Station
- Sand Creek Road, about 5 miles from the Antioch Station
- Balfour Road, about 7 miles from the Antioch Station
- Marsh Creek Road about 11 miles from the Antioch Station

These locations represent each of the major intersections/interchanges planned along State Route 4 (as well as the crossing of the Mokelumne Trail) southeast of Antioch. The study also included the Pittsburg Center Station site in Pittsburg. This station will be located on the portion of eBART which is currently under construction. All of these locations were then the focus of the study which included the following elements:

1. Review of Land Use Plans
2. Update of Ridership Forecasts
3. Conceptual Station Layouts
4. Cost Assessment
5. Overall Evaluation of Alternatives

In conjunction with this study BART conducted a major public and stakeholder outreach effort which included over 20 public meetings, including 17 meetings at elected bodies such as the City Councils in each of the cities along the corridor. BART also conducted a town hall style meeting where the general public was invited and given the opportunity to view information on the project, to interact with project team members and to provide comments and input. There were also four meetings with the eBART Partnership Policy Advisory Committee (ePPAC) and two meetings with Contra Costa Transportation Authority board. A summary of the outreach effort is provided in the appendix to this report.

Figure 1 shows all the station sites that were considered.



Source: BART, City of Oakley, City of Antioch, Contra Costa County, Contra Costa County

Figure 1 POTENTIAL STATION SITES

Summary of Findings

Land Use

Each of the station sites was evaluated in terms of the suitability of its existing and future land use to support a transit station. Land use information was obtained from each of the cities and the county.

The chart below (Figure 2) summarizes the results. The station sites showing the greatest opportunities for transit supportive development were Pittsburg Center in Pittsburg, Lone Tree Way in Antioch, Mokelumne Trail in Brentwood, and Sand Creek Road in Brentwood.

Figure 2 - Land Use Evaluation

Potential Station Site	Existing Land Use	Potential Land Use
Pittsburg Center		
Laurel Road		
Lone Tree Way		
Mokelumne Trail		
Sand Creek Road		
Balfour Road		
Discovery Bay/Byron		

 Low Potential
  Medium Potential
  High Potential

The other three station sites showed limited transit supportive land use potential. The land around the Laurel Road site is largely committed to uses which are weak generators of transit trips. The same is true of Balfour Road. Discovery Bay/Byron is the area surrounding the intersection of Marsh Creek Road with State Route 4. This area is mostly agricultural and is beyond the urban limit line. Overall the Mokelumne and Sand Creek Road sites offer the best potential of the sites east of the Antioch Station because there is ample land for future development and favorable zoning in terms of allowing transit supportive commercial and residential development. Lone Tree Way has less potential because it is already largely developed and the current land uses which are largely commercial retail are not strongly transit supportive.

Ridership

Updated ridership estimates were developed assuming that each of the station options would be the new terminus station for the transit service (See Table 1). In the year 2035 it is expected that the

Antioch Station would attract 8,400 daily riders. The Pittsburg Center Station would attract 1,700 daily riders. Moving southeast of the Antioch Station it can be seen that total line ridership on eBART from the Pittsburg/Bay Point BART Station to the end station would gradually increase from 10,100 riders with an Antioch Station terminus to 14,000 daily riders with the terminus at the Mokelumne Station. South of the Mokelumne Station the ridership for the corridor would decline. This is because the station location would be south of the centroid of population and employment density. That means that most people would have to drive in the wrong direction in order to use the station, which is a disincentive to using eBART.

Table 1: Year 2035 Transit Ridership Estimates by End Station

End Station Alternative	To Pittsburg Center	To Antioch Station	To End Station	Total
Antioch	1,700	8,400	-	10,100
Laurel	1,700	3,600	8,100	13,400
Lone Tree	1,700	6,300	5,700	13,700
Mokelumne	1,700	7,600	4,700	14,000
Sand Creek	1,700	7,700	3,000	12,400
Balfour	1,700	7,900	2,300	11,900
Discovery Bay/Byron	1,700	8,200	1,700	11,600

Costs

This study did not involve any detailed engineering of the eBART alignment or the potential stations. Conceptual level engineering was conducted by BART engineering to provide a measure of what level of construction would be necessary to extend eBART from the Antioch Station to each of the new candidate terminus stations. The major components of the construction costs include the cost of preparing the median of State Route 4 to accommodate eBART, the cost of the trackwork and train control systems, the cost of the stations and parking, the cost of support facilities for train storage and maintenance and the cost of the additional vehicles to operate the extended service. Table 2 provides a summary of the estimated costs in current dollars.

Table 2: Estimated Construction Cost (\$ 2012)

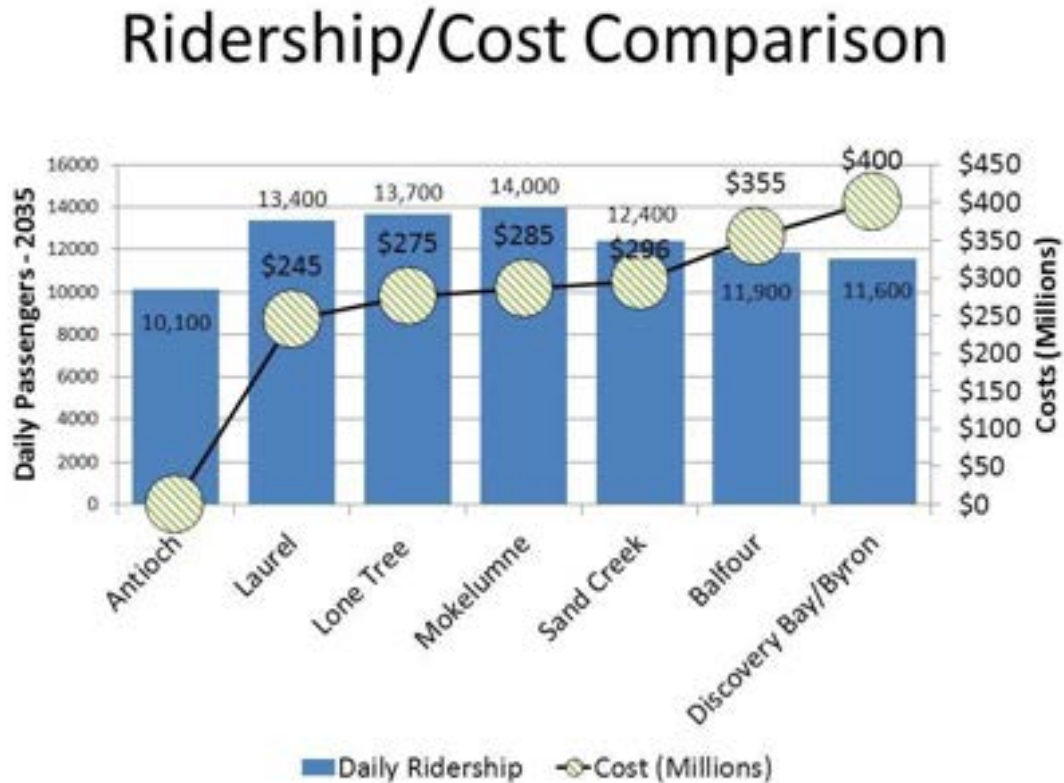
End Station	Miles from Antioch Station	Cost (\$ millions)
Laurel	2.8	\$244
Lone Tree	4.2	\$274
Mokelumne	4.9	\$284
Sand Creek	5.5	\$296
Balfour	6.9	\$355
Discovery Bay/Byron	9.3	\$398
Note: Soft costs and contingencies are included.		

The total cost of each extension option is very strongly related to the length of the extension. A 2.8 mile extension to the Laurel Road station site has a planning level cost estimate of \$244 million. The longest extension under consideration would be the extension to a Discovery Bay/Byron station, 9.3 miles. This extension option also would have the highest planning level costs at \$398 million.

Findings/Next Steps

The comparison of potential ridership and costs provides a revealing view of the productivity or cost effectiveness of the extension options. While the cost of the extension is related to the length of the alignment between the Antioch Station and the new terminus station, the ridership is sensitive to the location of the terminus station in relation to the future concentration of housing and jobs in this area of the East County. This comparison is shown in Figure 3. Moving to the southeast, total eBART ridership increases with each new station, reaching a peak at the Mokelumne Station. After that point total ridership declines for the stations further to the southeast. Costs however, increase with distance in a linear fashion. From the chart it is clear that the cost of the furthest stations (Balfour and Discovery Bay) is not justified by the ridership as compared with the higher ridership and lower costs characteristic of the Laurel, Lone Tree, Mokelumne, and Sand Creek stations.

Figure 3 - Ridership/Cost Comparison



The Laurel Station site offers limited opportunities for station area land use development. It is also very close to the Antioch Station. The area around the Lone Tree Station is largely developed and it will be difficult to find adequate space for the station and its supporting parking and transit facilities. However, there are development opportunities immediately to the south of this station. In terms of overall performance the Mokelumne Station offers the greatest potential for transit supportive development. It offers the opportunity for a good station site and has ample land which is zoned to support new transit supportive development. Lone Tree and Sand Creek offer slightly less potential, but should not be dropped as candidates.

In order to advance a next phase of eBART, strong local support would need to be demonstrated. One ~~The best~~ way to do this would be to have the next segment included in a future funding initiative sponsored by the Contra Costa Transportation Authority. The current Measure J funding program extends to the year 2035, but it does not include any additional eBART funding beyond the Phase 1 project that is now under construction. Another potential funding source would be to include a transit funding element in the impact fees required for new East County development. This would require the local jurisdictions to modify their current impact fee policies. Once a good measure of local support is indicated, the project would be positioned to compete for other regional and state funding.

If the City of Brentwood, with the support of the rest of East County, were to want to advance a station site in the city, the City Council would seek a designation of the selected station site as a Planned Development Area (PDA). This would make a potential station location PDA, eligible for the One Bay

Area grant program sponsored by MTC and ABAG. Brentwood would then be eligible for regional funding for site planning, and at a future phase, for capital investment funding.

Future steps could include entering into the environmental phase and defining funding for the next segment. This environmental analysis would consider the alternative locations for the next station as well as various technologies. A decision would need to be made as to whether to prepare an EIR or an EIS which would allow federal funding to be pursued. At this time it appears that federal funding is highly unlikely.

Chapter 2

Land Use Evaluation for Station Sites

This chapter documents the baseline conditions for land uses surrounding the seven eBART potential and future station sites. For each station option this report identifies existing and planned land uses within a half-mile of the potential station location, applicable existing plans and policies, and an outline of pipeline projects.

The seven station sites include the following:

- Pittsburg Center and State Route 4 (Pittsburg);
- Laurel Road and State Route 4 (Antioch);
- Lone Tree Way and State Route 4 (Antioch/Brentwood boundary);
- Mokelumne Trail and State Route 4 (Brentwood);
- Sand Creek Road and State Route 4 (Brentwood);
- Balfour Road and State Route 4 (Brentwood); and
- Discovery Bay/Byron and State Route 4 (Contra Costa County).

Pittsburg Center (Railroad Avenue & State Route 4) Station Site

Existing Plans and Policies

The Railroad Avenue Specific Plan provides a set of planning principles, policies, and land uses for the Pittsburg Center station site. The Specific Plan provides a framework of policies and programs to guide future development surrounding the eBART station. Policies in the Specific Plan are related to land use, design, transportation, infrastructure, and natural resources.

The Railroad Avenue Specific Plan includes the following four guiding principles.

- Establish a transit-oriented community that prioritizes pedestrians and supports multi-modal transportation.
- Ensure an enjoyable and accessible environment for people of all ages, abilities and cultures.
- Promote development practices that are ecologically sound, socially equitable and economically feasible.
- Create a high quality environment that is clean and safe.

The Specific Plan boundaries roughly encompass the area located within a half-mile of the future Pittsburg Center eBART Station. This distance is generally considered to be the maximum distance an average person will typically travel on foot between a transit station and his or her destination.

Existing Land Uses

The City Hall, Contra Costa County Courts, County library, City recreation buildings, and Pittsburg Unified School District offices are located just north of State Route 4. In this Civic Center subarea, low-rise buildings and adjacent underutilized surface parking may provide an opportunity for future consolidation of civic uses, and an increase in the density of new development.

Established neighborhoods (Parkside Manor, Los Medanos, East Leland Corridor and Atlantic Avenue Corridor sub-areas) encircle the proposed eBART Station. The residential neighborhoods within these sub-areas are predominantly low-density, with one to seven dwelling units per acre of land. There are some medium density residential areas primarily in the southeastern part of the area (the Atlantic Avenue Corridor) with duplexes, apartment buildings and several senior housing facilities.

Railroad Avenue is the retail corridor serving the nearby industrial workforce, governmental offices, other professionals and people living in the surrounding neighborhoods. The retail spine includes office strip commercial uses, freeway-oriented retail, restaurants, small family-owned businesses as well as larger franchises. The corridor's low intensity style of development; limited, auto-oriented uses; deferred maintenance; and large open spaces between buildings and between the sidewalk and front door of businesses contribute to an uninviting street environment. Incremental redevelopment with a greater density and mix of uses paired with good urban design would create a more engaging pedestrian environment.

Industrial uses are concentrated in the southeast portion of the Specific Plan Area. The nature of industrial uses transitions from shipping, storage and automobile-oriented uses around Railroad Avenue to more active industrial and light manufacturing uses between Harbor Street and Loveridge Road. Preserving viable industrial uses east of Harbor Street in the Industrial Mixed-Use and Los Medanos Industrial Center sub-areas is critical as they provide a distinct character and key source of employment in the community and in the planning area. In 2006, approximately 5,000 workers were employed in the industrial and commercial areas within the Specific Plan Area.

There are sizeable underutilized or vacant lands within the Specific Plan Area that provide major opportunities for future transformation.

General Plan Land Use

Together, the City of Pittsburg's General Plan and the Railroad Avenue Specific Plan provide a framework to guide future development in the Specific Plan Area. The Specific Plan serves as an extension of the General Plan, and can be used as both a policy and regulatory document. The Specific Plan is consistent with all elements of the General Plan, and specifically fulfills the General Plan's policies to create a Specific Plan for the eBART station area featuring a mix of commercial and residential uses with extensive pedestrian amenities and linkages to surrounding neighborhoods. It also fulfills policies to allow for expansion, intensification and densification of commercial and residential uses along the Railroad Avenue corridor closest to the future eBART Station. Circulation improvements envisioned by the General Plan will also be implemented through the Specific Plan including the extension of Garcia Avenue to Railroad Avenue; development of transit-oriented development patterns such as smaller blocks to support pedestrian activity; and, improvements in

public transit amenities by including streetscape amenities such as pedestrian-scaled lighting, benches and bus shelters.

The following land uses are defined in the Specific Plan and General Plan.

Low Density Residential (1 to 7 units/gross acre)

The Low Density Residential classification allows for single-family residential units built at a density of one to seven units per gross acre. The classification is intended to promote and protect single family neighborhoods. It is mainly intended for detached single family dwellings, but attached single-family units may be permitted in select areas provided that each unit has ground-floor living area and private or common outdoor open space.

Medium Density Residential (7 to 14 units/gross acre)

The Medium Density Residential classification allows for single and multi-family residential units built at a density of seven to 14 units per gross acre. The classification accommodates more intensive forms of residential development, such as one or two story garden apartments, townhouses, and attached and detached single-family residences.

High Density Residential (14 to 25 units/gross acre)

The High Density Residential classification allows for a mix of housing types built at a density of 14 to 25 units per gross acre. This classification permits products ranging from single-family attached units to multi-family complexes. Subject to design review by the Planning Commission, additional discretionary density increases up to a maximum project density of 40 units per gross acre may be granted for projects that meet community objectives.

Community Commercial

The Community Commercial classification allows for a variety of commercial uses and service-oriented businesses at scales ranging from large retail stores serving the greater community to smaller businesses oriented towards neighborhood activity. Permitted uses include retail stores, eating and drinking establishments, commercial recreation and entertainment, service stations, auto sales and service, financial, educational and social services. The maximum permitted floor-area ratio (FAR) in this land use designation is 0.4. However, commercial projects along Railroad Avenue between State Route 4 and Leland Road are permitted a maximum FAR of 2.0. For mixed use projects located on Railroad Avenue between State Route 4 and Leland Road, a maximum FAR of 1.0 is permitted for the commercial portion of the development, and an additional 25 dwelling units per acre may be allowed for the residential portion of the development.

Business Commercial

The Business Commercial classification focuses on providing sites for administrative, financial, business, research and development and public offices, as well as custom manufacturing, limited assembly, light manufacturing, warehousing and distribution, and limited retail and office uses. Live-work lofts with ground floor commercial and custom manufacturing uses are appropriate in the light industrial areas within the Transit Village and Industrial/Mixed Use Center sub-areas. The maximum permitted FAR in this land use designation is 1.0; however, an additional 0.25 FAR may be permitted to accommodate residential uses.

