Central Rohnert Park
Priority
Development
Area Plan

City of Rohnert Park

CENTRAL ROHNERT PARK
PRIORITY DEVELOPMENT AREA PLAN
Draft Environmental Impact Report

SCH # 2015102081

Prepared for:

City of Rohnert Park
Development Services Department
Planning Division

Prepared by:

AECOM

December 2015

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Acronyms

µin/sec	micro-inch per second
µmho/cm	micromho per centimeter
2009 CTP	2009 Comprehensive Transportation Plan for Sonoma County
AB	Assembly Bill
ABAG	Association of Bay Area Governments
ACMs	asbestos-containing materials
ADWF	average dry weather flow
AFY	acre-feet per year
AIRFA	American Indian Religious Freedom Act
Alquist-Priolo Act	Alquist-Priolo Earthquake Fault Zoning Act
AQP	air quality plan
ARB	California Air Resources Board
ATCM	Airborne Toxics Control Measure
BA 2010 CAP	Bay Area 2010 Clean Air Plan
BAAQMD	Bay Area Air Quality Management District
bgs	below ground surface
BMP	best management practice
BMPs	Best Management Practices
Board	State Mining and Geology Board
CAA	Clean Air Act
CAAQS	California ambient air quality standards
CAL FIRE	California Department of Forestry and Fire Protection
CalEEMod	California Emissions Estimator Model
Cal-EPA	California Environmental Protection Agency
CALGreen Code	California Green Building Standards Code
Cal-OSHA	California Occupational Safety and Health Administration
CalRecycle	California Department of Resources Recycling and Recovery
Caltrans	California Department of Transportation
CAP	Climate Action Plan
CBC	California Building Standards Code
CCAA	California Clean Air Act

CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CGS	California Geological Survey
CIWMA	California Integrated Waste Management Act
CIWMB	California Integrated Waste Management Board
CMA	Congestion Management Agency
CMP	Carl Moyer Program
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNW	California Northwestern Railway Company
CO	carbon monoxide
C-O	Office-Commercial zone
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CPRR	California Pacific Railroad
C-R	Regional-Commercial zone
CRPR	California Rare Plant Rank
CRPUSD	Cotati–Rohnert Park Unified School District
CTS	California tiger salamander
CUPA	Certified Unified Program Agency
CWA	Clean Water Act
dB	decibel scale
dBA	A-Weighted Decibel
DDAZ	Downtown District Amenity zone
Dispatch Center	Rohnert Park Department of Public Safety Communications Center
DO	dissolved oxygen
DTSC	Department of Toxic Substances Control
DTM-U	Downtown Mixed-Use zone
DTR-H	Downtown High Density Residential zone
DWR	California Department of Water Resources
EB	eastbound
ECP	Erosion Control Plan
EIR	Environmental Impact Report
EMS	emergency medical services
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAR	floor area ratio
FD	Rohnert Park's Fire Division
FEMA	Federal Emergency Management Agency

FHWA	Federal Highway Administration
FIRM	flood insurance rate map
FTA	Federal Transit Administration
GGT	Golden Gate Transit
GHG	greenhouse gas
gpm	gallons per minute
GWP	high–global warming potential
HAWK	High-Intensity Activated crossWalK (signal)
HCD	California Department of Housing and Community Development
HCM	Highway Capacity Manual
HCP	habitat conservation plans
HI	Hazard Index
HWCL	Hazardous Waste Control Law
ID	Identification
I-L	Industrial zone
IL/CR	Industrial with Regional Commercial Overlay zone
I-L/O	Industrial with Office Overlay zone
in/sec	inches per second
IPCC	Intergovernmental Panel on Climate Change
IS/MND	Initial Study/Mitigated Negative Declaration
lb/day	pounds per day
LCFS	Low Carbon Fuel Standard
L_{dn}	Day-Night Level
L_{eq}	Equivalent Sound Level
LID	low-impact development
L_{max}	Maximum Sound Level
L_{min}	Minimum Sound Level
LOS	Level of Service
LRA	local responsibility area
Manual	Sonoma County 2011 Storm Water Low Impact Development Technical Design Manual
MCL	Maximum Contaminant Level
mg/m^3	milligrams per cubic meter
million gpd	million gallons per day
MMth	millions of therms
MOE	measure of effectiveness
MOU	Memorandum of Understanding
MRZs	Mineral Resource Zones
MS4	municipal separate storm sewer system
MSL	mean sea level
MT CO_2e/SP/yr	metric tons of carbon dioxide equivalent per service population per year
MT	metric ton
MTC	Metropolitan Transportation Commission
MTC	Metropolitan Transportation Commission

