APPENDIX K: TRAFFIC IMPACT ANALYSIS

Waterman Avenue High Cube Warehouse

TRAFFIC IMPACT ANALYSIS

CITY OF SAN BERNARDINO

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LIST OF ABBREVIATED TERMS

(1)	Reference
ADT	Average Daily Traffic
Av.	Avenue
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CMP	Congestion Management Program
DIF	Development Impact Fee
E+P	Existing Plus Project
EA	Existing Plus Ambient Growth
EAC	Existing Plus Ambient Growth Plus Cumulative
EAP	Existing Plus Ambient Growth Plus Project
EAPC	Existing Plus Ambient Growth Plus Project Plus Cumulative
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
ITE	Institute of Transportation Engineers
LOS	Level of Service
MUTCD	Manual on Uniform Traffic Control Devices
PHF	Peak Hour Factor
Project	Waterman Avenue High Cube Warehouse
Rd.	Road
SCAG	Southern California Association of Governments
St.	Street
TIA	Traffic Impact Analysis

1 INTRODUCTION

This report presents the results of the traffic impact analysis (TIA) for the proposed Waterman Avenue High Cube Warehouse ("Project") located in the City of San Bernardino on the east side of Waterman Avenue between Mill Street and Rialto Avenue, as shown on Exhibit 1-1.

The purpose of this traffic impact analysis is to evaluate the potential impacts to traffic and circulation associated with the development of the proposed Project, and to recommend improvements to mitigate impacts considered significant in comparison to established regulatory thresholds. The scope of this study has been developed through consultation with the City of San Bernardino, and follows the City of San Bernardino Traffic Impact Study Guidelines (September 2004), and also where appropriate addresses requirements as identified by the County of San Bernardino Congestion Management Program (CMP) and Caltrans traffic study guidelines. The approved Project Traffic Study Scoping agreement with the City of San Bernardino is provided in Appendix "1.1" of this TIA.

1.1 PROJECT OVERVIEW

The Project is proposed to consist of approximately 430,000 square feet of high-cube distribution warehouse use within a single building. The Project is proposed to have access to Waterman Avenue via Driveways 1 and 2. Both Project driveways are proposed to be stop controlled and allow for full access. It is assumed that the Project will be constructed and occupied by 2015.

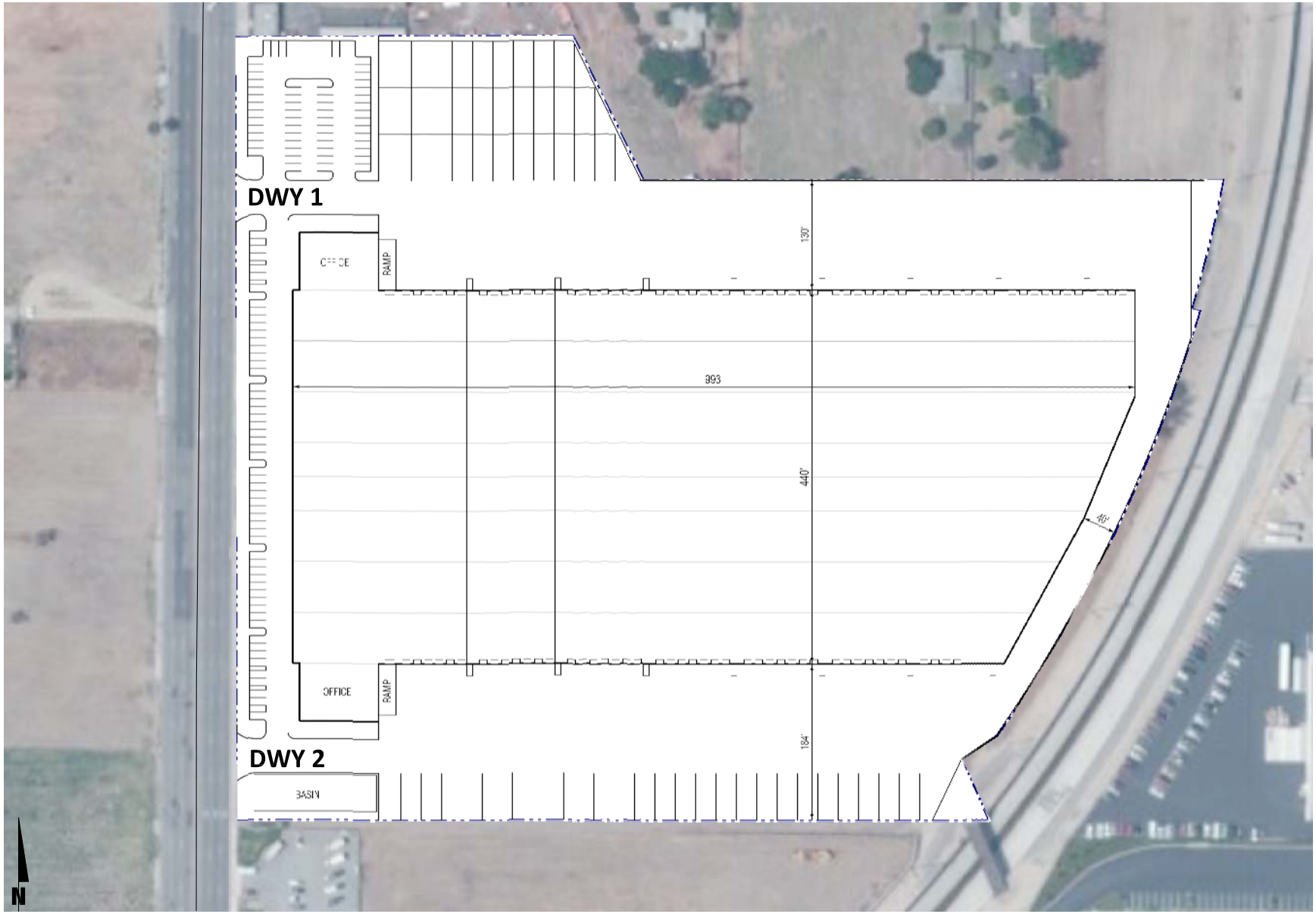
Trips generated by the Project's proposed land uses have been estimated based on trip generation rates collected by the Institute of Transportation Engineers (ITE) as presented in ITE's most current edition of Trip Generation (9th Edition, 2012). The Project is estimated to generate a net total of approximately 976 PCE trip-ends per day on a typical weekday with approximately 64 PCE AM peak hour trips and 70 PCE PM peak hour trips. The assumptions and methods used to estimate the Project's trip generation characteristics are discussed in detail in Section 4.1 *Project Trip Generation* of this report.

1.2 ANALYSIS SCENARIOS

For the purposes of this traffic study, potential impacts to traffic and circulation have been assessed for each of the following conditions:

- Existing (2014) (1 scenario)
- Existing plus Project (1 scenario)
- Existing plus Ambient Growth, without and with Project (2015) (2 scenarios) – ambient growth only (EA and EAP)
- Existing plus Ambient Growth plus Cumulative Development Projects (2015), without and with Project (2 scenarios) – ambient growth and cumulative development projects (EAC and EAPC)
- Horizon Year (2035), without and with Project (2 scenarios)

EXHIBIT 1-1: PRELIMINARY SITE PLAN



1.2.1 Existing (2014) Conditions

Information for Existing conditions is disclosed to represent the baseline traffic conditions as they existed at the time this report was prepared.

1.2.2 Existing Plus Project Conditions

The Existing and Existing Plus Project (E+P) analysis determines direct project-related traffic impacts that would occur on the existing roadway system in the theoretical scenario of the Project being placed upon existing conditions. Consistent with the City's TIA guidelines, project impacts have been determined through a comparison of the EA and EAP traffic conditions for the purposes of this analysis. As such, the E+P scenario has been provided for informational purposes only.

1.2.3 Existing Plus Ambient Growth without and with Project (2015) Conditions

The Existing plus Ambient Growth (2015) without and with Project conditions analyses determines the project-related traffic impacts based on a comparison of the Existing plus Ambient Growth plus Project (EAP) traffic conditions to the Existing (E) and Existing plus Ambient Growth (EA) conditions. The EA (2015) and EAP (2015) conditions analyses uniquely identifies the specific traffic impacts associated with the development of the proposed Project. To account for background traffic, a total ambient growth from Existing (2014) conditions of 1.54% (1.54% per year x 1 year) is included for EA (2015) and EAP (2015) traffic conditions. Cumulative development projects are not included as part of the EA (2015) and EAP (2015) analyses. The EAP (2015) analysis is intended to identify the project-specific impacts associated solely with the development of the proposed Project based on the expected background growth within the project study area.

1.2.4 Existing Plus Ambient Growth Plus Project Plus Cumulative (2015) without and with Project Conditions

Existing plus Ambient Growth plus Cumulative (2015) without and with Project conditions analyses will be utilized to determine if improvements funded through local and regional transportation mitigation fee programs such as the City of San Bernardino Development Impact Fee (DIF) program can accommodate cumulative traffic at the target LOS identified in the City of San Bernardino General Plan. If the "funded" improvements can provide the target LOS, then the Project's payment into the DIF will be considered as cumulative mitigation through the conditions of approval. Other improvements needed beyond the "funded" improvements (such as localized improvements to non-DIF facilities) are identified as such. To account for background traffic, thirty-seven other known cumulative development projects in the study area were included in addition to 1.54% of ambient growth. This comprehensive list was compiled from information provided by the City of San Bernardino Planning Department and research conducted in August 2014 to identify known pending development projects.

1.2.5 Horizon Year (2035) Conditions

The Horizon Year (2035) conditions analysis will be utilized to determine if improvements funded through local and regional transportation mitigation fee programs, such as the City of

San Bernardino Development Impact Fee (DIF) program, or other approved funding mechanism can accommodate the cumulative traffic at the target LOS identified by the City of San Bernardino. If the planned and funded improvements can provide the necessary improvements in delay, then the Project's payment into these established fee programs will be considered as long-range cumulative mitigation. Other improvements needed beyond the "funded" improvements (such as localized improvements to non-funded facilities) are identified as such. Traffic projections for Horizon Year (2035) with Project conditions were derived from the San Bernardino Transportation Analysis Model (SBTAM) using accepted procedures for model forecast refinement and smoothing.

1.3 STUDY AREA

To ensure that this TIA satisfies the City of San Bernardino's traffic study requirements, Urban Crossroads, Inc. prepared a Project traffic study scoping package for review by City of San Bernardino staff prior to the preparation of this report. The Agreement provides an outline of the Project study area, trip generation, trip distribution, and analysis methodology. The Agreement approved by the City of San Bernardino is included in Appendix "1.1".

The following three study area intersections were selected for this TIA based on the City of San Bernardino's traffic study guidelines that require analysis of intersection locations in which the proposed Project is anticipated to contribute 50 or more peak-hour trips. The intersection locations are also indicated on Exhibit 1-2.

TABLE 1-1: INTERSECTION ANALYSIS LOCATIONS

ID	Intersection Location	Jurisdiction	CMP
1	Waterman Avenue / Driveway 1 – Future Intersection	City of San Bernardino	No
2	Waterman Avenue / Driveway 2 – Future Intersection	City of San Bernardino	No
3	Waterman Avenue / Mill Street	City of San Bernardino	Yes

It should be pointed out that the "50 peak hour trip" criterion utilized by the City of San Bernardino is consistent with the methodology employed by the County of San Bernardino CMP. Although each intersection may have unique operating characteristics, the "50 peak hour trip" criterion is a valid and proven way to establish a study area as it generally represents a threshold of trips at which an intersection would have the potential to be impacted.

1.4 ANALYSIS FINDINGS

This section provides a summary of the analysis results for Existing (2014), E+P, EA (2015), EAP (2015), EAC (2015), EAPC (2015), and Horizon Year traffic conditions.

EXISTING (2014) CONDITIONS

For Existing traffic conditions, the intersection of Waterman Avenue and Mill Street was found to operate at acceptable LOS during both AM and PM peak hours.

EXHIBIT 1-2: LOCATION MAP

LEGEND:

- = EXISTING INTERSECTION ANALYSIS LOCATION
- = FUTURE INTERSECTION ANALYSIS LOCATION

N

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URBAN CROSSROADS

E+P CONDITIONS

For E+P traffic conditions, the proposed Project driveways and the intersection of Waterman Avenue and Mill Street are anticipated to continue to operate at acceptable LOS in both AM and PM peak hours.

EA (2015) CONDITIONS

For EA (2015) traffic conditions, the intersection of Waterman Avenue and Mill Street is anticipated to continue to operate at acceptable LOS in both AM and PM peak hours.

EAP (2015) CONDITIONS

For EAP traffic conditions, the proposed Project driveways and the intersection of Waterman Avenue and Mill Street are anticipated to continue to operate at acceptable LOS in both AM and PM peak hours. In other words, there are no deficiencies associated with the addition of 1.54% ambient growth along with Project traffic.

EAC (2015) CONDITIONS

For EAC (2015) traffic conditions, the intersection of Waterman Avenue and Mill Street is anticipated to continue to operate at acceptable LOS in both AM and PM peak hours.