Service Commercial

The Service Commercial classification provides sites for commercial businesses that are not appropriate in other commercial areas because they generate high volumes of vehicle traffic or other potential adverse impacts on adjacent uses. Allowable uses in Service Commercial areas include contractors, automotive repair, equipment rental, and wholesaling and storage. The maximum permitted FAR in this land use designation is 0.5; however, an additional 0.25 FAR may be permitted to accommodate residential uses.

Public/Institutional

The Public/Institutional classification allows schools, government offices, transit sites, public utilities, and other facilities with a unique public character. Other permitted uses on Public/Institutional sites located within half-mile of the eBART Station includes residential uses, offices, restaurants and office-supporting commercial uses in order to support the public/institutional uses located on the block during business hours, and to activate the area during evenings and weekends when public/institutional uses are typically closed. Residential and commercial uses are permitted provided that the City Planner, Planning Commission or City Council, as appropriate, finds that the land will not be needed in the future for a public/institutional use.

Parks/Recreation

The Parks/Recreation classification provides for parks, recreation complexes, community fields, greenways, and trails.

Mixed-Use (Residential: 20 to 50 dwelling units per gross acre; Non-residential: Maximum 0.25 FAR)

The Mixed-Use classification is targeted on vacant and underutilized land within the Railroad Avenue Specific Plan area, within a half mile of the Railroad Avenue/State Route 4 intersection. This classification allows for significant flexibility of land uses, including residential and non-residential. This general plan designation is intended to encompass the specific land uses identified in the Railroad Avenue Specific Plan.

TOD Medium (Residential: 15 to 30 dwelling units per gross acre; Non-residential: Maximum 1.0 FAR)

The TOD Medium classification is intended to allow primarily multi-family residential development. Secondly, ground floor commercial uses are permitted below residential uses within half-mile of regional transit facilities. In the High School Village sub-area, there is not a minimum residential development component, and commercial development is permitted at a maximum 1.0 FAR.

Pipeline Projects

This station site is largely developed compared to other site locations. However, there are several opportunity sites identified in the Railroad Avenue Specific Plan that may be utilized for redevelopment.

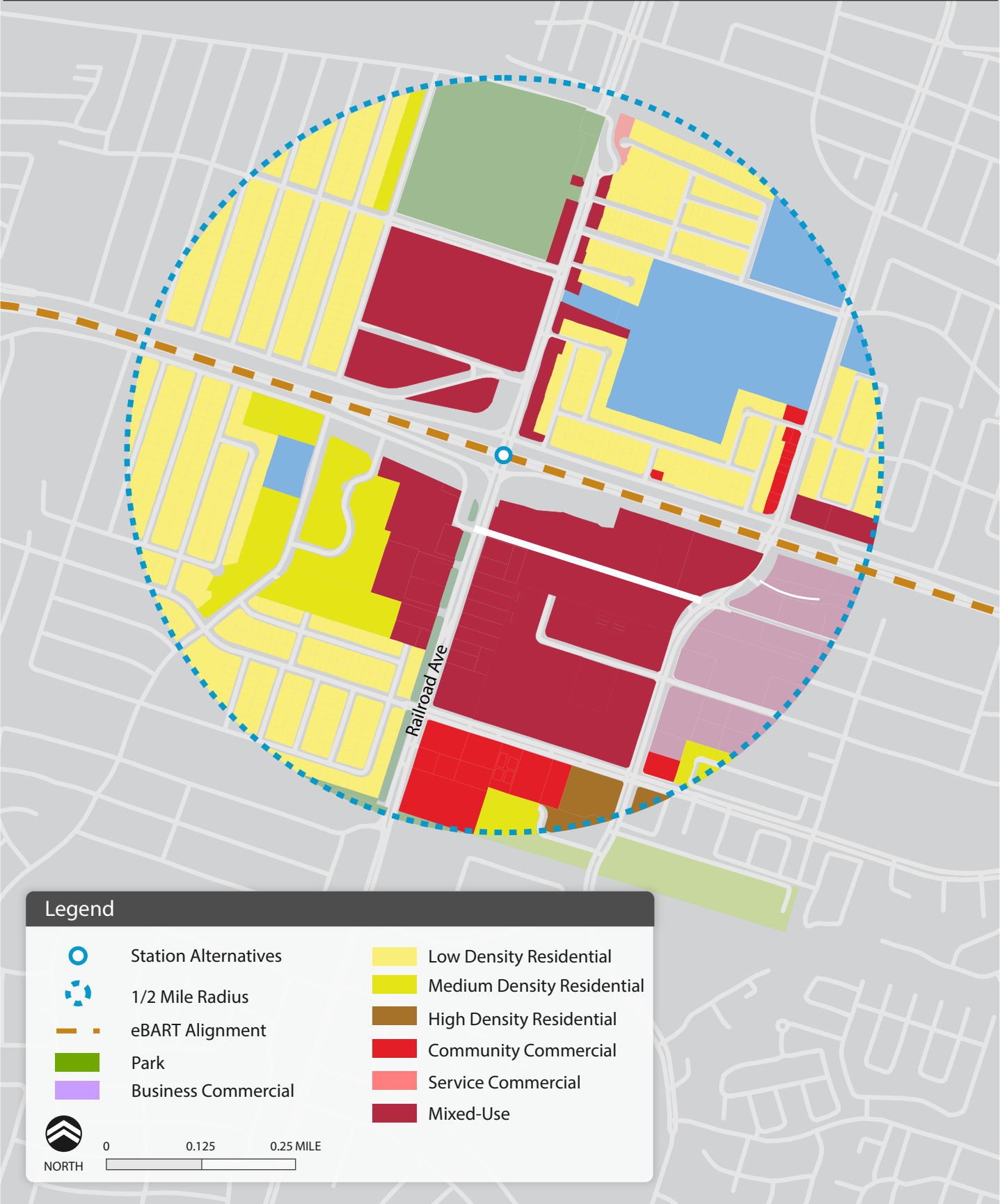


Figure 4 PITTSBURG CENTER GENERAL PLAN LAND USE

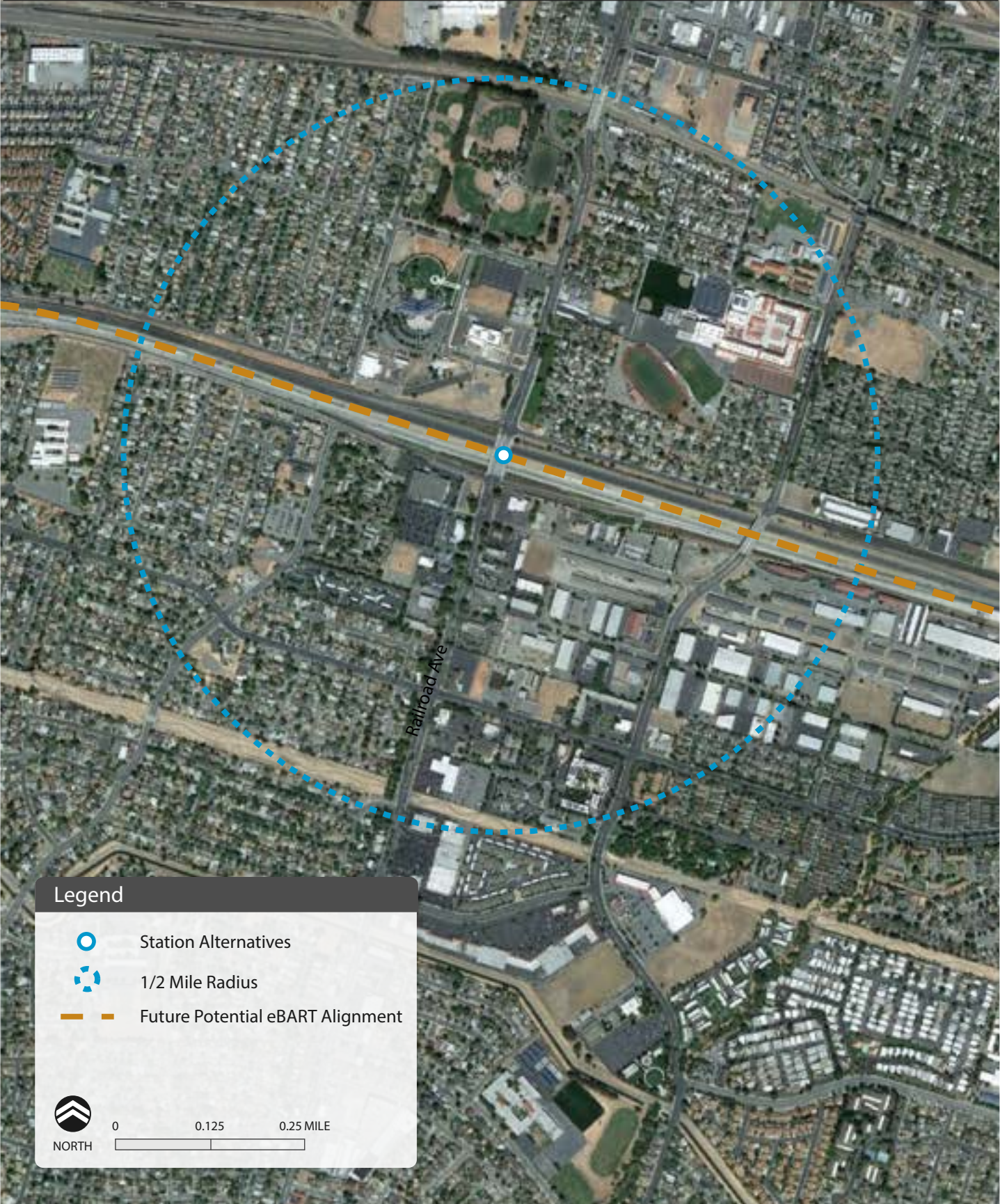


Figure 5 PITTSBURG CENTER AERIAL

Laurel Road and State Route 4 Potential Station Site

The Laurel Road potential station site is located on the eastern edge of the City of Antioch where Laurel Road intersects with State Route 4. While this location is within Antioch, this potential station site is within a quarter mile from the City of Oakley border. The following analysis considers land use from both jurisdictions.

Existing Plans and Policies

The General Plans from both Antioch and Oakley provide land use policies that apply to this potential station site. Antioch's East Lone Tree Focus Area and Oakley's South Oakley Special Planning Area cover property within half-mile of the station site.

Antioch

The City of Antioch's General Plan was prepared in 2003. It seeks to provide a wide variety of residential choices for its residents, including high-density housing in transit-oriented settings. Policies in the land use element state that the General Plan should be implemented in such a way as to foster close land use and transportation relationships to promote alternative transportation use and minimize travel by single occupant vehicles. However, all Antioch planned land use in the Laurel Road potential station site is either very low density residential or low density residential.

The General Plan outlines ten Focus Areas for focused policy analysis and direction. One of the focus areas is the East Lone Tree Focus Area, a portion of which is located within a half-mile of the potential station site at Laurel Road. There is a Specific Plan for this focus area, and planned development is detailed in the Pipeline Projects section below. In essence, the goal of the East Lone Tree Focus Area is to provide a new employment center in the city. The Specific Plan covers 796 acres and calls for employment-generating and commercial uses on the east side of State Route 4 and around the intersections of State Route 4 with Laurel Road and Lone Tree Way. The remainder of the land would be devoted to residential units and open space. The Specific Plan also planned for a commuter rail stop in this vicinity; although, at the time of the plan, the stop was anticipated to be on the Union Pacific Railroad line located to the east of State Route 4. The General Plan adds to the provisions of the Specific Plan by allowing the commercial/employment area adjacent to the transit stop to be developed as a mixed-use area with high intensity residential, commercial, and office uses. Development could occur with an FAR as high as 1.0 for non-residential and mixed uses and up to 20 units per acre for residential uses.

Oakley

The City of Oakley's General Plan was adopted in December 2002. It was last amended in January 2010. Beyond providing typical land-use designations, the General Plan discusses the possibility of a future Specific Plan zoning district that would cover properties near the intersection of Neroly Road and Empire Avenue. This district would possibly have properties that fall within the half-mile radius of the Laurel Road potential station site. However, the Specific Plan district has not been created at this time.

Also defined in the General Plan, the South Oakley special planning area includes properties within half-mile of the Laurel Road potential station site. The special planning area defines a vision for development along the border with the City of Brentwood to the south. The South Oakley special planning area is envisioned to build out with mostly low density residential development that has commercial nodes at key entry points and intersections. Of the properties located in Oakley within a half-mile of the Laurel Road potential station site, only the properties designated as commercial or public/semi-public actually fall within the South Oakley special planning area. The commercial properties would be considered one of the commercial nodes for the larger planning area.

Existing Land Uses

Existing land uses within a half-mile radius of the Laurel Road potential station site include mostly community facilities and open space in the immediate vicinity, followed by single family residential developments, and new residential development in the outer vicinity (see Table 3 and Figure 7). Community facilities include warehouses and the Randall-Bold Water Treatment Plant. A local landmark is the Laurel Ridge Community Church. Furthermore, the Delta de Anza Regional Trail is located in the area and connects to trails in Pittsburg, Antioch, Oakley, and Brentwood.

Table 3: Laurel Road Existing Land Use Within Half-mile Radius

Existing Land Use	Acres	Percent
Single Family	28.7	5.7%
Community Facilities	152.8	30.5%
Agriculture	100.5	20.1%
Rural	13.4	2.7%
Vacant	72.7	14.5%
Other Areas (undefined, ROW, etc)	132.9	26.5%
Laurel Road Total	501.0	100.0%

General Plan Land Use

General Plan land uses within the Laurel Road potential station site include a mix of residential, open space, and commercial uses in both cities (see Table 4 and Figure 8). The following table shows General Plan land uses within half-mile from the Laurel Road potential station site.

Table 4: Laurel Road General Plan Land Use Within Half-mile Radius

General Plan Land Use	Acres	Percent
Antioch		
Low Density Residential (4 DU/AC)	63.2	12.6%
Residential/Open Space	158.6	31.7%
Regional Retail/Employment- Generating Lands	77.4	15.5%
Office/Retail	13.0	2.6%
Public	7.1	1.4%
Open Space/Public	14.8	2.9%
Oakley		
Single Family Low	28.2	5.6%
Commercial	14.7	2.9%
Public and Semi-Public	47.1	9.4%
Waterways	4.5	0.9%
Other Areas (undefined, ROW, etc)	72.4	14.5%
Laurel Road Total	501.0	100.0%

Land uses from each jurisdiction are described in more detail below.

Antioch

The East Lone Tree Specific Plan defines the land use for the area around the Laurel Road potential station site. Within half a mile of this potential station site, the Specific Plan identifies areas for Regional Retail/Employment Generating, Office/Retail, Public, Open Space/Public, and Residential/Open Space. The General Plan provides the following constraints on these Specific Plan areas.

Single-family residential units developed within the Residential/Open Space areas are subject to the Low and/or Medium Low Density Residential categories described in the General Plan. Up to 1,100 single family units are allowed by the General Plan in the East Lone Tree Focus Area; however, only a portion of the Focus Area falls within half a mile of the Laurel Road alternative.

- The Low Density Residential category is primarily meant to be single-family detached houses. The maximum density is four dwelling units per gross developable acre, and the anticipated population density is 12 to 14 persons per acre.
- The Medium Low Density Residential category is characterized by single-family homes in typical subdivision development as well as other detached housing such as zero lot line units, patio homes, or duplexes. The maximum density is six dwelling units per gross developable acre. The anticipated population density is 14 to 18 persons per acre.



*East Lone Tree Focus Area from
Antioch General Plan*

Multi-family residential units developed within the Residential/Open Space areas are subject to the High Density Residential category in the General Plan. Up to 250 multi-family units are allowed by the General Plan in the East Lone Tree Focus Area; however, only a portion of the Focus Area falls within half a mile of the Laurel Road potential station site.

- The High Density Residential land use category is characterized by multi-family dwellings, including apartments and condominiums. Typical densities will not exceed 16 to 18 dwelling units per acre; however, projects with extraordinary amenities could be allowed to have up to 20 dwelling units per gross developable acre. The expected population density is generally 40 persons per acre. In transit oriented development, anticipated population density is 45 to 60 persons per acre.

Up to 1,135,000 square feet of Commercial/Office development can be developed within the areas labeled Office/Retail, Regional Retail/Employment Generating, or Regional Retail. Such development may include mixes of uses that comply with the provisions of the Regional Commercial land use category or the Office land use category, as defined by the General Plan.

