CHULA VISTA LIGHT RAIL CORRIDOR IMPROVEMENTS PROJECT STUDY REPORT

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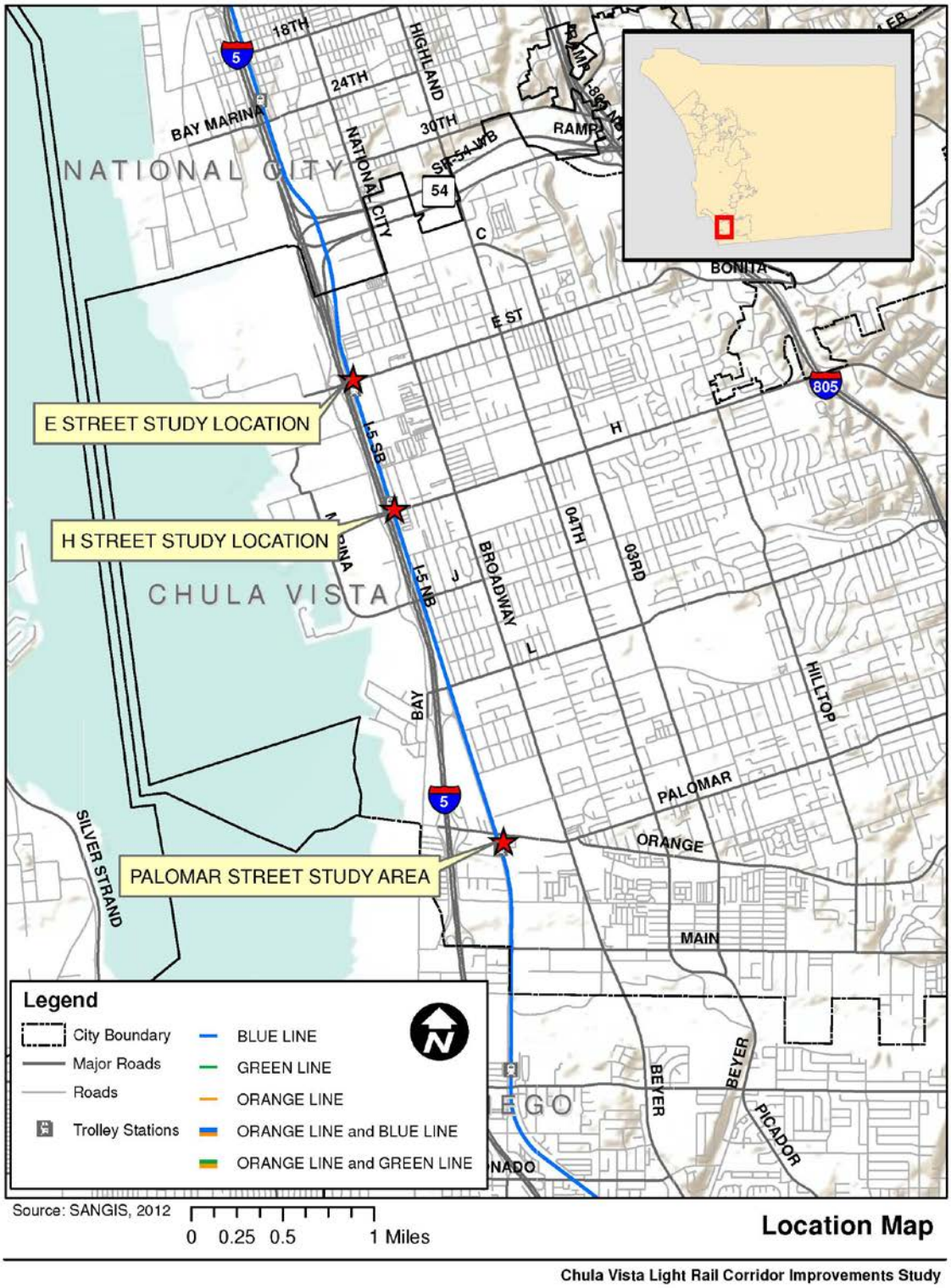
Abbreviations

The following acronyms, initials, and short forms are used in this report:

ADA	Americans with Disabilities Act
BMP	Best Management Practices
BRT	Bus Rapid Transit
CDFG	California Department of Fish and Game
CIDH	Cast in Drilled Hole
Comm.	Community
CPUC	California Public Utilities Commission
CSP	Corrugated Steel Pipe
FEMA	Federal Emergency Management Agency
HOV	High Occupancy Vehicle
I-5	Interstate 5
kV	Kilovolt
LRT	Light Rail Trolley
MBTA	Migratory Bird Treaty Act
mph	Miles Per Hour
MOU	Memorandum of Understanding
MSE	Mechanically Stabilized Embankment
NPDES	National Pollution Discharge Elimination System
NRCS	National Resources Conservation Service
PA/ED	Project Approval/Environmental Document
Ped.	Pedestrian
PGD	Palomar Gateway District
PS&E	Plans, Specifications, and Estimate
RCP	Reinforced Concrete Pipe
RTP	Regional Transportation Plan
SANDAG	San Diego Association of Governments
SDG&E	San Diego Gas & Electric
SUSMP	Standard Urban Storm Mitigation Plan
SWPPP	Storm Water Pollution Prevention Plan
TCIF	Trade Corridors Improvement Fund
USACE	U.S. Army Corps of Engineers
VCP	Vitrified Clay Pipe

Figure 1: Study Area Location Map



1. INTRODUCTION

The San Diego Association of Governments (SANDAG) has initiated this Project Study Report for The Chula Vista Light Rail Corridor Improvements. The Study will document the analysis of alternatives for grade separating the LRT tracks from the roadway crossings at E Street, H Street and Palomar Street. The three project study locations are shown in Figure 1. Alternatives being considered include elevating the tracks over the roadway; lowering the tracks under the roadway; and in the case of Palomar Street, lowering the roadway under the tracks. Currently the tracks in this area are also used by freight trains. Each of the projects will include an at-grade bypass track for the freight trains to utilize.

2. BACKGROUND

The Blue Line Light Rail Trolley (LRT), operated by the San Diego Metropolitan Transit System (MTS) runs north and south from the San Ysidro Transit Center near the U.S.-Mexico Border through Downtown San Diego to the Old Town Transit Center. This line experiences the highest ridership of any LRT line in the San Diego region with over 20 million riders in 2009 (State of the Commute, SANDAG 2010). Projections indicate that the ridership will continue to rise into the foreseeable future. This projected rise can be attributed to expected population growth and the development of the Bayfront area to the west. Within the Chula Vista city limits the LRT traverses east of and parallel to Interstate 5 (I-5). Vehicular traffic along Chula Vista's major east-west arterials heading to and from the I-5 is increasing due to area build-out in the City's western urban areas.

Three at grade street crossing locations along the Blue Line LRT in Chula Vista have been identified as candidates for future grade separations. E Street, H Street and Palomar Street all are major arterial streets that convey traffic to and from Interstate 5 (I-5). The current at grade crossings require traffic to stop each time a train passes the crossings (normally 196 times per day for LRT and 2 times for freight). Ridership of the Blue Line LRT is expected to increase, and as such plans are in place to increase the number of trolley trips per day. Consequently, headways between trains are expected to decrease. The combination of increased vehicular traffic and increased wait time behind the rail crossing arms will result in major traffic delays for vehicles at the at grade crossings of E Street, H Street and Palomar Street, and diminish the Level of Service.

The Blue Line typically operates trolleys at 15 minute headways, with 7.5 minute headways during weekday rush hours and late night service from 9:00 pm to 1:00 am at 30 minute headways. With the forecasted increase in ridership of the Blue Line, MTS will reduce headways to 7.5 minutes for longer periods of the day. Each of the grade separation alternatives proposed in this study will reduce the associated impacts this would have on vehicular traffic and improves the safety of bicycle and pedestrian movements at the study area crossings.

The San Diego and Imperial Valley Short Line Operator (SD&IV), a subsidiary of Rail America Inc., provides freight train services on the same tracks as the Blue Line during the hours the trolley is out of service. The current operations on the freight line are limited to a two and a half hour period Monday through Saturday mornings from 1:31 a.m. to 4:04 a.m. This creates a temporal separation from the trolley service that allows for the freight trains to utilize the same lines. Freight trains run from the San Diego Rail Yard to the San Ysidro Rail Yard, and also to numerous customers along the route via spurs from the main line. Current freight improvements between the international border and the E Street station will increase the capacity for freight trains per night from 2 to 4.

2.1. Existing Facilities

E Street

The E Street rail crossing intersection is the farthest north of the three study locations. E Street is classified as a four-lane Major Arterial with on-ramps and off-ramps to I-5 immediately west of the LRT tracks. Traffic counts from 2010 showed that the volume of traffic on E Street was 39,303 vehicles per day. The signalized intersection of E Street and the northbound exit and entrance ramps is adjacent to the at-grade crossing of the LRT line. The right-of-way width of E Street is 108 feet and the design speed is 45 mph. E Street is considered a view corridor with westerly views to San Diego Bay. The existing transit station is south of E Street and east of the LRT tracks (See Attachment 23 & 24). The station has 267 parking spaces, a bus loop serving three bus routes, and a shuttle to the Living Coast Discovery Center. Properties in the vicinity of the study area include the I-5 corridor to the west, commercial properties to the east, and a trailer park to the northeast.

The rail facilities in this location consist of a northbound track and southbound track, or railroad westbound and railroad eastbound, that are utilized both by LRT and freight operators. Both tracks are

electrified with overhead catenary. A freight siding track abuts the eastern (northbound) LRT platform but is currently not in use. The tracks are at a higher elevation than I-5 in this location with an on-ramp and off-ramp in between. There are retaining walls separating the freeway from the ramps. Existing LRT station facilities consist of two low-level platforms and a small station house with ticket vending. Pedestrians currently access the platforms via sidewalks on E Street, from the Bus loop loading/unloading area, and from a pedestrian at-grade crossing at the southern and northern end of the platforms.

H Street

H Street is approximately 0.75 miles south of E Street. It is striped as a four lane facility but is designated as a six-lane Major Arterial. Traffic counts from 2009 showed that the traffic volume on H Street was 30,898 vehicles per day. The signalized intersection of H Street and the I-5 northbound exit and entrance ramps is adjacent to the at-grade crossing of the LRT line. The right-of-way for H Street is 122 feet wide, and the design speed is 45 mph. The existing transit station is on the north side of H Street east of the LRT tracks (As shown on Attachment 25 & 26). The station has 295 parking spaces and a bus loop that serves three bus routes.

There is a concrete lined drainage channel parallel to the LRT tracks on the east side which conveys runoff towards the south. The drainage is picked up by a 54" RCP which runs under the transit station before re-emerging on the south side of H Street where it is joined by another covered concrete channel from the east. Properties in the vicinity of the study area include the I-5 corridor to the west, with residential properties, a gas station, and a school to the east. The tracks are at a higher elevation than I-5 in this location with an on-ramp and off-ramp between. There are retaining walls separating the freeway from the ramps.

The rail facilities in this location include a northbound rail and a southbound rail, or railroad westbound and railroad eastbound, serving both LRT and freight. Existing LRT station facilities consist of two low-level platforms and a small station house with ticket vending. Current pedestrian access to the platforms is via sidewalks on H Street, the Bus loop loading/unloading area, and from a pedestrian at-grade crossing over the railroad tracks at the southern end of the platforms.

Palomar Street

The Palomar Street study location is approximately 1.8 miles south of H Street. Palomar Street is designated as a 6-lane major arterial. Traffic counts from 2011 showed a volume of 38,997 vehicles per day. Vehicles access I-5 around 0.2 miles west of the study location. The existing transit station is on the south side of Palomar Street east of the LRT tracks (As shown on Attachment 27, 28, & 29). It has 305 parking spaces and a bus loop that serves three bus routes.

There is an existing SDG&E easement that crosses the LRT tracks north of the station. Within this easement are a 230 kilovolt (kV) overhead transmission line and a 138kV overhead transmission line. A 15" vitrified clay pipe (VCP) sewer line crosses under the tracks at Oxford Street and a 78" corrugated steel pipe (CSP) culvert crosses under the tracks south of Ada Street. Properties in the vicinity of the study area include single- and multi-family residential units located west of the LRT tracks and Industrial Boulevard , a San Diego County Public Health building on the north side of Oxford Street, and commercial/industrial properties north of Palomar Street and east of the transit station.

The rail facilities at the Palomar Street crossing include a northbound rail and a southbound rail, or railroad westbound and railroad eastbound, serving both LRT and freight. An additional third track runs from the station to the south parallel to the LRT line which serves active freight customers. There is also a siding track that is approximately 350 feet long on the east side between Oxford Street and Palomar Street. Existing LRT station facilities consist of two low-level platforms and a small station house with ticket vending. Pedestrians currently access the platforms via sidewalks on Industrial Boulevard and Palomar Street, the Bus loop loading/unloading area, and a pedestrian at-grade crossing over the railroad tracks.

2.2. Previous Studies

A 2004 report by Berryman & Henigar titled *Final Concept Engineering Report for E Street and H Street Grade Separations* analyzed the feasibility of constructing grade separations at E Street and H Street. This report assumed that the stations would remain at grade and each location would be constructed as a separate project. It included conceptual designs for tracks on structure over the road and tracks under the road at each location, and provided cost estimates for each option. The report recommended grade separating the LRT tracks under the road at both locations with dual freight bypass tracks at grade, citing

that "the vertical difference to grade separate the Trolley and surface street is less (vertical difference in grade) than a LRT bridge structure, the required transitions are shorter, and the noise and visual impacts would be less than the LRT crossing on an elevated bridge."

A 2010 study by AECOM titled Interstate 5 (I-5) South Multimodal Corridor Study analyzed various forms of transportation along the I-5 South corridor and recommended ways to maximize their effectiveness. Modes of transportation studied were light rail transit, freight rail, bicycle, pedestrian, and the freeway. Seven conceptual alternatives along with a no build alternative were considered. Six of the alternatives included rail/grade separations at E Street, H Street, and Palomar Street. The study recommended Alternative 2, stating that "the SANDAG Board of Directors, at the May 28, 2010 meeting, approved Alternative 2 to be the preferred alternative for consideration in the 2050 RTP." Alternative 2 included rail/grade separations at E Street, H Street, and Palomar Street (the report did not specify above or below grade since the effects on rail and vehicular traffic would be equal); eight freeway main lanes plus two high occupancy vehicle (HOV) lanes; a braided ramp system; access improvements (ramp metering and auxiliary lanes); Trade Corridors Improvement Fund (TCIF) mainline track improvements; increased local bus frequency; bus rapid transit (BRT) route 640 (two in-line BRT stations); increased transit parking facilities; and arterial improvements.

The SANDAG 2050 Regional Transportation Plan (RTP) was adopted by the SANDAG Board of Directors on October 28, 2011. The plan includes a list of at-grade crossing locations throughout the San Diego region that have been ranked by need to grade separate (See Attachment 21). The criteria that were taken into consideration when determining whether a grade separation is warranted were: peak-hour vehicular traffic, total number of trains, blocking delays, accident history, pedestrian safety, and benefit to emergency services. Palomar Street, H Street, and E Street ranked 4, 5 and 6 in this list, respectively, making them high priority projects for grade separation within the San Diego region.

3. PURPOSE AND NEED

Project Need

E, H and Palomar Streets are major east-west arterials within Chula Vista and provide the major connections to the I-5 freeway in this area of the city. These streets serve as gateways to Chula Vista and their usage is expected to increase as Chula Vista redevelops its Bayfront area to the west. This

region is expected to grow faster than the average rate for the San Diego area. According to the 2010 census the population of Chula Vista was 243,916 and had grown 40.5% since 2000. According to the SANDAG 2050 Regional Transportation Plan, the population of Chula Vista is expected to rise to 330,049 by the year 2050, which is a 35% increase from 2010.

The Blue Line Trolley, which runs along Interstate 5 at the westerly edge of the City, experiences the highest ridership of any LRT line in the San Diego region, over 20 million riders in 2009 (State of the Commute, SANDAG 2010), and projections indicate that ridership will continue to rise. This rise is attributed to population growth within the City and the development of the Bayfront to the west. The increased demand will be serviced by additional trains, which will result in a decrease of trolley headways and more frequent rail preemptions at the existing grade crossings on E, H and Palomar Streets. This will increase congestion and delay for motorists accessing I-5 or destinations in Chula Vista.

Pedestrian and cyclist circulation and safety is a concern at all three station locations. At E Street pedestrians currently jaywalk across the street from the transit station to access the mini-mart and fast food restaurant on the north side. At Palomar Street large numbers of pedestrians cross the street to access the public health building rather than utilize the crosswalk designed for this purpose on the west side of the tracks. Future development, including the Bayfront Master Plan and a new conference center, will increase pedestrian crossings of the rail and the local streets. On August 9, 2012, the California Coastal Commission (CCC) approved the Bayshore Master Plan, allowing the project to progress into the development phase. The completion of the Bayshore Bikeway around the San Diego Bay will serve to increase cycling traffic east and west over the rail lines for recreational users.