EAPC (2015) CONDITIONS

For EAPC traffic conditions, the proposed Project driveways and the intersection of Waterman Avenue and Mill Street are anticipated to continue to operate at acceptable LOS in both AM and PM peak hours.

HORIZON YEAR (2035) CONDITIONS

Based on the assessment of Horizon Year without and with Project traffic conditions, all three study area intersections are anticipated to continue to operate at acceptable LOS in both AM and PM peak hours without and with Project traffic.

1.5 SITE ACCESS IMPROVEMENTS

The Project is proposed to have access to Waterman Avenue via Driveways 1 and 2. Both Project driveways are proposed to be stop controlled and allow for full access.

1.5.1 ON-SITE ROADWAY IMPROVEMENTS

Waterman Avenue - Waterman Avenue is a north-south oriented roadway located along the Project's western boundary and is currently built out to its ultimate cross-section width as a major divided highway (100-foot right-of-way), consistent with the City of San Bernardino General Plan Circulation Element. Additional curb, gutter and limited landscaping improvements are recommended along the Project's frontage, consistent with City of San Bernardino standards and the final conditions of approval.

1.5.2 SITE ACCESS IMPROVEMENTS

The recommended site access driveway improvements for the Project are described below. Exhibit 1-3 illustrates the on-site and site adjacent recommended roadway lane improvements. Construction of on-site and site adjacent improvements shall occur in conjunction with adjacent Project development activity or as needed for Project access purposes.

Waterman Avenue / Driveway 1 – Install a stop control on the westbound approach and construct the intersection with the following geometrics:

- Northbound Approach: Two through lanes and one shared through-right turn lane.
- Southbound Approach: One two-way left-turn-lane and three through lanes.
- Eastbound Approach: N/A
- Westbound Approach: One shared left-right turn lane.

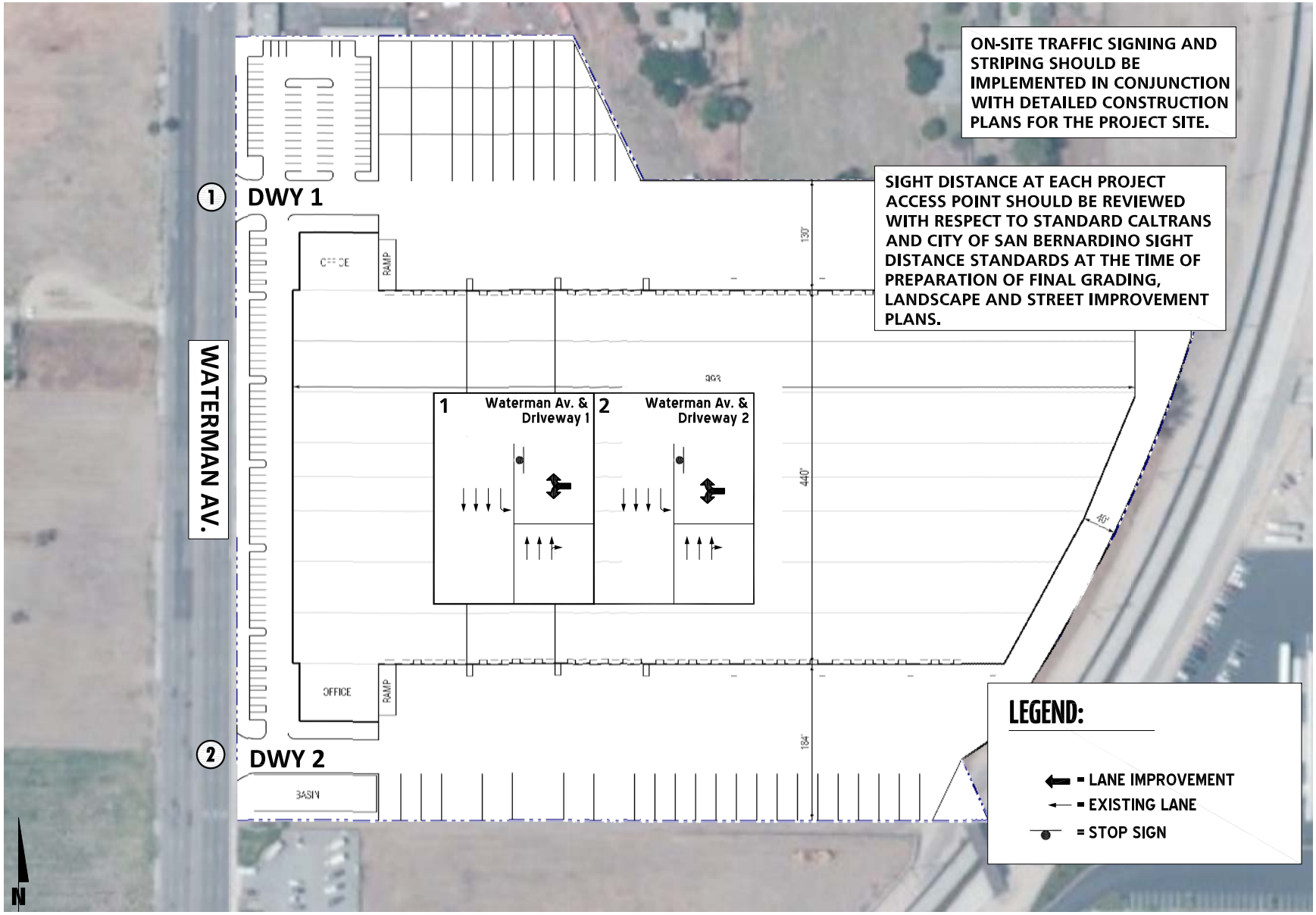
Waterman Avenue / Driveway 2 – Install a stop control on the westbound approach and construct the intersection with the following geometrics:

- Northbound Approach: Two through lanes and one shared through-right turn lane.
- Southbound Approach: One two-way left-turn-lane and three through lanes.
- Eastbound Approach: N/A
- Westbound Approach: One shared left-right turn lane.

On-site traffic signing and striping should be implemented in conjunction with detailed construction plans for the Project site.

Sight distance at each project access point should be reviewed with respect to standard Caltrans and City of San Bernardino sight distance standards at the time of preparation of final grading, landscape and street improvement plans.

EXHIBIT 1-3: SITE ACCESS AND SITE ADJACENT ROADWAY RECOMMENDATIONS



2 METHODOLOGIES

This section of the report presents the methodologies used to perform the traffic analyses summarized in this report. The methodologies described are generally consistent with City of San Bernardino traffic study guidelines. (1)

2.1 LEVEL OF SERVICE

Traffic operations of roadway facilities are described using the term "Level of Service" (LOS). LOS is a qualitative description of traffic flow based on several factors such as speed, travel time, delay, and freedom to maneuver. Six levels are typically defined ranging from LOS "A", representing completely free-flow conditions, to LOS "F", representing breakdown in flow resulting in stop-and-go conditions. LOS E represents operations at or near capacity, an unstable level where vehicles are operating with the minimum spacing for maintaining uniform flow. (2)

2.2 INTERSECTION CAPACITY ANALYSIS

The definitions of LOS for interrupted traffic flow (flow restrained by the existence of traffic signals and other traffic control devices) differ slightly depending on the type of traffic control. The LOS is typically dependent on the quality of traffic flow at the intersections along a roadway. The *Highway Capacity Manual* (HCM) methodology expresses the LOS at an intersection in terms of delay time for the various intersection approaches. (2) The HCM uses different procedures depending on the type of intersection control.

2.2.1 SIGNALIZED INTERSECTIONS

The City of San Bernardino requires signalized intersection operations analysis based on the methodology described in Chapter 16 of the (HCM). Intersection LOS operations are based on an intersection's average control delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. For signalized intersections LOS is directly related to the average control delay per vehicle and is correlated to a LOS designation as described in Table 2-1.

TABLE 2-1: SIGNALIZED INTERSECTION LOS THRESHOLDS

L O S	Description	Average Control Delay (Seconds)
A	Operations with very low delay occurring with favorable progression and/or short cycle length.	0 to 10.00
B	Operations with low delay occurring with good progression and/or short cycle lengths.	10.01 to 20.00

L O S	Description	Average Control Delay (Seconds)
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	20.01 to 35.00
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	35.01 to 55.00
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. This is considered to be the limit of acceptable delay.	55.01 to 80.00
F	Operation with delays unacceptable to most drivers occurring due to over saturation, poor progression, or very long cycle lengths	80.01 and up

Source: HCM 2000, Chapter 16

All the study area intersections have been analyzed using the software package Traffix (Version 8.0 R1, 2008).

The peak hour traffic volumes have been adjusted using a peak hour factor (PHF) to reflect peak 15 minute volumes. Common practice for LOS analysis is to use a peak 15-minute rate of flow. However, flow rates are typically expressed in vehicles per hour. The PHF is the relationship between the peak 15-minute flow rate and the full hourly volume (e.g. PHF = [Hourly Volume] / [4 x Peak 15-minute Flow Rate]). The use of a 15-minute PHF produces a more detailed analysis as compared to analyzing vehicles per hour. Existing PHFs have been used for Existing, E+P, EA (2015) and EAC (2015) without and with Project traffic conditions. A PHF of 0.92 or higher (if higher for Existing conditions) has been used for Horizon Year (2035) without and with Project traffic conditions. The intersection parameters for Existing, E+P, EA (2015), EAC (2015) and Horizon Year (2035) without and with Project traffic conditions are consistent with those defined by the CMP traffic study guidelines.

2.2.2 UNSIGNALIZED INTERSECTIONS

The City of San Bernardino requires the operations of unsignalized intersections be evaluated using the methodology described in Chapter 17 of the HCM. (2) The LOS rating is based on the weighted average control delay expressed in seconds per vehicle (see Table 2-2).

TABLE 2-2: UNSIGNALIZED INTERSECTION DESCRIPTION OF LOS

Description	Average Control Delay Per Vehicle (Seconds)	Level of Service, V/C ≤ 1.0	Level of Service, V/C > 1.0
Little or no delays.	0 to 10.00	A	F
Short traffic delays.	10.01 to 15.00	B	F
Average traffic delays.	15.01 to 25.00	C	F
Long traffic delays.	25.01 to 35.00	D	F
Very long traffic delays.	35.01 to 50.00	E	F
Extreme traffic delays with intersection capacity exceeded.	> 50.00	F	F

Source: HCM 2000, Chapter 17

At two-way or side-street stop-controlled intersections, LOS is calculated for each controlled movement and for the left turn movement from the major street, as well as for the intersection as a whole. For approaches composed of a single lane, the delay is computed as the average of all movements in that lane. For all-way stop controlled intersections, LOS is computed for the intersection as a whole. Analysis of the unsignalized Project site driveways has utilized the Traffix software package (Version 8.0 R1, 2008).

2.3 TRAFFIC SIGNAL WARRANT ANALYSIS METHODOLOGY

The term "signal warrants" refers to the list of established criteria used by Caltrans and other public agencies to quantitatively justify or ascertain the potential need for installation of a traffic signal at an otherwise unsignalized intersection. This TIA uses the signal warrant criteria presented in the latest edition of the Federal Highway Administration's (FHWA) *Manual on Uniform Traffic Control Devices (MUTCD)*, as amended by *the MUTCD 2012 California Supplement*, for all study area intersections. (4)

The signal warrant criteria for Existing conditions are based upon several factors, including volume of vehicular and pedestrian traffic, frequency of accidents, and location of school areas. Both the FHWA's *MUTCD* and the *MUTCD 2012 California Supplement* indicate that the installation of a traffic signal should be considered if one or more of the signal warrants are met. As the one existing study area intersection is currently signalized, this TIA will assess the potential need for new traffic signals at future unsignalized intersections based on future average daily traffic (ADT) volumes, using the Caltrans planning level ADT-based signal warrant analysis worksheets.

As shown on Table 2-3, traffic signal warrant analyses were performed for the following unsignalized study area intersections:

TABLE 2-3: UNSIGNALIZED INTERSECTION LOCATIONS

ID	Intersection Location	Jurisdiction	CMP
1	Waterman Avenue / Driveway 1 – Future Intersection	City of San Bernardino	No
2	Waterman Avenue / Driveway 2 – Future Intersection	City of San Bernardino	No

The traffic signal warrant analysis for future conditions is presented in Section 5 *Existing Plus Project Traffic Analysis*, Section 6 *EA and EAP (2015) Traffic Analysis*, Section 7 *EAC and EAPC (2015) Traffic Analysis*, and Section 8 *Horizon Year (2035) Traffic Analysis* of this report.

It is important to note that a signal warrant defines the minimum condition under which the installation of a traffic signal might be warranted. Meeting this condition does not require that a traffic control signal be installed at a particular location, but rather, that other traffic factors and conditions be evaluated in order to determine whether the signal is truly justified. It should also be noted that signal warrants do not necessarily correlate with LOS. An intersection may satisfy a signal warrant condition and operate at or above acceptable LOS or operate below acceptable LOS and not meet a signal warrant.

2.4 LOS CRITERIA

The definition of an intersection deficiency in the City of San Bernardino is based on the City of San Bernardino General Plan Circulation Element. The City of San Bernardino General Plan states that target LOS "D" be maintained at City intersections wherever possible.