- Regional Commercial land use areas provide for large-scale retail and supporting uses. Regional Commercial areas consist of 30 to 50 acres or more of commercial uses and typically serve a market area of 8 to 20 miles or more. The maximum floor-area ratio (FAR) allowed is 0.5.
- The Office land use category is meant to provide park-like working environments for corporate, professional, and administrative businesses, along with supporting commercial services. Office developments may include low-rise or mid-rise structures. The maximum allowable FAR is 0.5.

Up to 2,152,300 square feet of Business Park/Industrial development may be developed in the Regional Retail/Employment Generating areas of the Specific Plan. These types of development are subject to the Business Park or Light Industrial land use categories, as defined in the General Plan.

- The Business Park land use category is meant to provide a pleasant and attractive working environment for light industrial, research and development, and office-based firms. Business Park areas are meant to have a density of employees that would be higher than areas focused on manufacturing or warehousing. The maximum allowable FAR is 0.5.
- The Light Industrial land use category is intended for industrial uses that are compatible for a relatively close proximity to residential areas. This is in contrast to typical heavy industry that would have negative impacts on nearby neighborhoods. The maximum FAR allowed for Light Industrial uses is 0.5.

Antioch City Council and City staff have indicated that the Laurel Road is too close to the Antioch Station at Hillcrest Avenue and that they would prefer not to have another eBART station at Laurel Road as they will to preserve the area for commercial development.

Oakley

Within a half-mile of the Laurel Road potential station site, planned land uses include Single Family Residential Low Density, Commercial, Public/Semi-public, and Waterway. The Single Family Residential, Low Density designation provides for a range of 0.8 to 2.3 dwelling units per gross acre, with an expected population density of 3 to 8 persons per acre.

- The Commercial designation is meant to provide for a large variety of commercial uses which range from salons to offices to large-scale retail. These uses generally abide by the following development regulations:
 - Maximum site coverage of 40%
 - Maximum building height of 35 feet
 - Maximum FAR is 1.0
 - Average number of employees per gross acre is 26
- The Public and Semi-public Facilities designation provides for a wide variety of community uses. Within a half-mile of the Laurel Road potential station site, the developed Public/Semi-public Facilities parcels include the Randall-Bold Water Treatment Facility. Private commercial uses are allowed in this land-use designation if they relate directly to the public or semi-public activity the land is planned for.

- The Waterway designation includes the CCWD canal.

Pipeline Projects

The Laurel Road potential station site may have benefits over the Lone Tree Way potential station site for Oakley residents, as Laurel Road is the principal connection to State Route 4 for the residents of Oakley. Most of the new population from approved developments in the City will also use Laurel Road to access State Route 4.

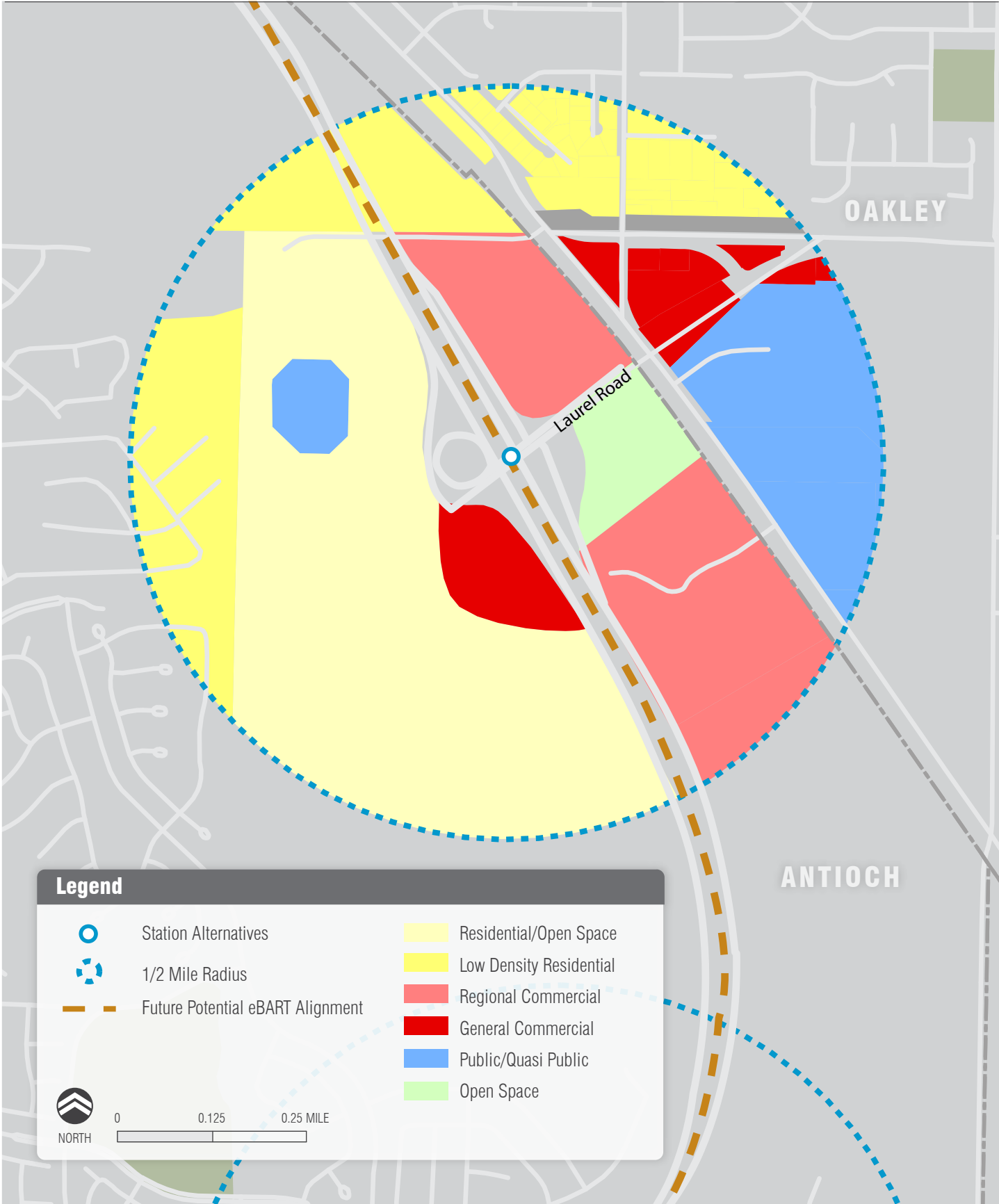
Within the City of Antioch, the Park Ridge development includes 525 single family dwellings on 171 acres. Significant portions of this development are located within a half-mile of the potential station site. Currently there is a gap on Laurel Road located on the north side of the Park Ridge site and would be constructed as part of this development.

Within the City of Oakley there are no pipeline projects within half-mile of the potential station site (City of Oakley Residential Project List). However, the Empire Station and Magnolia Park II on Neroly Road are nearby.



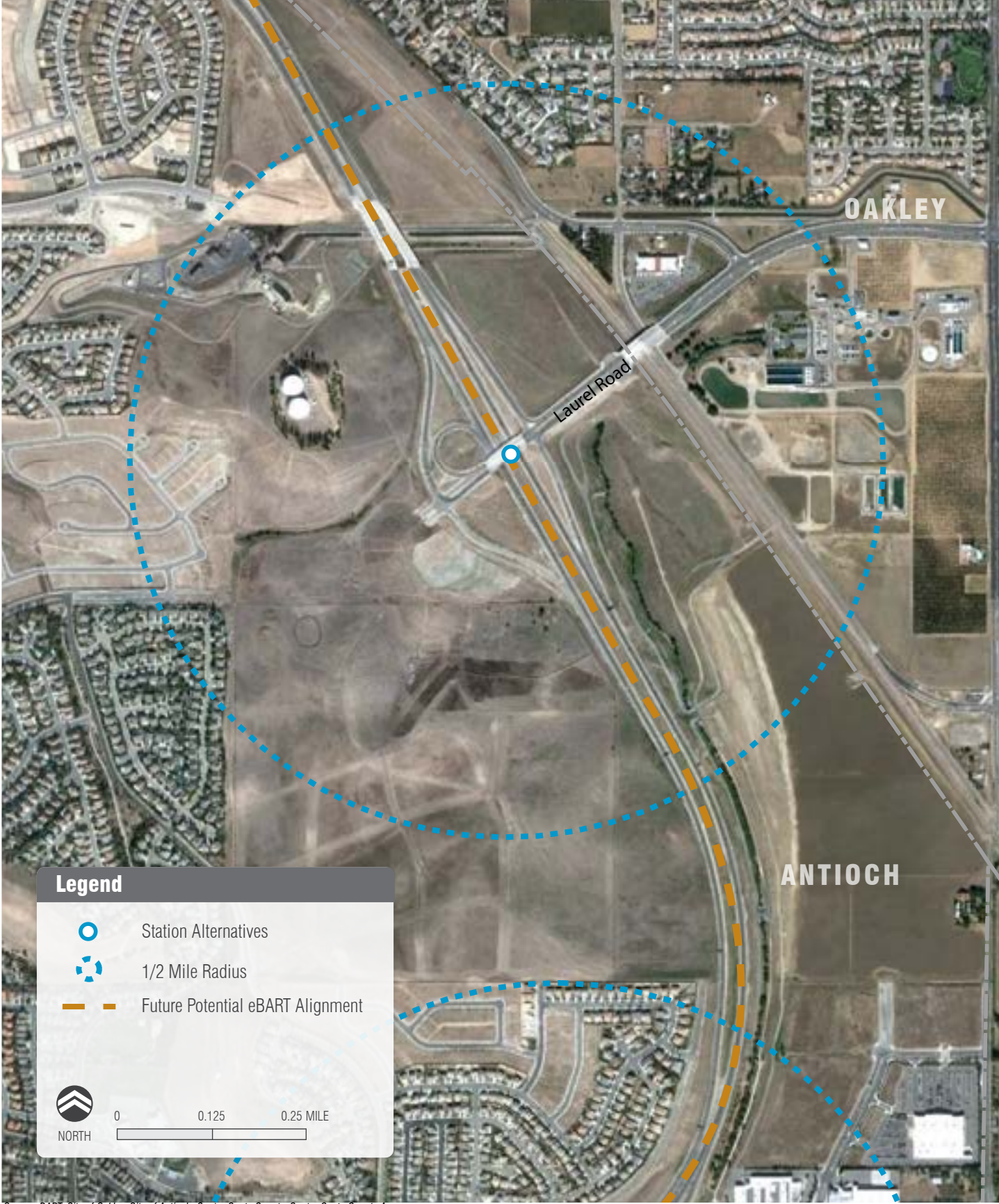
Source: BART, City of Oakley, City of Antioch, Contra Costa County, Contra Costa County Assessor

Figure 6 LAUREL ROAD EXISTING LAND USE



Source: BART, City of Oakley, City of Antioch, Contra Costa County, Contra Costa County Assessor

Figure 7 LAUREL ROAD GENERAL PLAN LAND USE



Source: BART, City of Oakley, City of Antioch, Contra Costa County, Contra Costa County Assessor

Figure 8 LAUREL ROAD AERIAL

Lone Tree Way and State Route 4 Potential Station Site

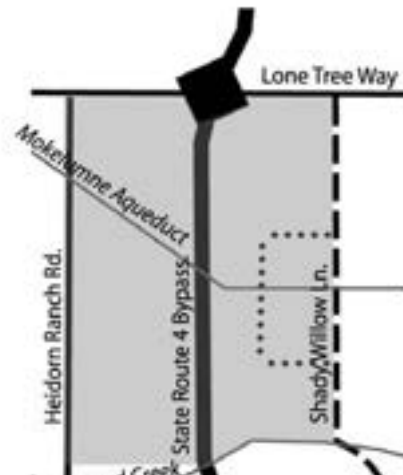
The Lone Tree Way potential station site is on the border of Antioch and Brentwood, at the intersection of State Route 4 and Lone Tree Way. The location is on the eastern side of Antioch and the western side of Brentwood. The City of Oakley boundary is also less than one mile away. Within a half-mile of the potential station site, the City of Antioch is located north of Lone Tree Way, which runs east and west. The City of Brentwood covers most of the area south of Lone Tree Way inside a half-mile buffer of the potential station site. The following analysis covers land use for both Antioch and Brentwood.

Existing Plans and Policies

Existing plans and policies include general plans from both Antioch and Brentwood, along with the East Lone Tree Specific Plan from the City of Antioch. The East Lone Tree Specific Plan covers the entire portion of Antioch that is within a half-mile of the Lone Tree Way potential station site. For a discussion of that Specific Plan and Antioch's general plan policies, refer to the Existing Plans and Policies section for the Laurel Road potential station site.

There are several major policies from Brentwood's Land Use element that may relate to development surrounding the Lone Tree Way potential station site, including the following.

- **Priority Planning Area One (PA-1) Priority Area** (PA-1) is identified in the General Plan (adopted July 2014). PA-1 is located in the northwest corner of the city, south of Lone Tree Way, west of Shady Willow Lane, generally north of Sand Creek, and east of Heidorn Ranch Road, within the Brentwood city limits. Policy guidance for PA-1 includes the opportunities for the mixed used pedestrian transit (MUPT) including the following: job generating commercial, integrated residential, a future transit facility (to accommodate eBART station and/or park and ride), transit oriented development, and flex live/work space. Large concentrations of residential only uses are discouraged. Approximately 80 percent of developable acreage are to be MUPT which is described in more detail below.
- **Planned Development (PD)** - The PD designation identifies areas where a master planned project has been approved and entitled, and site specific zoning has been established. The PD land use designation defaults to the zoning that is in place for the subject parcel. A planned development is located in PA-1.



City of Brentwood Special Planning Area P

Residential Land Use Designations

- *Residential Very Low Density (R-VLD)*- Allows suburban large lot single family residences with a permitted density range of 1.1 to 3.0 units per gross acre, with a mid-range of 2.0 units per gross acre.
- *Residential Low Density (R-LD)*- Permits single family detached houses allowed with ability for higher densities through open space off-sets. The permitted density range is 1.1 to 5.0 units per gross acre, with a mid-range of 3.0 units per gross acre.
- *Residential Medium Density (R-MD)*- Permits a range of housing types are accommodated from single family detached on small lots through apartments buildings. The permitted density range is 5.1 to 11.0 units per gross acre, with a mid-range of 8.0 units per gross acre.
- *Residential High Density (R-HD)*- Provides for multifamily development in structures of two to three stories, with off-street parking. The permitted density range is 11.1 to 20.0 units per gross acre, with a mid-range of 15.5 units per gross acre.
- *Residential Very High Density (R-VHD)*- Provides for multifamily development and is primarily intended for apartments or condominiums of two to three stories (or greater) in mixed-use areas with accompanying facilities and services. The permitted density range is 20.1 to 30.0 units per gross acre (there is no applicable mid-range density for this designation).

Commercial, Office, and Mixed-Use Land Use Designations

- *Regional Commercial (RC)*- Allows large-scale retail stores and service uses to serve the general needs of the community and the region, primarily along the State Route 4 corridor on large development sites.
- *General Commercial (GC)*- Allows for concentrations of a variety of mixed commercial uses and service type businesses to serve specific areas of the city and neighborhoods that are related to State Route 4 and some arterial intersections, on parcels generally ranging from one to 20 acres. These uses are not usually located in an RC and usually anchored by a major tenant.
- *Business Park (BP)*- Provides for integrated business and research parks, large individual corporate establishments, professional and administrative office centers, and light industrial complexes. Selected complementary commercial activities and limited residential uses may also be allowed.
- *Mixed Use Pedestrian Transit (MUPT)* This is new land use designation under PA-1 in the 2014 General Plan. The MUPT designation identifies an area which, because of its strategic location, access, and visibility to SR 4, shall be developed predominately with jobs-generating and commercial uses. This designation is intended to provide high-quality jobs in office, professional, research and technology, and light industry sectors, and to allow commercial uses with a regional focus.

This area is envisioned to be served by mass transit. Other uses may include integrated medium to very high-density residential development and amenities, in a pedestrian-friendly environment.

- *Professional Office (PO)*- The PO designation is predominantly intended for development with a professional, institutional, or medical-dental orientation.

Existing Land Uses

Existing land uses within a half-mile radius of the Lone Tree Way potential station site include mostly big box retail/commercial uses, including major retailers such as Target, JC Penney, Bed Bath and Beyond, Cost Plus, Old Navy, Lowe's, Trader Joe's, and Kohl's, among others. Single family residential and multi-family residential developments are located to the northwest and southeast, and open space to the south. Local community facilities and landmarks include Pioneer Elementary School, Golden Hills Christian School and Lighthouse Baptist Church. There are also several parks located in the vicinity, including Heidorn Park and Meadow Creek States Park.