MUP	multi-use path
NAAQS	national ambient air quality standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
NB	Northbound
NCCP	natural community conservation plans
NFPA	National Fire Protection Agency
NO_2	nitrogen dioxide
North Coast RWQCB	North Coast Regional Water Quality Control Board
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRCS	U.S. Natural Resources Conservation Service
NWP	Northwestern Pacific Railroad
OSHA	Occupational Safety and Health Administration
pc/mi/ln	passenger cars per mile per lane;
PCA	Priority Conservation Area
PCE	tetrachloroethene
PCP	pentachlorophenol
PD	Planned Development
PDA Plan	Priority Development Area Plan
PDA	Priority Development Area
PG&E	Pacific Gas and Electric Company
P-I	Public/Institutional zone
PM	particulate matter
PM_{10}	particulate matter with aerodynamic diameter less than 10 micrometers
$PM_{2.5}$	particulate matter with aerodynamic diameter less than 2.5 micrometers
Porter-Cologne Act	Porter-Cologne Water Quality Control Act
ppd	pounds per day
ppm	parts per million
PPV	Peak Particle Velocity
PRC	Public Resources Code
Proposed Plan	Central Rohnert Park PDA Plan
PSO	public safety operator
RCRA	Resource Conservation and Recovery Act
RHNA	Regional Housing Needs Allocation
RMS	root-mean-square
ROG	reactive organic gases
RPDPS	Rohnert Park Division of Public Safety
RPX	Rohnert Park Expressway
RTP	Regional Transportation Plan
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SB	Southbound

SCS	Sustainable Community Strategy
SCT	Sonoma County Transit
SCTA	Sonoma County Transportation Authority
SCWA	Sonoma County Water Agency
SCWMA	Sonoma County Waste Management Agency
SFBAAB	San Francisco Bay Area Air Basin
SFNP	San Francisco and North Pacific Railroad
SIP	state implementation plan
SLM	Sound Level Meter
SMARA	California Surface Mining and Reclamation Act
SMART	Sonoma Marin Area Rail Transit
SO_2	sulfur dioxide
SP	service population
SPRR	Southern Pacific Railroad
SR	State Route
SUSMP	Stormwater Mitigation Plan
SVE	soil vapor extraction
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	toxic air contaminant
TCE	trichloroethene
TDM	transportation demand management
TeNS	Technical Noise Supplement
TMDL	total maximum daily loads
TPH-g	Total petroleum hydrocarbons as gasoline
tpy	tons per year
U.S. 101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
v/c	volume to capacity
VdB	vibration decibels
VMT	vehicle miles traveled
VOCs	volatile organic compounds
WDR	waste discharge requirement
WGCEP	Working Group on California Earthquake Probabilities
WRS	Waste Reduction Strategy
WSAs	water supply assessments
$\mu g/m^3$	micrograms per cubic meter

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This environmental impact report (EIR) has been prepared by the City of Rohnert Park (City) as lead agency to evaluate the potential environmental effects of the proposed Central Rohnert Park Priority Development Area (PDA) Plan (proposed plan). This document has been prepared in accordance with the California Environmental Quality Act (CEQA) (Public Resources Code [PRC], Section 21000 et seq.) and the State CEQA Guidelines (California Code of Regulations, Section 15000 et seq.).[1]

This executive summary briefly summarizes the environmental analysis for the proposed plan, as required by Section 15123 of the State CEQA Guidelines. This executive summary includes:

- an overview of the project description;
- alternatives to the plan that could reduce potentially significant effects;
- known areas of controversy; and
- impacts of the plan and mitigation measures designed to reduce potentially significant2 impacts (Table ES-1).