2.5 THRESHOLDS OF SIGNIFICANCE

Based on the City of San Bernardino TIA Guidelines, a "significant" project-related traffic impact occurs when the addition of project traffic as defined by the EAP scenario causes an intersection that operates at an acceptable LOS under EA traffic conditions (i.e., LOS "D" or better) to fall to an unacceptable LOS (i.e., LOS "E" or worse). Therefore, EAP traffic conditions are compared to EA traffic conditions in order to identify significant project-related traffic impacts according to the following criteria:

- If an intersection is projected to operate at an acceptable level of service (i.e., LOS "D" or better) without the project and the addition of Project traffic, as measured by 50 or more peak hour trips, is expected to cause the intersection to operate at an unacceptable level of service (i.e., LOS "E" or worse), the impact is considered a significant direct impact.
- If an intersection is projected to operate at an unacceptable level of service (i.e., LOS "E" or "F") without the project, and the project contributes 50 or more peak hour trips, the impact is considered a significant cumulative impact.

3 EXISTING CONDITIONS

This section provides a summary of the existing circulation network, the City of San Bernardino General Plan Circulation Network, and a review of existing peak hour intersection operations.

3.1 EXISTING CIRCULATION NETWORK

Pursuant to the Traffic Study Scoping Agreement (Appendix "1.1") and discussion with City of San Bernardino staff, the study area includes a total of three existing and future intersections as shown previously on Exhibit 1-2. Of these three intersections, the existing study area circulation network includes one intersection. Two intersections in the study area are future planned intersections that do not currently exist.

Exhibit 3-1 illustrates the study area intersections located near the proposed Project and identifies the number of through traffic lanes for existing roadways and intersection traffic controls.

3.2 CITY OF SAN BERNARDINO GENERAL PLAN CIRCULATION ELEMENT

As previously noted, the Project site is located within the City of San Bernardino. Exhibit 3-2 shows the City of San Bernardino General Plan Circulation Element, and Exhibit 3-3 illustrates the City of San Bernardino General Plan roadway cross-sections.

The roadway classifications and planned (ultimate) roadway cross-sections of the major roadways within the City of San Bernardino in the vicinity of the proposed Project as identified on the City's General Plan Circulation Element are described subsequently.

Waterman Avenue is designated as a major divided highway (100-foot right-of-way) in the City of San Bernardino General Plan Circulation Element. The roadway cross-section for a major arterial consists of two travel lanes in each direction and a landscaped median. Waterman Avenue currently exists as a 6 lane roadway with a two-way left-turn-lane median adjacent to the Project site.

Mill Street is designated as a major divided highway (100-foot right-of-way) in the City of San Bernardino General Plan Circulation Element. The roadway cross-section for a major arterial consists of two travel lanes in each direction and a landscaped median.

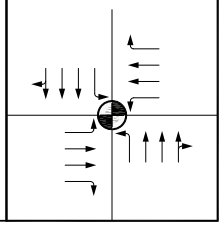
3.3 TRANSIT SERVICE

The study area is currently served by Omnitrans, a public transit agency serving the County of San Bernardino and the City of San Bernardino, with bus service in the vicinity of the Project site along Waterman Avenue Route 5. Omnitrans Route 5 is illustrated on Exhibit 3-4. Transit service is reviewed and updated by Omnitrans periodically to address ridership, budget and community demand needs. Changes in land use can affect these periodic adjustments which may lead to either enhanced or reduced service where appropriate.

EXHIBIT 3-1: EXISTING NUMBER OF THROUGH LANES AND INTERSECTON CONTROLS

LEGEND:

- = TRAFFIC SIGNAL
- 4 = NUMBER OF LANES
- D = DIVIDED
- U = UNDIVIDED
- SPEED LIMIT 25 = SPEED LIMIT (MPH)

1 Waterman Av. & Driveway 1	2 Waterman Av. & Driveway 2	3 Waterman Av. & Mill St.
Future Intersection	Future Intersection	

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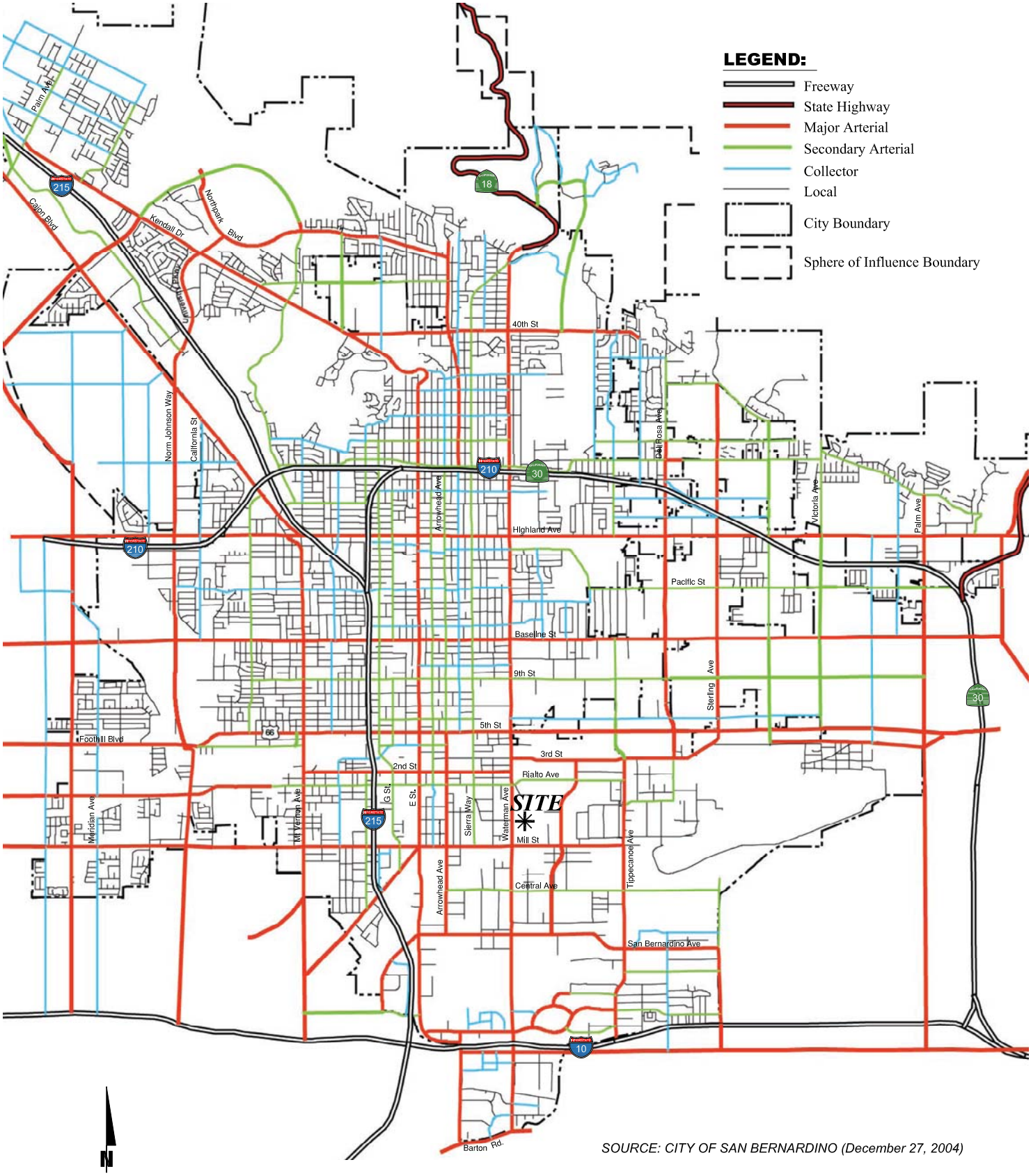
URBAN CROSSROADS

EXHIBIT 3-2: CITY OF SAN BERNARDINO GENERAL PLAN CIRCULATION ELEMENT



SOURCE: CITY OF SAN BERNARDINO (December 27, 2004)

EXHIBIT 3-3: CITY OF SAN BERNARDINO GENERAL PLAN ROADWAY CROSS-SECTION

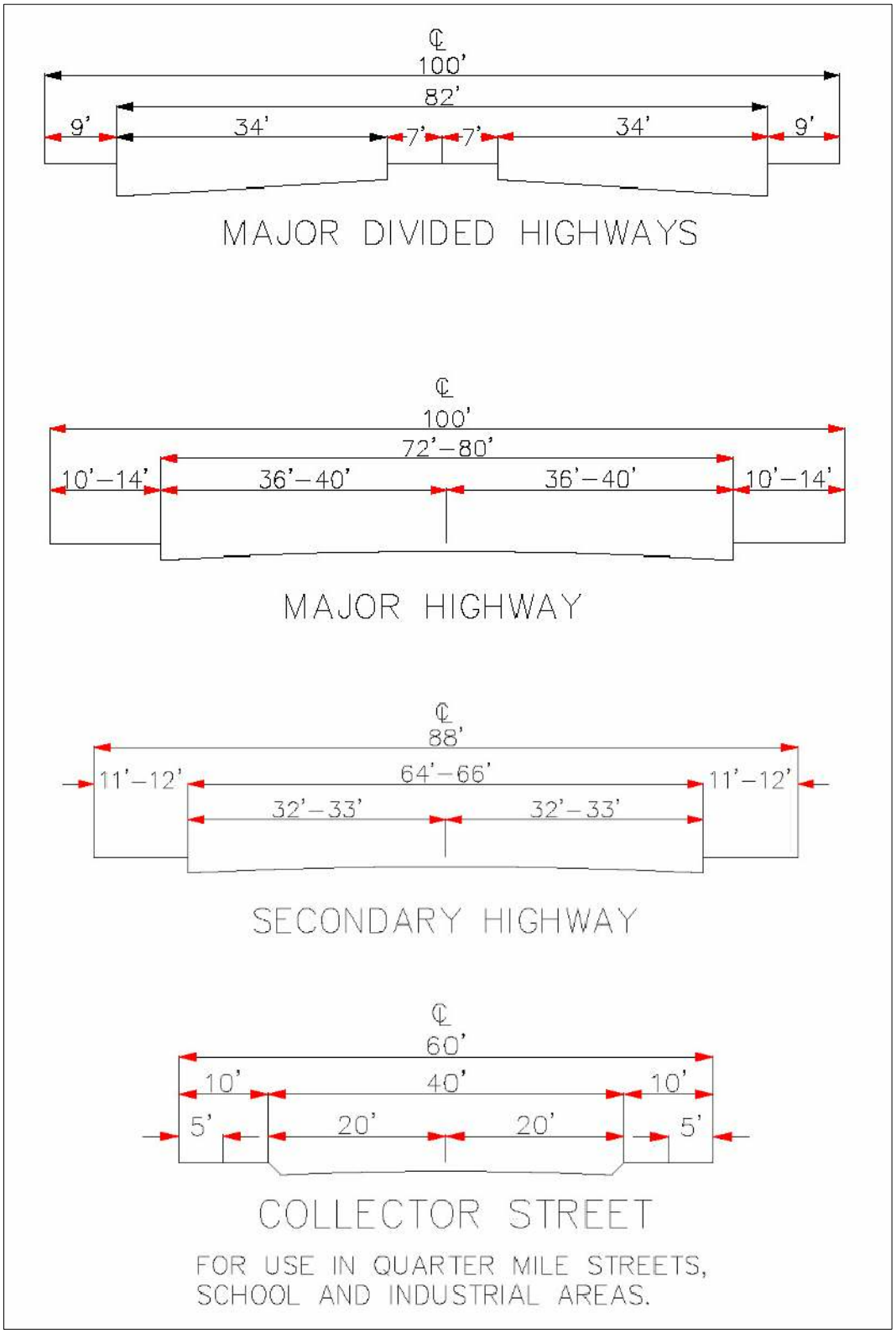


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EXHIBIT 3-4: EXISTING TRANSIT SERVICES

LEGEND:

▪ OMNITRANS ROUTE 5

N

3.4 BICYCLE & PEDESTRIAN FACILITIES

The City of San Bernardino Conceptual Trail System is illustrated on Exhibit 3-5. As shown on the Conceptual Trail System, there is a proposed regional multi-purpose trail (the Mid-City Connector) along the eastern boundary of the Project site. The Mid-City Connector trail will connect with the Santa Ana River Regional Trail System approximately two miles south of the Project site. Additionally, there are proposed bicycle routes along Mill Street from the western City boundary to its eastern terminus and along the entire length of Waterman Avenue.

The existing pedestrian facilities within the study area are shown on Exhibit 3-6. Existing bus stop locations, crosswalks and sidewalks are shown. Bike routes currently do not exist along Waterman Avenue or Mill Street.

3.5 EXISTING (2014) TRAFFIC COUNTS

The intersection LOS analysis is based on the traffic volumes observed during the peak hour conditions using traffic count data collected on August 19, 2014. In consultation with nearby school schedules, this count date is considered representative of traffic in this effort as nearby schools were in session. The raw manual peak hour turning movement traffic count data sheets are included in Appendix "3.1".