Table 5: Lone Tree Way Existing Land Use Within Half-mile Radius

Existing Land Use	Acres	Percent
Single Family	63.0	12.6%
Multi-family	22.3	4.5%
Commercial	124.6	24.9%
Service	5.7	1.1%
Community Facilities	43.7	8.7%
Urban Acreage	0.0	0.0%
Agriculture	21.9	4.4%
Rural	11.1	2.2%
Vacant, Commercial	48.3	9.6%
Vacant, SF	20.4	4.1%
Vacant, Unbuildable	0.1	0.0%
Other Areas (undefined, ROW, etc)	139.9	27.9%
Lone Tree Way Total	501.0	100.0%

General Plan Land Use

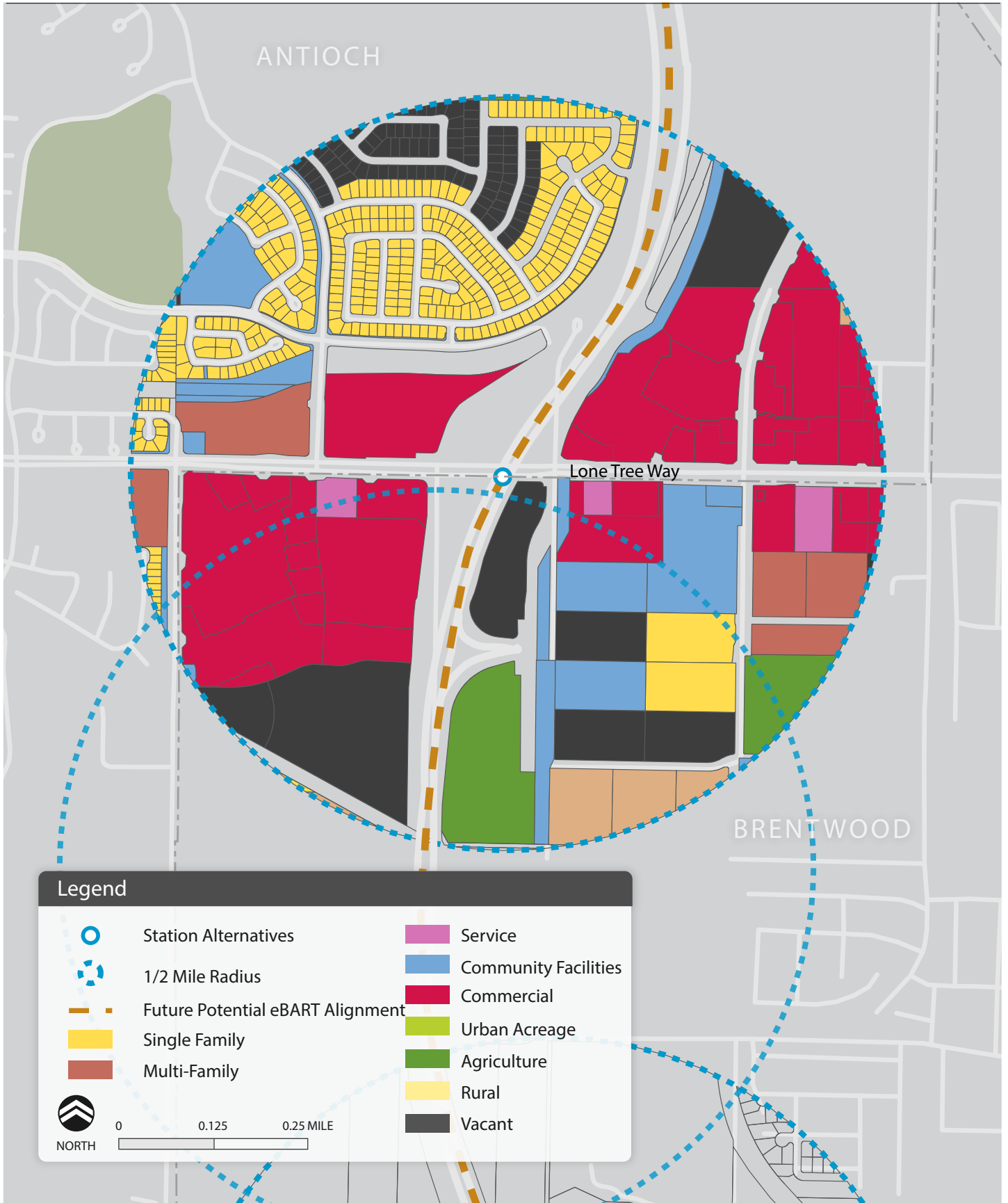
Within a half-mile of the Lone Tree Way potential station site, planned land uses include a variety of residential, regional retail, commercial, and public uses.

Table 6: Lone Tree Way General Plan Land Use Within Half-mile Radius

General Plan Land Use	Acres	Percent
Antioch		
Medium Low Density Residential (6 DU/AC)	7.5	1.49%
High Density Residential up to (20 DU/AC)	3.1	0.61%
High Density Residential	10.7	2.13%
Residential/Open Space	120.1	23.98%
Regional Retail/Employment-Generating Lands	31.0	6.19%
Regional Retail	49.9	9.96%
Brentwood		
Medium Density Residential	10.13	2.02%
High Density Residential	8.32	1.66%
Very High Density Residential	5.36	1.07%
General Commercial	9.46	1.89%
Regional Commercial	61.86	12.35%
Mixed-Use Pedestrian Transit (MUPT)	61.62	12.30%
Planned Development (PD)	22.40	4.47%
Semi-Public	16.83	3.36%
Other Areas (undefined, ROW, etc)	82.8	16.52%
Lone Tree Way Total	501	100.00%

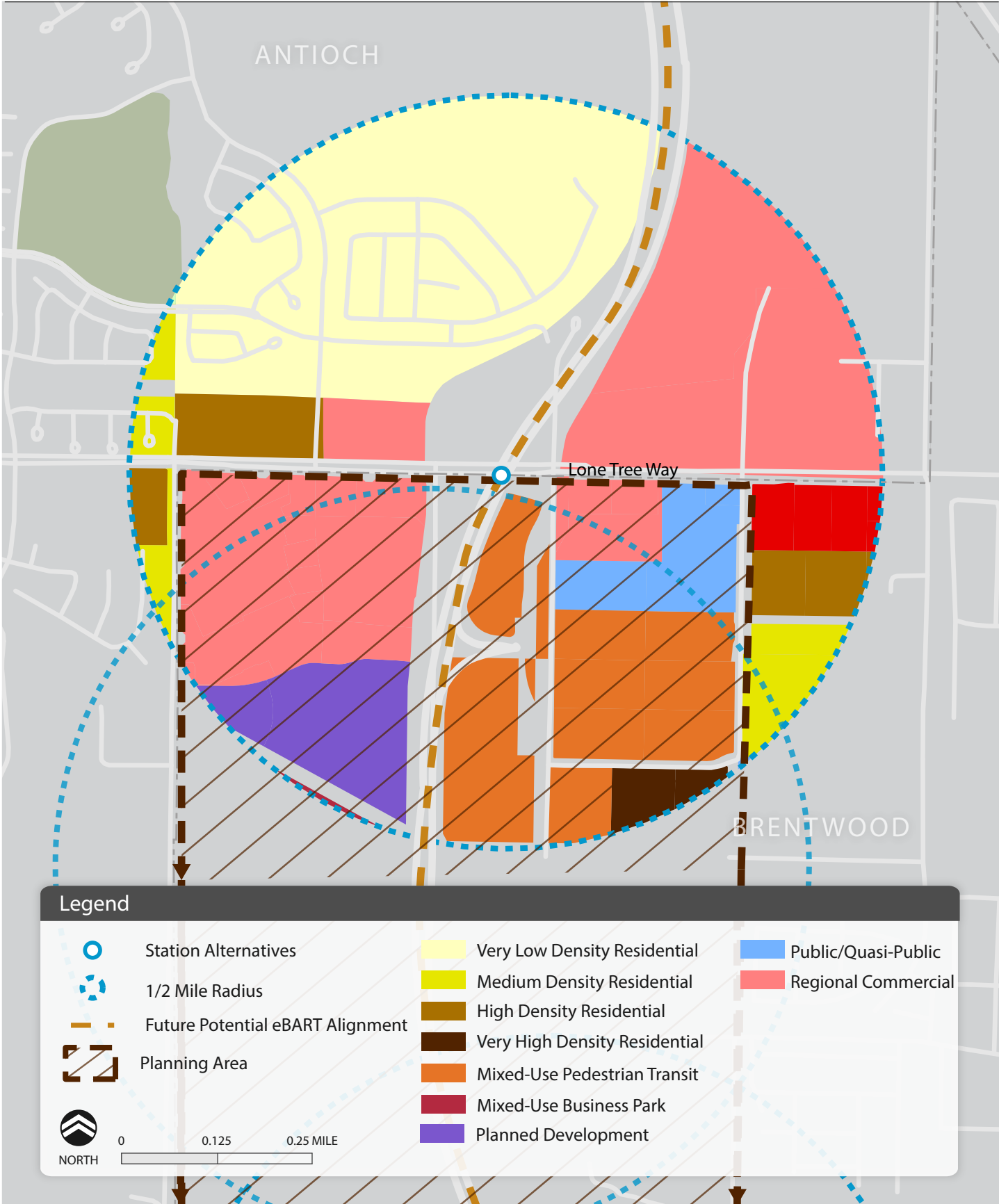
Pipeline Projects

There is one pipeline project located within a half-mile of the potential station site, a 120-unit apartment complex called Casa Bella Apartments. The location for this project is on the west side of Shady Willow Lane, south of Amber Lane.



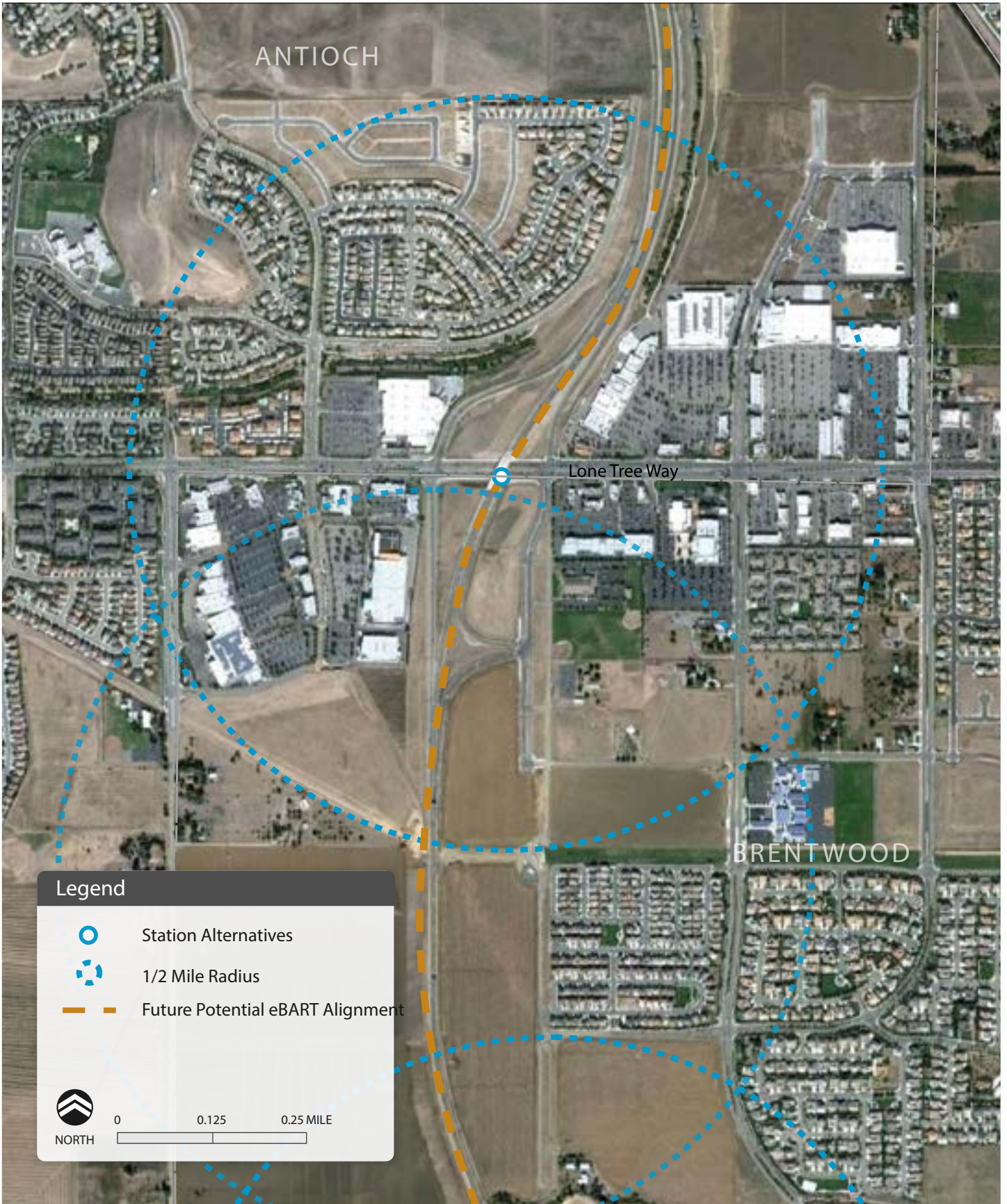
Source: BART, City of Oakley, City of Antioch, Contra Costa County, Contra Costa County

Figure 9 LONE TREE WAY EXISTING LAND USE



Source: BART, City of Oakley, City of Antioch, Contra Costa County, Contra Costa County

Figure 10 LONE TREE WAY GENERAL PLAN LAND USE



Source: BART, City of Oakley, City of Antioch, Contra Costa County, Contra Costa County

Figure 11 LONE TREE WAY AERIAL

Mokelumne Trail and State Route 4 Potential Station Site

The Mokelumne Trail potential station site is located in Brentwood where an extension of the existing Mokelumne Trail is planned to pass over State Route 4. The location is in the western side of Brentwood near the border with Antioch.

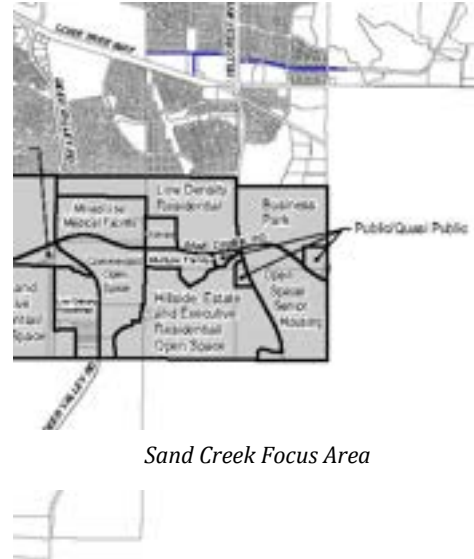
Existing Plans and Policies

Antioch General Plan

A small portion of the Sand Creek Focus Area identified in the Antioch General Plan is within a half-mile of the potential station site. The Focus Area has land use suggestions, including a business park.