Project Purpose

The purpose of the proposed Chula Vista Light Rail Improvements project is to:

- Improve traffic circulation and reduce delays and congestion on the main east-west routes in western Chula Vista where they intersect with the rail corridor;
- Increase mobility in the region for all users; and
- Enhance Safety and increase ridership at the trolley stations.

The proposed grade separations will improve regional mobility and traffic flow both east and west, and to and from the light rail facilities and the local street network. They will be consistent with local planning documents (such as the Chula Vista General Plan, the Urban Core Specific Plan, the Chula Vista Municipal Code, the Palomar Gateway District (PGD) Specific Plan, the Bayfront Master Plan, etc.), and will consider impacts to right-of-way and other utilities. Congestion relief provided by the grade separations will serve to improve vehicle, bicycle and pedestrian safety by improving mobility.

4. DEFICIENCIES

Blue Line ridership is the highest in the San Diego region. It is expected to increase with future development of the Bayfront in Chula Vista. Transit oriented development is anticipated at E Street, H Street and Palomar Street. To accommodate the increase in ridership, MTS will run the line at shorter headways in the future. The average blocking delay (the time period beginning when the warning devices are activated to when they are de-activated) is 53 seconds. The at-grade crossings will create more delays for all traffic when shorter headways are introduced. By grade separating the LRT tracks, delays on the street will be eliminated. Freight will still cross the street at grade but only run late at night, when traffic is minimal.

The *City of Chula Vista General Plan Update Transportation Study* (Kimley-Horn, 2005) analyzed the impacts of grade separations at E Street and H Street. The study showed that existing delays are expected to worsen in the future as a result of increased traffic and reduced trolley headways (See Attachment 22). During peak hours the intersections in the area of the at-grade crossings would operate at Level of Service (LOS) E or F in most cases. The study showed that by grade separating the trolley the LOS of these intersections would increase to at least a D and in most cases B. Average delay would be reduced by as much as two minutes in some cases.

The I-5 South Multimodal Corridor Study also shows that without improvements the Level of Service for each of the intersections will worsen in the future (Summarized in Table 1 and Table 2). By the year 2035 the LOS for the intersection of E Street and the easterly I-5 ramps will decrease from LOS C to LOS D, the intersection at H Street and the easterly I-5 ramps will decrease from LOS E to LOS F and the LOS for the intersection of Palomar St. and Industrial Blvd. will decrease from D to F. LOS ranges from A to F

with A having an average delay of less than10 seconds and F having an average delay of greater than 80 seconds.

Table 1: Projected 2020 Intersection Level of Service

Intersection	2020 AM Peak Hour - No Build			2020 PM Peak Hour - No Build		
	Volume	Delay	LOS	Volume	Delay	LOS
E St and E'ly I-5 Ramps	2385	15.4	B	3259	23.2	C
H St and E'ly I-5 Ramps	2296	17.7	B	2594	61.6	E
Palomar St and Industrial Blvd	2515	28.9	C	3668	37.0	D

Table 2: Projected 2035 Intersection Level of Service

Intersection	2035 AM Peak Hour - No Build			2035 PM Peak Hour - No Build		
	Volume	Delay	LOS	Volume	Delay	LOS
E St and E'ly I-5 Ramps	5053	24.1	C	5079	37.4	D
H St and E'ly I-5 Ramps	3700	29.0	C	6441	>80.0	F
Palomar St and Industrial Blvd	3942	50.6	D	5716	>80.0	F

E Street and H Street are the closest access points to I-5 for the Chula Vista Fire Station Number 1 and the Chula Vista Police Department on F Street. Ambulances travel down H Street from I-5 to Scripps Mercy Hospital. Palomar Street is the nearest access to I-5 for Chula Vista Fire Station 5 on the corner of Oxford Street and 4th Avenue. At-grade crossings can delay emergency vehicles if they reach the crossing while a trolley is passing. Grade separating the trolley would eliminate these delays for emergency vehicles.

Noise from crossing bells can be a nuisance to sensitive receptors that are nearby. The E Street crossing is located 366 feet away from the nearest sensitive receptor, while H Street is only 81 feet away, and Palomar Street is 178 feet away from the nearest sensitive receptor. By eliminating the at-grade LRT crossings the bells would only be needed for freight train crossing which is limited to less than three hours per day.

Other deficiencies at E Street include:

- Pedestrians currently jaywalk across the street from the transit station to access the mini-mart and fast food restaurant.
- E Street is an important pedestrian access corridor. Attractors for pedestrian traffic include the Bayshore Bikeway and the Living Coast Discovery Center. While F Street is the planned pedestrian corridor for the Bayfront development, pedestrian traffic across the tracks is also expected to increase after development of the Bayfront.
- An additional right-turn lane from westbound E Street to the Northbound I-5 on-ramp may be required in the future.

Other deficiencies at H Street include:

- The amount of space required for transit needs.
- More parking is needed at the transit station.
- H Street is scheduled to be connected to the marina area of the bayfront within the next 6 months. This will draw more traffic from western Chula Vista, increasing the volume of all traffic crossing the tracks.
- The Bayfront Master Plan, including significant residential, office and commercial development, was approved by Coastal Commission on Thursday, August 9, 2012. This proposed development west of the trolley station will increase pedestrian, bicycle and vehicular traffic volumes crossing the tracks.
- An additional right-turn lane from westbound H Street to the Northbound I-5 on-ramp may be required in the future.
- Bicycle traffic across the tracks will increase because H Street provides a connection to the Bayshore Bikeway to the west.
- The proximity to residential areas.

Other deficiencies at Palomar Street include:

- Large numbers of pedestrians cross Palomar Street illegally along the tracks rather than at the Industrial Boulevard crosswalks.

- The City recently prepared the Palomar Gateway District (PGD) Draft Specific Plan for this area, which contemplates the improvement and densification of the area with a mixed of residential and commercial uses. The PGD Draft Specific Plan is expected to be presented to the City's Planning Commission and City Council for approval in the next few months. The future implementation of the Specific Plan land uses will create additional activity, which will lead to an increase in population and pedestrian, bicycle and vehicular traffic.

5. CORRIDOR AND SYSTEM COORDINATION

Scheduled for completion in 2015, SANDAG has implemented a robust program to upgrade stations along the Blue Line from the Barrio Logan Station to the San Ysidro Station (including E Street, H Street, and Palomar Street). Proposed improvements will lower the tracks through the station or raise the station platforms to allow for level boarding of the new low floor trolleys. Additional improvements to the Blue Line include storm drain upgrades, Americans with Disabilities Act (ADA) accessibility upgrades, replacement of grade crossings, and parking lot improvements.

Future improvements within the project study area may include additional parking at each of the stations. Options to increase parking could include above grade parking via structure, below grade parking via structure, or a combination of both. Ancillary improvements may be constructed as a separate future project depending on need and funding.

Coordination with future master plan development in the project areas is required for final design of the grade separations. Specifically, in the area E and H Streets, the Chula Vista Bayfront Master Plan received approval from the California Coastal Commission on August 9, 2012. The Bayfront Master Plan proposes redevelopment of 556 acres along the waterfront extending from E Street to J Street, and would include new hotels, condominiums, retail and commercial spaces, as well as parks and bike trails (See Attachment 30). All of these features will serve as traffic generators and will increase vehicular traffic on E and H Streets.

At Palomar Street, the PGD Draft Specific Plan proposes to extend Oxford Street, just north of Palomar, across the tracks to intersect with Industrial Boulevard (See Attachment 32). If this road extension is

implemented the LRT grade separation at Palomar Street may need to extend farther north to cross Oxford Street.

The I-5 South Multimodal Corridor Study recommended Alternative 2, which includes construction of an additional lane for the freeway on-ramps at E Street and H Street. The final design of the grade separations should be coordinated with the proposed changes to the adjacent ramps.

6. ALTERNATIVES

A series of workshops was held from January to July 2012. The workshops were attended by various stake-holders on the project. The attendees included representatives from SANDAG, the City of Chula Vista, MTS, Caltrans, KTU+A (responsible for preparing visual simulations for the project) and T.Y. Lin International. The alternative analysis used was a scientific process consisting of five steps: Preparation, Investigation/Discovery, Evaluation, Alternatives Development, and Reporting. The Preparation phase included gathering supporting data for the studies, and assembling the project team. In the Investigation/Discovery phase members of the team conducted site visits, reviewed the existing facilities, researched existing utilities, and reviewed past studies. During the Evaluation phase the project team developed and weighted a list of evaluation criteria from which the proposed alternatives at each study location would ultimately be ranked. Proposed Alternatives that met the Project Purpose and Need were then developed over a series of workshops, with some alternatives being rejected after group discussion due to fatal flaws. All alternatives still considered viable at the end of the workshop process were scored on a one to ten scale against the weighted criteria to determine an overall score and ranking for each alternative.

Several items were discussed in the workshops but were not included in the alternative analysis. These included the possibility of an express trolley service via a third rail line for the Blue Line, and future road extensions. The express trolley would run through certain stops to allow faster trips between busier stations. It should be noted that the I-5 Multimodal Study recommended Alternative 2, which does not include the express trolley.

6.1. Alternative Development

As noted above the alternatives were compared and ranked based on various criteria selected by the project development team. Although many of the evaluation criteria are common to all three study locations, the criteria for each site were considered independently. A brief definition of each evaluation criteria is shown below:

- Constructability – Considers construction duration, throwaway costs, maintaining LRT operations during construction, and impacts to vehicular traffic.
- Customer Experience – This is meant to convey the customer's total experience in using the station facilities, including perception of safety in and around the station, the ease of access to the trolley, the connectivity between the trolley and bus stops, distance from parking to the station, etc.
- Right-of-way Impacts – The likelihood that additional properties outside the existing right-of-way would need to be acquired either for construction or permanent facilities.
- Improvements to Site Efficiency – How the project would impact bus operations, taxi operations, the general flow of pedestrians and vehicles, and the ability to expand parking at the station.
- Long Term Maintenance – This involves any additional maintenance requirements the alternative would create, and would include care and upkeep of mechanical equipment such as elevators, pumps, or railroad turnouts.
- Visual Impacts – Considers the impacts to user groups from a visual standpoint by adding above or below grade stations. It would apply to all three stations but has a larger effect at E Street where there is a view corridor from the street to San Diego Bay.
- Enhancement to Pedestrian Movement – Several locations within the study corridor currently have problems with pedestrians jaywalking rather than moving to the closest crosswalk in order to access facilities. This criterion will evaluate improvements to the pedestrian walking and street crossing patterns.
- Improve Community/Agency Acceptance – Considers the overall integration of local plans, redevelopment plans, and gages general public sentiment and acceptance of a proposed alternative.

- Minimize Utility Impacts – Considers the number of utility impacts an alternative would involve and the scale of the required relocations or modifications.

These criteria were "weighted" against each other at all three study locations using a simple matrix similar to that shown in Table 3. The number of times each criterion "won" was counted and taken as a percentage of the total number of comparisons made and a final weight was assigned to the criteria.

Table 3: Sample Criteria Weighting Table

					Total	
A	A vs B	A vs C	A vs D	A vs E	# of A	
	B	B vs C	B vs D	B vs E	# of B	
		C	C vs D	C vs E	# of C	
			D	D vs E	# of D	
				E	# of E	
					Total	**100%**

Once the criteria were weighted for each study area the workshop attendees looked at each viable alternative and assigned a score from 1 to 10 for each criterion. The scores were then multiplied by the weights as a percentage to give a weighted score. The evaluation rankings for each viable alternative using the criteria are included in Appendix A.

6.2. Design Standards and Assumptions

The preliminary designs for each alternative were developed using the SANDAG Draft Design Standards and the applicable General Orders of the CPUC. The design standards used are summarized in Table 4.

Table 4: Summary of Geometric Design Standards

Caltrans Highway Design Manual, 2012	
Chapter 200 Section 204.8 Grade Line of Structures	The minimum vertical falsework clearance over freeways and nonfreeways shall be 15 feet.
SANDAG Draft Design Standards, 2010	
Section 3.2.3-A. Platform Length	Platforms shall be 360 ft. in length to accommodate a four-car train.
Section 3.2.3-C. Platform Width	The minimum standard platform width shall be 15 ft.
Section 3.3.1.2-B. Minimum Clearances	Minimum distance between the centerline of tracks shall be 14.76 ft. for exclusive or semi-exclusive LRT right-of-way with catenary poles centered between tracks including a center emergency walkway.
Section 3.3.1.6-B. Mainline	The maximum design grade for any vehicle shall not exceed 4.3 percent without prior approval of the SANDAG Director of Engineering and Construction.
Section 3.3.1.6-C. Stations	A grade of 0.5 percent is the desired grade in all station areas, if drainage can be accommodated.
Section 3.3.1.6-C. Stations	Constant grade tangents shall extend 75 ft. beyond the limits of station platforms.
Section 3.3.1.7-A. Mainline	The desired length of mainline vertical curves above the minimum is determined by the following formulas: Crest $L = \frac{V^2(G_1-G_2)}{30}$ (English) Sag $L = \frac{V^2(G_1-G_2)}{60}$ (English) The lengths of vertical curve are generally rounded up to the nearest 50 foot length.

CPUC General Order 26-D	
Section 2-Overhead Clearances	2.1 The minimum overhead clearance above railroad and street railroad tracks, which are used or proposed to be used for transporting freight cars, shall be twenty-two (22) feet six (6) inches.
Section 3-Side Clearances	3.2 The minimum side clearance to all structures and obstructions above the top of the rail is 8'6".
CPUC General Order 95	
Rule 37 Table 1	Basic minimum allowable vertical clearance of wires crossing or paralleling above tracks of railroads operated by overhead trolleys is 34 feet.

Order of magnitude cost estimates were generated for the viable alternatives. Unit costs were taken from past projects, Caltrans cost data, and the San Diego County Unit Price List. These figures were all adjusted to 2012 dollars and in some cases were scaled to reflect the local market prices. Future year escalations were not provided because the build years for the each of the projects have not yet been determined.

The following assumptions were made during the design process:

- For a station that is over the street, only one elevator is required on each side of the street to comply with ADA. The redundant elevator being on the opposite side of the street is considered equal access;
- Below grade options may require pump stations to remove storm water;
- No exceptions to design standards will be given; and
- The LRT line can be single tracked during construction.

6.3. Construction Issues

Due to the high transit passenger volume each of the stations experiences, MTS prefers that they remain operational during construction. To accommodate this need, a temporary platform would be required along the existing southbound track for E and H Streets, and along the east side of the new freight track at Palomar Street. Other additional temporary pedestrian improvements may be required. During construction of the grade separations LRT and freight would be operated on a single track

through the construction zone. The length of single tracking for each of the grade separations would be approximately 0.6 miles. Trains and trolleys would use crossovers on either end of the work area to access the single track. At Palomar Street this track would be on the east side adjacent to the station parking. At E and H Streets, the single track would be located on the west side, opposite of the station parking. For E and H Streets, providing pedestrian walkways across the tracks clear of the construction areas may prove challenging. The existing right-of-way south of H Street is constrained to the east. Therefore construction activities in this area will be more challenging than construction north of H Street. Some existing parking at the station may be temporarily lost, but will be restored after construction is complete. The Visitor Center located in the parking lot of the E Street Station may need to be relocated, at least temporarily. Bus routes at H Street will likely remain unaffected, since the bus loading area is along H Street rather than adjacent to the LRT platforms.

For the below grade alternatives a bridge would be constructed to span the LRT tracks at the roadway intersection, with abutments extending across the entire length of the road. One possibility to minimize road closures for the construction of the bridge abutments would be to excavate in trenches across the street during nighttime roadway closures, and then cover the trenches with steel plates during the day to allow vehicular traffic to operate. Once the abutments are completed, half of the bridge slab could be constructed at a time, allowing the other half of the roadway to remain open to traffic. After the bridge slab is in place, the trench beneath the roadway could be excavated and the retaining walls constructed.

6.4. Design Alternatives

E STREET

ALTERNATIVES CONSIDERED VIABLE:

No-Build Alternative

The No-Build alternative would maintain the at-grade crossing and E Street LRT station in their current configuration. It is inconsistent with the project purpose and need. It does not meet the goals of the project to relieve traffic congestion and reduce the potential for conflict between pedestrians, bicycles and vehicles at the crossing, which will increase as street traffic increases and trolley headways are

reduced to 7-1/2 minutes. The no build alternative would result in a reduction in level of service for the intersection of E Street and the northbound I-5 ramps to an unacceptable level in the future.