The traffic counts collected include the vehicle classifications as shown below:

- Passenger Cars
- 2-Axle Trucks
- 3-Axle Trucks
- 4 or More Axle Trucks

To represent the impact large trucks, buses and recreational vehicles have on traffic flow at study intersections; all trucks were converted into Passenger Car Equivalents (PCEs). By their size alone, these vehicles occupy the same space as two or more passenger cars. In addition, the time it takes for them to accelerate and slow down is also much longer than for passenger cars, and varies depending on the type of vehicle and number of axles. For the purpose of this analysis, a PCE factor of 2.0 has been applied to 2-axle trucks, 2.5 for 3-axle trucks and 3.0 for 4+-axle trucks to estimate each turning movement. These factors are consistent with the values recommended for use in the City of San Bernardino and CMP Guidelines. (1) (4)

Existing (2014) weekday average daily traffic (ADT) on arterial highways in the study area are shown on Exhibit 3-7. Existing (2014) ADT volumes are based upon factored intersection peak hour counts collected by Urban Crossroads, Inc. using the following formula for each intersection leg:

Weekday PM Peak Hour (Approach Volume + Exit Volume) x 14.064 = Leg Volume

For roadway segments which have 24-hour tube count data available in close proximity to the study area, a comparison between the PM peak hour and daily traffic volumes indicated that the peak-to-daily relationship of approximately 7.111 percent would sufficiently estimate ADT volumes for planning-level analyses.

EXHIBIT 3-5: CITY OF SAN BERNARDINO CONCEPTUAL TRAIL SYSTEM

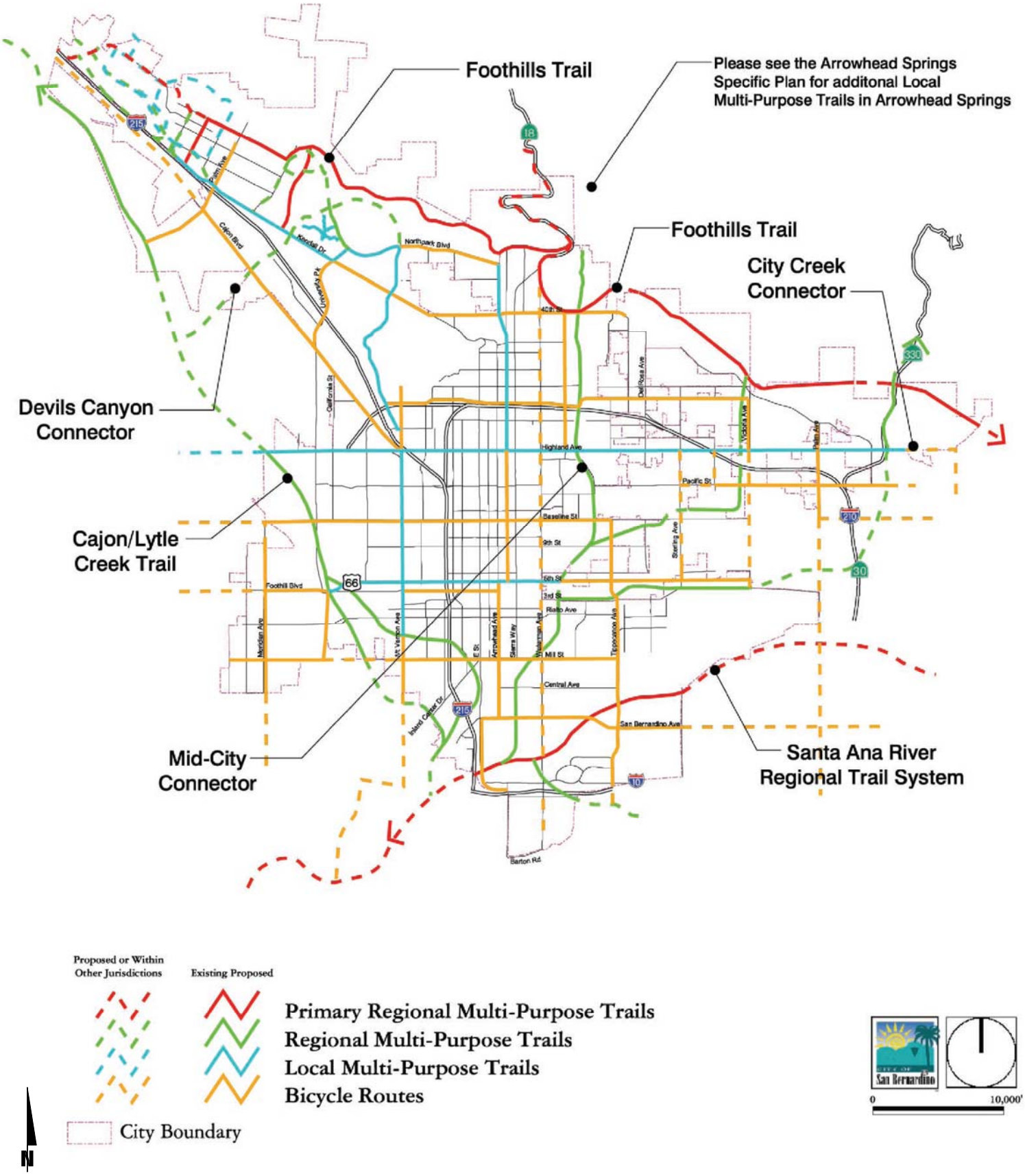

EXHIBIT 3-6: EXISTING PEDESTRIAN FACILITIES

LEGEND:

- B = BUS STOP
- = CROSSWALK
- = SIDEWALK

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URBAN CROSSROADS

EXHIBIT 3-7: EXISTING (2014) VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES

1 Waterman Av. & Driveway 1	2 Waterman Av. & Driveway 2	3 Waterman Av. & Mill St.
Future Intersection	Future Intersection	65(87), 456(627), 78(101) / 41(45), 316(463), 110(139) / 119(126), 398(287), 71(85) / 118(126), 492(575), 78(56)

As such, the above equation utilizing a factor of 14.064 estimates the ADT volumes on the study area roadway segments assuming a peak-to-daily relationship of approximately 7.111 percent (i.e., 1/0.07111 = 14.064). Existing weekday AM and PM peak hour intersection volumes are also shown on Exhibit 3-7. All of the traffic volumes illustrated on the exhibit and used in the traffic analysis are shown in terms of PCE.

3.6 EXISTING (2014) CONDITIONS INTERSECTION OPERATIONS ANALYSIS

Existing (2014) peak hour traffic operations have been evaluated for the study area intersections based on the analysis methodologies presented in Section 2.2 *Intersection Capacity Analysis* of this report. The intersection operations analysis results are summarized in Table 3-1 which indicates that the existing intersection of Waterman Avenue at Mill Street is currently operating at acceptable LOS during the peak hours.

Consistent with Table 3-1, a summary of the peak hour intersection LOS for Existing conditions is shown on Exhibit 3-8. The intersection operations analysis worksheets are included in Appendix "3.2" of this TIA.

3.7 TRAFFIC SIGNAL WARRANTS ANALYSIS

Traffic signal warrant analysis for Existing traffic conditions has not been performed as the intersection of Waterman Avenue and Mill Street is currently signalized.

Table 3-1

Existing (2014) Conditions Intersection Analysis

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Delay[2] (secs.)		LOS		Acceptable LOS
			Northbound			Southbound			Eastbound			Westbound							
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM	
1	Waterman Av. / Driveway 1	--	Future Intersection												--	--	--	--	D
2	Waterman Av. / Driveway 2	--	Future Intersection												--	--	--	--	D
3	Waterman Av. / Mill St.	TS	1	3	0	1	3	0	1	2	1	1	2	1	31.7	32.3	C	C	D

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right

[2] Per the 2000 Highway Capacity Manual, overall average intersection delay and level of service are shown for intersections with a traffic signal or all-way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] TS = Traffic Signal

EXHIBIT 3-8: SUMMARY OF EXISTING (2014) INTERSECTION LOS

LEGEND:

- = AM PEAK HOUR ACCEPTABLE LOS
- = AM PEAK HOUR DEFICIENT LOS
- = PM PEAK HOUR ACCEPTABLE LOS
- = PM PEAK HOUR DEFICIENT LOS

N

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URBAN CROSSROADS

4 PROJECTED FUTURE TRAFFIC

This section presents the traffic volumes estimated to be generated by the Project, as well as the Project's trip assignment onto the study area roadway network. The Project is proposed to consist of approximately 430,000 square feet of high-cube distribution warehouse use within a single building. The Project is proposed to have access to Waterman Avenue via Driveways 1 and 2. Both Project driveways are proposed to be stop controlled and allow for full access. It is assumed that the Project will be constructed and occupied by 2015.

4.1 PROJECT TRIP GENERATION

Trip generation represents the amount of traffic which is both attracted to and produced by a development. Determining traffic generation for a specific project is therefore based upon forecasting the amount of traffic that is expected to be both attracted to and produced by the specific land uses being proposed for a given development.

The ITE Trip Generation manual is a nationally recognized source for estimating site specific trip generation. ITE recently released an updated edition of the *Trip Generation* manual in 2012. (4) The Trip Generation manual is based on more than 4,800 trip generation studies submitted to ITE by public agencies, consulting firms, universities/colleges, developers, associations and local sections/districts/student chapters of ITE. The trip generation rates utilized for the purposes of this analysis are based upon data collected by the Institute of Transportation Engineers (ITE) and presented in ITE's most recent edition of *Trip Generation* and the City of Fontana *Truck Trip Generation Study* for purposes of determining vehicle mix. (5) For the purposes of this analysis, the Heavy Warehouse (LU 150) vehicle mix has been utilized along with ITE land use High-Cube Warehouse (LU 152) in an effort to most accurately estimate Project traffic.

The proposed use for the Project building is described as high-cube warehouse/distribution facility consisting of approximately 430,000 square feet. Passenger Car Equivalents (PCE) factors have been applied to the trip generation rates for heavy trucks (large 2-axles, 3-axles, 4+-axles). Consistent with standard traffic engineering practice in Southern California, PCE factors have been utilized due to the expected heavy truck component for the proposed Project uses. PCE factors allow the typical "real-world" mix of vehicle types to be represented as a single, standardized unit, such as the passenger car, for the purposes of capacity and level of service analyses. PCE factors are applied to large truck types such as large two-axles, three-axles, 4+-axles. A PCE factor of 2.0 has been applied to large 2-axle trucks, a factor of 2.5 for 3-axle trucks and a factor of 3.0 for 4+-axle trucks. These PCE factors are consistent with values recommended for use in the City of San Bernardino Traffic Impact Study Guidelines. (1)

Trip generation rates used to estimate Project traffic are shown in Table 4-1 and a summary of the Project's trip generation, in both actual vehicles and PCE factored vehicles, is shown in Table 4-2. As shown on Table 4-2, the Project is anticipated to generate a net total of approximately 722 actual trip-ends per day with 47 actual AM peak hour trips and 52 actual PM peak hour trips. After the utilization of PCE factors, the Project is anticipated to generate a net total of approximately 976 PCE trip-ends per day with 64 PCE AM peak hour trips and 70 PCE PM peak hour trips.

Table 4-1

Project Trip Generation Rates[1]

Passencer Car Equivalent (PCE) Trip Generation Rates

Land Use	Units[2]	ITE LU Code	AM Peak Hour			PM Peak Hour			Daily
			Inbound	Outbound	Total	Inbound	Outbound	Total	
High-Cube Warehouse[3]	TSF	152	0.076	0.034	0.110	0.037	0.083	0.120	1.680
79.57% Passenger Cars			0.060	0.027	0.088	0.030	0.066	0.095	1.337
3.46% 2-Axle Trucks (PCE = 2.0)			0.005	0.002	0.008	0.003	0.006	0.008	0.116
4.64% 3-Axle Trucks (PCE = 2.5)			0.009	0.004	0.013	0.004	0.010	0.014	0.195
12.33% 4-Axle+ Trucks (PCE = 3.0)			0.028	0.013	0.041	0.014	0.031	0.044	0.621

Actual Vehicle Trip Generation Rates

Land Use	Units[2]	ITE LU Code	AM Peak Hour			PM Peak Hour			Daily
			Inbound	Outbound	Total	Inbound	Outbound	Total	
High-Cube Warehouse[3]	TSF	152	0.076	0.034	0.110	0.037	0.083	0.120	1.680
79.57% Passenger Cars			0.060	0.027	0.088	0.030	0.066	0.095	1.337
3.46% 2-Axle Trucks			0.003	0.001	0.004	0.001	0.003	0.004	0.058
4.64% 3-Axle Trucks			0.004	0.002	0.005	0.002	0.004	0.006	0.078
12.33% 4-Axle+ Trucks			0.009	0.004	0.014	0.005	0.010	0.015	0.207

[1] Trip Generation Source: Institute of Transportation Engineers (ITE), Trip Generation, Ninth Edition (2012).