Brentwood General Plan

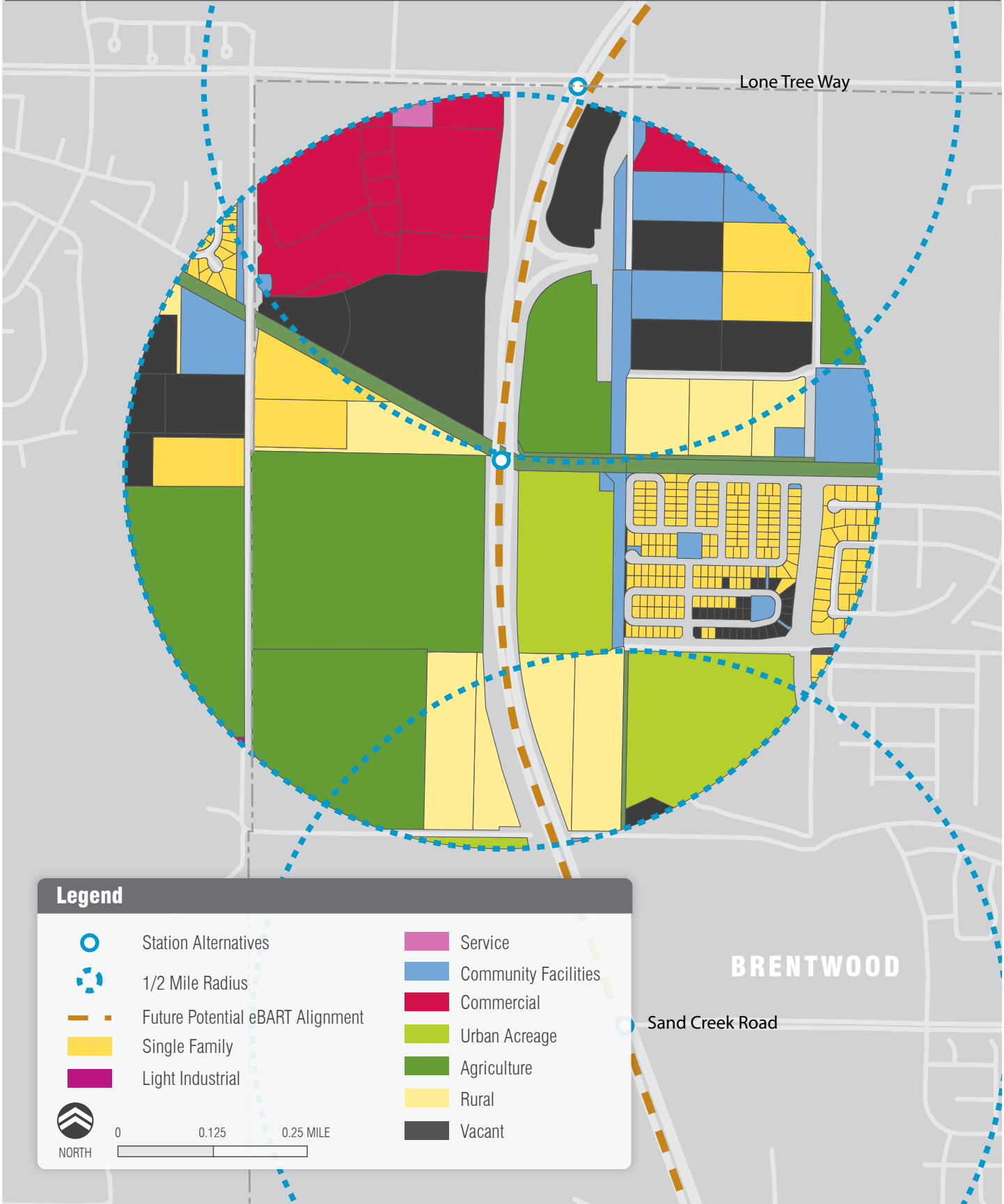
There are several policies from Brentwood's General Plan Land Use element that may relate to development surrounding the Mokelumne potential station site. For a discussion of Brentwood's relevant general plan policies, refer to the Existing Plans and Policies section for the Lone Tree Way Station site.



Sand Creek Focus Area

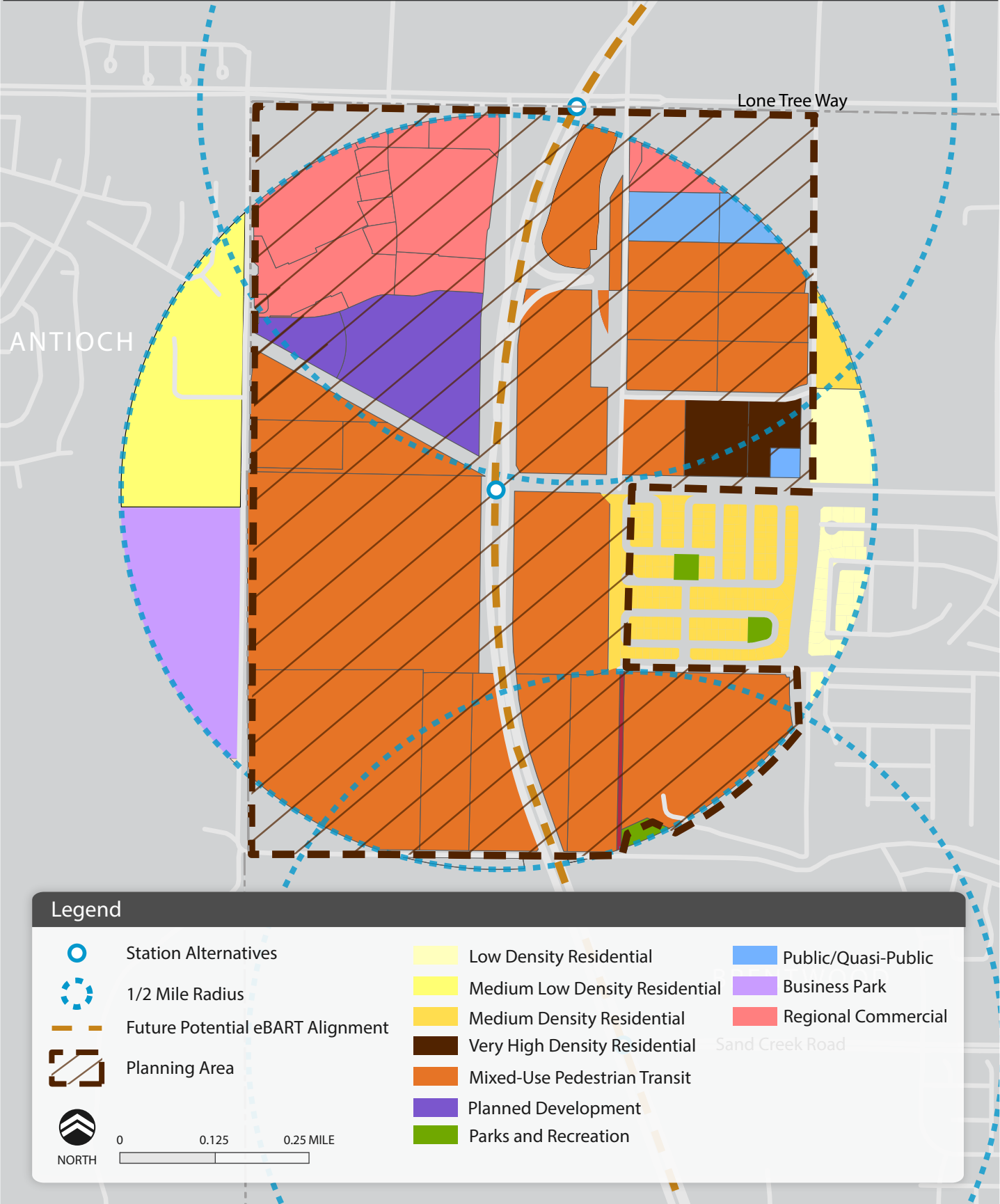
Existing Land Uses

Existing land uses within a half-mile radius of the Mokelumne potential station site include mostly agriculture, urban acreage, rural and vacant land (see Table 7). There are two retail plazas to the north that are part of Lone Tree Plaza, and single family residential to the southeast. Retail anchors include Kohls, Home Depot, and Sports Authority. Local landmarks include Pioneer Elementary School, Heritage Baptist Church and Church of Jesus Christ of Latter Day Saints.



Source: BART, City of Oakley, City of Antioch, Contra Costa County, Contra Costa County Assessor

Figure 12 MOKELUMNE EXISTING LAND USE



Legend



Station Alternatives



1/2 Mile Radius



Future Potential eBART Alignment



Planning Area



NORTH

0 0.125 0.25 MILE

Low Density Residential

Medium Low Density Residential

Medium Density Residential

Very High Density Residential

Mixed-Use Pedestrian Transit

Planned Development

Parks and Recreation

Public/Quasi-Public

Business Park

Regional Commercial

Sand Creek Road

Figure 13 MOKELUMNE GENERAL PLAN LAND USE

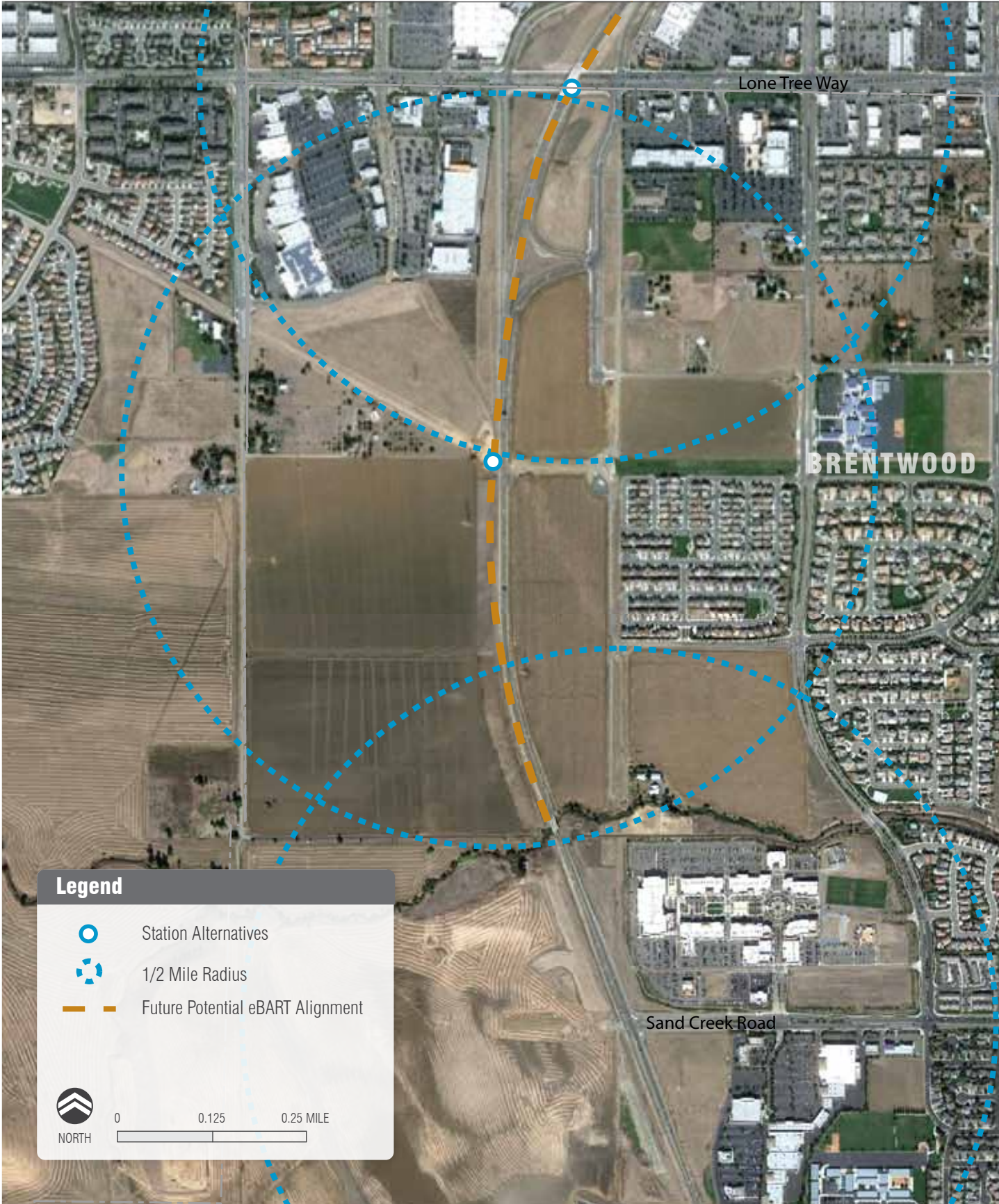


Figure 14 MOKELUMNE AERIAL

Sand Creek Road and State Route 4 Potential Station Site

The Sand Creek Road potential station site is located in Brentwood at the interchange of State Route 4 and Sand Creek Road. The location is in the western side of Brentwood near the border with Antioch.

Existing Plans and Policies

Brentwood General Plan

There are several policies from Brentwood’s General Plan Land Use element that may relate to development surrounding the Sand Creek Road potential station site. For a discussion of Brentwood’s relevant general plan policies, refer to the Existing Plans and Policies section for the Lone Tree Way Station.

A Specific Plan was started for this area, but was not completed or adopted.

Existing Land Use

Existing land uses within a half-mile radius of the Sand Creek Road potential station site include open space to the north and west, two retail plazas, and single family residential. Retail anchors include REI, Raley’s, TJ Maxx, and Ross. Local landmarks include Loma Vista Elementary School, Sunshine House Preschool, and Loma Vista Park to the southeast.

Table 9: Sand Creek Road Existing Land Use within Half-mile Radius

Existing Land Use	Acres	Percent
Single Family	63.2	12.6%
Multi-family	4.5	0.9%
Commercial	75.1	15.0%
Community Facilities	60.9	12.2%
Urban Acreage	153.5	30.6%
Agriculture	9.5	1.9%
Rural	30.4	6.1%
Vacant, Commercial	6.5	1.3%
Vacant, Unbuildable	0.7	0.1%
Other Areas (undefined, ROW, etc)	96.7	19.3%
Sand Creek Road Total	501.0	100.0%

General Plan Land Use

Within a half-mile of the Sand Creek Road potential station site, planned land uses include Very Low Density Residential, Low Density Residential, Medium Density Residential, Mixed-Use Business Park, Regional Commercial, School, and Park.

Table 10: Sand Creek Road General Plan Land Use within Half-mile Radius

General Plan Land Use	Acres	Percent
Very Low Density Residential (1.1-3.0 du/ac)	16.6	3.3%
Low Density Residential (1.1-5.0 du/ac)	56.9	11.4%
Medium Density Residential (5.1-11 du/ac)	10.9	2.2%
High Density Residential (11.1-20.0 du/ac)	9.2	1.8%
Mixed-Use Business Park	76.2	15.2%
Regional Commercial	80.9	16.1%
Existing School	12.3	2.5%
SPA-E	125.9	25.1%
Park	5.0	1.0%
Other Areas (undefined, ROW, etc)	107.1	21.4%
Sand Creek Total	501.0	100.0%

Pipeline Projects

There are two pipeline projects with applications into the City of Brentwood: Bridle Gate subdivision and Trilogy at the Vineyards subdivision. Bridle Gate proposes 166 single family units and Trilogy at the Vineyards proposes 1,750 units with a mix of attached and detached single family units as well as multi-family units.