Each of these topics is discussed in detail in this Draft EIR.

The proposed plan would be located in a developed portion of the City with existing infrastructure capacity. As a developed area, the City, as the lead agency, determined that this Draft EIR would address the following technical issue areas: air quality, biological resources, cultural resources, geology and soils, greenhouse gas (GHG) emissions, hazards and hazardous materials, hydrology and water quality, noise, and transportation and traffic. As demonstrated in this EIR, with the exception of a significant and unavoidable traffic and transportation impact, all project impacts would be less than significant or would be reduced to a less-than-significant level with implementation of feasible mitigation measures. A synopsis of the proposed plan follows; refer to Chapter 2, “Project Description” for the complete summary of the proposed plan and envisioned improvements.

ES.2 PROJECT DESCRIPTION

The proposed plan is a programmatic land use master plan that covers an approximately 330-acre developed area of the city, roughly centered along Rohnert Park Expressway and State Farm Drive. The plan area is slated to include one of ten rail station stops in Sonoma County along the Sonoma-Marin Area Rail Transit (SMART) rail line and multi-use path, which follows the existing Northwestern Pacific Railroad line in the plan area, as shown in Figure 1, “Regional Setting.” The proposed plan is funded by the Association of Bay Area Governments’ PDA planning grant program, which is intended to support transit-oriented development and infill growth in existing communities adjacent to transit. As shown in Figure 2, “Local Setting,” the plan area encompasses a diverse mixed-use area with a mix of multifamily residential, office, light industrial, and retail and service uses and provides opportunities for infill and reuse/redevelopment of vacant and underutilized buildings and properties.