[2] TSF = thousand square feet

[3] Vehicle Mix Source: City of Fontana Truck Trip Generation Study for LU 150 (Heavy Warehouse), August 2003.
PCE rates are per City of San Bernardino Traffic Impact Study Guidelines

Table 4-2

Project Trip Generation Summary

PCE Trip Generation Summary

Land Use	Quantity	Units[1]	AM Peak Hour			PM Peak Hour			Daily
			In	Out	Total	In	Out	Total	
High-Cube Warehouse	**430.000**	TSF							
Passenger Cars:			26	12	38	13	28	41	575
Truck Trips:									
2-axle:			*2*	*1*	*3*	*1*	*2*	*4*	*50*
3-axle:			*4*	*2*	*5*	*2*	*4*	*6*	*84*
4+-axle:			*12*	*5*	*17*	*6*	*13*	*19*	*267*
- Net Truck Trips (PCE)			*18*	*8*	*26*	*9*	*20*	*29*	*401*
Total Trips (PCE) [2]			*44*	*20*	*64*	*22*	*48*	*70*	*976*

Actual Vehicles Trip Generation Summary

Land Use	Quantity	Units[1]	AM Peak Hour			PM Peak Hour			Daily
			In	Out	Total	In	Out	Total	
High-Cube Warehouse	**430.000**	TSF							
Passenger Cars:			26	12	38	13	28	41	575
Truck Trips:									
2-axle:			*1*	*1*	*2*	*1*	*1*	*2*	*25*
3-axle:			*2*	*1*	*2*	*1*	*2*	*2*	*34*
4+-axle:			*4*	*2*	*6*	*2*	*4*	*6*	*89*
- Net Truck Trips (Actual Vehicles)			*7*	*3*	*10*	*3*	*7*	*11*	*148*
Total Trips (Actual Vehicles) [3]			*33*	*15*	*47*	*16*	*36*	*52*	*722*

[1] TSF = thousand square feet

[2] TOTAL TRIPS (PCE) = Passenger Cars + Net Truck Trips (PCE).

[2] TOTAL TRIPS (Actual Vehicles) = Passenger Cars + Net Truck Trips (Actual Vehicles).

4.2 PROJECT TRIP DISTRIBUTION

Trip distribution is the process of identifying the probable destinations, directions or traffic routes that will be utilized by Project traffic. The potential interaction between the planned land uses and surrounding regional access routes are considered, to identify the route where the Project traffic would distribute. The Project trip distribution was developed based on anticipated travel patterns to and from the Project site for both truck and passenger car traffic. The truck trip distribution patterns have been developed based on the anticipated travel patterns for the high-cube warehousing trucks. The Project trip distribution patterns for trucks was developed based on an understanding of existing travel patterns in the area, the geographical location of the site, and the site's proximity to the regional arterial and state highway system in conjunction with City of San Bernardino staff. The Project trip distribution pattern for passenger cars was based on a select-zone run of the San Bernardino Transportation Analysis Model (SBTAM) at direction from City of San Bernardino staff.

The total volume on each roadway was divided by the total site traffic generation to indicate the percentage of Project traffic that would use each component of the regional roadway system in each relevant direction. The Project truck trip distribution pattern is graphically depicted on Exhibit 4-1. The Project passenger car trip distribution pattern is graphically depicted on Exhibit 4-2. Each of these distribution patterns was reviewed and approved by the City of San Bernardino as part of the traffic study scoping process.

4.3 MODAL SPLIT

The traffic reducing potential of public transit, walking or bicycling have not been considered in this TIA. Essentially, the traffic projections are "conservative" in that these alternative travel modes might be able to reduce the forecasted traffic volumes.

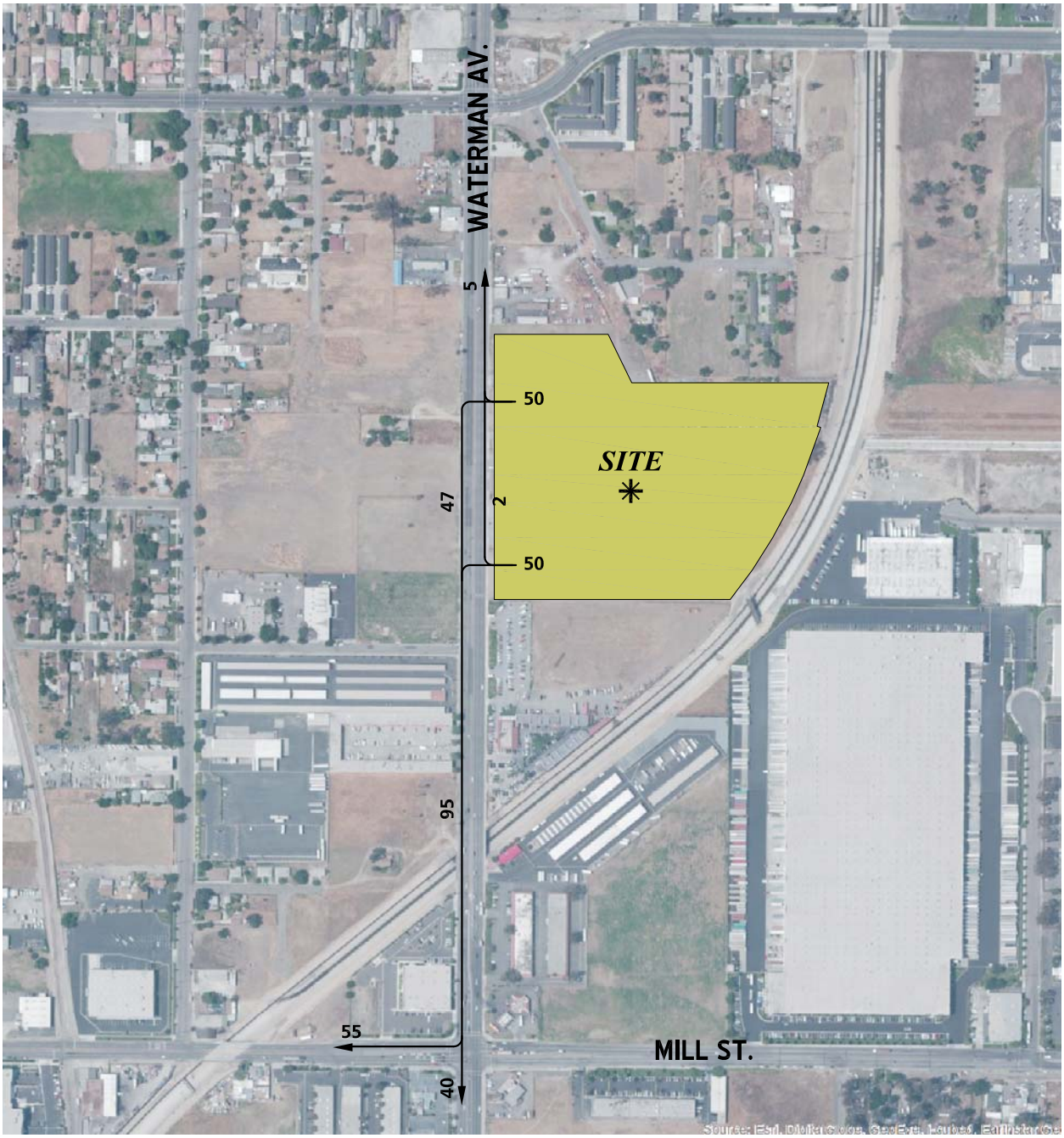
4.4 PROJECT TRIP ASSIGNMENT

The assignment of traffic from the Project area to the adjoining roadway system is based upon the Project trip generation, trip distribution, and the arterial highway and local street system improvements that would be in place by the time of initial occupancy of the Project. Based on the identified Project traffic generation and trip distribution patterns, PCE factored Project ADT, AM and PM peak hour volumes are shown on Exhibits 4-3. Consistent with City of San Bernardino standards, PCE Project volumes were utilized for the purposes of this traffic impact study.

4.5 BACKGROUND TRAFFIC

Future year traffic forecasts have been based upon one year of background (ambient) growth at 1.54% per year for 2015 traffic conditions. This ambient growth rate was based on the growth from Existing to post-processed SBTAM 2035 model data as directed by City staff. This ambient growth rate is added to existing traffic volumes to account for area-wide growth not reflected by cumulative development projects.

EXHIBIT 4-1: PROJECT TRUCK TRIP DISTRIBUTION



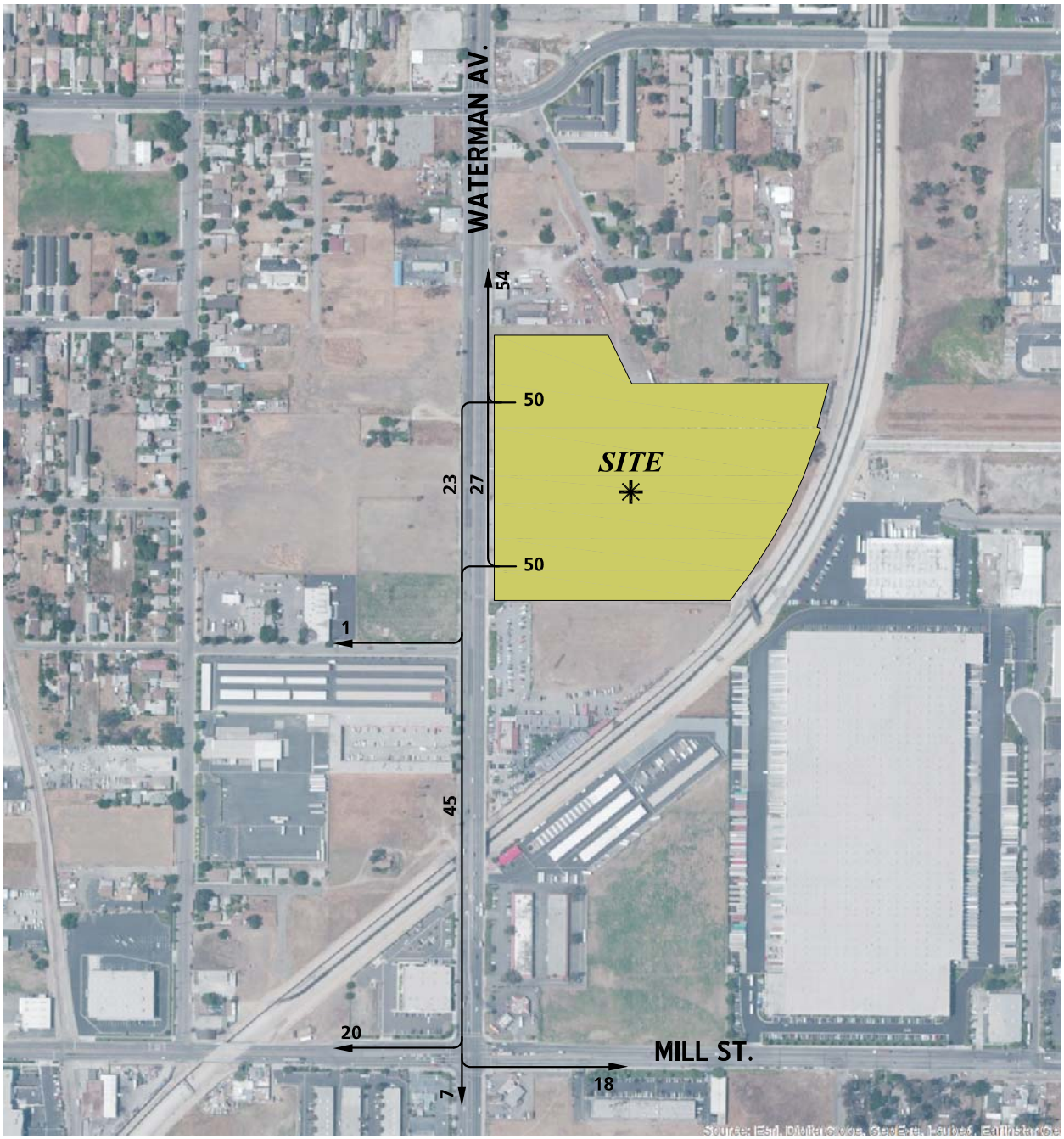
LEGEND:

10 = PERCENT TO/FROM PROJECT

◄ = OUTBOUND

N

EXHIBIT 4-2: PROJECT CAR TRIP DISTRIBUTION



LEGEND:

10 = PERCENT TO/FROM PROJECT

◄ = OUTBOUND

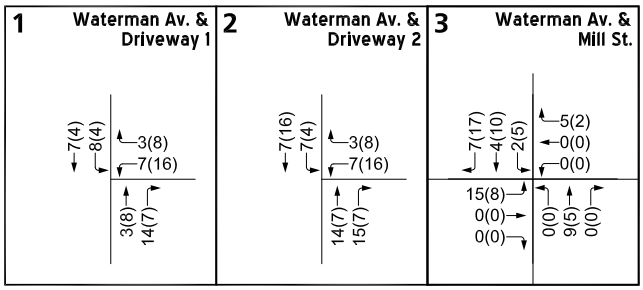
N

EXHIBIT 4-3: PROJECT ONLY VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES



Ambient growth has been added to daily and peak hour traffic volumes on surrounding roadways, in addition to traffic generated by the development of future projects that have been approved but not yet built and/or for which development applications have been filed and are under consideration by governing agencies.