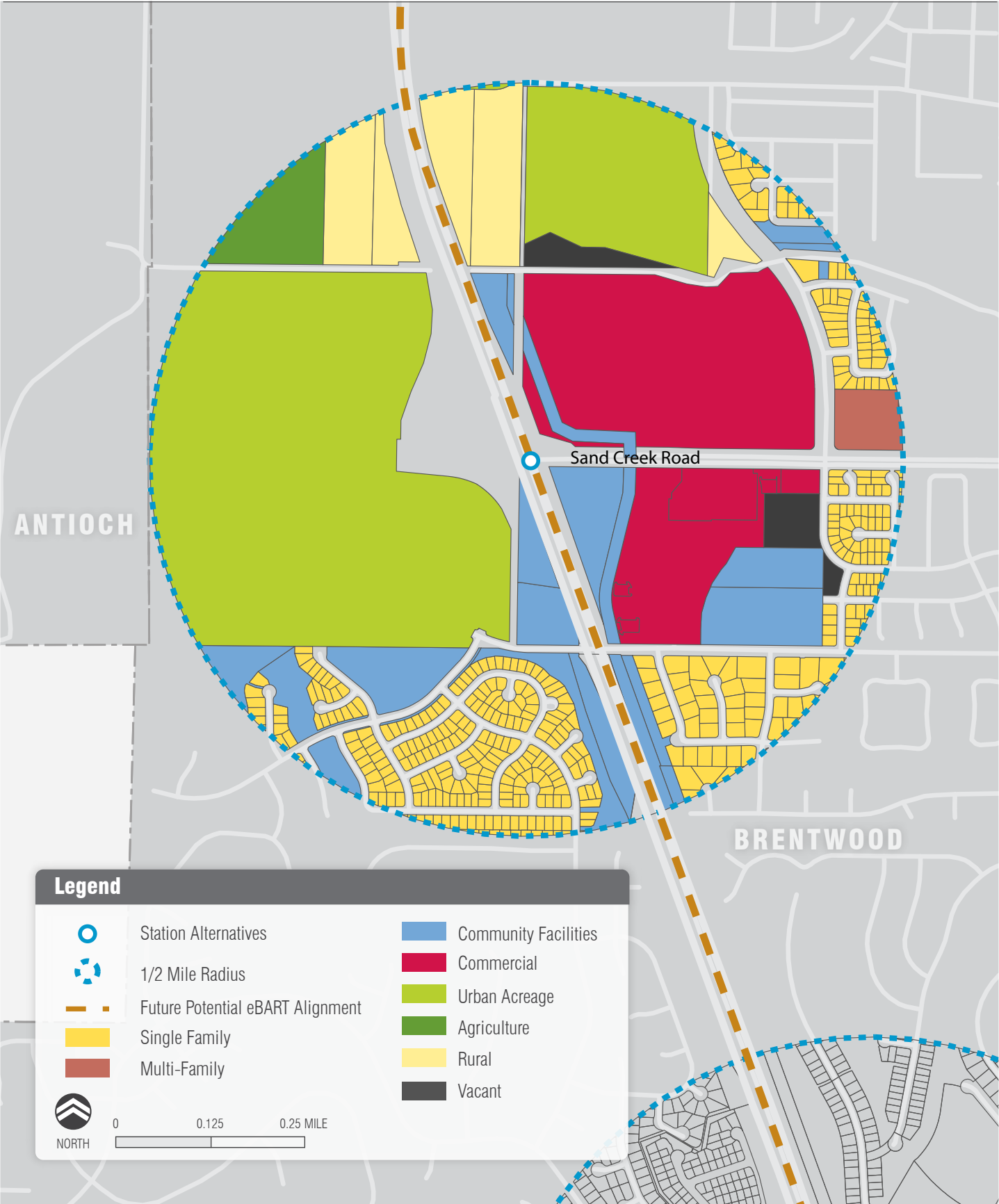


Figure 15 SAND CREEK ROAD EXISTING LAND USES

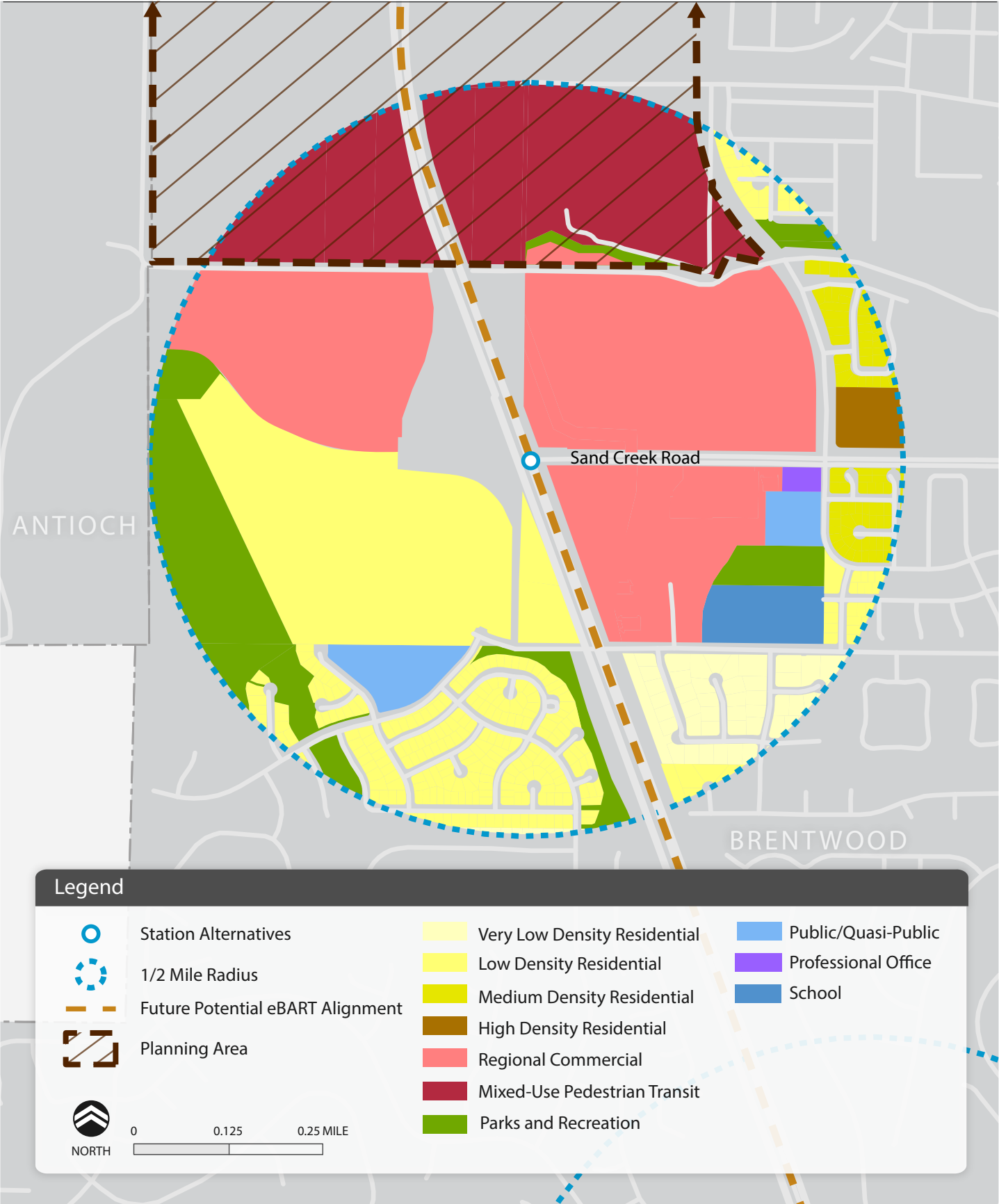


Figure 16 SAND CREEK ROAD GENERAL PLAN LAND USE

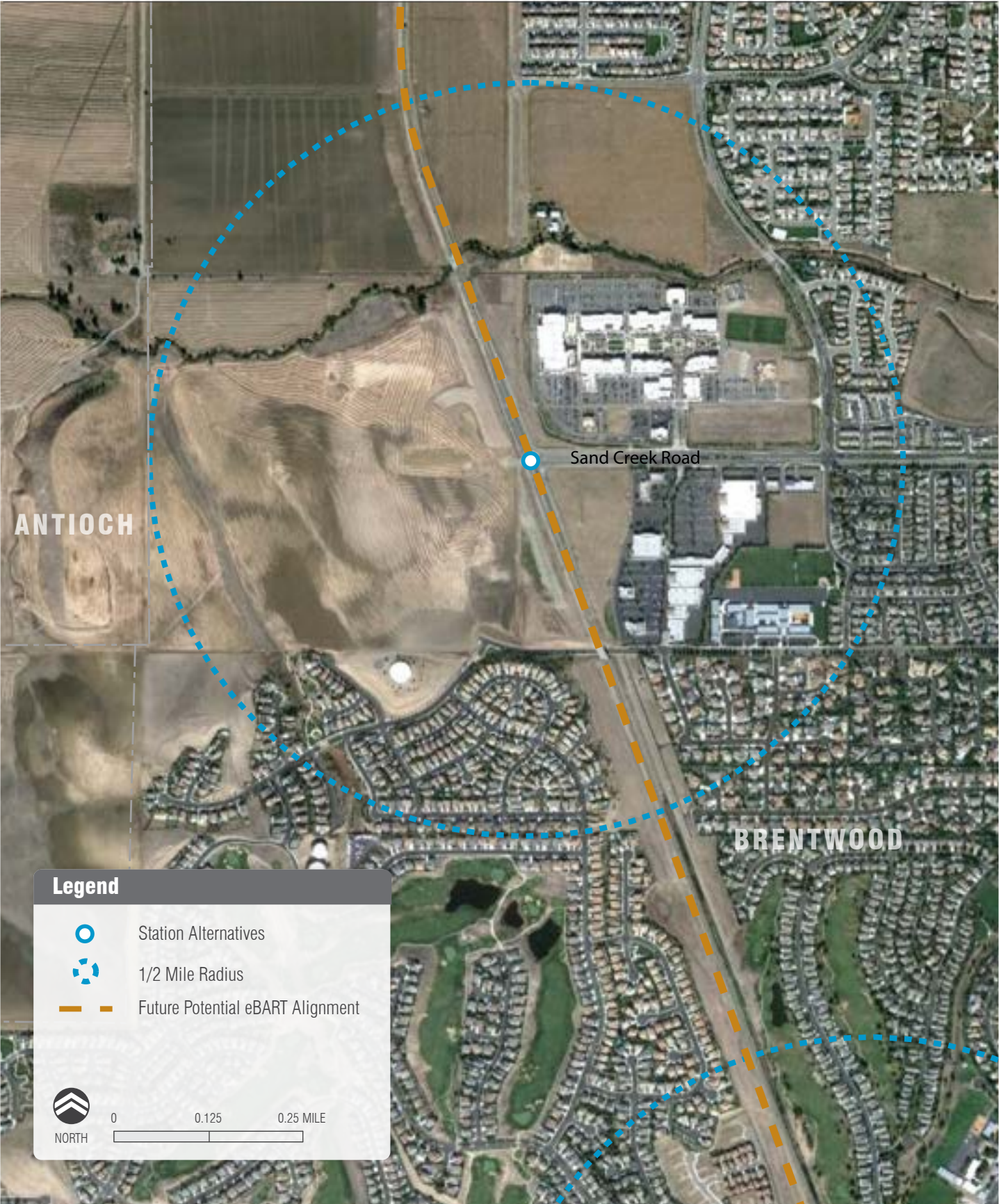


Figure 17 SAND CREEK ROAD AERIAL

Balfour Road and State Route 4 Potential Station Site

The Balfour Road potential station site is located in Brentwood at the interchange of State Route 4 and Balfour Road. The location is in the southwestern portion of Brentwood near the border with Antioch. Within a half-mile radius of this potential station site there are several different existing and planned land uses, which are described below.

Existing Plans and Policies

Brentwood General Plan

There are several policies from Brentwood's Land Use element that may relate to development surrounding the Balfour Road potential station site. For a discussion of Brentwood's relevant general plan policies, refer to the Existing Plans and Policies section for the Lone Tree Way Station.

Existing Land Uses

Existing land uses within a half-mile radius of the Balfour Road potential station site include golf courses, schools, open space, and medical offices. Residential developments are oriented around three golf clubs: Shadow Lakes Golf Club, Deer Ridge Golf Club, and Brentwood Country Club. There are also two elementary schools in the vicinity: Ron Nunn Elementary School and R. Paul Krey Elementary School. Medical facilities in the area include John Muir Medical Center, Dale Giessman medical office and Eskaton Assisted Living. There is a small retail/commercial plaza around the intersection of Balfour Road and Cortona Way with Walgreens as the anchor store. There is also another retail/commercial plaza located just outside of the half-mile radius to the east with CVS, Safeway, fast food and restaurants. Also located just outside the radius to the north is Apple Hill Park.

Table 11: Balfour Road Existing Land Use within Half-mile Radius

Existing Land Use	Acres	Percent
Single Family	129.2	25.8%
Multi-family	0.2	0.0%
Other Residential	31.0	6.2%
Commercial	29.8	6.0%
Medical	7.4	1.5%
Service	2.5	0.5%
Parking	8.6	1.7%
Community Facilities	117.4	23.4%
Public Facilities	16.6	3.3%
Vacant, Commercial	47.5	9.5%
Vacant, SF	5.3	1.1%
Vacant, Unbuildable	5.2	1.0%
Other Areas (undefined, ROW, etc)	100.3	20.0%
Balfour Road Total	501.0	100.0%

General Plan Land Use

Within a half-mile of the Lone Creek Way potential station site, planned land uses include residential, commercial, and public uses.

Table 12: Balfour Road General Plan Land Use within Half-mile Radius

General Plan Land Use	Acres	Percent
Very Low Density Residential	45.1	9.01%
Low Density Residential	119.5	23.86%
Medium Density Residential	32.7	6.52%
Very High Density Residential	30.4	6.06%
Business Park	41.4	8.26%
General Commercial	14.9	2.96%
Professional Office	12.4	2.47%
Existing School	9.2	1.84%
Park	4.8	0.97%
Public/Semi-Public	78.9	15.74%
Other Areas (undefined, ROW, etc)	111.8	22.31%
Balfour Road Total	501	100.00%

Pipeline Projects

There are no pipeline projects within a half-mile of this potential station site.