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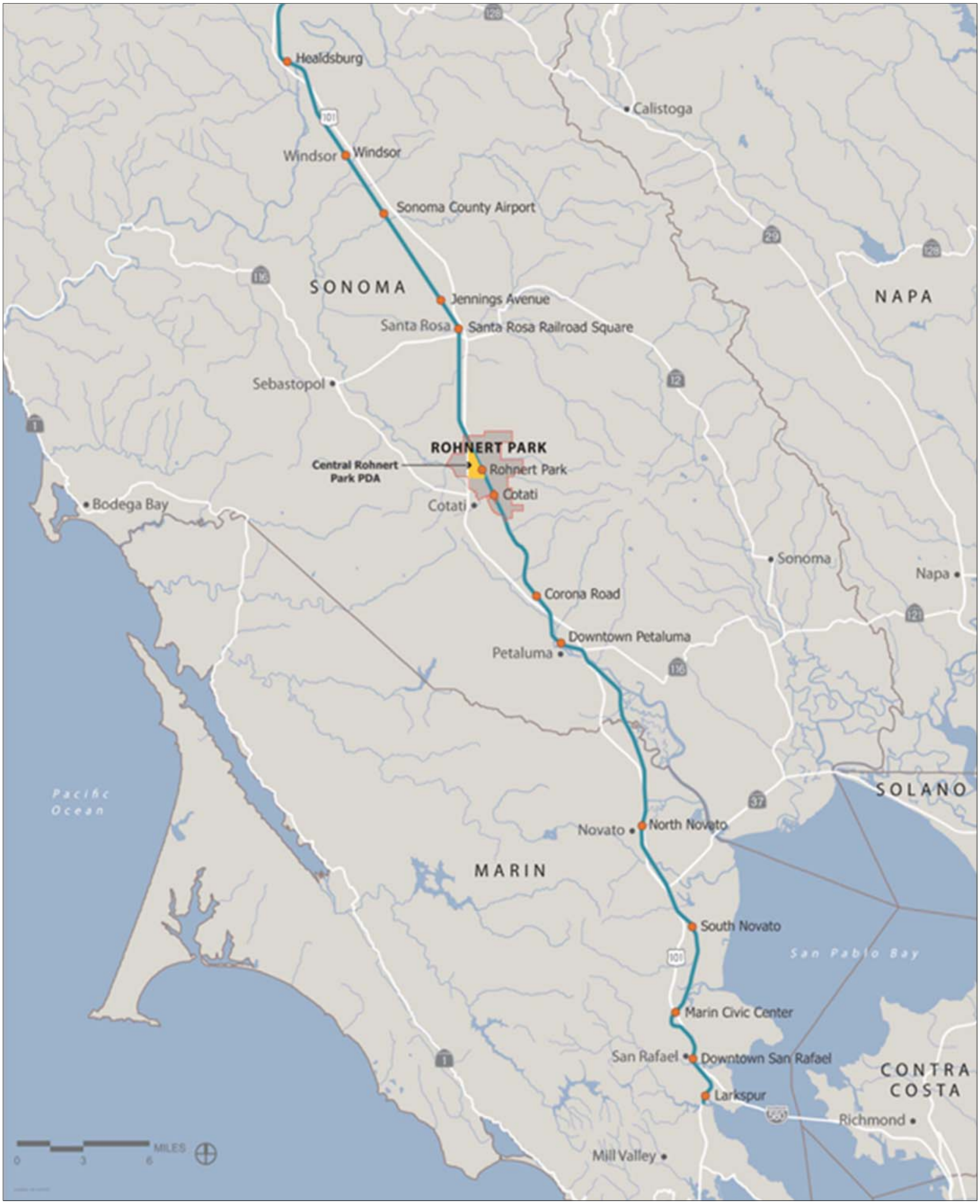
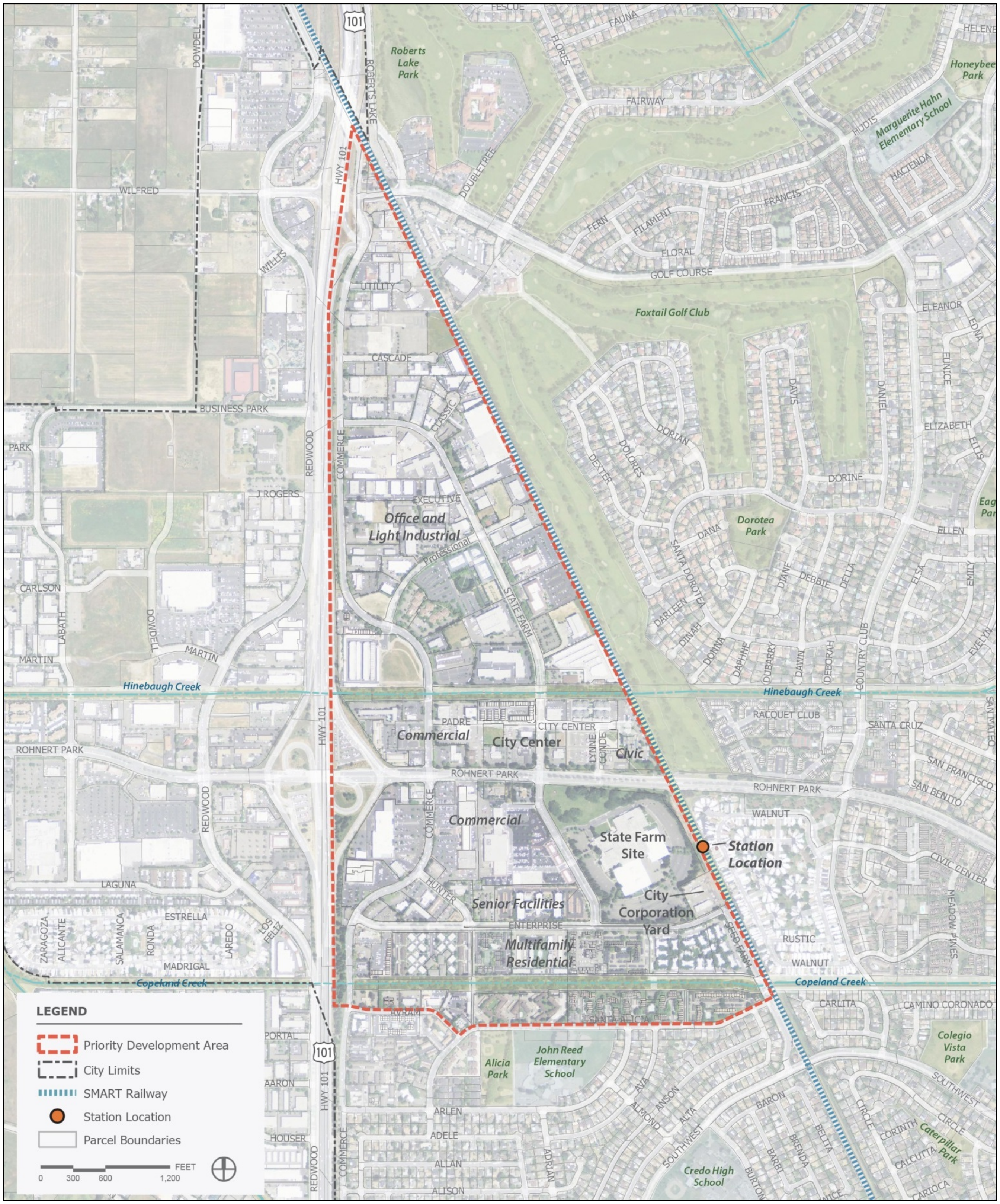
1 The PRC includes provisions for streamlining CEQA review for certain projects, such as eligible infill projects. Chapter 4.0 of this EIR, “Other CEQA-Required Sections,” provides a detailed discussion of streamlining provisions relevant to this EIR.