The adopted Southern California Association of Governments (SCAG) 2012 Regional Transportation Plan (RTP) (April 2012) growth forecasts for the City of San Bernardino identifies projected growth in population of 209,900 in 2008 to 261,400 in 2035, or a 24.5% increase over the 27 year period. The change in population equates to roughly a 1.01 percent growth rate compounded annually. Similarly, growth over the same 27 year period in households is projected to increase by 29.5 percent, or 1.01 percent annual growth rate. Finally, growth in employment over the same 27 year period is projected to increase by 43.4 percent, or a 1.01 percent annual growth rate. (6) Therefore, the annual growth rate of 1.54% in conjunction with cumulative project traffic would appear to be conservative and tend to overstate as opposed to understate future traffic growth.

4.6 CUMULATIVE DEVELOPMENT TRAFFIC

California Environmental Quality Act (CEQA) guidelines require that other reasonably foreseeable development projects which are either approved or being processed concurrently in the study area also be included as part of a cumulative analysis scenario. A cumulative project list was developed for the purposes of this analysis through consultation with planning and engineering staff from the City of San Bernardino. Exhibit 4-4 illustrates the cumulative development location map. A summary of cumulative development projects and their proposed land uses are shown on Table 4-3. If applicable, the traffic generated by individual cumulative projects was manually added to both the EAC/EAPC and Horizon Year forecasts to ensure that traffic generated by the listed cumulative development projects in Table 4-4 are reflected as part of the background traffic.

4.7 NEAR-TERM (2015) CONDITIONS

The “buildup” approach combines existing traffic counts with a background ambient growth factor to forecast the near-term 2015 traffic conditions. An ambient growth factor of 1.54% accounts for background (area-wide) traffic increases that occur over time up to the year 2015 from the year 2014. Traffic volumes generated by the Project are then added to assess the EAP (2015) traffic conditions. Traffic produced by Cumulative Developments was then subsequently added to the EA and EAP (2015) volumes in order to assess the EAC and EAPC (2015) traffic conditions, respectively.

The near-term traffic analysis includes the following traffic conditions, with the various traffic components:

- EA (2015)
    - Existing 2014 counts
    - Ambient growth traffic (1.54%)

EXHIBIT 4-4: CUMULATIVE DEVELOPMENT LOCATION MAP

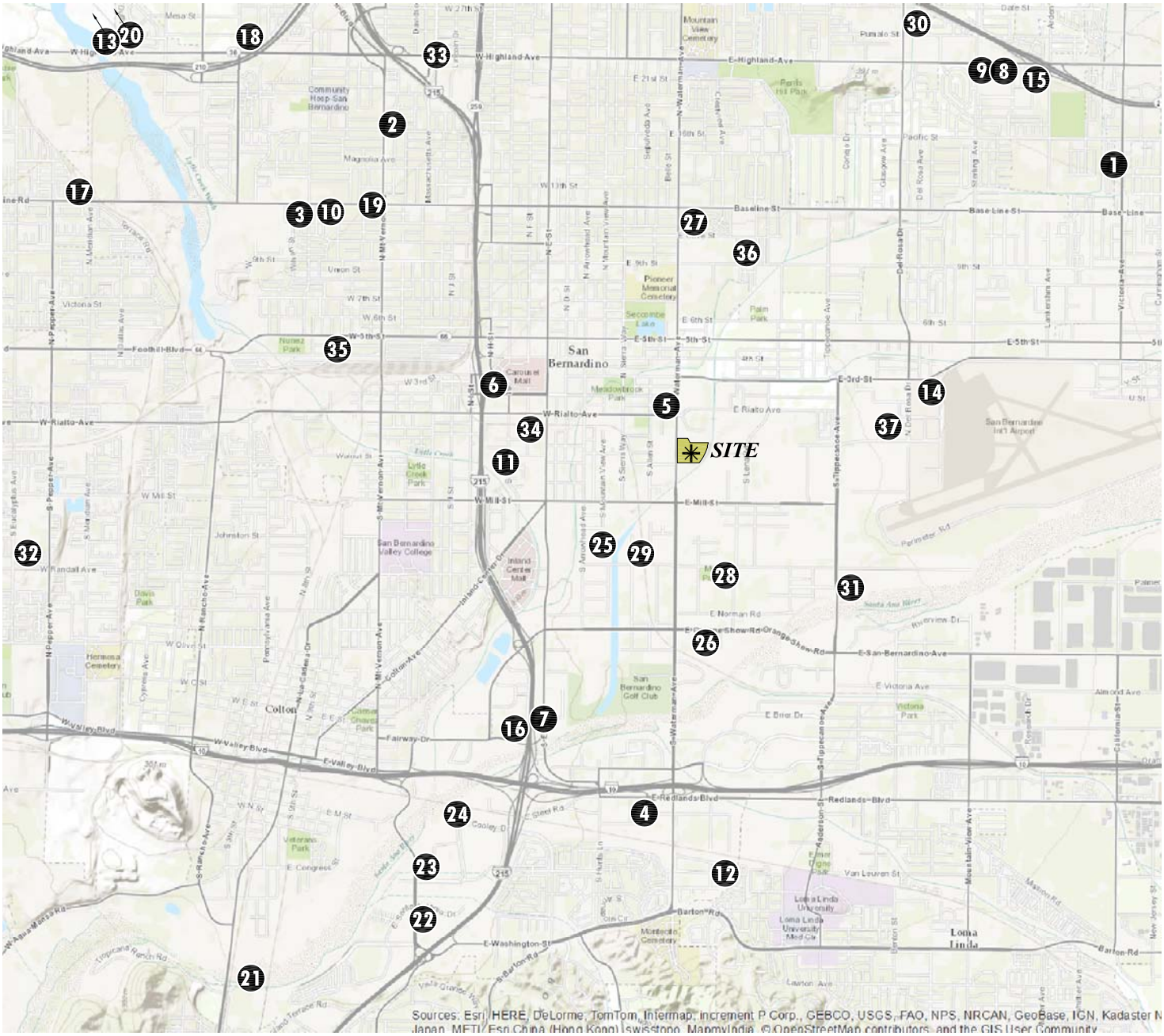


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Table 4-3

List of Cumulative Developments

#	Project Name	Land Use[1]	Quantity	Units[2]
1	CUP 12-04	Religious Facility Addition	0.714	TSF
2	CUP 12-06	Commercial Retail	9.180	TSF
		Fast Food w/ Drive Thru	2.400	TSF
3	CUP 12-12	K-6 Charter School	300	STU
4	CUP 12-13	Auditorium, Community Center	20.000	TSF
5	CUP 12-14	Discount Store	9.026	TSF
6	CUP 12-20	Discount Store	10.500	TSF
7	CUP 12-22	Auditorium, Banquet Hall	5.233	TSF
		Restaurant	0.800	TSF
8	CUP 13-01	Discount Store	26.907	TSF
9	CUP 13-07	Discount Store	12.500	TSF
10	CUP 13-14	Gas Station w/ Convenience Market	2.789	TSF
11	Tentative Parcel Map 19534, Development Permit-D 14-16	Medical/Medical Education Facility	150.000	TSF
12	DP2 12-03	Automobile Parts and Service Center	24.953	TSF
13	DP2 12-09	Industrial Park	1,789.990	TSF
14	Development Permit-D 14-014	Freight Handling Building	5.000	TSF
15	CUP 11-08	Commercial Retail	68.630	TSF
		Home Improvement Store	136.090	TSF
16	DP2 12-18	Automobile Dealership	30.300	TSF
17	DP-D13-01	Shipping Container Storage Yard	12	AC
18	DP-D13-02	Discount Store	12.406	TSF
19	DP-D13-05	Commercial Retail	9.180	TSF
20	Spring Trails Specific Plan	SFDR	304	DU
21	Soil Safe Land Improvement Project	Soil Safe Project	19	AC
22	Education/Office Building	General Office	114.071	TSF
23	Pacific Rail - Metal Shredder	Metal Shredder	1	MS
24	Steel Road/Santa Ana Redevelopment	Industrial Park	159.276	TSF
25	National Orange Show Industrial	High-Cube Warehouse	616.000	TSF
		General Light Industrial	57.750	TSF
		Warehousing	78.960	TSF
26	Alliance California Gateway South Building 3	High-Cube Warehouse	1,119.360	TSF
27	TTM No. 18829, CUP NO. 11-13	Attached Senior Housing	74	DU
		Townhomes	299	DU
		Condominiums	38	DU
		Recreational Center	45.000	TSF
		Community Center	58.200	TSF
		Administration/Multi-Purpose Building	7.400	TSF
28	Development Permit-D No. 13-03	Elementary School Expansion	17	Rooms
29	CUP 13-03	Mosque	5.440	TSF
30	CUP 08-18	Car Wash	1.120	TSF
31	Development Permit-D No. 13-07	General Light Industrial	298.254	TSF
32	Development Permit DP-P 13-03	Single Family Residential	20	DU
33	CUP 11-21	Fast Food w/ Drive Thru	2.380	TSF
34	Development Permit-D 13-10	Transit Center	7.500	TSF
35	Development Permit-D 13-06	Commercial Retail	1.710	TSF

Table 4-3

List of Cumulative Developments

#	Project Name	Land Use[1]	Quantity	Units[2]
36	Tentative Parcel Map 19533, Development Permit-P 14-03	Apartments	76	DU
		Administration/Multi-Purpose Building	2.200	TSF
37	Development Permit-D 14-12	High School Expansion	10	Rooms

[1] SFDR = Single Family Detached Residential

[2] DU = Dwelling Units; TSF = Thousand Square Feet; STU = Students; AC = Acres; MS = Metal Shredder

- EAP (2015)
    - Existing 2014 counts
    - Ambient growth traffic (1.54%)
    - Project Traffic
- EAC (2015)
    - Existing 2014 counts
    - Ambient growth traffic (1.54%)
    - Cumulative Development traffic
- EAPC (2015)
    - Existing 2014 counts
    - Ambient growth traffic (1.54%)
    - Cumulative Development traffic
    - Project Traffic

4.8 HORIZON YEAR (2035) CONDITIONS

Traffic projections for Horizon Year (2035) with Project conditions were derived from the SBTAM using accepted procedures for model forecast refinement and smoothing. The traffic forecasts reflect the area-wide growth anticipated between Existing conditions and Horizon Year (2035) traffic conditions. In most instances the traffic model zone structure is not designed to provide accurate turning movements along arterial roadways unless refinement and reasonableness checking is performed. Therefore, the Horizon Year (2035) peak hour forecasts were refined using the model derived long-range forecasts, base (validation) year model forecasts, along with existing peak hour traffic count data. The SBTAM has a base (validation) year of 2008 and a horizon (future forecast) year of 2035. The difference in model volumes (2035-2008) defines the growth in traffic over the 27-year period.

The refined future peak hour approach and departure volumes obtained from the model output data are then entered into a spreadsheet program consistent with the National Cooperative Highway Research Program (NCHRP Report 255), along with initial estimates of turning movement proportions. A linear programming algorithm is used to calculate individual turning movements which match the known directional roadway segment forecast volumes computed in the previous step. This program computes a likely set of intersection turning movements from intersection approach counts and the initial turning proportions from each approach leg.

Horizon Year (2035) turning volumes were compared to EAPC (2015) volumes in order to ensure a minimum growth as a part of the refinement process. The minimum growth includes any additional growth between EAPC (2015) and Horizon Year (2035) traffic conditions that is not accounted for by the traffic generated by cumulative development projects and ambient growth rates assumed between Existing and EAPC (2015) conditions. Future estimated peak hour traffic data was used for new intersections to further refine the Horizon Year (2035) peak hour forecasts.

The future Horizon Year (2035) with Project peak hour turning movements were then reviewed by Urban Crossroads for reasonableness, and in some cases, were adjusted to achieve reasonable growth. The result of this traffic forecasting procedure is a series of traffic volumes which are suitable for traffic operations analysis.

The Project only traffic forecasts have been generated by applying the trip generation, distribution and traffic assignment calculations. Project traffic volumes were then subtracted from the refined future year SBTAM traffic model volumes to determine Horizon Year (2035) without Project traffic conditions. Flow conservation checks and forecast adjustments were performed as necessary to ensure that all future EAPC (2015) and Horizon Year (2035) traffic volume forecasts are reasonable. Flow conservation checks have been performed in an effort to ensure the flow of traffic volumes between closely spaced intersections is maintained. In order words, traffic flow between two closely spaced intersections, such as two freeway ramp locations, is verified in order to make certain that vehicles leaving one intersection are entering the adjacent intersection and that there are no unexplained loss of vehicles. The result of this traffic forecasting procedure is a series of traffic volumes which are suitable for traffic operations analysis.

Post-processing worksheets for Horizon Year (2035) with Project traffic conditions are provided in Appendix “4.1”.

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5 EXISTING PLUS PROJECT TRAFFIC ANALYSIS

This section discusses the traffic forecasts for Existing plus Project (E+P) conditions and the resulting intersection operations and traffic signal warrant analysis. As noted previously, this scenario is presented for informational purposes only. Consistent with the City of San Bernardino traffic study guidelines, direct impacts are evaluated and identified through the analysis of EAP traffic conditions.