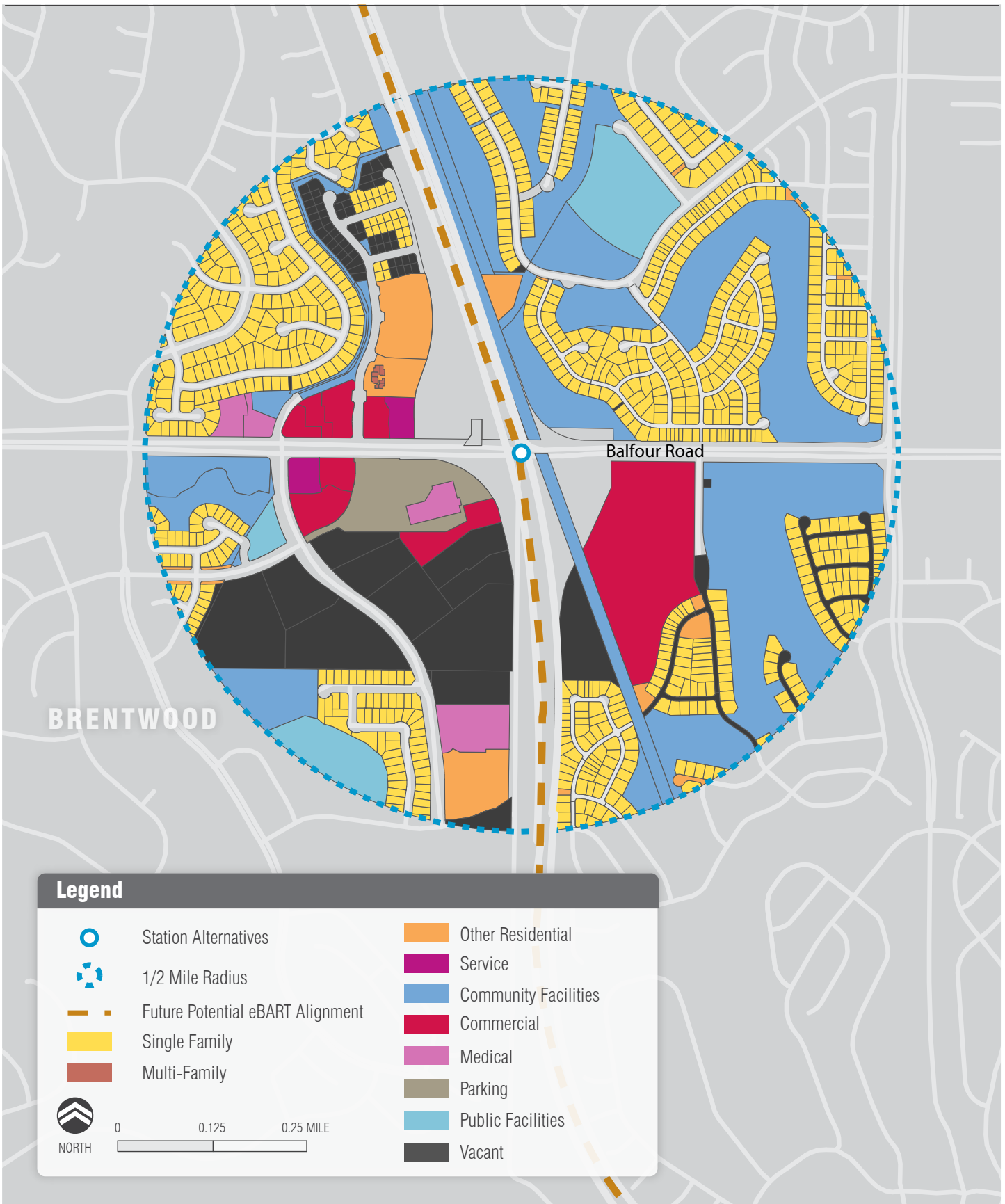


Figure 18 **BALFOUR ROAD EXISTING LAND USES**

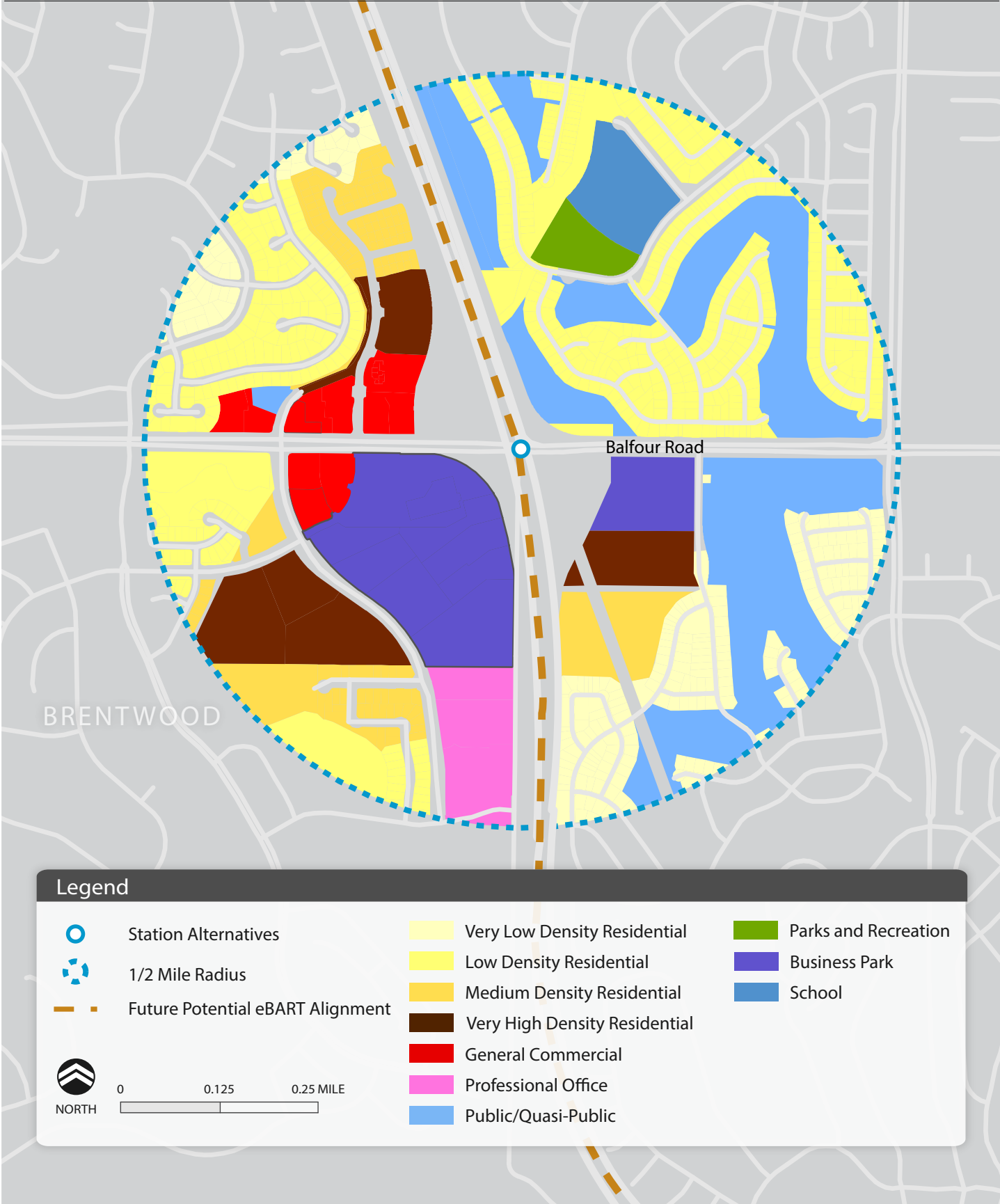


Figure 19 BALFOUR ROAD GENERAL PLAN LAND USE

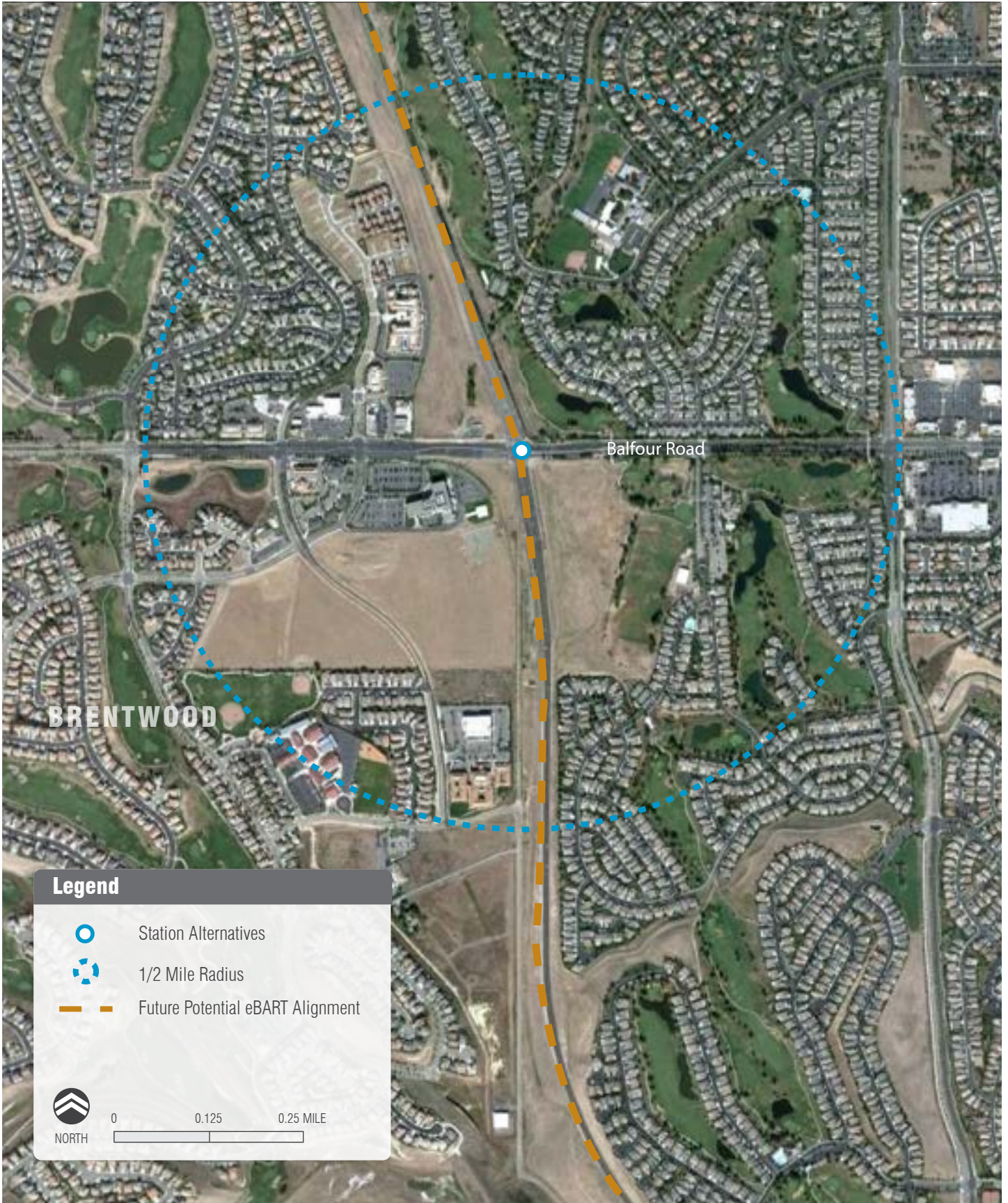


Figure 20 **BALFOUR ROAD AERIAL**

Discovery Bay/Byron and State Route 4 Potential Station Site

The Discovery Bay/Byron potential station site is located in Brentwood at the interchange of State Route 4 and Discovery Bay/Byron. The location is in the southern portion of Brentwood near the border with Contra Costa County. Within a half-mile radius of this potential station site there are several different existing and planned land uses, which are described below.

Existing Plans and Policies

Brentwood

There are two policies from Brentwood's Land Use element that may relate to development surrounding the Discovery Bay/Byron potential station site. For a discussion of Brentwood's relevant general plan policies, refer to the Existing Plans and Policies section for the Lone Tree Way Station.

County

The Contra Costa County General Plan does not include specific mention of the Discovery Bay/Byron area. Preservation of agricultural lands is a key component of the General Plan with several supporting goals and policies.

Another consideration is the urban limit line. The potential station site falls outside the urban limit line designated by the County. In this case the urban limit line and the boundary between Brentwood and the County are identical. According to the Contra Costa County General Plan the purpose of the ULL is twofold:

1. To ensure preservation of identified non-urban agricultural, open space and other areas by establishing a line beyond which no urban land uses can be designated during the term of the General Plan; and
2. To facilitate the enforcement of the 65/35 Land Preservation Standard.

Existing Land Uses

Existing land uses within a half-mile radius of the Discovery Bay/Byron potential station site include mostly orchards and open space. To the northeast there are a few rural homes located adjacent to agricultural land. Some agricultural based businesses, such as DC's Extraordinary Cherries, are located in the area. Other notable uses outside the half-mile radius include the Marsh Creek Reservoir to the southwest and single family homes and a golf course to the northwest.

Table 13: Discovery Bay/Byron Existing Land Use within Half-mile Radius

Existing Land Use	Acres	Percent
Community Facilities	128.3	25.6%
Urban Acreage	45.8	9.1%
Agriculture	199.6	39.9%
Rural	58.1	11.6%
Vacant, SF	4.7	0.9%
Other Areas (undefined, ROW, etc)	64.5	12.9%
Discovery Bay/Byron Total	501.0	100.0%

General Plan Land Uses

Within a half-mile of the Discovery Bay/Byron potential station site, planned land uses include mostly agricultural uses, along with a variety of residential, commercial, and public uses (see Table 14).

Table 14: Discovery Bay/Byron General Plan Land Use within Half-mile Radius

General Plan Land Use	Acres	Percent
Brentwood		
Low Density Residential	8.3	1.65%
Planned Development	32.8	6.55%
Regional Commercial	17.1	3.41%
Community College	15.7	3.13%
Park	32.0	6.38%
Public/Semi-Public	4.2	0.84%
County		
Low Density Residential	43.7	8.72%
Regional Commercial	52.7	10.52%
Public and Semi-Public	5.8	1.15%
Agricultural Core	169.4	33.81%
Parks and Recreation	72.2	14.41%
Other Areas (undefined, ROW, etc)	47.2	9.42%
Discovery Bay/Byron Total	501	100.00%

Pipeline Projects

There are no pipeline projects within a half-mile of the potential station site.

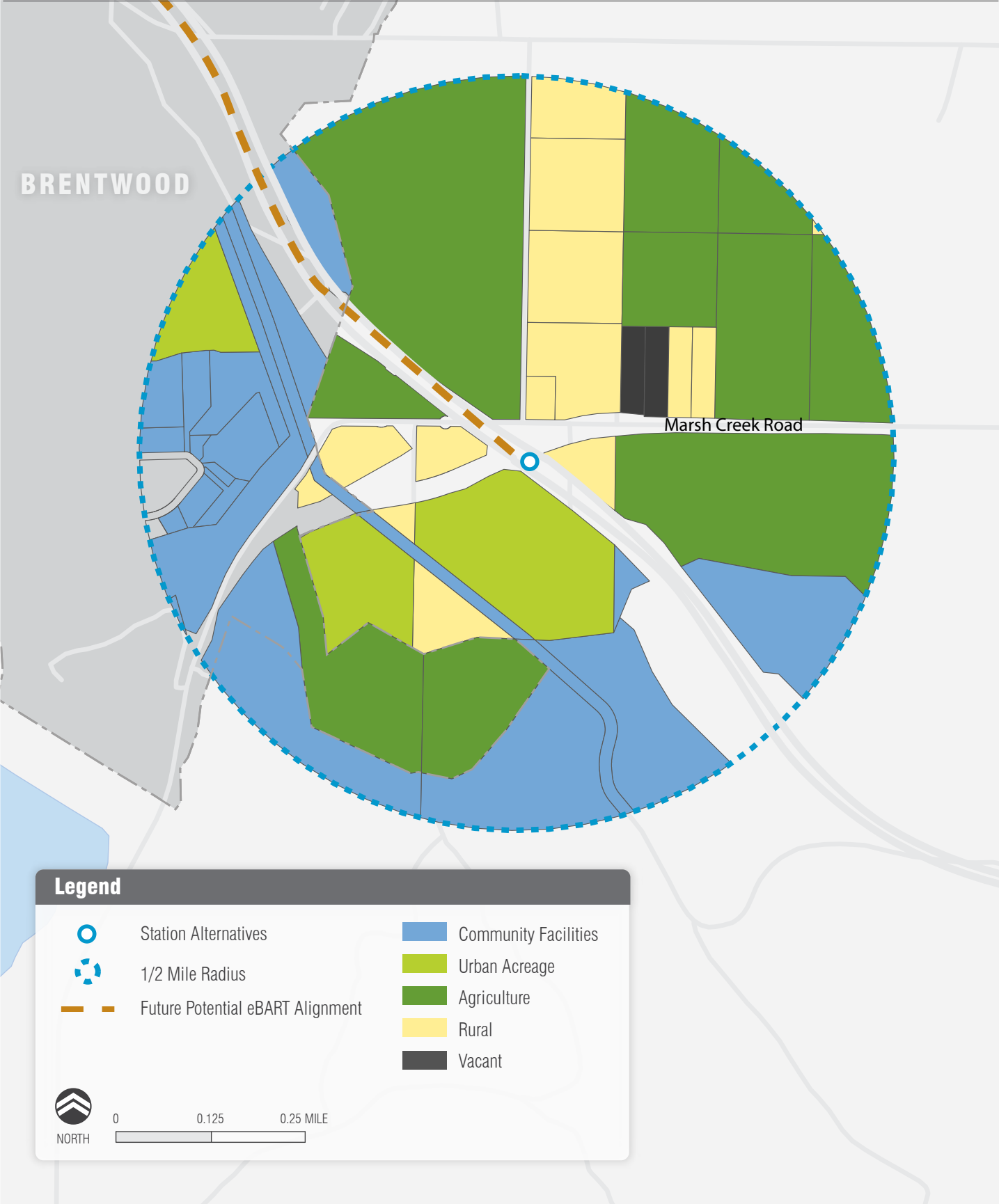


Figure 21 **DISCOVERY BAY/BYRON EXISTING LAND USES**

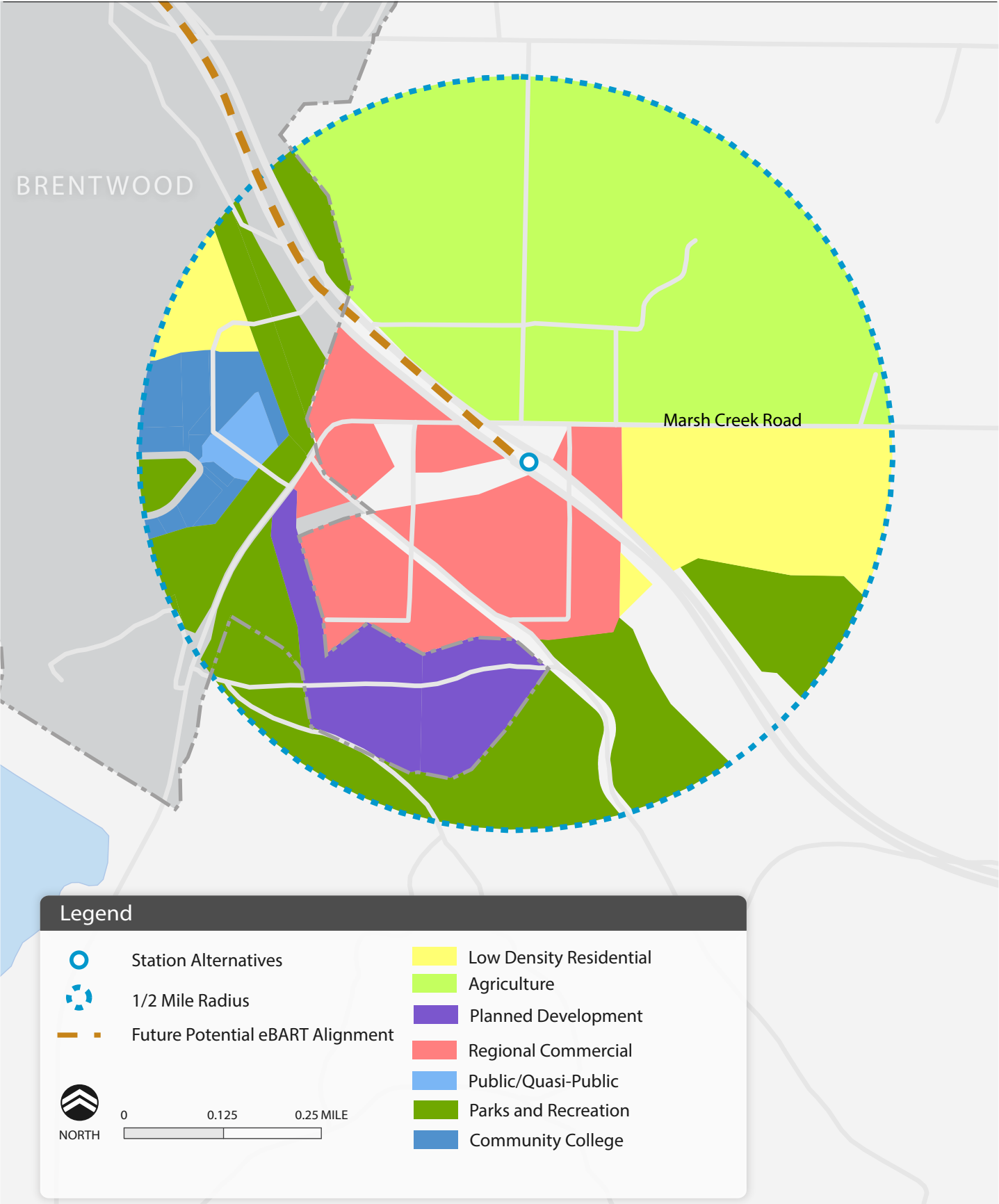


Figure 22 DISCOVERY BAY/BYRON GENERAL PLAN LAND USE



Figure 23 **DISCOVERY BAY/BYRON AERIAL**

Chapter 3

eBART Ridership

This chapter describes forecasted ridership for an extension of eBART to each of the potential future stations:

- Pittsburg Center at Railroad Avenue and State Route 4 (Pittsburg, this is an infill station on the eBART line)
- Laurel Road and State Route 4 (Antioch)
- Lone Tree Way and State Route 4 (Antioch)
- Mokelumne Trail and State Route 4 (Brentwood)
- Sand Creek Road and State Route 4 (Brentwood)
- Balfour Road and State Route 4 (Brentwood)
- Discovery Bay/Byron and State Route 4 (Contra Costa County)

The ridership forecasts are based on the assumption that there is only one new station beyond the Antioch Station.