2 State CEQA Guidelines Section 15382 defines a significant effect as a substantial, or potentially substantial, adverse change in any physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance.



Sources: Data provided by City of Rohnert Park and compiled by AECOM in 2014

Figure ES-1: **Regional Location**



Sources: Data provided by City of Rohnert Park and compiled by AECOM in 2014

Figure ES-2: Local Setting

As shown in Figure 3, "Proposed Priority Development Area Subareas and Downtown District," the plan area has been organized into five subareas and a new downtown district that contain the following existing features:

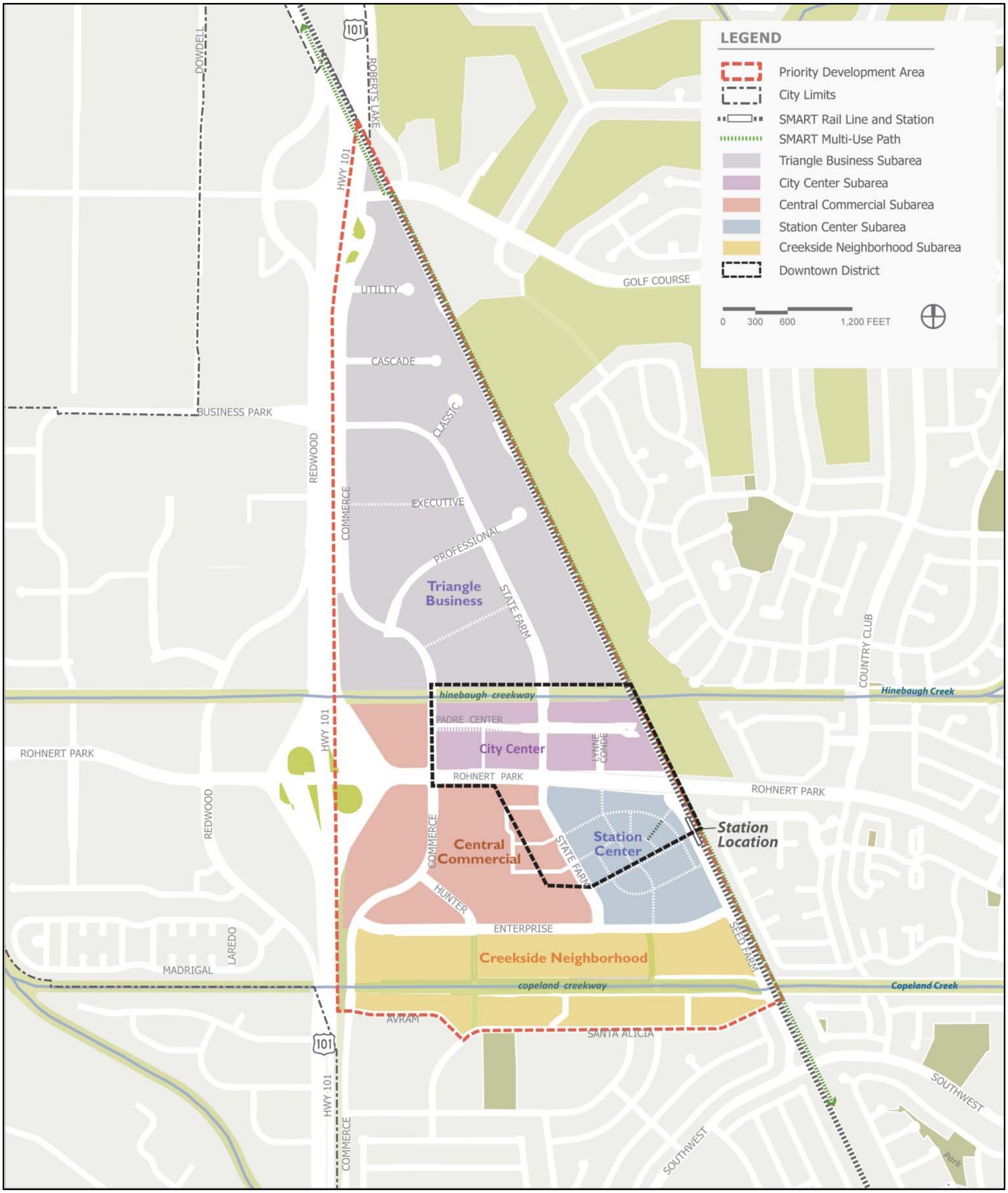
- The Station Center subarea is the site of the vacant former State Farm office campus site, adjacent to the planned Rohnert Park SMART rail station.
- The City Center subarea, north of the SMART rail station at the intersection of City Center Drive and State Farm Drive, is an emerging civic center and urban, mixed-use neighborhood.
- The Central Commercial subarea consists of several shopping centers, accessed along Commerce Boulevard and State Farm Drive.
- The Triangle Business subarea north of Hinebaugh Creek is essentially an employment area, with predominantly office and industrial business uses and some retail uses in its northern portion.
- The Creekside Neighborhood, located between Enterprise Drive and Avram Avenue, consists of multifamily residential housing and some neighborhood-serving retail uses at the corner of Commerce Boulevard and Enterprise Drive.
- A new Downtown District, called the Downtown District Amenity Zone (DDAZ), would implement the community's vision for a compact, walkable downtown area that is unique to the city.

Together, the plan's subareas and DDAZ support the community's needs for diverse retail experiences, jobs, services, housing, and attractive places to live, work, and play. The DDAZ is proposed to help focus improvements and investments in downtown Rohnert Park, including amenities (e.g., benches, plazas, signage, and lighting). The DDAZ would be applied as a new overlay zone that would include unique urban design standards and design guidelines that promote compact, multistory development; support flexible approaches to accommodating parking demand in the DDAZ; and potentially incentivize those features and amenities desired in a downtown setting.