5.1 ROADWAY IMPROVEMENTS

The lane configurations and traffic controls assumed to be in place for E+P conditions are consistent with those shown previously on Exhibit 3-1, with the exception of the Project driveways and those facilities assumed to be in place prior to or constructed by the Project to provide site access are also assumed to be in place for E+P conditions.

5.2 EXISTING PLUS PROJECT TRAFFIC VOLUME FORECASTS

This scenario includes Existing traffic volumes plus Project traffic. Exhibit 5-1 shows the weekday ADT and peak hour volumes which can be expected for E+P traffic conditions.

5.3 INTERSECTION OPERATIONS ANALYSIS

E+P peak hour traffic operations have been evaluated for the study area intersections based on the analysis methodologies presented in Section 2 *Methodologies* of this TIA. The intersection analysis results are summarized in Table 5-1, which indicates that all study area intersections are anticipated to continue to operate at acceptable levels of service with the addition of Project traffic.

Consistent with Table 5-1, a summary of the peak hour intersection LOS for E+P conditions are shown on Exhibit 5-2. The intersection operations analysis worksheets for E+P traffic conditions are included in Appendix “5.1” of this TIA.

5.4 TRAFFIC SIGNAL WARRANTS ANALYSIS

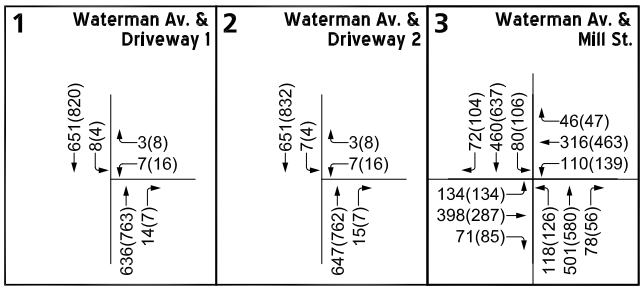
For E+P conditions, neither of the Project driveways are anticipated to warrant a traffic signal (see Appendix “5.2”).

EXHIBIT 5-1: E+P VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES



N

EXHIBIT 5-2: SUMMARY OF E+P INTERSECTION LOS

LEGEND:

- = AM PEAK HOUR ACCEPTABLE LOS
- = AM PEAK HOUR DEFICIENT LOS
- = PM PEAK HOUR ACCEPTABLE LOS
- = PM PEAK HOUR DEFICIENT LOS

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Table 5-1

E+P Conditions Intersection Analysis

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Existing (2014)				E+P			
			Northbound			Southbound			Eastbound			Westbound			Delay[2] (secs.)		LOS		Delay[2] (secs.)		LOS	
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM	AM	PM	AM	PM
1	Waterman Av. / Driveway 1	**CSS**	0	3	0	1	3	0	0	0	0	0	**1**	0	--	--	--	--	12.6	14.0	B	B
2	Waterman Av. / Driveway 2	**CSS**	0	3	0	1	3	0	0	0	0	0	**1**	0	--	--	--	--	12.7	14.0	B	B
3	Waterman Av. / Mill St.	TS	1	3	0	1	3	0	1	2	1	1	2	1	31.7	32.3	C	C	33.0	32.8	C	C

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; **1** = Improvement

[2] Per the 2000 Highway Capacity Manual, overall average intersection delay and level of service are shown for intersections with a traffic signal or all-way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross-Street Stop; TS = Traffic Signal

6 EA AND EAP (2015) TRAFFIC ANALYSIS

This section discusses the traffic forecasts for EA and EAP conditions and the resulting intersection operations and traffic signal warrant analysis.

6.1 ROADWAY IMPROVEMENTS

The lane configurations and traffic controls assumed to be in place for EA and EAP conditions are consistent with those shown previously on Exhibit 3-1, with the exception of the Project driveways and those facilities assumed to be in place prior to or constructed by the Project to provide site access are also assumed to be in place for EAP conditions.

6.2 EA (2015) TRAFFIC VOLUME FORECASTS

This scenario includes Existing traffic volumes plus an ambient growth factor of 1.54%. The weekday ADT, weekday AM, and PM peak hour volumes which can be expected for EA traffic conditions are shown on Exhibit 6-1.

6.3 EAP (2015) TRAFFIC VOLUME FORECASTS

This scenario includes Existing traffic volumes plus an ambient growth factor of 1.54% and the addition of Project traffic. The weekday ADT, weekday AM, and PM peak hour volumes which can be expected for EAP traffic conditions are shown on Exhibit 6-2.

6.4 INTERSECTION OPERATIONS ANALYSIS

LOS calculations were conducted for the study intersections to evaluate their operations under EA and EAP conditions with roadway and intersection geometrics consistent with those described in Section 6.1 *Roadway Improvements*. As shown on Table 6-1, the intersection of Waterman Avenue and Mill Street is anticipated to operate at acceptable levels of service under EA conditions.

As shown on Table 6-1, all study area intersections are anticipated to continue to operate at acceptable LOS with the addition of Project traffic and therefore is not resulting in any significant project impacts.

Consistent with Table 6-1, summaries of the peak hour intersection LOS for EA and EAP conditions are shown on Exhibits 6-3 and 6-4, respectively. The intersection operations analysis worksheets for EA and EAP traffic conditions are included in Appendices “6.1” and “6.2” of this TIA, respectively.

6.5 TRAFFIC SIGNAL WARRANTS ANALYSIS

Traffic signal warrant analysis for EA (2015) traffic conditions has not been performed as the intersection of Waterman Avenue and Mill Street is currently signalized.

EXHIBIT 6-1: EA (2015) VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES

1 Waterman Av. & Driveway 1	2 Waterman Av. & Driveway 2	3 Waterman Av. & Mill St.
Future Intersection	Future Intersection	66(88), 463(637), 79(103), 42(46), 321(470), 112(141), 121(128), 404(291), 72(86), 120(128), 500(584), 79(57)

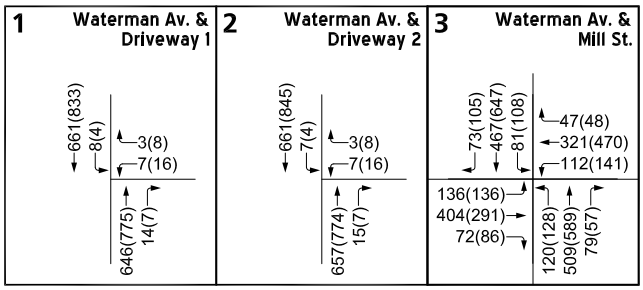
N

EXHIBIT 6-2: EAP (2015) VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES



N

EXHIBIT 6-3: SUMMARY OF EA (2015) INTERSECTION LOS

LEGEND:

- = AM PEAK HOUR ACCEPTABLE LOS
- = AM PEAK HOUR DEFICIENT LOS
- = PM PEAK HOUR ACCEPTABLE LOS
- = PM PEAK HOUR DEFICIENT LOS

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EXHIBIT 6-4: SUMMARY OF EAP (2015) INTERSECTION LOS

LEGEND:

- = AM PEAK HOUR ACCEPTABLE LOS
- = AM PEAK HOUR DEFICIENT LOS
- = PM PEAK HOUR ACCEPTABLE LOS
- = PM PEAK HOUR DEFICIENT LOS

N

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Table 6-1

EA and EAP (2015) Conditions Intersection Analysis

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Without Project				With Project			
			Northbound			Southbound			Eastbound			Westbound			Delay[2] (secs.)		LOS		Delay[2] (secs.)		LOS	
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM	AM	PM	AM	PM
1	Waterman Av. / Driveway 1	**CSS**	0	3	0	1	3	0	0	0	0	0	**1**	0	--	--	--	--	12.7	14.1	B	B
2	Waterman Av. / Driveway 2	**CSS**	0	3	0	1	3	0	0	0	0	0	**1**	0	--	--	--	--	12.8	14.1	B	B
3	Waterman Av. / Mill St.	TS	1	3	0	1	3	0	1	2	1	1	2	1	32.4	33.1	C	C	33.3	33.4	C	C

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; **1** = Improvement

[2] Per the 2000 Highway Capacity Manual, overall average intersection delay and level of service are shown for intersections with a traffic signal or all-way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross-Street Stop; TS = Traffic Signal

Traffic signal warrants for EAP traffic conditions are based on EAP ADT volumes. For EAP traffic conditions, neither of the Project driveways are anticipated to warrant a traffic signal (see Appendix "6.3").

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7 EAC AND EAPC (2015) TRAFFIC ANALYSIS

This section discusses the traffic forecasts for EAC and EAPC conditions and the resulting intersection operations and traffic signal warrant analysis.

7.1 ROADWAY IMPROVEMENTS

The lane configurations and traffic controls assumed to be in place for EAC and EAPC conditions are consistent with those shown previously on Exhibit 3-1, with the exception of the Project driveways and those facilities assumed to be in place prior to or constructed by the Project to provide site access are also assumed to be in place for EAPC conditions only.

7.2 EAC (2015) TRAFFIC VOLUME FORECASTS

This scenario includes Existing traffic volumes plus an ambient growth factor of 1.54% plus traffic from pending and approved but not yet constructed but known development projects (as previously shown on Table 4-3) in the area. The weekday ADT, weekday AM, and PM peak hour volumes which can be expected for EAC traffic conditions are shown on Exhibit 7-1.

7.3 EAPC (2015) TRAFFIC VOLUME FORECASTS

This scenario includes Existing traffic volumes plus an ambient growth factor of 1.54%, traffic from pending and approved but not yet constructed but known development projects in the area and the addition of Project traffic. The weekday ADT, weekday AM, and PM peak hour volumes which can be expected for EAPC traffic conditions are shown on Exhibit 7-2.

7.4 INTERSECTION OPERATIONS ANALYSIS

LOS calculations were conducted for the study intersections to evaluate their operations under EAC and EAPC conditions with roadway and intersection geometrics consistent with those described in Section 7.1 *Roadway Improvements*. As shown on Table 7-1, the intersection of Waterman Avenue and Mill Street is anticipated to operate at acceptable levels of service under EAC conditions.

As shown on Table 7-1, all study area intersections are anticipated to continue to operate at acceptable LOS with the addition of Project traffic.

Consistent with Table 7-1, summaries of the peak hour intersection LOS for EAC and EAPC conditions are shown on Exhibits 7-3 and 7-4, respectively. The intersection operations analysis worksheets for EAC and EAPC traffic conditions are included in Appendices “7.1” and “7.2” of this TIA, respectively.

7.5 TRAFFIC SIGNAL WARRANTS ANALYSIS

Traffic signal warrant analysis for EAC traffic conditions has not been performed as the intersection of Waterman Avenue and Mill Street is currently signalized.

EXHIBIT 7-1: EAC (2015) VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES

1 Waterman Av. & Driveway 1	2 Waterman Av. & Driveway 2	3 Waterman Av. & Mill St.
Future Intersection	Future Intersection	68(93), 496(667), 79(103), 42(46), 329(528), 112(141), 123(134), 459(299), 83(93), 133(132), 526(620), 79(57)

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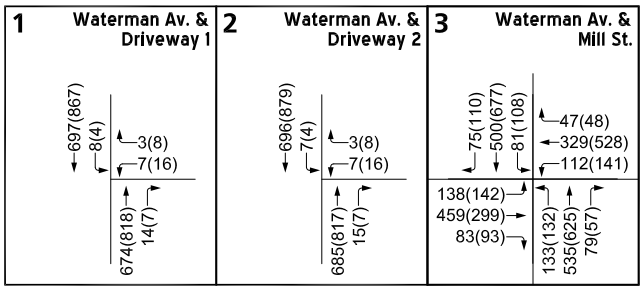
EXHIBIT 7-2: EAPC (2015) VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES



N

EXHIBIT 7-3: SUMMARY OF EAC (2015) INTERSECTION LOS

LEGEND:

- = AM PEAK HOUR ACCEPTABLE LOS
- = AM PEAK HOUR DEFICIENT LOS
- = PM PEAK HOUR ACCEPTABLE LOS
- = PM PEAK HOUR DEFICIENT LOS

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EXHIBIT 7-4: SUMMARY OF EAPC (2015) INTERSECTION LOS

LEGEND:

- = AM PEAK HOUR ACCEPTABLE LOS
- = AM PEAK HOUR DEFICIENT LOS
- = PM PEAK HOUR ACCEPTABLE LOS
- = PM PEAK HOUR DEFICIENT LOS

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Table 7-1

EAC and EAPC (2015) Conditions Intersection Analysis

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Without Project				With Project			
			Northbound			Southbound			Eastbound			Westbound			Delay [2] (secs.)		LOS		Delay [2] (secs.)		LOS	
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM	AM	PM	AM	PM
1	Waterman Av. / Driveway 1	**CSS**	0	3	0	1	3	0	0	0	0	0	**1**	0	--	--	--	--	13.0	14.6	B	B
2	Waterman Av. / Driveway 2	**CSS**	0	3	0	1	3	0	0	0	0	0	**1**	0	--	--	--	--	13.1	14.6	B	B
3	Waterman Av. / Mill St.	TS	1	3	0	1	3	0	1	2	1	1	2	1	33.0	33.4	C	C	34.4	33.7	C	C

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; **1** = Improvement

[2] Per the 2000 Highway Capacity Manual, overall average intersection delay and level of service are shown for intersections with a traffic signal or all-way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross-Street Stop; TS = Traffic Signal

Traffic signal warrants for EAPC traffic conditions are based on EAPC ADT volumes. For EAPC traffic conditions, neither of the Project driveways are anticipated to warrant a traffic signal (see Appendix "7.3").