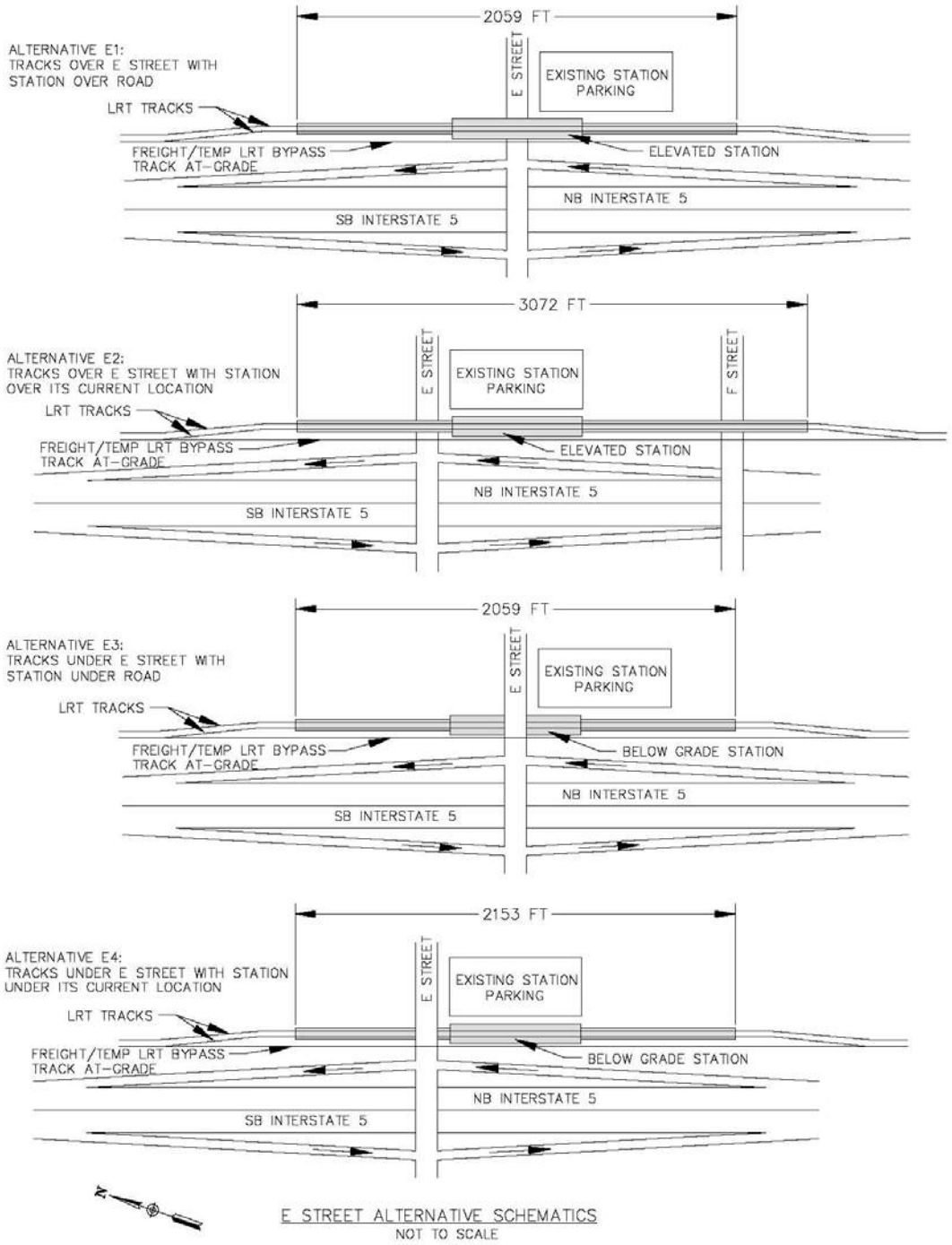
Alternative E1 – LRT Tracks Crossing E Street Above Grade with Station Over Street

Alternative E1 proposes to relocate the LRT tracks on an aerial structure over E Street. See Figure 3 for schematic and Attachments 1 and 2 for plan, profile, elevation view, and cross sections. The overall length of the grade separation would be 2,059 feet with a maximum height of 22.5 feet from the existing grade at E Street to the top of rails. The existing station would be relocated from its current position to an elevated location over E Street on structure. Stairs and an elevator would be provided on each side of E Street. The existing northbound track would be removed and the existing southbound track would remain in place as a permanent freight track. The southbound track would also function as a single LRT track during the construction phase. The existing catenary would be removed and a temporary catenary would be installed over the existing southbound track only. The freight track would remain at grade, and looking southerly, would also cross F Street at grade with the two LRT tracks (which would have touched back down). This would require removal of the existing F Street crossings and installation of three new crossings with updated active updated traffic control devices. Modifications to the crossings at F Street would require a separate request and approval from the CPUC through the formal General Order 88-B authorization process (See Attachment 31).

Figure 2: E St. looking west at simulation of station over street.

The proposed centerline for the southbound LRT track would be offset approximately 28 feet to the east of the centerline of the freight bypass track, with the northbound LRT track offset an additional 15 feet from there. Switches, turnouts and crossovers would be installed to the north and south of the grade separation so that LRT vehicles can transition from the mainline to the

Figure 3: E Street Alternative Schematics



proposed bypass track approaching the station. E Street and H Street are in close proximity to one another, only 0.75 miles. To avoid unnecessary oscillation of the alignment the centerline of the LRT tracks between E Street and H Street would be shifted 28 feet east of the existing tracks for the distance between the grade separations. During the period of time when only one of the grade separations is completed (either E or H Street) a temporary crossover would return the tracks from the grade separation to the existing track alignment.

The aerial guideway portion of the grade separation would be 1,229 feet long. The transition from at grade to aerial guide-way would be made on retained fill. This portion of the structure would be 400' to 430' long on either end of the grade separation and would require approximately 6,800 cubic yards of fill. The retained fill portion would be constructed with mechanically stabilized embankment (MSE) walls supporting each side. The superstructure type is anticipated to be a cast-in-place concrete box girder which will also support the elevated station.

There are minimal utility relocations required with this alternative. A Sprint Fiber Optic Line would need to be relocated for around 520 feet at the north end of the grade separation and a 24 inch storm drain would need to be relocated as well. A billboard structure located near E Street overhangs the tracks and would need to be relocated or removed.

Alternative E1 received a ranking score of 614 from the alternatives analysis workshops (See Attachment 18). The estimated order of magnitude construction cost for Alternative E1 is $25 million to $31 million (See Attachment 15).

Alternative E4 – LRT Tracks Crossing Under E Street with Station Beneath its Current Location

Alternative E4 proposes a LRT undercrossing, lowering the LRT tracks below the existing grade of E Street with retaining walls on each side. See Figure 3 for schematic and Attachments 3 and 4 for plan, profile and elevation views, as well as typical sections. The overall length of the grade separation would be 2,153 feet, with a maximum depth of 25 feet. The proposed trench would have a typical width of 31 feet, and would widen to approximately 55 feet at the location of the platforms. A new station would be constructed very close to its existing footprint, but lowered to the grade of the proposed tracks. The existing southbound track would remain in place. During construction temporary catenary wires would be installed over this track, and it would function as the single track main line for both LRT and freight.

After construction the catenary wires would be removed and the track would function as a freight bypass track for both northbound and southbound trains, allowing them to remain at grade through the E Street crossing.

The sides of the trench carrying the LRT tracks below grade and under E Street would be retained with concrete retaining walls. The excavation would require export of approximately 50,000 cubic yards of soil from the site. Since the cost of different wall types can vary greatly due to constructability concerns, the alternatives development team analyzed the proposed project site and determined that the retaining walls will most likely be soldier pile walls requiring support struts during construction. Since these walls will be up to 25 feet in height, soil nail and tie-back walls were considered in order to eliminate the inevitable settlement that would cause soldier pile walls of this height to list towards the center of the trench under the weight of the retained soil. However, because of the proximity of residences, public utilities, underground petroleum tanks and the 2:1 slope to the west towards the freeway, soil nail and tie-back wall types were eliminated from consideration along the majority of the retaining wall length. A tie-back type wall could be used for the portions of the walls beneath the E Street bridge, since there are no utilities or slopes that would interfere with the tie-backs or soil nails in this location. This is the assumption made in the cost estimate for this alternative. Bridge railing would be installed along the top of the retaining walls for their entire length.

Figure 4: Oblique overhead view of simulated E St. below grade station.

The proposed centerline for the southbound LRT track would be offset approximately 28 feet to the east of the centerline of the freight bypass track, with the northbound LRT track offset an additional 15 feet from there. Switches, turnouts and crossovers would be installed to the north and south of the grade separation so that LRT vehicles can transition from the mainline to the proposed bypass track approaching the station. E Street and H Street are in close proximity to one another, only 0.75 miles. To avoid unnecessary oscillation of the alignment the centerline of the LRT tracks between E Street and H

Street would be shifted 28 feet east of the existing tracks for the distance between the grade separations. During the period of time when only one of the grade separations is completed (either E or H Street) a temporary crossover would return the tracks from the grade separation to the existing track alignment.

E Street would remain at its existing grade, spanning the new below-grade tracks on a structure. The bridge span will be approximately 31 feet. The abutments for this bridge would be constructed crossing E Street perpendicularly on cast-in-drilled-hole (CIDH) piles.

Although the proposed LRT tracks would meet existing grade north of F Street, the horizontal alignment of the new LRT tracks will still be transitioning back to the mainline tracks. Therefore, the existing northbound LRT crossing at F Street would be removed and two new grade crossings would be installed where the proposed LRT tracks cross F Street. At E Street the existing at-grade northbound track would be removed, and two new grade separated tracks would be installed. Both of these modifications to the existing at-grade crossings at F Street would require a separate request and approval from the CPUC through the formal General Order 88-B authorization process (See Attachment 31).

Utility impacts include relocation of a 1.5 ft x 4.5 ft box culvert and a 24 inch storm drain. Additionally, a 4 inch high pressure gas line, a 12kV underground electrical line, and a 12 inch water line would be relocated through the bridge. A pump station would be required beneath the station to pump storm water out of the trench to a nearby storm drain.

Alternative E4 received a score of 718 as part of the PDTs alternatives analysis (See Attachment 18), and the estimated order of magnitude construction cost for Alternative E4 is from $32 million to $40 million (See Attachment 15).

ALTERNATIVES ANALYZED BUT NO LONGER CONSIDERED:

Alternative E2 – LRT Tracks Crossing E Street Above Grade with Station Over its Current Location

Alternative E2 proposes to construct the LRT tracks on an aerial structure over E Street (See Figure 3 for schematic). The overall length of the grade separation would be 3,072 feet. The station would be constructed very close to its existing footprint, but raised to the grade of the proposed tracks. Similarly to Alternative E1, the existing northbound track would be removed, and the existing southbound track

would remain in place, functioning as the single track main line for both LRT and freight during construction, and a freight bypass track after construction is complete. Geometric design constraints would not allow the tracks to return to existing grade north of F Street. Therefore the aerial guideway would continue over F Street, requiring an additional 1,000 feet of structure when compared to Alternative E4, where the station is centered over E Street. This alternative was removed from further consideration due to the additional cost and construction impacts associated with the extended aerial structure and additional grade separation at F Street.

Alternative E3 – LRT Tracks Crossing Under E Street with Station Beneath the Street

Alternative E3 proposes a LRT undercrossing, which will result in the LRT tracks below the existing grade of E Street by the use of retaining walls on either side (See Figure 3 for schematic). The overall length of the grade crossing would be 2059 feet with a maximum depth of 25 feet. This alternative is similar to E4, except that the new station would be constructed directly beneath the road with E Street crossing on a bridge overhead. The bridge would have a span of 55 feet, versus the 31 feet span proposed in Alternative E4. This longer span length would require a much deeper structural section for the bridge, which in turn would push the elevation of the tracks lower, thereby increasing the depth of grade separation and lengthening the project footprint. Visibility of the platforms from the surrounding area would be limited, and therefore the perceived security of the station in this alternative would be reduced. This alternative was removed from further consideration due to the increased costs associated with a larger bridge and larger project footprint, as well as the reduced security of a subterranean station.

H STREET

ALTERNATIVES CONSIDERED VIABLE:

No-Build Alternative

The No-Build alternative would maintain the at-grade crossing and H Street LRT station in their current configuration. It is inconsistent with the project purpose and need. It does not meet the goals of the project to alleviate traffic congestion and delay at the crossing, which will both increase as street traffic increases and trolley headways are reduced to 7-1/2 minutes. The no build alternative would result in a

reduction in level of service for the intersection of H Street and the northbound I-5 ramps to an unacceptable level in the future.

Alternative H2 – LRT Tracks Crossing Over H Street with Station Over its Current Location

Alternative H2 proposes to raise the LRT tracks on an aerial structure over H Street as shown in Attachments 5 and 6 (See Figure 6 for schematic). A new station would be constructed very close to its existing footprint, but raised to the grade of the proposed tracks. The overall length of the grade separation would be 2,185 feet, with a maximum height of 22.5 feet relative to the existing tracks. The existing northbound track would be removed, and replaced with two new elevated tracks (for both northbound and southbound LRT).

Figure 5: Simulation of overhead station at H Street looking north.

The new northbound tracks would be shifted to the east in order to accommodate the required separation between track centerlines. The existing southbound track would remain in place at grade as a freight bypass track for both northbound and southbound trains, allowing them to remain at grade through the H Street crossing. During construction temporary catenary wires would be installed over this track, and it would function as the single track main line for both LRT and freight. The proposed centerline for the southbound LRT track would be offset approximately 28 ft to the east of the centerline of the freight bypass track, with the northbound LRT track offset an additional 15 feet from there. Switches, turnouts and crossovers would be installed to the north and south of the grade separation so that LRT and freight vehicles can transition from the mainline to the bypass track approaching the station. Two stairwells and two elevators would be constructed adjacent to the westerly platform.

The aerial guide-way portion of the grade separation would be approximately 1370 feet long. The transition from at grade to aerial guide-way would be made on retained fill. These portions of the grade separation would be 350 feet and 460 feet long on either end of the grade separation and contain a

total of approximately 6,300 cubic yards of fill. The retained fill portion would be constructed with mechanically stabilized embankment (MSE) walls supporting each side. The superstructure is anticipated to be a cast-in-place concrete box girder which will also support the elevated station.

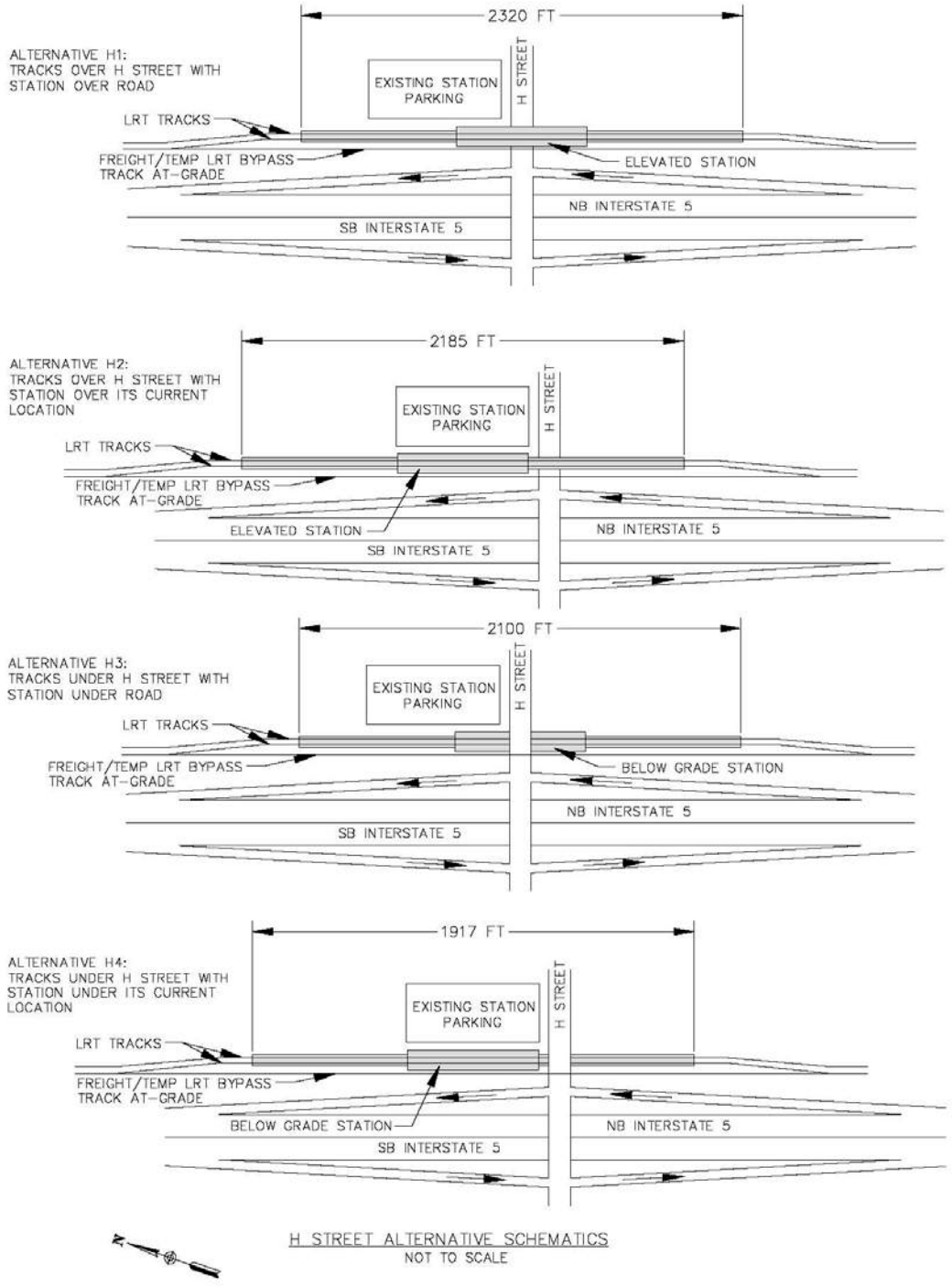
An existing concrete lined drainage channel runs parallel to the tracks along the east side. It would be replaced with a reinforced concrete pipe (RCP) storm drain, with estimated dimensions of 54 inch x363 feet, along the northern retained fill portion of the grade separation. Along the southern portion of retained fill the channel is larger requiring a box culvert for replacement, with estimated dimensions of 5 feet x 10 feet x 500 feet. Beyond the grade separated portion of track to the north and south, masonry retaining walls 2 feet to 4 feet in height would be constructed between the channel and tracks. The channel side slope would become steeper in these locations. A billboard structure located near H Street overhangs the tracks and would need to be relocated or removed.