The plan area is envisioned as a central business area for the city, with a downtown and urban neighborhoods, achieved through new mixed-use, infill, building reuse/repurposing, and streetscape and other public and private improvements. The separate SMART rail station project was strategically moved to a location adjacent to the State Farm property (the largest opportunity site in the plan area), with the vision of creating a central downtown for Rohnert Park that would serve as the social and economic heart of the city. This proposed downtown area is envisioned to expand upon recent improvements occurring in the existing City Center, an urban, walkable neighborhood area, north of the SMART rail station, with a civic center and mixed-use neighborhood focus.

The plan proposes various development types: multifamily residential units, retail/service commercial uses, public-institutional uses, office uses, light industrial uses, and park and open space facilities. To estimate the carrying capacity of plan area infrastructure, assumptions were made about the maximum expected development potential in the plan area. The assumptions made include the following added development potential in the plan area:

- 835 multifamily residential units, concentrated within the one-half-mile radius of the SMART rail station, in the City Center and Station Center subareas. Allowed densities would range from 12 to 75 units per acre.



Source: Data compiled by AECOM in 2015

Figure ES-3: Proposed Priority Development Area Subareas and Downtown District

- Up to 440,880 square feet of retail and service, generally consisting of one- to two-story infill development distributed within the plan area. Allowed floor area ratios (FARs) would range from a maximum of 0.4 in the regional commercial zone to 1.5 for a mix of nonresidential uses and 2.0 for a mix of residential and nonresidential uses within the Downtown Mixed-Use zone.
- Up to 189,320 square feet of new office facilities, generally consisting of one- to three-story developments, focused within the Triangle Business, City Center, and Station Center subareas. Allowed FARs would range from a maximum of 0.5 in the Industrial with Office Overlay zone (1.0 if approved by a discretionary action by the Planning Commission, subject to the requirements in the proposed plan and other City-adopted design guidelines) to 1.5 for a mix of nonresidential uses and 2.0 for a mix of residential and nonresidential uses in the Downtown Mixed-Use zone.
- Up to 62,800 square feet of public-institutional uses, generally consisting of one- and two-story infill development within the plan area. The maximum allowed FAR would be 0.5.
- Up to 129,320 square feet of light industrial uses located within the Triangle Business subarea. Maximum allowed density would be 0.5, or 1.0 with approval of discretionary action by the Planning Commission and subject to the requirements in the proposed plan and other City-adopted design guidelines.
- 8.5 acres of public parks/open space within the Station Center and Triangle Business subareas.

The plan proposes new roadways, transit, bicycle, and pedestrian improvements and corresponding circulation connections, to improve nonvehicular access in the plan area; connect to and complete regional trails; and support the development of existing and new mixed-use areas of the community, with a particular focus on providing community access to the SMART rail station and regional multi-use path.

ES.3 ALTERNATIVES

The purpose of the alternatives evaluation in an EIR, as stated in Section 15126.6(c) of the State CEQA Guidelines, is to ensure that “[t]he range of potential alternatives to the proposed project shall include those that could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects” associated with implementation of the proposed project—in this case, the proposed plan. Chapter 6.0 of this EIR, “Alternatives,” describes the range of alternatives to the proposed project that are analyzed in this EIR and presents how specific impacts differ in severity from those associated with the proposed plan.

Except for transportation and traffic, as with the proposed plan, significant impacts of the alternatives can be mitigated to a less-than-significant level through adoption of mitigation measures identified in Sections 3.1 through 3.9 of this EIR, which contains the environmental analysis for the proposed plan. The following alternatives would be similar to or slightly lessen project impacts, including the significant and unavoidable impact related to transportation and traffic; with the exception of the No Project/No Development Alternative, the alternatives would not reduce these impacts to a less-than-significant level.