Table 15 provides a summary of forecasted ridership for 2035 and represents bi-directional weekday volumes. It is estimated that most of the proposed project passengers would be transferring directly to/from the BART system.

Each future station alternative affects ridership at the Antioch Station to varying degrees based on the new station's proximity to the Antioch Station site. It is assumed riders will choose the most convenient station to access and the new station would attract some riders who would have initially used the Antioch Station, but now find the new station to be more attractive. With service only to the Antioch Station, which is currently under construction, ridership on eBART is estimated to be 10,100 daily riders in the year 2035. Each alternative will add a single second station, reaching a greater portion of the population and employment base in Eastern Contra Costa County than the original project to the Antioch Station. For example, adding a station at Laurel Road would increase the total daily ridership to 13,400 or an increase of 3,300 daily riders over the ridership forecast for the original project terminating at Antioch Station. Ridership at the Antioch Station would decrease to 3,600 daily riders as a result of the 8,100 daily riders which would now use the new Laurel Road station. As shown in the table, total daily ridership increases as the location of the terminus station moves to southeast, peaking with the Mokelumne Station option. Southeast of this point the total population and employment served begins to drop off resulting in lower ridership as compared to that expected at the Mokelumne Station.

Table 15: Ridership Estimate for Potential eBART End Station Alternatives – Year 2035

Potential Future End Station Alternative	Trips To/From Pittsburg Center Station	Trips To/From Antioch Station	Trips To/From Potential Future End Station	Total Trips
Antioch	1,700	8,400	-	10,100
Laurel	1,700	3,600	8,100	13,400
Lone Tree	1,700	6,300	5,700	13,700
Mokelumne	1,700	7,600	4,700	14,000
Sand Creek	1,700	7,700	3,000	12,400
Balfour	1,700	7,900	2,300	11,900
Discovery Bay/Byron	1,700	8,200	1,700	11,600

Ridership Methodology and Assumptions

The estimated transit ridership for the year 2035 was developed based on the ridership forecasts prepared for the Eastern Contra Costa County eBART EIR in 2009. These ridership forecasts were prepared using the Contra Costa Transportation Authority’s regional transportation model. The results from the model were used to identify the relationship between ridership and the population and employment of the area surrounding the eBART stations. These relationships were then used to calculate potential ridership for the new station sites under consideration.

Catchment areas were developed for the Antioch Station and each end station to determine the ridership forecast. The catchment area around a given station is the geographic area from which the station will attract ridership. Where catchment areas of two stations overlap, it is assumed that riders will go to the closest station. Catchments surrounding the Antioch Station changed depending on the location of the end station. Aggregate demographics were developed for two-mile catchment areas around each station and ridership ratios for population and employment were developed using the original ridership forecasts and future population and employment estimates. Furthermore, planned land use development was used to make minor adjustments and scaling between existing and planned station alternatives. Since the original ridership estimate for the EIR included the Pittsburg Center Station, an equivalent Pittsburg Center ridership (1,700) was assumed for each alternative.

2035 Population and Employment

Ridership ratios were developed based on catchment area 2030 population and employment projections for each of the end station pairs. The 2030 projections were developed in 2007, before the major economic downturn in 2008. More recent population and employment data for the East County suggests that the 2030 projects are overly optimistic and that current employment and population estimates are five years behind the numbers suggested by the older forecasts. To correct for this situation it is assumed in this analysis that the original 2030 projections are actually more representative of the year 2035. Table 16 shows the estimated population and employment within two miles of each station site.

Table 16: 2035 Population and Employment

Station	Two-Mile Radius	
	Population	Employment
Antioch	67,098	20,260
Laurel Road	68,333	24,230
Lone Tree	55,821	17,879
Mokelumne Trail	52,875	17,819
Sand Creek	48,593	15,956
Balfour Road	37,391	7,230
Byron/Discovery Bay	13,305	716

Table 17 shows how the total East County population and employment would be distributed between each pair of candidate stations, that is the Antioch Station paired with each potential new terminus station. This information was used to distribute the total ridership between each pair of stations. The center of population for this area of the county is just to the southeast of Antioch. As the location of the potential terminus station moves to the southeast it actually moves away from the center of population which reduces the ridership potential for the new terminus station and increases the portion of the ridership which would use the Antioch Station. This is the reason that ridership potential declines for those stations southeast of the Mokelumne Station. Stations to the southeast of Mokelumne would require a larger number of people to travel out of direction to get to eBART, encouraging riders to travel to Antioch Station or to just not use eBART.

Table 17: 2035 Population and Employment Distribution

Station Pairs	Population Distribution	Employment Distribution
Antioch	31%	34%
Laurel	69%	66%
Antioch	52%	56%
Lone Tree	48%	44%
Antioch	62%	63%
Mokelumne	38%	37%
Antioch	72%	75%
Sand Creek	28%	25%
Antioch	77%	82%
Balfour	23%	18%
Antioch	83%	88%
Byron/Discovery Bay	17%	12%

Chapter 4

Design Concepts and Cost

Capital and Operating and Maintenance Costs were developed for an eBART extension from the Antioch Station to each of the six potential terminus station sites:

- Laurel Road and State Route 4 (Antioch)
- Lone Tree Way and State Route 4 (Antioch/Brentwood)
- Mokelumne Trail and State Route 4 (Brentwood)
- Sand Creek Road and State Route 4 (Brentwood)
- Balfour Road and State Route 4 (Brentwood)
- Discovery Bay/Byron and State Route 4 (Contra Costa County)

These cost estimates were based upon a conceptual design study of each of the alternatives assuming the use of the median of State Route 4 for the eBART extension and an appropriate station design for each of the candidate station sites, taking into consideration the configuration of the area around the station. The costs estimates also included consideration of eBART vehicle requirements, vehicle maintenance and storage needs, as well as costs of right-of-way required outside of the State Route 4 right-of-way.

Design Concepts

The main variable for each of the eBART extension options would be the configuration of the stations. Otherwise all of the options involve a double track guideway located in the median of State Route 4. The median is generally wide enough to accommodate the guideway. The exception to this is the area in the vicinity of the interchange of State Route 4 and SR-160. Because of the complex configuration of the ramps and structures in this interchange and the hilly terrain, the median area is not wide enough to accommodate the eBART guideway, and modifications to the ramps and roadway structure would be required to create the necessary width. Once the alignment is south of this interchange area, the median of State Route 4 is wide enough to accommodate the eBART guideway. However, it is not wide enough to accommodate the width of both the guideway and the station platforms in the area where the new station would be developed. To accommodate a station the median would have to be widened by about ten feet which requires some reconstruction of the roadways on either side to create the needed width.

Each of the alternative stations must be configured to operate within the median of State Route 4. The station design must allow for pedestrian access over or under the State Route 4 roadway lanes. Since most of the station sites were located at or near an interchange of State Route 4 with local streets, the station design must be compatible with the spatial configuration of the interchange.

- Below Grade – This is where the local street at the interchange passes over State Route 4. In this case the station would be in the median of State Route 4 at the same elevation as State Route 4 and below the local street bridge that passes overhead. Pedestrian connections could be via the overpass bridge or a separate pedestrian-only bridge. The Pittsburg Center Station features this design with the station below the Railroad Avenue overpass with stair and elevator connections provided between the bridge sidewalks and the platform below.
- Above Grade – This is where State Route 4 crosses over the local street at the interchange. The eBART station would be elevated at the same level as State Route 4 and pedestrian connections would be provided from the local street up to the station platform above or via a pedestrian undercrossing of State Route 4.
- At-Grade – In this case the station is at the same level as State Route 4 and access to the station is provided by a pedestrian overpass of State Route 4. This configuration applies in areas where the station is not actually at an interchange. The Antioch Station features this design.

For each station it was assumed that about ten acres of land would be required outside of State Route 4 to accommodate parking (1,000 spaces), facilities for passenger drop-off/pick-up, buses, and bicycles. It was assumed that the 1,000 spaces of surface parking would be the initial supply and that future expansion of parking could occur through the development of parking structures on the site of the parking lot. That is what is currently planned for the Antioch Station. Connections to the local street network would also be necessary. The concepts for each candidate station are discussed below.

Laurel Road

The concept for the Laurel Road Station is depicted in Figure 24. This would be a below grade station with the station platform located in the median of State Route 4 under the Laurel Road overpass. The station facilities and parking would be located on a parcel northeast of the interchange and pedestrian access to and from the station would be via the sidewalks on the Laurel Road bridge. The design of this station will be similar to the Pittsburg Center Station.

Figure 24 - eBART Laurel Road Station Area



Lone Tree Way Station

The Lone Tree Way Station concept is shown in Figure 25. This would be an above grade station located just south of the State Route 4 bridge over Lone Tree Way. Access to the station would be via pedestrian connections underneath the elevated lanes of State Route 4. The station facilities would be located on a vacant parcel that is part of the State Route 4 right-of-way located just east of the station. This station would be similar in design to the MacArthur and Rockridge BART Stations.

Figure 25 – eBART Lone Tree Way Station Area



Mokelumne

There are actually two concepts for the Mokelumne Station, one that is in the median of State Route 4 and one that is located outside of the median. A station site outside of the median allows for better station access and creates more opportunities for land use development that are transit supportive. This is because the barriers that the traffic lanes of State Route 4 create would be eliminated by a station outside the median. The median station concept is an at-grade configuration with the station located at ground level, the same level as State Route 4. A pedestrian bridge would provide access and would also serve to allow the Mokelumne Trail, a bicycle/pedestrian facility, to cross State Route 4. This concept is shown in Figure 26.

Figure 26 – eBART Mokelumne Station Area



The second option is shown in Figure 27. In this option the eBART guideway would leave the median of State Route 4 and swing to the west on an elevated structure to an above-grade station located just west of State Route 4. A disadvantage of this concept is that once the guideway leaves the median of State Route 4, it becomes very expensive and difficult to return to the median if an extension southward was considered for the future.

Figure 27 – eBART Mokelumne Station Area Outside the Median



The two design concepts for this station were coordinated with the already completed design of the Mokelumne Trail pedestrian bridge across State Route 4. This was to assure that the station design would be compatible with the bridge and that the bridge would be able to effectively provide pedestrian/bicycle access to the station. Funding for the bridge had not yet been obtained. There is substantial undeveloped land to the west of the station site which is an opportunity for transit supportive development and the planned local street network (Jeffery Way and Heidorn Ranch Road) will provide good access to the station.

Sand Creek Road

The Sand Creek Road Station would be an above grade station located in the median of State Route 4 above Sand Creek Road. Access to the station would be via pedestrian connections, stairs and elevators, from the sidewalks on Sand Creek Road as it passes under State Route 4. The station parking and other support facilities would be located in the southwest quadrant of the interchange as shown in Figure 28. This type of stations is similar in design to the MacArthur or Rockridge BART stations.

Figure 28 – eBART Sand Creek Road Station Area



Balfour Road

Figure 29 presents the station concept for the Balfour Road Station. This would be an at-grade station in the median of State Route 4. A pedestrian bridge would provide access to the station and the station facilities would be located on a parcel just west of State Route 4. This station would have a design similar to the Antioch eBART Station.

Figure 29 – eBART Balfour Road Station Area



Discovery Bay/Byron Station

This station would be located at the future interchange of State Route 4 with Marsh Creek Road. It would be an above-grade station as shown in Figure 30. Access to the station would be from the sidewalks along Marsh Creek Road which would pass underneath the station. The station parking and support facilities are proposed to be located in the southwest quadrant of the interchange. The design of this station would be similar to the MacArthur or Rockridge BART stations.

Figure 30 – eBART Discovery Bay/Byron Station Area



Vehicles

The potential extensions of eBART would require additional vehicles to allow the planned service frequency of 15 minutes to be maintained. BART operations staff conducted an operating plan analysis to determine how many vehicles would be required to service the extension alternatives. This analysis takes into consideration the forecast ridership, the length of the extension, operating speeds, travel time, and train crew operating rules. Per this analysis eight vehicles are being purchased to serve the Phase I portion of the project which extends to Hillcrest Avenue. This includes spare vehicles to replace those vehicles that require servicing and maintenance. The number of additional vehicles required to serve each of the six extension options is six, including spares, for a total fleet of 14 vehicles.

Maintenance Facilities

The maintenance facility located just east of the Antioch Station would need to be augmented in size to accommodate the 14 vehicle fleet required to serve the extension. The facility was designed to be able to accommodate this level of expansion, although the required expansion would be an additional cost. In addition, train storage tracks known as tail tracks would be provided beyond the platform of any terminus station.

Capital Costs

The design concepts for each of the extension alternatives as described above were used as a basis to estimate the project development costs. The capital costs include construction, vehicles, right-of-way and related soft costs such as contingencies, costs of project design and construction management and other project implementation costs. The cost estimates were prepared by BART's engineering team. It is important to note that these cost estimates are based on very limited engineering work and should be considered as order-of-magnitude estimates with limited accuracy.

Table 18 below summarizes the cost estimates for each end station extension alternative. The major cost categories are identified. Highway modifications refer to the costs of modifying the median area of State Route 4 to accommodate the eBART guideway through the SR-160 Interchange and in the vicinity of the end station. The other key categories of cost are the trackwork and guideway, the stations, maintenance and train operations facilities, and the vehicles. The cost of these last two items is the same for all the alternatives. The station cost depends on the type of station required for each end station option and the costs range from \$48M to \$65M. The most variable items of the costs are the highway modifications and the trackwork/guideway costs. These costs increase with the length of the extension.

As shown in the table the total costs range from \$244M to \$398M. In general, the further to the southeast the terminus station is located, the higher the total cost. The costs of the two options for the Mokelumne Station, either in the median of State Route 4, or outside of the median are almost identical. This suggests that costs should not be a factor in the selection of one of these options.

Table 18: Order of Magnitude Costs (\$Millions – 2012)

Cost Item:	End Station						
	Laurel	Lone Tree	Mokelumne In Median	Mokelumne Out-of-Median	Sand Creek	Balfour	Discovery Bay/ Bryon
Highway Modifications	\$50	\$65	\$63	\$70	\$76	\$105	\$123
Trackwork/Guideway	\$30	\$51	\$58	\$69	\$66	\$87	\$111
Station Facilities and Parking	\$65	\$59	\$64	\$48	\$55	\$64	\$65
Maintenance/ Control Facilities	\$19	\$19	\$19	\$19	\$19	\$19	\$19
Vehicles	\$80	\$80	\$80	\$80	\$80	\$80	\$80
Total	\$244	\$274	\$284	\$286	\$296	\$355	\$398

Operating and Maintenance Costs

The cost of operating and maintaining the eBART system includes costs of administration, service delivery, and maintenance of vehicles and facilities. These are referred to as O&M Costs. A preliminary study conducted in 2009 involved the development of a staffing plan and the estimation of the vehicle hours and miles of service required to operate the Phase I project between the Pittsburg/Bay Point BART Station and the Antioch Station. At that time it was estimated that it would require a total staff of 51 full time equivalent employees and that total O&M costs would be \$9.1 million. Assuming a 4% annual escalation of costs, these cost expressed in 2013 dollars would be \$10.6 million. This escalated cost information was used to estimate the additional O&M costs that would be associated with each of the extension alternatives (see Table 19). The costs are based on the added vehicle hours and vehicle miles of travel that would be required to operate each of the extension alternatives. These costs are very much related to the length of the extension. An extension ending at Laurel Road would involve \$3.3 million per year in O&M expenses in addition to the \$10.6 million required to operate the original service to the Antioch Station. The longest extension to the Discovery Bay/Byron Station at Marsh Creek Road would have additional O&M Costs of \$11.0 million per year.

Table 19: O&M Cost Estimates

End Station	Additional Annual O&M Costs - \$ Millions - 2013
Laurel	\$3.3
Lone Tree	\$4.9
Mokelumne	\$5.8
Sand Creek	\$6.5
Balfour	\$8.1
Discovery Bay/Byron	\$ 11.0