Alternative H2 received a score of 600 as part of the PDTs alternatives analysis (See Attachment 19), and the estimated order of magnitude construction cost for Alternative H2 is from $26 million to $33 million (See Attachment 16).

Alternative H4 – LRT Tracks Crossing Under H Street with Station Beneath its Current Location

Alternative H4 proposes a LRT undercrossing, lowering the LRT tracks below the existing grade of H Street with retaining walls on each side. See Figure 6 for schematic and Attachments 7 and 8 for plan, profile and elevation views, as well as typical sections. The overall length of the grade separation would be 1,917 feet, with a maximum depth of 25 feet. The proposed trench would have a typical width of 31 feet, and would widen to approximately 55 feet at the location of the platforms. A new station would be constructed very close to its existing footprint, but lowered to the grade of the proposed tracks. The existing southbound track would remain in place. During construction temporary catenary wires would be installed over this track, and it would function as the single track main line for both LRT and freight. After construction the catenary wires would be removed and the track would function as a freight bypass track for both northbound and southbound trains, allowing them to remain at grade through the H Street crossing.

Figure 6: H Street Alternative Schematics



The sides of the trench carrying the LRT tracks below grade and under H Street would be retained with concrete retaining walls. The excavation would require export of approximately 46,000 cubic yards of soil from the site. Since the cost of different wall types can vary greatly due to constructability concerns, the alternatives development team analyzed the proposed project site and determined that the retaining walls will most likely be soldier pile walls requiring support struts during construction. Since these walls will be up to 25 feet in height, soil nail and tie-back walls were considered in order to eliminate the inevitable settlement that would cause soldier pile walls of this height to list towards the center of the trench under the weight of the retained soil. However, because of the proximity of residences, public utilities, and the 2:1 slope to the west towards the freeway, soil nail and tie-back wall types were eliminated from consideration along the majority of the retaining wall length. These wall types could be used for the portions of the walls beneath the H Street bridge, since there are no utilities or slopes that would interfere with the tie-backs or soil nails in this location, and this is the assumption made in the cost estimate for this alternative. Bridge railing would be installed along the top of the retaining walls for their entire length.

Figure 7: Oblique overhead view of simulated H St. below grade station.

The proposed centerline for the southbound LRT track would be offset approximately 28 ft to the east of the centerline of the freight bypass track, with the northbound LRT track offset an additional 15 ft from there. Switches, turnouts and crossovers would be installed to the north and south of the grade separation so that LRT vehicles can transition from the mainline to the proposed temporary bypass track approaching the station. E Street and H Street are in close proximity to one another, only 0.75 miles. To avoid unnecessary oscillation of the alignment the centerline of the LRT tracks between E Street and H Street would be shifted 28 feet east of the existing tracks for the distance between the grade separations. During the period of time when only one of the grade separations is completed (either E or H Street) a temporary crossover would return the tracks from the grade separation to the existing track alignment.

H Street would remain at its existing grade, spanning the new below-grade tracks on a structure. The bridge span will be approximately 31 feet. The abutments for this bridge would be constructed crossing H Street perpendicularly on cast-in-drilled-hole (CIDH) piles.

An existing concrete lined drainage channel runs parallel to the tracks along the east side. It would be replaced with a reinforced concrete pipe (RCP) storm drain with an estimated diameter of 54 inches. The 54 inch storm pipe would be routed through the station parking lot and tie in to the box culvert on the south side of H Street totaling around 1,300 feet of pipe. Along the southern portion of retained fill, the channel is larger requiring a box culvert for replacement, with estimated dimensions of 5 feet x 10 feet x 760 feet. Beyond the grade separated portion of track to the north and south, masonry retaining walls 2 feet to 4 feet in height would be constructed between the channel and tracks. The channel side slope would become steeper in these locations. A pump station would be required beneath the station to pump storm water out of the trench to a nearby storm drain.

Alternative H4 received a score of 548 as part of the PDTs alternatives analysis (See Attachment 19), and the estimated order of magnitude construction cost for Alternative H4 is from $32 million to $40 million (See Attachment 16).

ALTERNATIVES ANALYZED BUT NO LONGER CONSIDERED:

Alternative H1 – LRT Tracks Crossing Over H Street with Station Over Street

Alternative H1 would construct the LRT tracks on an aerial structure over H Street (See Figure 6 for schematic). The overall length of the grade separation would be 2,320 feet with a maximum height of 22.5 feet relative to the existing grade of H Street. The existing station would be relocated from its current position to an elevated location over H Street on structure. Stairs and an elevator would be provided on each side of E Street. The existing northbound track would be removed, and replaced with two new elevated tracks (for both northbound and southbound LRT). The new northbound tracks would be shifted to the east in order to accommodate the required separation between track centerlines. The existing southbound track would remain in place at grade as a freight bypass track for both northbound and southbound trains, allowing them to remain at grade through the H Street crossing. During construction temporary catenary wires would be installed over this track, and it would function as the single track main line for both LRT and freight. On the south side of H Street there is a retail building

with a small parking lot and a concrete lined drainage channel with freeway ramps west of the tracks. These constraints do not allow room for pedestrian access, via stairs or elevator, to the station on the south side of the street; which was the reason Alternative H1 was removed from consideration.

Alternative H3 – LRT Tracks Crossing Under H Street with the Station Beneath the Street

Alternative H3 proposes a LRT undercrossing, which will result in the LRT tracks below the existing grade of H Street by the use of retaining walls on either side (See Figure 6 for schematic). The overall length of the grade crossing would be 2,100 feet with a maximum depth of 25 feet. This alternative is similar to H4, except that the new station would be constructed directly beneath the road with H Street crossing on a bridge overhead. The bridge would have a span of 55 feet, versus the 31 foot span proposed in Alternative H4. This longer span length would require a much deeper structural section for the bridge, which in turn would push the elevation of the tracks lower, thereby increasing the depth of grade separation and lengthening the project footprint. Alternative H3 was removed from consideration for the same reason as Alternative H1. There is not enough room on the south side of H Street to construct stairs or an elevator for pedestrians to access the station.

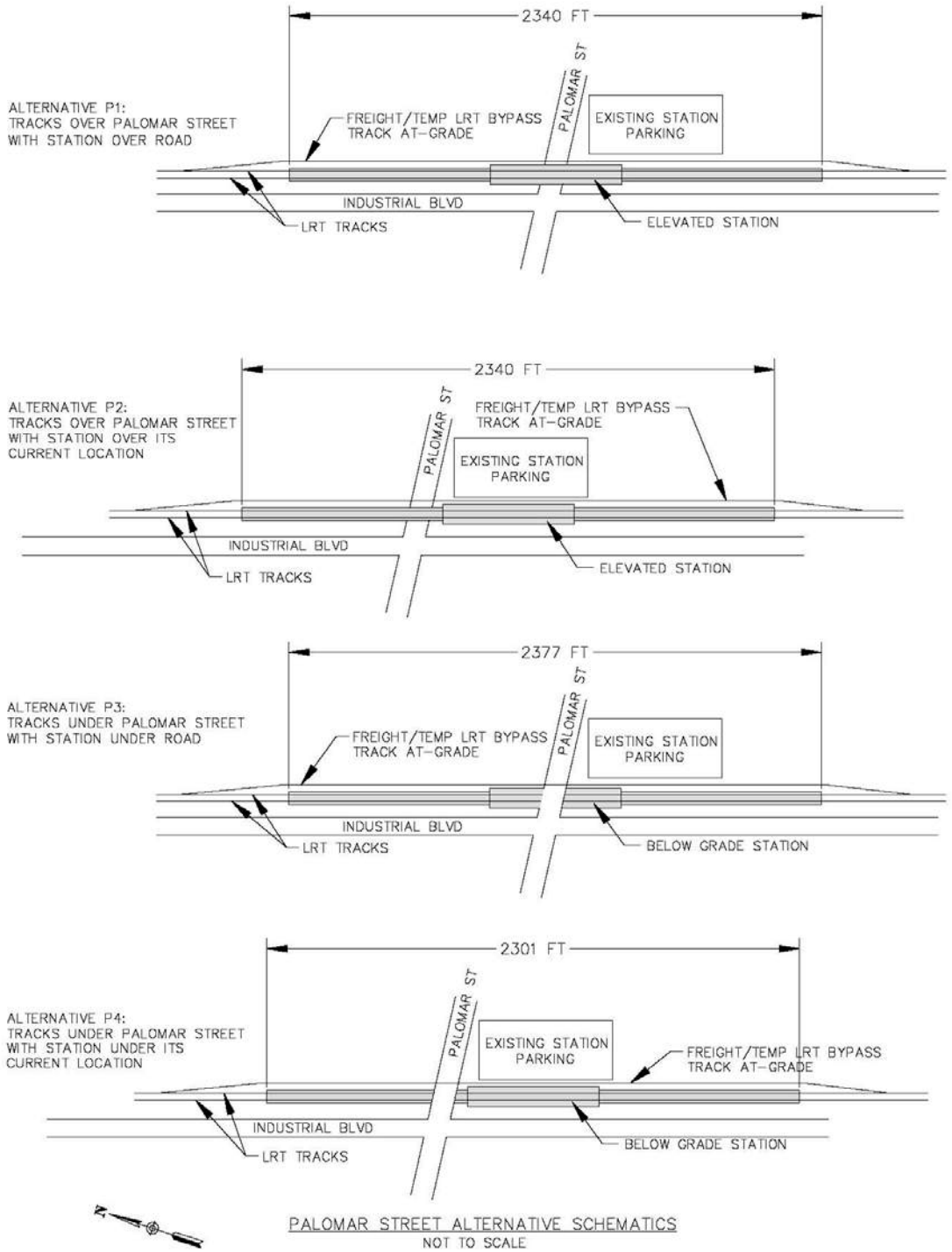
PALOMAR STREET

ALTERNATIVES CONSIDERED VIABLE:

No-Build Alternative

The No-Build alternative would maintain the at-grade crossing and Palomar Street LRT station in their current configuration. It is inconsistent with the project purpose and need. It does not meet the goals of the project to relieve traffic congestion and reduce the potential for conflict between pedestrians, bicycles, and vehicles at the crossing, which will increase as street traffic increases and trolley headways are reduced to 7-1/2 minutes. The no build alternative would result in a reduction in level of service for the intersection of Palomar Street and Industrial Boulevard to an unacceptable level in the future.

Figure 8: Palomar Street Alternative Schematics



Alternative P1 – LRT Tracks Crossing Over Palomar Street with Station Over Street

Alternative P1 proposes to relocate the LRT tracks on an aerial structure over Palomar Street. See Figure 8 for schematic and Attachments 9 and 10 for plan, profile, elevation view, and cross sections. The overall length of the grade separation would be 2,340 feet with a maximum height of 22.5 feet from the existing grade at Palomar Street to the top of rails. The existing station would be relocated from its current position to an elevated location over Palomar Street on structure. Stairs and an elevator would be provided on each side of Palomar Street. Both of the existing LRT tracks would be removed. The freight line on the east side of the existing tracks would be extended across Palomar Street and used as permanent freight bypass and a temporary single LRT track during construction. The existing catenary would be removed and a temporary catenary would be installed over the freight track on the east side of the grade separation. The freight track would remain at grade and cross Palomar Street in a new location east of the existing LRT tracks. This crossing modification would require approval from the CPUC through the formal General Order 88-B authorization process (See Attachment 31).

Figure 9: Palomar St. looking west at simulated overhead station.

The proposed centerline for the two LRT tracks would remain on the existing horizontal alignment. The Freight bypass track would be offset about 28 feet to the east from the northbound LRT track. Switches, turnouts and crossovers would be installed to the north and south of the grade separation so that LRT vehicles can transition from the mainline to the proposed temporary bypass track approaching the station.

The aerial guideway portion of the grade separation would be 1,340 feet long. The transition from at grade to aerial guide-way would be made on retained fill. This portion of the structure would be 500 feet long on either end of the grade separation and would contain approximately 8,300 cubic yards of fill. The retained fill portion would be constructed with mechanically stabilized embankment (MSE)

walls supporting each side. The superstructure type is anticipated to be a cast-in-place concrete box girder which will also support the elevated station.

There is an existing SDG&E 230kV overhead transmission line and 138kV overhead transmission line crossing over the tracks north of Palomar Street. These lines appear to be around 50 feet above existing grade. General Order 95 requires 34 feet from the top of LRT rail to overhead electrical lines over 22Kv (See Attachment 35). In order to construct this alternative these lines would need to be raised ten to twenty feet. This would include replacing the existing lattice steel towers on either side of the span with taller structures. The lines would need to be brought down and extended by splicing sections of wire in or adding additional length to the insulators. Alternatively, the 230kV and 138kV lines could be relocated underground across the tracks. The construction cost of undergrounding lines of this voltage would be roughly five times the cost of raising the lines. There is also a SDG&E 12kV overhead electrical distribution line crossing the tracks north of Palomar Street that would need to be relocated underground to cross the aerial guideway. An 8 inch sewer line and 78 inch CSP culvert crossing at the south end of the grade separation would need to be encased in concrete where the structure on retained fill passes over them.

Alternative P1 received a ranking score of 529 from the alternatives analysis workshops (See Attachment 20). The estimated order of magnitude construction cost for Alternative P1 is $29 million to $36 million (See Attachment 17).

Alternative P2 – LRT Tracks Crossing Over Palomar Street with Station Over its Current Location

Alternative P2 proposes to relocate the LRT tracks on an aerial structure over Palomar Street. See Figure 8 for schematic and Attachments 11 and 12 for plan, profile, elevation view, and cross sections. The overall length of the grade separation would be 2,340 feet with a maximum height of 22.5 feet from the existing grade at Palomar Street to the top of rails. A new station would be constructed very close to its existing footprint, but raised to the grade of the proposed tracks. Both of the existing LRT tracks would be removed. The freight line on the east side of the existing tracks would be extended across Palomar Street and used as permanent freight bypass and a temporary single LRT track during construction. The existing catenary would be removed and a temporary catenary would be installed over the freight track on the east side of the grade separation. The freight track would remain at grade and cross Palomar

Street in a new location east of the existing LRT tracks. This crossing modification would require approval from the CPUC through the formal General Order 88-B authorization process.

The proposed centerline for the two LRT tracks would remain on the existing horizontal alignment. The Freight bypass track would be offset about 28 feet to the east from the northbound LRT track. Switches, turnouts and crossovers would be installed to the north and south of the grade separation so that LRT vehicles can transition from the mainline to the proposed temporary bypass track approaching the station.

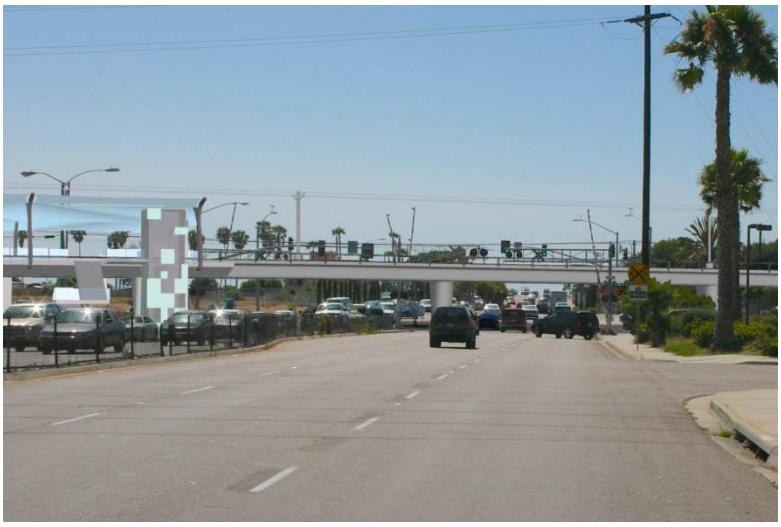


Figure 10: Palomar Street looking west with overhead station at existing location.

The aerial guideway portion of the grade separation would be 1,340 feet long. The transition from at grade to aerial guide-way would be made on retained fill and would require approximately 8,300 cubic yards of fill. This portion of the structure would be 500 feet long on either end of the grade separation. The retained fill portion would be constructed with mechanically stabilized embankment (MSE) walls supporting each side. The superstructure type is anticipated to be a cast-in-place concrete box girder which will also support the elevated station.