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8 HORIZON YEAR (2035) TRAFFIC ANALYSIS

This section discusses the methods used to develop Horizon Year without and with Project traffic forecasts, and the resulting intersection operations and traffic signal warrants.

8.1 ROADWAY IMPROVEMENTS

The lane configurations and traffic controls assumed to be in place for Horizon Year conditions are consistent with those shown previously on Exhibit 3-1, with the exception of Project driveways and those facilities assumed to be constructed by the Project to provide site access.

8.2 HORIZON YEAR (2035) WITHOUT PROJECT TRAFFIC VOLUME FORECASTS

This scenario includes the refined post-processed volumes based on SBTAM, less the traffic generated by the proposed Project (see Section 4.8 *Horizon Year (2035) Conditions* of this TIA for a detailed discussion on the post-processing methodology). Exhibit 8-1 shows the weekday ADT and peak hour volumes which can be expected for Horizon Year without Project traffic conditions.

8.3 HORIZON YEAR (2035) WITH PROJECT TRAFFIC VOLUME FORECASTS

This scenario includes the refined post-processed volumes based on SBTAM. Exhibit 8-2 shows the weekday ADT and peak hour volumes which can be expected for Horizon Year with Project traffic conditions.

8.4 HORIZON YEAR (2035) INTERSECTION OPERATIONS ANALYSIS

LOS calculations were conducted for the study intersections to evaluate their operations under Horizon Year without and with Project conditions with roadway and intersection geometrics consistent with those described in Section 8.1 *Roadway Improvements*. As shown on Table 8-1, all study area intersections are anticipated to operate at acceptable levels of service under Horizon Year (2035) without Project conditions.

As shown on Table 8-1, all study area intersections are anticipated to continue to operate at acceptable LOS with the addition of Project traffic.

Consistent with Table 8-1, summaries of the peak hour intersection LOS for Horizon Year without and with Project conditions are shown on Exhibits 8-3 and 8-4, respectively. The intersection operations analysis worksheets for Horizon Year without and with Project traffic conditions are included in Appendices “8.1” and “8.2” of this TIA, respectively.

8.5 TRAFFIC SIGNAL WARRANTS ANALYSIS

Traffic signal warrant analysis for Horizon Year without Project traffic conditions has not been performed as the intersection of Waterman Avenue and Mill Street is currently signalized.

EXHIBIT 8-1: HORIZON YEAR (2035) WITHOUT PROJECT VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES

1 Waterman Av. & Driveway 1	2 Waterman Av. & Driveway 2	3 Waterman Av. & Mill St.
Future Intersection	Future Intersection	113(121) 600(744) 140(169) / 51(91) 492(764) 123(172) / 152(200) 738(511) 95(103) / 170(145) 587(729) 111(77)

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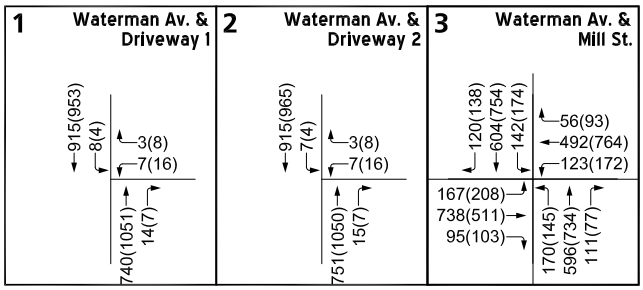
EXHIBIT 8-2: HORIZON YEAR (2035) WITH PROJECT VOLUMES

LEGEND:

10.0 = VEHICLES PER DAY (1000'S)

10(10) = AM(PM) PEAK HOUR VOLUMES



N

EXHIBIT 8-3: SUMMARY OF HORIZON YEAR (2035) WITHOUT PROJECT INTERSECTION LOS

LEGEND:

- = AM PEAK HOUR ACCEPTABLE LOS
- = AM PEAK HOUR DEFICIENT LOS
- = PM PEAK HOUR ACCEPTABLE LOS
- = PM PEAK HOUR DEFICIENT LOS

N

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EXHIBIT 8-4: SUMMARY OF HORIZON YEAR (2035) WITH PROJECT INTERSECTION LOS

LEGEND:

- = AM PEAK HOUR ACCEPTABLE LOS
- = AM PEAK HOUR DEFICIENT LOS
- = PM PEAK HOUR ACCEPTABLE LOS
- = PM PEAK HOUR DEFICIENT LOS

N

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Table 8-1

Horizon Year (2035) Conditions Intersection Analysis

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Without Project				With Project			
			Northbound			Southbound			Eastbound			Westbound			Delay[2] (secs.)		LOS		Delay[2] (secs.)		LOS	
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM	AM	PM	AM	PM
1	Waterman Av. / Driveway 1	**CSS**	0	3	0	1	3	0	0	0	0	0	**1**	0	--	--	--	--	13.7	17.7	B	C
2	Waterman Av. / Driveway 2	**CSS**	0	3	0	1	3	0	0	0	0	0	**1**	0	--	--	--	--	13.8	17.7	B	C
3	Waterman Av. / Mill St.	TS	1	3	0	1	3	0	1	2	1	1	2	1	35.3	39.6	D	D	36.6	40.0	D	D

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; **1** = Improvement

[2] Per the 2000 Highway Capacity Manual, overall average intersection delay and level of service are shown for intersections with a traffic signal or all-way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross-Street Stop; TS = Traffic Signal

Traffic signal warrants for Horizon Year with Project traffic conditions are based on Horizon Year with Project ADT volumes. For Horizon Year with Project traffic conditions, neither of the Project driveways are anticipated to warrant a traffic signal (see Appendix "8.3").

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9 SITE ACCESS AND ON-SITE CIRCULATION

Section 9 *Site Access and On-Site Circulation* summarizes Project site access and on-site circulation recommendations.

The Project is proposed to have access to Waterman Avenue via Driveways 1 and 2. Both Project driveways are proposed to be stop controlled and allow for full access. It is assumed that the Project will be constructed and occupied by 2015.

Roadway improvements necessary to provide site access and on-site circulation are assumed to be constructed in conjunction with site development and are described below. These improvements should be in place prior to occupancy.

9.1 ON-SITE ROADWAY IMPROVEMENTS

Waterman Avenue - Waterman Avenue is a north-south oriented roadway located along the Project's western boundary and is currently built out to its ultimate cross-section width as a major divided highway (100-foot right-of-way), consistent with the City of San Bernardino General Plan Circulation Element. Additional curb, gutter and limited landscaping improvements are recommended along the Project's frontage, consistent with City of San Bernardino standards and the final conditions of approval.

9.2 SITE ACCESS IMPROVEMENTS

The recommended site access driveway improvements for the Project are described below. Exhibit 9-1 illustrates the on-site and site adjacent recommended roadway lane improvements. Construction of on-site and site adjacent improvements shall occur in conjunction with adjacent Project development activity or as needed for Project access purposes.

Waterman Avenue / Driveway 1 – Install a stop control on the westbound approach and construct the intersection with the following geometrics:

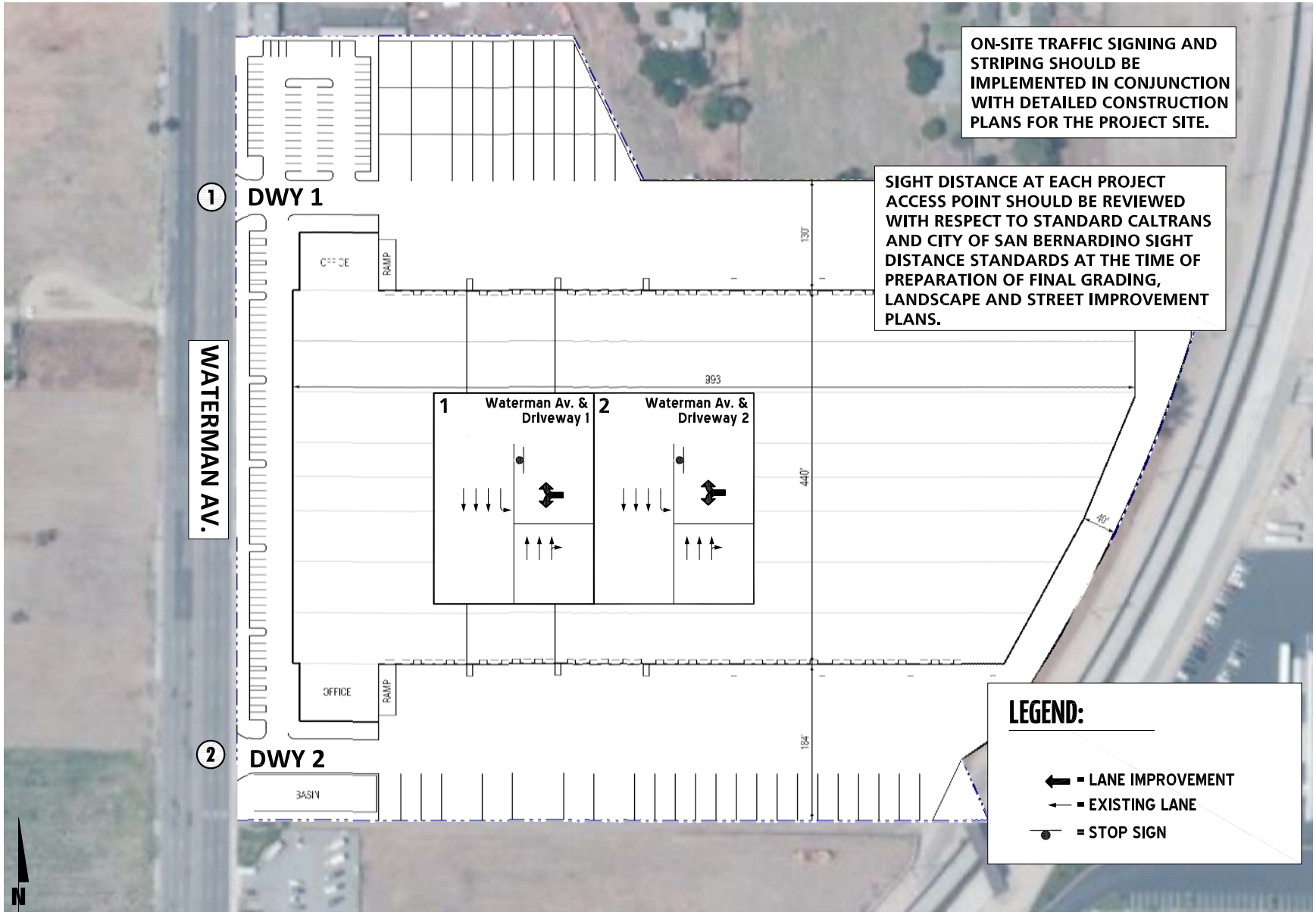
- Northbound Approach: Two through lanes and one shared through-right turn lane.
- Southbound Approach: One two-way left-turn-lane and three through lanes.
- Eastbound Approach: N/A
- Westbound Approach: One shared left-right turn lane.

Waterman Avenue / Driveway 2 – Install a stop control on the westbound approach and construct the intersection with the following geometrics:

- Northbound Approach: Two through lanes and one shared through-right turn lane.
- Southbound Approach: One two-way left-turn-lane and three through lanes.
- Eastbound Approach: N/A
- Westbound Approach: One shared left-right turn lane.

On-site traffic signing and striping should be implemented in conjunction with detailed construction plans for the Project site.

EXHIBIT 9-1: SITE ACCESS AND SITE ADJACENT ROADWAY RECOMMENDATIONS



Sight distance at each project access point should be reviewed with respect to standard Caltrans and City of San Bernardino sight distance standards at the time of preparation of final grading, landscape and street improvement plans.

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10 REFERENCES

1. **City of San Bernardino Development Services Department .** *The City of San Bernardino Traffic Impact Study Guidelines.* San Bernardino : City of San Bernardino Development Services Department , 2004.
2. **Transportation Research Board.** *Highway Capacity Manual (HCM).* s.l. : National Academy of Sciences, 2000.
3. **Federal Highway Administration.** Manual on Uniform Traffic Control Devices (MUTCD). [book auth.] California Department of Transportation. *California Manual on Uniform Traffic Control Devices (CAMUTCD).* 2012.
4. **Institute of Transportation Engineers.** *Trip Generation.* 9th Edition. 2012.
5. **City of Fontana.** *City of Fontana Truck Trip Generation Study.* Fontana : s.n., 2003.
6. **Southern California Association of Governments.** *2012-2035 Regional Transportation Plan.* April 2012.
7. **San Bernardino Association of Governments.** *San Bernardino County Congestion Management Program Appendix "G" .* s.l. : San Bernardino County, 2003 Update.

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