There is an existing SDG&E 230kV overhead transmission line and 138kV overhead transmission line crossing over the tracks north of Palomar Street. These lines appear to be around 50 feet above existing grade. General Order 95 requires 34 feet from the top of LRT rail to overhead electrical lines over 22kV (See Attachment 35). In order to construct this alternative these lines would need to be raised ten to twenty feet. This would include replacing the existing lattice steel towers on either side of the span with taller structures. The lines would need to be brought down and extended by splicing sections of wire in or adding additional length to the insulators. Alternatively, the 230kV and 138kV lines could be relocated underground across the tracks. The construction cost of undergrounding lines of this voltage would be roughly five times the cost of raising the lines. There is also a SDG&E 12kV overhead electrical

distribution line crossing the tracks north of Palomar Street that would need to be relocated underground to cross the aerial guideway. A 15 inch VCP sewer line crosses the tracks from Oxford Street to Industrial Boulevard at between 8 and 9 feet deep. This line would need to be relocated for 270 feet to avoid being under the retained fill or left in place and encased in concrete. An 8 inch sewer line and 78 inch CSP culvert crossing Industrial Boulevard and the tracks at the south end of the grade separation would require concrete encasement where the structure on retained fill passes over them.

Alternative P2 received a ranking score of 600 from the alternatives analysis workshops (See Attachment 20). The estimated order of magnitude construction cost for Alternative P2 is $30 million to $37 million (See Attachment 17).

Alternative P4 – LRT Tracks Crossing Under Palomar Street with Station Beneath its Current Location

Alternative P4 proposes a LRT undercrossing, lowering the LRT tracks below the existing grade of Palomar Street with retaining walls on each side. See Figure 8 for schematic and Attachments 13 and 14 for plan, profile and elevation views, as well as typical sections. The overall length of the grade separation would be 2,301 feet, with a maximum depth of 25 feet. The proposed trench would have a typical width of 35 feet, and would widen to approximately 58 feet at the location of the platforms. A new station would be constructed very close to its existing footprint, but lowered to the grade of the proposed tracks. Both of the existing LRT tracks would be removed. The freight line on the east side of the existing tracks would be extended across Palomar Street and used as permanent freight bypass and a temporary single LRT track during construction. The existing catenary would be removed and a temporary catenary would be installed over the freight track on the east side of the grade separation. The freight track would remain at grade and cross Palomar Street in a new location east of the existing LRT tracks. This crossing modification would require approval from the CPUC through the formal General Order 88-B authorization process.

The sides of the trench carrying the LRT tracks below grade and under Palomar Street would be retained with concrete retaining walls. The excavation would require export of approximately 52,000 cubic yards of soil from the site. Since the cost of different wall types can vary greatly due to constructability concerns, the alternatives development team analyzed the proposed project site and determined that the retaining walls will most likely be soldier pile walls requiring support struts during construction.

Since these walls will be up to 25 feet in height, soil nail and tie-back walls were considered in order to eliminate the inevitable settlement that would cause soldier pile walls of this height to list towards the center of the trench under the weight of the retained soil. However, because of the proximity of residences, public utilities, and the 2:1 slope to the west towards the freeway, soil nail and tie-back wall types were eliminated from consideration along the majority of the retaining wall length. These wall types could be used for the portions of the walls beneath the Palomar Street bridge, since there are no utilities or slopes that would interfere with the tie-backs or soil nails in this location. Therefore, this is the assumption made in the cost estimate for this alternative. Bridge railing would be installed along the top of the retaining walls for their entire length.

The proposed centerline for the two LRT tracks would remain on the existing horizontal alignment. The Freight bypass track would be offset about 28 feet to the east from the northbound LRT track. Switches, turnouts and crossovers would be installed to the north and south of the grade separation so that LRT vehicles can transition from the mainline to the proposed temporary bypass track approaching the station.

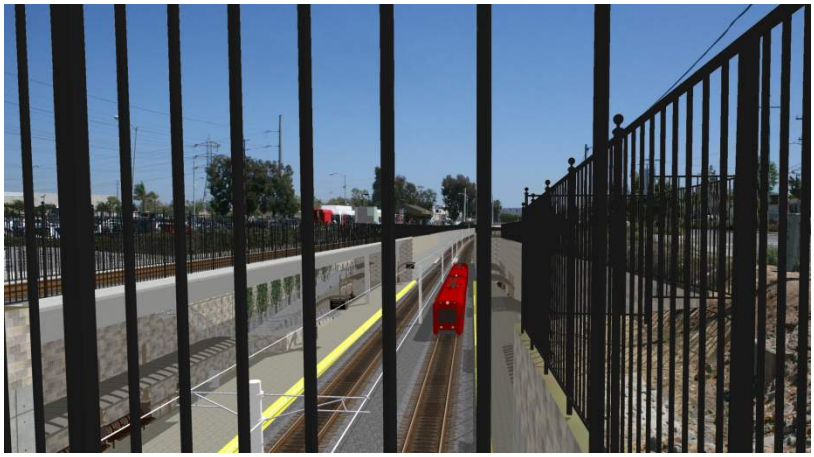


Figure 11: Simulation of below grade station looking south from Palomar St.

Palomar Street would remain at its existing grade, spanning the new below-grade tracks on a structure. The bridge span will be approximately 35 feet. The abutments for this bridge would be constructed crossing Palomar Street on cast-in-drilled-hole (CIDH) piles.

A 15 inch VCP sewer line runs from Oxford Street to Industrial Boulevard across the tracks. This line would need to be relocated for 2,100 feet from Oxford Street south across Palomar Street through the Station parking lot to the end of the grade separation then connect back in with the line in Industrial Boulevard. A 78 inch CSP culvert crossing Industrial Boulevard and the tracks would need to be re-aligned to cross the tracks where the finished grade is at a high enough elevation to provide cover for the pipe. A pump station would be required beneath the station to pump storm water out of the trench to a nearby storm drain.

Alternative P4 received a score of 676 as part of the PDTs alternatives analysis (See Attachment 20), and the estimated order of magnitude construction cost for Alternative P4 is from $36 million to $46 million (See Attachment 17).

ALTERNATIVES ANALYZED BUT NO LONGER CONSIDERED:

Alternative P3 – LRT Tracks Crossing Under Palomar Street with Station Beneath the Street

Alternative P3 proposes a LRT undercrossing, which will result in the LRT tracks below the existing grade of Palomar Street by the use of retaining walls on either side (See Figure 8 for schematic). The overall length of the grade crossing would be 2,377 feet with a maximum depth of 25 feet. This alternative is similar to P4, except that the new station would be constructed directly beneath the road with Palomar Street crossing on a bridge overhead. The bridge would have a span of 58 feet, versus the 35 feet span proposed in Alternative P4. This longer span length would require a much deeper structural section for the bridge, which in turn would push the elevation of the tracks lower, thereby increasing the depth of grade separation and lengthening the project footprint. Visibility of the platforms from the surrounding area would be limited, and therefore the perceived security of the station in this alternative would be reduced. This alternative was removed from further consideration due to the increased costs associated with a larger bridge and larger project footprint, as well as the reduced security of a subterranean station.

Alternative P5 – Lowering Palomar Street Under the Existing LRT Tracks

Alternative P5 is unique to Palomar Street and proposes lowering the grade of Palomar Street under the tracks to a maximum depth of approximately 23 feet. A bridge would be constructed over the road to support the LRT tracks as well as the freight track. Lowering Palomar Street in this location would require that Industrial Boulevard and a number of driveways in the vicinity that intersect with Palomar Street or Industrial Boulevard are lowered as well. Retaining walls would be constructed along both sides of the entire lowered area. The length required for Palomar Street and Industrial Boulevard to reach existing grade from 23 feet deep is approximately 800 feet in either direction. This would involve adjusting as many as eight driveways to match grade; or providing alternate access points for the adjacent properties where it is not possible to match the street grade. It would also require the 15 inch

sewer line running south on Industrial Avenue to be relocated to avoid the dip in the road. This alternative was rejected due to the number of conflicts involved with lowering the road in this location.

OTHER ALTERNATIVES ANALYZED BUT NO LONGER CONSIDERED

LRT Tracks Over Both E and H Streets

This alternative proposes to construct the LRT tracks on a single aerial structure over both E Street and H Street (See Figure 12 for schematic). The overall length of the grade separation would be 5,800 feet at a maximum height of 22.5 feet. The station at E Street would be relocated from its current position to an elevated location over E Street on structure. The station at H Street would be constructed very close to its existing footprint, but raised to the grade of the proposed tracks. The existing northbound track would be removed, and the existing southbound track would remain in place, functioning as the single track main line for both LRT and freight during construction, and a freight bypass track after construction is complete. A 5,800 foot single track section would create a queue on the trolley tracks as trolleys travelling in opposite directions would need to wait for the track to clear before proceeding. For this reason MTS would require two operational tracks at all times for a 5,800 foot section of track to maintain the desired LRT volume. Constructing two bypass tracks would require a large amount of additional right-of-way. The freeway and access ramps are adjacent to the LRT tracks on the west so the additional right-of-way for the second bypass track would need to be acquired on the east side of the existing tracks. This would reduce the size of the station parking lots, as well as displace a large number of residents and businesses. Therefore, this alternative was removed from further consideration.

LRT Tracks Under Both E and H Streets

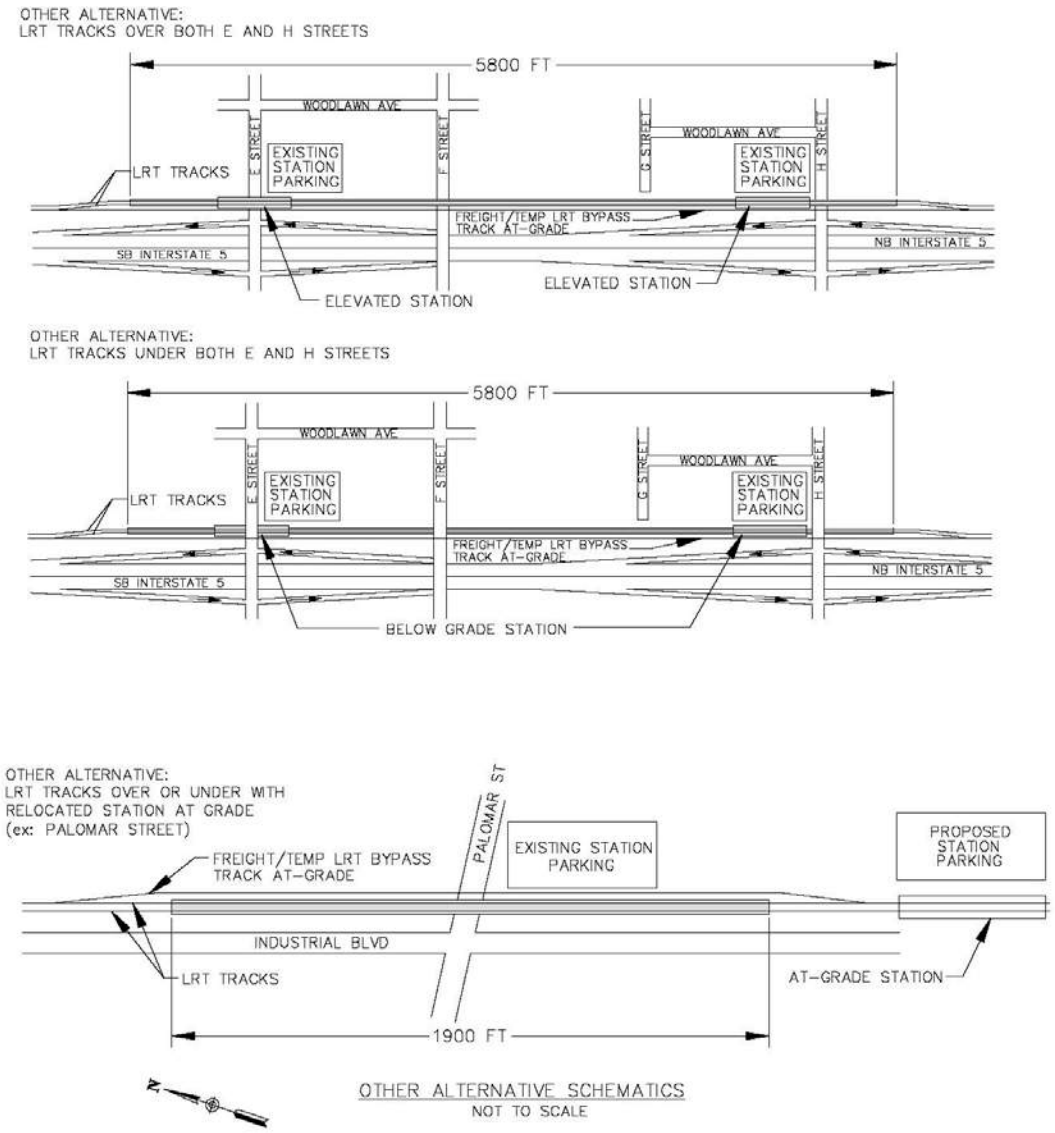
The next alternative analyzed but no longer considered proposes a LRT undercrossing, which will result in the LRT tracks below the existing grade from E Street to H Street by the use of retaining walls on either side (See Figure 12 for schematic). The overall length of the grade crossing would be 5,800 feet with a maximum depth of 25 feet. The existing northbound track would be removed, and the existing southbound track would remain in place, functioning as the single track main line for both LRT and freight during construction, and a freight bypass track after construction is complete. Bridges would be constructed where roads cross the tracks at E Street, F Street, and H Street. This Alternative was removed from consideration for the same reason as the previous alternative. It would require

construction of a second bypass track and require the acquisition of a large amount of additional right-of-way.

LRT Tracks Over or Under With Relocated Station at Grade

Another alternative for each location proposed to grade separate the LRT tracks as with the other alternatives but keep the station at grade and relocate it along the tracks past the end of the grade separation (See Figure 12 for schematic). The stations would need to move 1500 feet in either direction to be located past the grade separated portion of tracks. There are three bus routes that make stops at each of the three stations. The bus routes would need to be changed if the stations were relocated. This would increase the distance travelled by the affected bus routes. Locating the stations away from the major arterial streets where they currently are would require pedestrians to walk down side streets which may be less pedestrian friendly and are farther from many of the businesses in the area. Relocating the parking lots associated with each of the stations would require acquisition of large parcels of land. These alternatives were removed from consideration because of the additional costs and lack of efficiency for buses and pedestrians associated with relocating the stations.

Figure 12: Other Alternative Schematics



6.5. Summary of Alternative Evaluation Results

After reviewing the issues associated with each alternative, scores were given in each of the criteria decided upon earlier and the results were weighted and normalized by the costs estimated for each alternative (See Table 5). The breakdown of scoring results for each criterion can be found in Attachments 18-20.

Table 5: Criteria Evaluation Results

Alternative	Criteria Weighted Score	Estimated Cost (in $1,000,000)	Cost Normalized Score	Score Based Ranking
E Street				
E1 - Station Over E Street	614	28	21.9	1
E4 - Station Under Existing	718	36	19.9	2
H Street				
H2 - Station Over Existing	600	30	20.3	1
H4 - Station Under Existing	548	32	17.4	2
Palomar Street				
P1 - Station Over Street	529	33	16.0	3
P2 - Station Over Existing	600	34	17.6	1
P4 - Station Under Existing	676	41	16.5	2

7. ENVIRONMENTAL DETERMINATION AND ISSUES

The following discussion of potential environmental issues from the proposed project alternatives within the project study area is based on available past studies in the project area, aerial maps, windshield site reviews, and basic data research. No field surveys or formal data collection has been conducted.

The 2050 RTP allocates $550 million (2010) to Blue Line rail grade separations projects. This includes Taylor St., Washington/Sassafras St., 28th St., 32nd St., E St., H St., and Palomar St. As such, future phases should be eligible for Transnet funding. Federal funding is also anticipated to be a source of funding for the future projects, and as such the Federal Transit Administration (FTA) is expected to be the lead agency for the National Environmental Policy Act (NEPA), and either SANDAG or the City of Chula Vista will serve as the lead agency for the California Environmental Quality Act (CEQA).

The document for compliance with CEQA and NEPA is anticipated to be an Environmental Impact Report/Environmental Assessment (EIR/EA). Preparation of the necessary studies for the EIR/EA could require approximately 18-24 months. The 18-24 months would include the start of environmental studies to the approval of the environmental document. The findings of the environmental technical studies to be prepared during PA/ED will ultimately determine the level of environmental documentation that is required for CEQA/NEPA compliance. Alternatively, there are possible CEQA exemptions for rail-grade separations, and the level of CEQA compliance may be down-scoped.

The project study corridor is located just east of the I-5 corridor in western Chula Vista. The terrain is relatively flat and is mostly developed to the east with residential, commercial, and industrial uses. West of the I-5 corridor are more commercial/industrial uses, future redevelopment, the Salt Ponds, and the San Diego Bay. Also, the Bayfront Master Plan was approved by the Coastal Commission on Thursday, August 9, 2012, and the residential portion of that plan is supposed to commence shortly.

Recently, the City prepared the PGD Draft Specific Plan for this area, which contemplates the improvement and densification of the area with a mix of residential and commercial uses. The PGD Draft Specific Plan is expected to be presented to the City's Planning Commission and City Council for approval in the next few months. The future implementation of the Specific Plan land uses will create additional activity, which will lead to an increase in population and pedestrian, bicycle and vehicular activity at the Palomar Transit Station.

7.1. Traffic

The existing at-grade crossings negatively impact traffic flow while trains are passing. The *City of Chula Vista General Plan Update Transportation Study* (Kimley-Horn, 2005) found that constructing a grade separation reduced the average delay per vehicle by 164 seconds for H Street and I-5 Northbound in the evening peak hours. This result was consistent with the findings for E Street and I-5 Northbound in the morning peak hours (See Attachment 22). By eliminating the rail pre-emptions during the passing of LRT trains, the construction of the grade separations would have beneficial effects on traffic circulation when complete.

Freight rail operations will remain largely unchanged by the proposed grade separations. Freight trains would utilize the bypass tracks at each location. Hours of operation for freight would remain the same, with trains running from 1:31 a.m. to 4:04 a.m. when the LRT is out of service.

During construction, there would be temporary adverse impacts on traffic circulation within the project vicinity. Underpass alternatives may require partial road closures lasting for multiple days while the bridge span and decking is constructed. This could have significant adverse impacts at E Street and H Street where freeway on-ramps are directly adjacent to the work areas. The overpass alternatives would also require road closures but of a shorter duration than the underpass options. Detours may be implemented during road closures. This would divert traffic from the major arterials to smaller streets which would increase traffic on those streets. An additional temporary adverse traffic impact associated with the underground alternatives is the amount of truck trips generated by the export of soil.

7.2. Air quality

The sensitive receptors near the three project areas include residential housing, a school, a County Public Health building and trailer parks. Temporary impacts to air quality in these areas would consist of elevated exposure to vehicle emissions and dust plumes during construction.

The end effect of the grade separations on air quality would be beneficial in and around the project areas. Idle time for vehicles will be reduced which will reduce emissions.

7.3. Biological resources

The grade separation locations at E Street, H Street, and Palomar Street are located in the City of Chula Vista and are subject to the City of Chula Vista's Multiple Species Conservation Plan (MSCP) Subarea Plan. The plan provides conservation of covered species and their habitat. Should habitat for sensitive species or sensitive plants be found within the project area the MSCP would provide the guidelines for permitted taking and mitigation of habitat or species.

The Sweetwater Marsh National Wildlife Refuge is located on the west side of I-5 and is approximately 700 feet from the northernmost extent of the E Street grade separation. The refuge contains tidal marsh and adjacent coastal upland habitat. It provides habitat for two federally listed bird species, the California Least Tern and Light-footed Clapper Rail; one threatened species of bird, the Western Snowy Plover; and one endangered plant species, the Salt Marsh Bird's Beak. The marsh also provides habitat for migrating shorebirds and wintering waterfowl. The Migratory Bird Treaty Act (MBTA) protects migratory birds that are native to the U.S. In practice the MBTA is used to restrict disturbance of active bird nests during the nesting season, which is generally from January 15 through August 31.

Each of the three study locations occur in two types of vegetation communities (See Figure 13 and Figure 14). There are two small areas at the north end and south end of the Palomar Street study area that are mapped as Disturbed Habitat. The rest of the project area is mapped as Urban/Developed vegetation community. Neither of these are considered likely habitat for sensitive species. Sensitive plant and animal species can be Federal listed, State listed or considered sensitive by the City of Chula Vista or California Native Plant Society. The I-5 South Multimodal Corridor Study-Preliminary Biological Constraint Analysis (Helix 2010) defines Urban/Developed land as "where permanent structures and/or pavement have been placed, which prevents the growth of vegetation, or where landscaping is clearly tended and maintained." It defines Disturbed Habitat as "land that has little or no habitat value because it has been cleared of vegetation for agricultural purposes or contains heavily compacted soils following disturbance such as grading." Focused rare plant and animal surveys will be conducted in each of the project sites.

Tributaries to Waters of the U.S. may be found within the three study areas. At E Street there is a natural channel flowing along the east side of the tracks which flows north to the Sweetwater River. At

H Street there is a lined drainage channel running along the east side of the tracks that flows under I-5 and discharges to San Diego Bay. And at Palomar Street there is a natural channel at the south end of the parking lot that drains into a culvert crossing under Industrial Boulevard and out to San Diego Bay. Future analysis will determine if these waters are considered Waters of the U.S. Drainage channels containing riparian vegetation would be determined to be within California Department of Fish and Game (CDFG) jurisdiction. The Regional Water Quality Control Board will have jurisdiction over all drainages on the project.

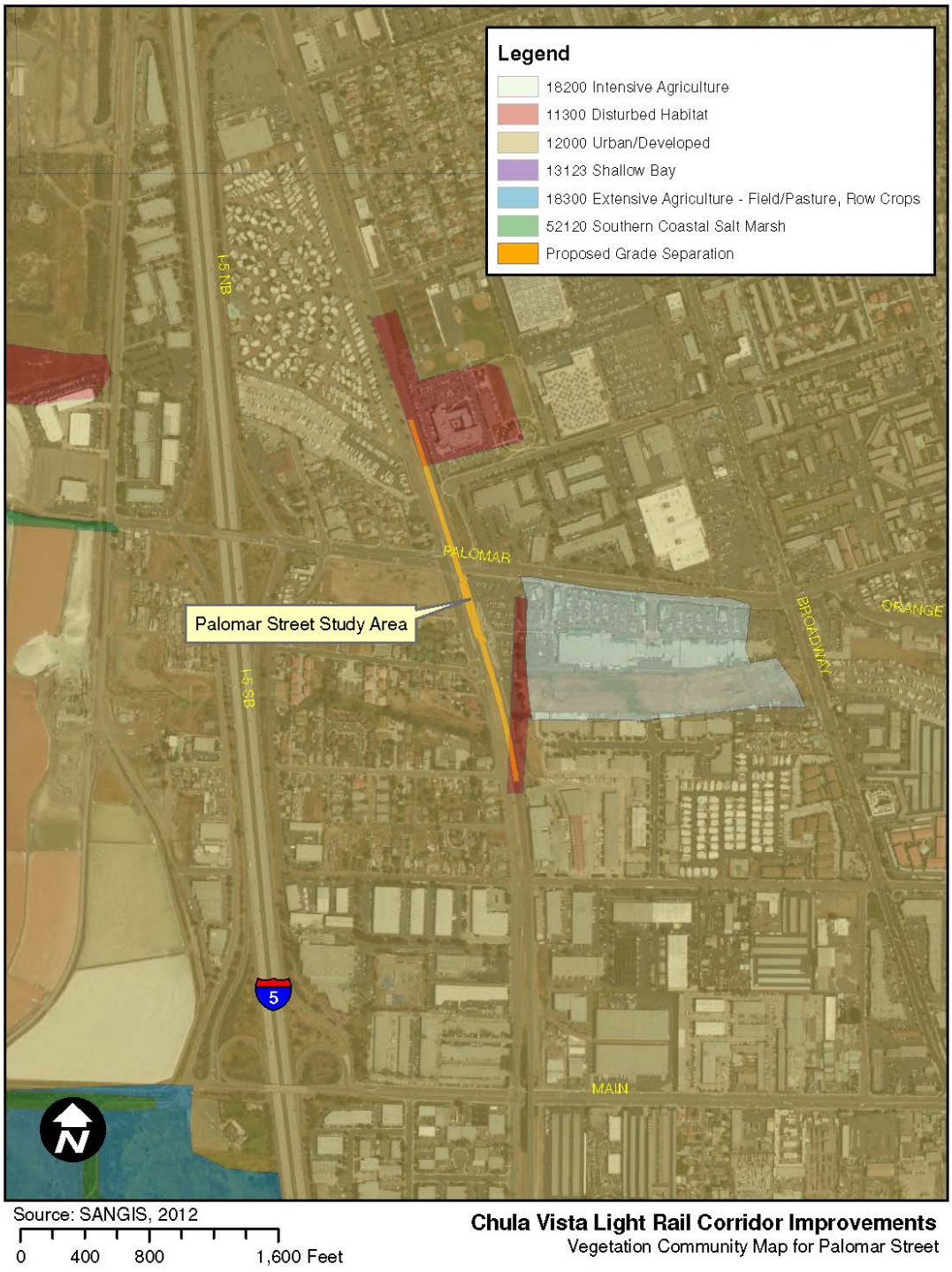
7.4. Community Characteristics

Most of the existing residences and commercial properties are located on the east side of the LRT tracks. The Palomar Street area is an exception with single family and multi-family dwellings on the west side of the tracks. A number of changes to the community are anticipated in all of the project study locations. The future Chula Vista Master Bayfront Development Plan will add traffic generators and will also increase traffic flow to the trolley system. The Urban Core Specific Plan identifies future transit oriented development near all three stations. This development would also include more multi-family development which will add to the population in the area. The Palomar Gateway District Specific Plan would add more retail and office space in the area of the Palomar Street station. This would increase the number of jobs in the area and bring in more daily commuters. The future grade separations would facilitate the implementation of these plans by allowing the LRT to run at shorter headways and therefore carry more passengers to and from the study areas.

The overhead alternatives could be considered a psychological barrier between community areas. The elevated structure would create a visual barrier that may give the impression of a gate from one side to the other. Avoiding the placement of columns in the center of the street and using the shortest section possible for the aerial guideway could help alleviate this feeling.

Figure 13: Vegetation Community Map for E Street and H Street

Figure 14: Vegetation Community Map for Palomar Street



7.5. Cultural resources

The I-5 South Multimodal Corridor Study-Cultural Resource Constraints Analysis (Affinis 2010) identified 9 recorded archeological and historic resources in the I-5 South Corridor area. Of those resources, only one occurs within the three Chula Vista Light Rail Corridor study areas: The segment of the San Diego and Arizona Railroad through the project area. This resource is not listed or considered eligible for National or California Registers. The *Cultural Resources Constraints Analysis* conducted a search of the Native American Heritage Commission's Sacred Lands File and found no known Native American cultural resources within a half mile of the I-5 South Corridor which encompasses the three project grade separations.

Alluvial deposits and undocumented fills underlay the project areas and have the potential to contain un-discovered cultural resources that could be exposed during excavation activities. The Kumeyaay are known to have inhabited the San Diego Bay shoreline prior to Spanish settlement. If any soils from these areas were used as fill during construction of the original railroad tracks there is a potential for encountering archeological materials during excavation.

7.6. Geology, soils, and seismic hazards

The three project locations lie on relatively flat marine terraces with elevations ranging from 25 to 55 feet. According to data from the National Resources Conservation Service (NRCS) Palomar Street lies on an area mapped as overlain by huerhuero loam, a sandy to clayey loam characterized by very slow permeability and slow to medium runoff (See Figure 15 and Figure 16). E Street and H Street are located on an area mapped as overlain by huerhuero urban land complex. This soil type occurs on marine terraces and consists of unconsolidated sandy marine sediments which are easily eroded. All of the project areas are mapped as underlain by the bay point formation. It is composed of marine and non-marine poorly consolidated sandstone.

The closest known fault is the Rose Canyon Fault which extends into San Diego Bay less than one mile from the project area. There is a potential for strong ground motion in the area due to seismic events on nearby faults. There is also potential for liquefaction in loose fill or alluvial soils below the groundwater table and dynamic settlement in area where loose fill or alluvial soils occur above the groundwater table. Should any loose fills or alluvial soils be discovered during field investigations or

construction, structural designs should reflect this and may require removal and replacement or consolidation.

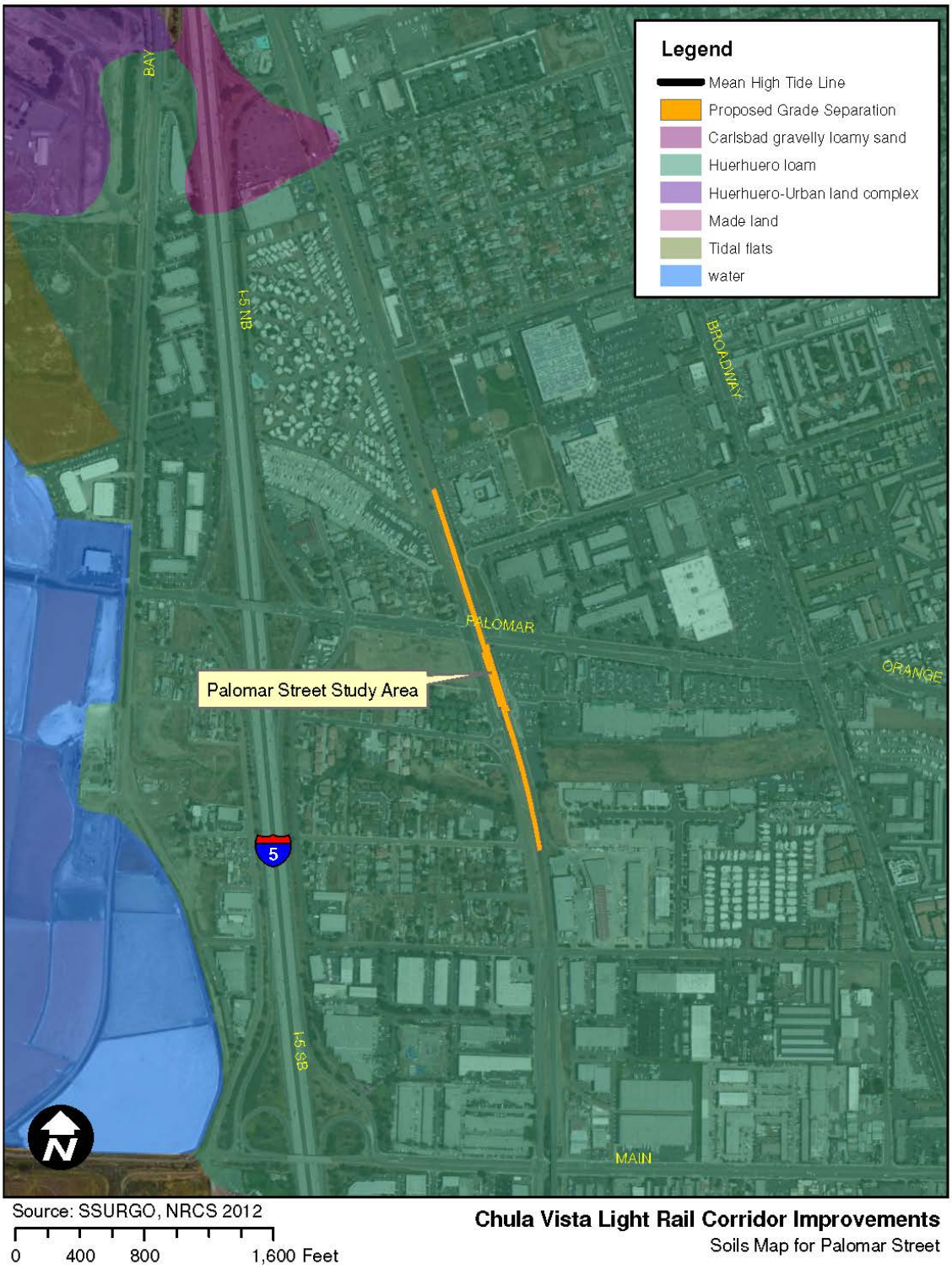
The static ground water table is likely to occur near the base of excavations at E Street and H Street. Groundwater monitoring wells located near the three study locations can be found on the State Water Resources Control Board website in the GeoTracker database. Included in the environmental data for each well are measured minimum and maximum groundwater depths shown in Table 6.

Table 6: Groundwater Monitoring Data Summary

Project Location	Nearest Groundwater Monitoring Well	Minimum Depth to Water (ft)	Maximum Depth to Water (ft)
E Street	Prudential Overall Supply 740 F Street	24.67	31.84
H Street	Former Exxon/Mobil 745 H Street	14.74	21.34
Palomar Street	ARCO #6133 800 Palomar Street	37.60	46.96

Figure 15: Soils Map for E Street and H Street

Figure 16: Soils Map for Palomar Street



7.7. Hazardous Waste/Materials

In general, ground disturbing activities and demolition during construction have the potential to encounter hazardous materials and contaminated soil or groundwater. Potential hazardous materials that may be encountered within the rail corridor include creosote treated wooden railroad ties, soil contaminated with grease or oil under tracks or turnouts, and soil contaminated with aerially deposited lead. The chances of encountering these materials are similar for all of the alternatives. At E Street there is a gas station adjacent to the project site, which is considered high risk for soil contamination. Due to the large amount of excavation involved there is a higher chance of encountering contaminated soil with the underground alternative.

The State Water Resources Control Board includes data for groundwater monitoring and clean up of leaks and discharges in Chula Vista and throughout the state on their Geotracker internet database. At E Street, a gasoline leak was reported at Hiram's Mobil gas station on the north side of E Street across from the trolley station parking lot in 1987. The cleanup was completed and the case closed. The H Street station parking lot sits on a former Exxon/Mobil gas station. Remediation began on the site in 2003 for soil and groundwater contaminated with gasoline. There are twenty-two groundwater monitoring wells at the site and further remediation is planned. There are no leaks recorded within 1,000 feet of the Palomar Street project area.

7.8. Drainage

The topography in each of the project areas is relatively flat. The areas have all previously been graded to construct the original railroad tracks. The storm drains within E Street outlet into a drainage swale running along the east side of the tracks. The swale then flows to the north to the Sweetwater River which then flows to San Diego Bay. The E Street study location does not fall within a flood hazard zone per the FEMA Flood Insurance Rate Map included in the I-5 South Multimodal Corridor Study. At H Street there is a concrete lined drainage channel that runs along the east side of the tracks. It flows into a 54 inch RCP storm drain where it crosses the H Street Station parking lot. Drainage from the parking lot flows into the 54 inch storm drain and it then outlets back into the concrete channel south of H Street. Another covered concrete channel flowing west along H Street joins the channel just south of the road. The channel then flows south along the tracks for approximately 1,200 feet where it crosses

under I-5 in a box culvert. It then flows south to J Street in an open channel and outlets into San Diego Bay. According to the FEMA Flood Insurance Rate Map from the I-5 South Multimodal Corridor Study, the H Street study area falls within a Zone X 500 year flood plain. At Palomar Street drainage flows into storm drains that convey runoff under the station parking lot to the south end. There it is picked up in a natural open channel to a 78 inch CSP culvert crossing Industrial Boulevard where it outlets into a natural open channel that flows west to San Diego Bay.

Construction of the grade separations would increase the impervious area at each site. The appropriate treatment and/or detention of this additional runoff will be determined in the PA/ED phase of the project.

At H Street both viable alternatives require replacement of the open channel with a concrete box culvert. This may create a deeper more narrow flow which could move at a higher velocity. Energy dissipation may be required at the outlet of the culvert. There is a sharp turn with a guide-vane where the channel reaches the existing box culvert and flows under the freeway. If velocities are too high this structure may need to be modified.

A site specific drainage study should be developed for each location in conjunction with the final design. The study should address the issues above and demonstrate that the proposed conditions are not modifying the existing drainage patterns downstream. All work should comply with the National Pollution Discharge Elimination System (NPDES) standards and incorporate Best Management Practices (BMP) as identified by the City of Chula Vista's Standard Urban Storm Mitigation Plan (SUSMP). BMPs should be implemented to reduce sediment discharge and reduce the risk of flooding during construction.

7.9. Land use

Existing land uses in the three project areas include single family attached, single family detached, commercial, and light industrial (See Figure 17 and Figure 18). The Chula Vista General Plan establishes land use plans and policies for future development of the city (See Figure 19 and Figure 20). This development will put additional demands on the light rail system and freeway interchange network.

Adjacent to the E Street study area there are three hotels, a gas station, a mobile home park, two restaurants, and a storage yard for a construction company. West of the tracks is the I-5 corridor, the Living Coast Discovery Center, the Sweetwater Marsh National Wildlife Refuge, one hotel, one restaurant, and two commercial buildings. The E Street study area is part of the Urban Core Specific Plan. The UC-15 E Street Trolley sub-district of the plan is a transit focus area (See Attachment 33). Future Development in this area would be limited to a maximum of 90% residential and 10% retail, hospitality, or office; with a minimum of 1% retail and 1% hospitality.

At H Street there is multi-family housing, a mobile home park, a school, and several retail stores on the east side. To the west is I-5, and beyond that is a heavy industrial facility along with a large vacant area. This vacant area will include much of the future Bayfront Master Plan development which received California Coastal Commission approval on August 9, 2012. This development will introduce additional land uses west of I-5 including, hotels, restaurants, and parks. The H Street study area is also part of the Urban Core Specific Plan. Sub-district UC-12 H Street Trolley is a transit focus area (See Attachment 33). Future Development in this area would be limited to a maximum of 90% residential and 10% retail, hospitality, or office; with a minimum of 1% retail and 1% hospitality.

On the east side of the tracks at Palomar Street there is a school, a San Diego County Public Health building, retail shops, and light industrial uses. West of the tracks is Industrial Boulevard, a trailer park, and single and multi-family residences. The Draft Palomar Gateway District Specific Plan would designate most of the area near the Palomar Street study area as a mixed use corridor (See Attachment 34). These sub-districts are designated as MU-1 and MU-2. This would allow future development in the area to include residential/commercial mixed use, commercial retail, or commercial office land uses. The area designated as PRV is named Palomar Residential Village and would only allow future development of apartment complexes, townhouse complexes, or garden apartments.

The trolley currently services the area, and grade separating the tracks will allow MTS to decrease headways and serve a larger number of riders. This will facilitate the anticipated growth in each of the study areas.

Figure 17: Existing Land Use Map for E Street and H Street

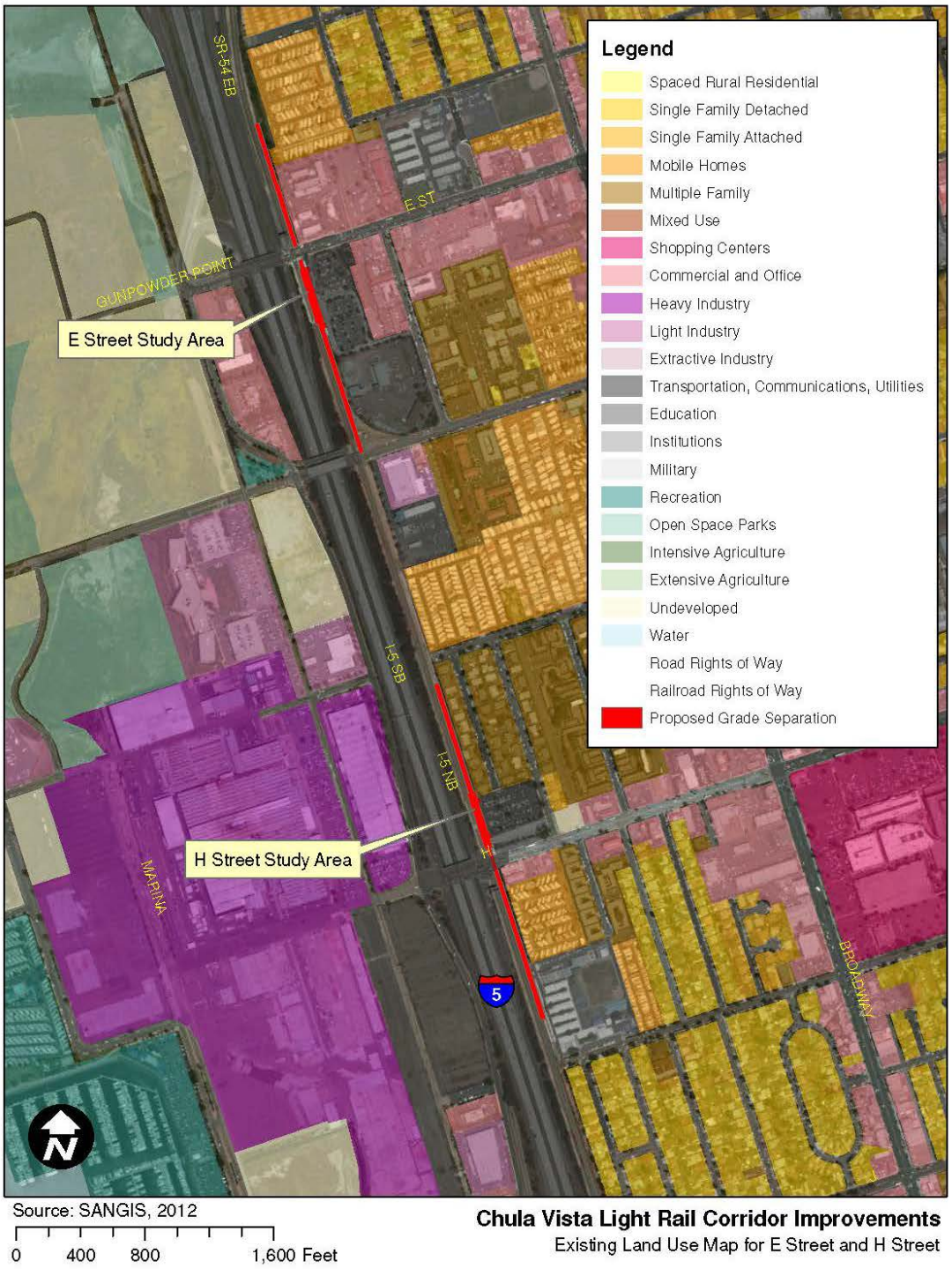


Figure 18: Existing Land Use Map for Palomar Street

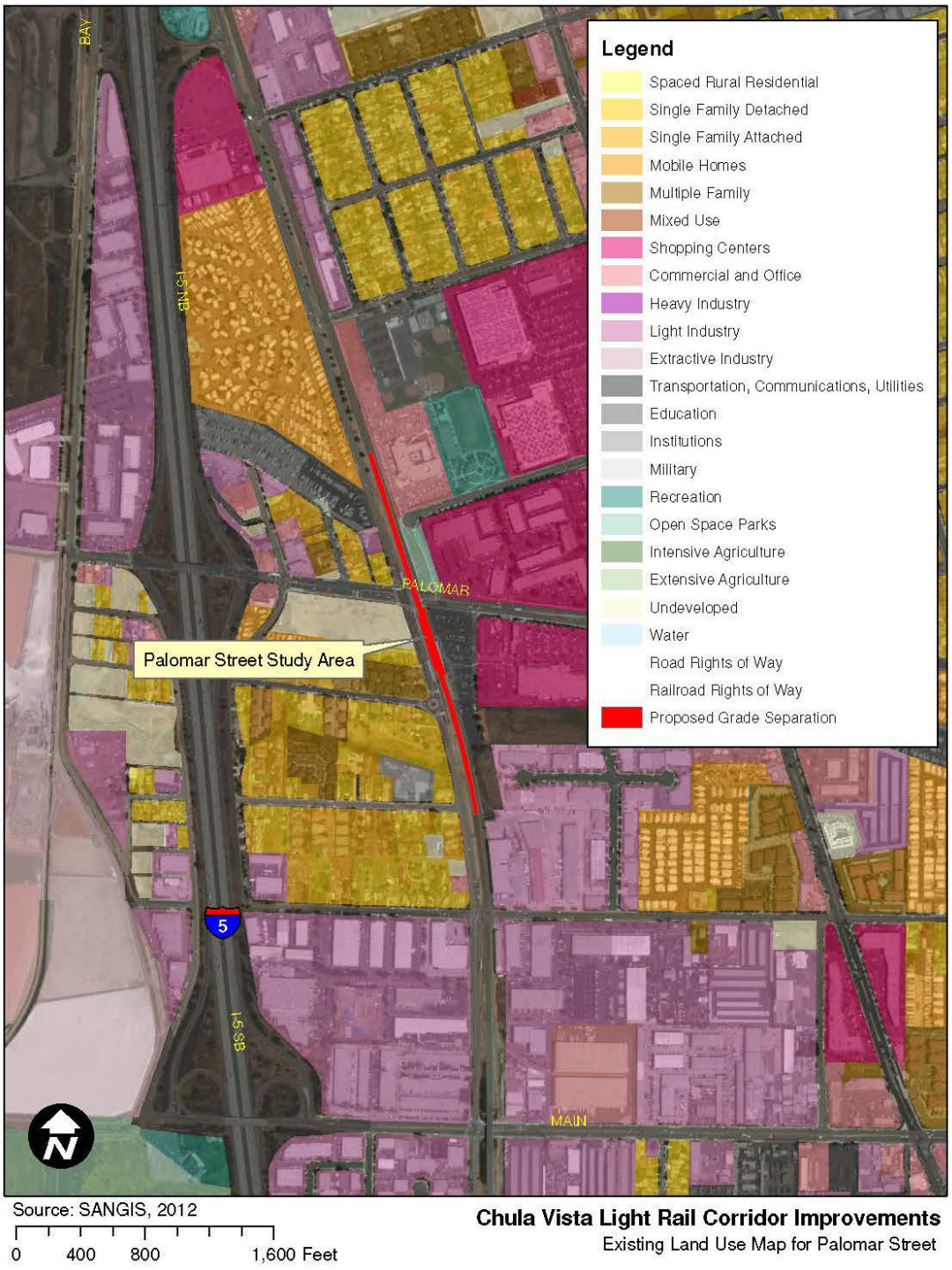


Figure 19: Chula Vista General Plan Land Use Designation for E Street and H Street

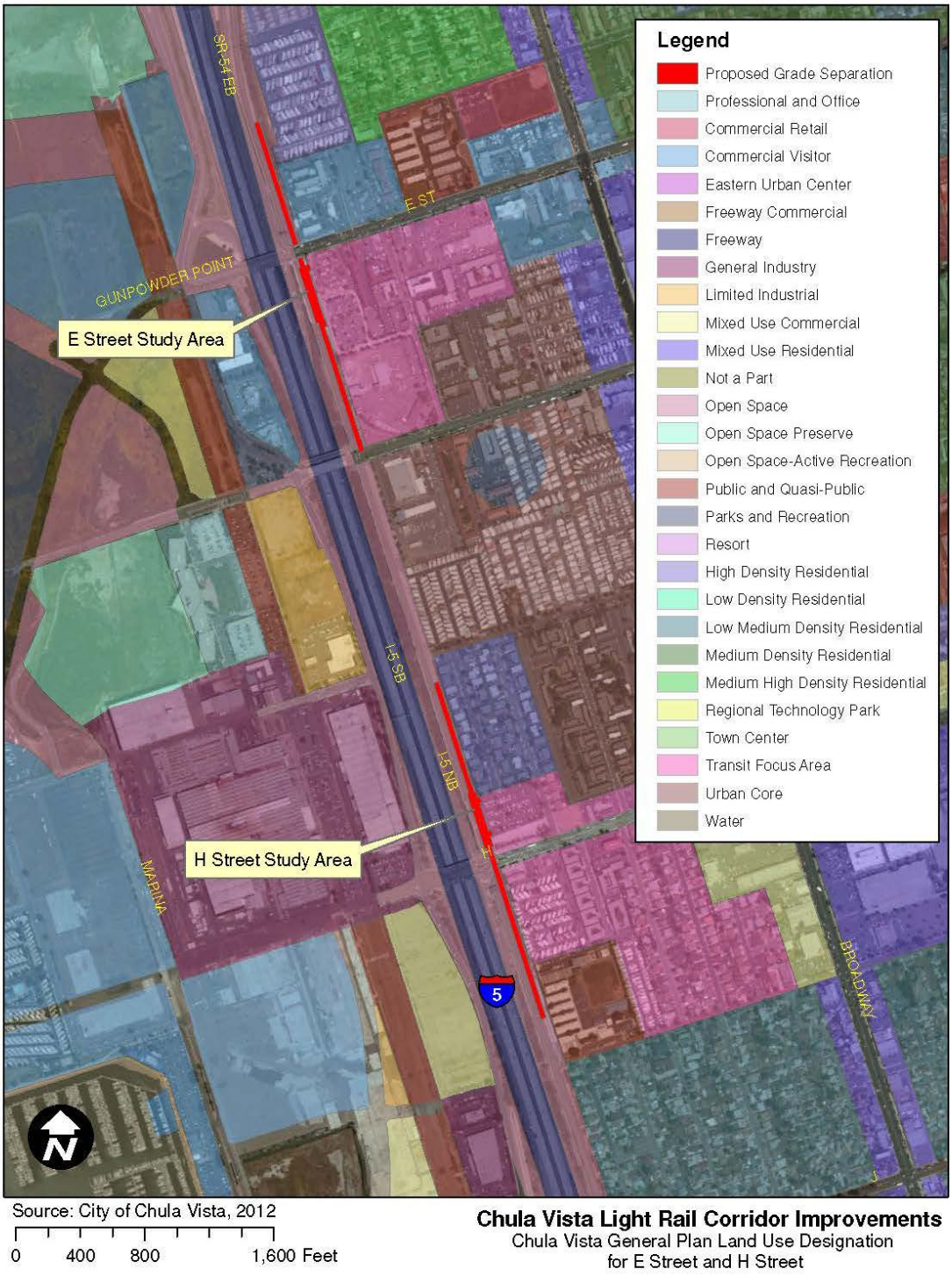
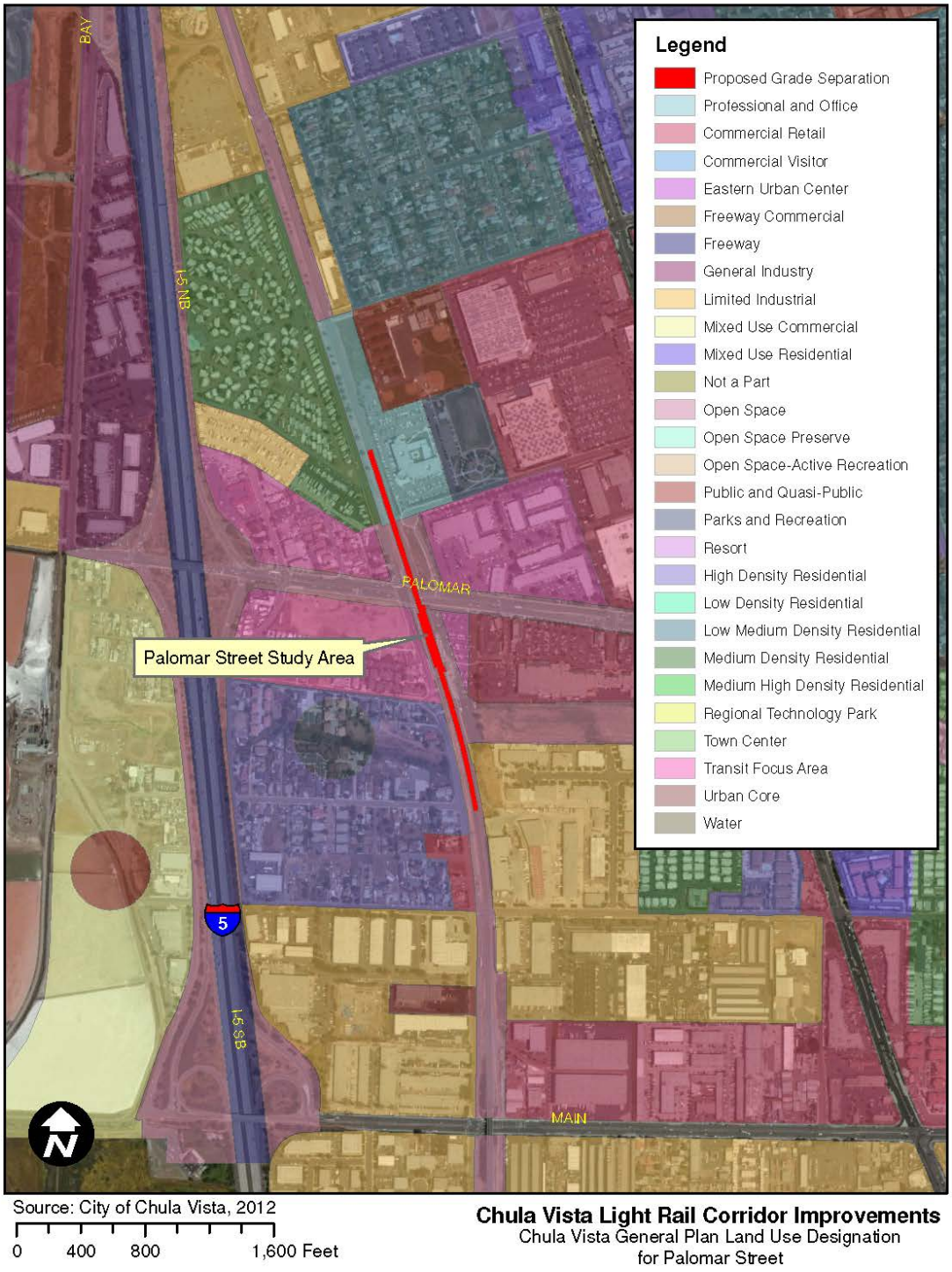


Figure 20: Chula Vista General Plan Land Use Designation for Palomar Street



7.10. Noise

Grade separating the trolley at the three study locations could have an impact on noise levels in the area and a noise study is needed to evaluate both potential temporary and permanent impacts. Elevating the trolley on an aerial guide-way could cause track noise to propagate more easily. Reduction in the number of trains crossing the street at grade would reduce the number of times per day the grade crossing bells would be tripped from 198 to 2 (196 LRT trips and 2 freight trips). Mitigation measures for any increase in noise levels could include sound walls on aerial guide or other dampening measures.

At E Street sensitive receptors near the project area include a trailer park to the north east, and a motel. At H Street sensitive receptors adjacent to the work area include residential housing, a mobile home park, and a school. At Palomar Street nearby sensitive receptors include the San Diego County Public Health building to the northeast and residential housing and trailers on the west side of Industrial Blvd.

7.11. Paleontology

According to data from the NRCS (See Figure 16) Palomar Street is located on an area mapped as overlain by huerhuero loam, while E Street and H Street are located on an area mapped as overlain by huerhuero urban land complex (See Figure 15). These areas are all mapped as underlain by the bay point formation, composed of marine and non-marine poorly consolidated sandstone.
The hueruero loam and hueruero urban land complex have a low potential for paleontological resources, however the Bay Point Formation has a high potential. The Bay Point Formation has been documented to contain marine fossils from the late Pleistocene age at 0 to 30m in elevation. Excavations for the grade separations may extend into the bay point formation and would require monitoring by a paleontologist during excavation. Should significant fossils be uncovered during excavation the work would be required to stop in the area until they could be recovered.

7.12. Visual resources

The affect of the proposed grade separations on the viewsheds and key users will need to be determined during future phases. Any overhead option will have the potential to obstruct key views such as those to the west in the E Street corridor. Mitigation for the partial loss of visual resources will

be determined and could include aesthetic finishing on the aerial guide way, landscaping components, or other types of incorporated artwork into the station designs.

At street level, only the E Street study area has a view of San Diego Bay. An elevated station at H Street could provide similar views of the bay for LRT customers, though future Bayfront development could reduce the view significantly. Elevated station platforms could also provide a view of the city and mountains to the east that is not currently visible from street level.

For all three of the study locations the underground alternatives would reduce the obtrusiveness of the trolley in the area by lowering the catenary out of view for several hundred feet. If sound walls were required for noise mitigation they could also introduce visual impacts. Required soundwalls could be treated using architectural finishes, textures, or colors. Lighting of elevated trolley stations could create a nuisance to adjacent residential homes. All station lighting should be designed to be shielded and directed away from nearby residences.

7.13. Water quality

Major water bodies downstream of the three study areas are the Sweetwater River and San Diego Bay. Run off through the project areas would originate in developed urban or industrial areas as surface flow and through storm drains. Runoff from urban areas can include such pollutants as fuel, grease, fertilizers, pesticides, residue from vehicle brake pads, and various forms of litter.

Water quality standards for each of the project areas would be set by the State Water Resources Control Board, which is represented locally by the San Diego Regional Water Quality Control Board. Impacts to Waters of the U.S. are regulated by the federal Clean Water Act (CWA). The NPDES program sets goals for pollution prevention in runoff. The development of a Storm Water Pollution Prevention Plan (SWPPP) and implementation of BMPs would be required by the NPDES. Additionally a Water Quality Technical Report may be required.

During construction pollutants that could affect runoff include sediments, cement, curing compounds, vehicle fluids, asphalt emulsion, solvents, thinners and paints. Post-construction, the possible impacts include contamination of runoff with fertilizer, pesticides, metals, and litter. The various alternatives would have similar effects on water quality both during construction and post-construction.

7.14. Electromagnetic field (EMF)

Traction power for the San Diego Trolley is distributed via 600 V overhead DC lines. As current passes through the lines an electromagnetic field (EMF) is generated. The strength of the EMF is related to the distance from the conductor, the voltage, and the configuration of the conductor. Neither the federal or state governments have regulations regarding limits for EMF exposure. The Federal Communications Commission (FCC) has adopted regulations that are applicable to EMF exposure, though they do not regulate health and safety. The FCC regulations apply to intentional radiators only such as wireless communications and would only apply to this project if its operations interfered with legitimate radiofrequency uses.

The proposed condition would require a study to determine if the new configuration of the catenary either elevated on the aerial guideway or below grade would have negative effects on customers, neighboring properties, or radio-communications in the area. At Palomar Street there are existing SDG&E 230kV and 138kV overhead transmission lines that cross over the tracks. If either of the overhead alternatives were chosen these lines may need to be raised to provide the proper clearance. Alternatively the lines could be undergounded, but this would mostly likely be at a much higher cost. This would require additional study to determine any impacts the transmission lines may have on the traction power equipment and vice versa.

8. COMMUNITY INVOLVEMENT

At this stage of the project development process, there have not been any required public hearings or scoping meetings. The purpose of this study is to look at the feasibility of above grade and below grade LRT crossing options and potential issues. Therefore, public hearings will be provided with future phases such as environmental clearance and design. It is expected that there will be community meetings that will utilize this study as a basis for discussion and preferred alternatives.

It should be noted that the preliminary alternatives prepared as part of the project study, along with a number of visual simulations, were presented to the Chula Vista City Council at the Transportation Workshop on April 5th, 2012. The presentation was open to members of the public in a workshop format with members of the PDT available after the presentation to answer project specific questions.

9. RISK MANAGEMENT

A Risk Management Plan (RMP) for the project has not yet been implemented, and it is anticipated that a formal RMP will be incorporated in future phases. This document would describe how risk management would be structured and performed on the project. The Risk Management Plan would typically include methodology, roles and responsibilities, budgeting, timing, risk categories, definitions of risk probability and impact, probability and impact matrix, reporting formats, and tracking.

At this point all of the designs incorporated in this study are preliminary, and are based on rough topography, GIS data, and as-built plans. With more detailed design information, other utilities may be found in need of relocation. For instance, the existing SDG&E 230 kV and 138 kV transmission lines have been determined to be in conflict with the elevated guide-way alternatives at Palomar Street by visual inspection only. The lines should ultimately be surveyed to verify the exact height over the tracks. Geometric designs will be further refined to maximize operations and minimize impacts. A complete drainage study will be required to verify that all modifications to drainage facilities will convey the design storm required by the City of Chula Vista. All modifications to at-grade crossings will require approval from the CPUC. All cost estimates included are order of magnitude only and are based on preliminary plans and do not include any station work to increase parking. All costs are given in 2012 dollars. The environmental discussion in Section 7 was based on previous studies, GIS data, and internal data. No formal field investigations or surveys were completed. Finally, it appears that, based on the preliminary design, these projects will not require additional right-of-way to be acquired. However, it is possible that the final design may require some right-of-way acquisitions and/or temporary construction easements that have not yet been identified.

10. FUNDING

The 2050 RTP allocates $550 million (2010) to Blue Line rail grade separations projects. This includes Taylor St., Washington/Sassafras St., 28th St., 32nd St., E St., H St., and Palomar St (See Attachment 21). Of the grade separations listed, the E Street, H Street, and Palomar Street projects would be lower in cost than the other crossings. As these projects progress to future development phases specific funding sources will be identified. The grade separation projects are anticipated to progress sequentially rather than concurrently, and the Palomar Street grade separation has been identified to go forward initially. A possible source of funding for the environmental phase of the Palomar Street grade separation has already been identified. The City of Chula Vista has additional Federal SAFETEA-LU funds from the *I-5 South Multimodal Corridor Study*. On June 19th the City Council approved Resolution 2012-118 to enter into a Memorandum of Understanding (MOU) between the City of Chula Vista and SANDAG which would allow these funds to be used for the Palomar Street grade separation environmental documents. Members of Chula Vista and SANDAG staff are finalizing the MOU and will execute the document in late Summer/Fall 2012.

11. PROJECT SCHEDULE AND COSTS

Table 7: Tentative Project Schedule

Milestone	Fiscal Year
Palomar Street	
Circulate Draft ED	6/2014
Public Hearing	7/2014
PA/ED	6/2015
PS&E	6/2017
Construction Complete	6/2020
H Street	
Circulate Draft ED	6/2019
Public Hearing	7/2019
PA/ED	6/2020
PS&E	6/2022
Construction Complete	6/2025
E Street	
Circulate Draft ED	6/2024
Public Hearing	7/2024
PA/ED	6/2025
PS&E	6/2027
Construction Complete	6/2030

The following cost data was developed based on order of magnitude costs and is to be used for long range planning purposes only. The costs shown are for each location using the highest and lowest construction costs from all of the viable alternatives.

Table 8: Palomar Street Capital Outlay Support Estimate for PA/ED

Palomar Street (in 2012 $1,000's)				
Fiscal Year	**PA/ED**	**PS&E**	**Const. Support**	**Capital**
7/2013-6/2014	350-450			
7/2014-6/2015	350-450			
7/2015-6/2016		TBD		
7/2016-6/2017		TBD		
7/2017-6/2018			TBD	
7/2018-6/2019			TBD	
7/2019-6/2020			TBD	
Total	700-900	TBD	TBD	TBD

Table 9: H Street Capital Outlay Support Estimate for PA/ED

H Street (in 2012 $1,000's)				
Fiscal Year	**PA/ED**	**PS&E**	**Const. Support**	**Capital**
7/2018-6/2019	350-450			
7/2019-6/2020	350-450			
7/2020-6/2021		TBD		
7/2021-6/2022		TBD		
7/2022-6/2023			TBD	
7/2023-6/2024			TBD	
7/2024-6/2025			TBD	
Total	700-900	TBD	TBD	TBD

Table 10: E Street Capital Outlay Support Estimate for PA/ED

E Street (in 2012 $1,000's)				
Fiscal Year	**PA/ED**	**PS&E**	**Const. Support**	**Capital**
7/2023-6/2024	350-450			
7/2024-6/2025	350-450			
7/2025-6/2026		TBD		
7/2026-6/2027		TBD		
7/2027-6/2028			TBD	
7/2028-6/2029			TBD	
7/2029-6/2030			TBD	
Total	700-900	TBD	TBD	TBD

12. CONCLUSION

Each of the viable alternatives, with the exception of the No-Build Alternatives, fulfill the purpose and need by grade separating the LRT tracks from the road, thus improving overall traffic mobility and reducing delay. All of the viable alternatives discussed in this report are recommended to be carried forward to the environmental analysis phase. As a result of the Alternatives Analysis workshops, potential alternatives were evaluated and given scores for several criteria as determined by the project team. The scores were weighted for each location and then tallied for each prospective alternative. The ultimate scores were also normalized by dividing the alterative total score by the estimated order-of-magnitude cost.

Alternative E1, constructing the LRT tracks elevated above E Street with the station centered above the street, was the highest ranking after normalizing the two viable alternatives at the E Street location. While the raw score was lower than the other viable Alternative E4, the much higher cost of Alternative E4 at $36 million caused its cost normalized score to drop below Alternative E1, which had a cost of $28 million. The final normalized scores for E1 and E4, respectively, were 21.9 and 19.9.

At H Street, Alternative H2 scored highest. Alternative H2 proposed to construct the LRT tracks elevated above H Street and keep the station over its existing location. Alternative H2 received both the highest raw score and highest cost normalized score when compared to Alternative H4, the other viable alternative. Alternative H2 has an anticipated cost of $30 million, while Alternative H4, which would construct the LRT tracks under H Street with the station, located under its existing location, had an estimated cost of $32 million. Alternative H2 received a cost normalized score of 20.3 and H4 received a cost normalized score of 17.4.

There were three viable alternatives considered at Palomar Street. Alternative P2 scored the highest with a cost normalized score of 17.6, followed by Alternative P4 with 16.5, and lastly Alternative P1 with 16.0. Alternative P2 would construct the LRT tracks elevated above Palomar Street with the station over its existing location along the tracks. It had an estimated cost of $34 million. Alternative P4 had an estimated cost of $41 million and would construct the LRT tracks under Palomar Street with the station located under its existing location along the tracks. Alternative P1 estimated costs at $33 million and would construct the LRT tracks elevated over Palomar Street with the station centered above the street.

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14. LIST OF ATTACHMENTS

Attachment 1	General Plan for Alternative E1
Attachment 2	Cross Sections for Alternative E1
Attachment 3	General Plan for Alternative E4
Attachment 4	Cross Sections for Alternative E4
Attachment 5	General Plan for Alternative H2
Attachment 6	Cross Sections for Alternative H2
Attachment 7	General Plan for Alternative H4
Attachment 8	Cross Sections for Alternative H4
Attachment 9	General Plan for Alternative P1
Attachment 10	Cross Sections for Alternative P1
Attachment 11	General Plan for Alternative P2
Attachment 12	Cross Sections for Alternative P2
Attachment 13	General Plan for Alternative P4
Attachment 14	Cross Sections for Alternative P4
Attachment 15	Cost Estimates for E Street
Attachment 16	Cost Estimates for H Street
Attachment 17	Cost Estimates for Palomar Street
Attachment 18	Scoring for E Street Alternatives
Attachment 19	Scoring for H Street Alternatives
Attachment 20	Scoring for Palomar Street Alternatives
Attachment 21	Table TA 4.24 – Rail Grade Separation Rankings, 2050 RTP
Attachment 22	Intersection Delay Benefits of Grade Sep. (Kimley-Horn, 2005)
Attachment 23	Aerial Photo Exhibit – Alternative E1
Attachment 24	Aerial Photo Exhibit – Alternative E4
Attachment 25	Aerial Photo Exhibit – Alternative H2
Attachment 26	Aerial Photo Exhibit – Alternative H4

Attachment 27	Aerial Photo Exhibit – Alternative P1
Attachment 28	Aerial Photo Exhibit – Alternative P2
Attachment 29	Aerial Photo Exhibit – Alternative P4
Attachment 30	Chula Vista Bayfront Master Plan Illustrative Map
Attachment 31	General Order 88-B Request Form
Attachment 32	Palomar Gateway Conceptual Mobility Plan
Attachment 33	Urban Core Specific Plan Sub-Districts Key Map
Attachment 34	Palomar Gateway District Sub-District Map
Attachment 35	Rule 37 Table 1 of CPUC General Order 95