The alternatives to the proposed plan analyzed in this EIR are:

- Alternative 1: No Project/No Development
- Alternative 2: No Regional Commercial Overlay Zone

- Alternative 3: Station Center Office and Residential Focus

The State CEQA Guidelines require that an EIR identify the environmentally superior alternative (Section 15126.6[e][2]). If the environmentally superior alternative is the "No Project" Alternative, the EIR must identify an environmentally superior alternative from among the other alternatives. Alternative 1, the No Project/No Development Alternative, could avoid the significant impacts of the proposed plan related to transportation and traffic and would result in less severe impacts in all other issue areas.

Of the development alternatives, Alternative 3 would be the environmentally superior alternative, because it would result in lesser traffic, noise, and GHG emissions impacts compared to the proposed plan and Alternative 2. Alternative 3 would meet most of the plan's objectives (presented in detail in Chapter 2.0, "Project Description"), but to a lesser extent than the proposed plan and Alternative 2. Alternative 3 would meet most of the plan objectives but would be less effective in supporting the community's desire or the plan's objective for a downtown retail environment, with substantial retail uses adjacent to the SMART rail station.

Furthermore, all of the alternatives would deliver fewer of the downtown retail and entertainment benefits desired by the community from the proposed plan. The plan area has the potential for retail and employment infill opportunities near transit. Reduction of some of the retail and residential development in the alternatives would not support the plan's objectives or leverage the advantages of the coming SMART rail station to support the creation of a downtown for the city.

ES.4 KNOWN AREAS OF CONTROVERSY

The State CEQA Guidelines (Section 15123) require that the summary of an EIR identify areas of controversy known to the lead agency, including issues raised by agencies and the public. The City has asked for input from federal, state, and local agencies; organizations; and members of the public regarding the issues that should be evaluated in the EIR. On October 28, 2015, the City circulated a Notice of Preparation (NOP) for a Draft EIR after initially preparing a Draft Initial Study/Mitigated Negative Declaration. A public scoping meeting was held on November 18, 2015. The City received two letters, from the County of Sonoma Permit and Resource Management Department and the California Department of Transportation (Caltrans). Both letters concerned traffic and transportation impacts. Please see Appendix I for both letters received on the NOP. The issues in these letters are summarized below.

ES.4.1 CULTURAL RESOURCES

Caltrans mentioned that project environmental documentation should include a current archaeological record search from the Northwest Information Center of the California Historical Resources Information System if any construction activity occurs within a state right-of-way.

ES.4.2 TRANSPORTATION AND TRAFFIC

Caltrans requested that the EIR include a discussion of the impacts of the proposed plan on U.S. Highway 101 and State Route 116. Caltrans also requested that the traffic impact study include Caltrans's *Guide for the Preparation of Traffic Impact Studies* for traffic impact scenarios and methodologies.

The County of Sonoma also requested that the EIR discuss the cumulative impacts of both the local and regional circulation system and identify appropriate mitigation. The County of Sonoma also requests that the EIR employ the Sonoma County Transit Authority's travel demand model.

ES.5 SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Table ES-1 displays a summary of potential impacts and proposed mitigation measures that would avoid, eliminate, minimize, or reduce potential impacts. The level of significance of the potential impact prior to and following implementation of each mitigation measure is also identified. For detailed descriptions of project impacts and mitigation measures, please see EIR Sections 3.1 through 3.9.

Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
3.1 Air Quality			
3.1a Potential for construction-related emissions to conflict or obstruct with the implementation of the applicable air quality plan. Potential for operational emissions to conflict with or obstruct implementation of the applicable air quality plan.	PS PS	**Mitigation Measure 3.1-1: Implement BAAQMD Basic Construction Control Measures** BAAQMD recommends that all projects, regardless of significance, implement the Basic Construction Control Measures during construction. Implementing the following measures would effectively minimize and control fugitive dust emissions from the proposed construction-related activities. All building or grading permits issued for projects within the plan area shall include the following Basic Construction Control Measures (BAAQMD, 2011) as a condition of the permit. All contractors selected to construct any component of the project shall implement the following measures: • All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. • All haul trucks transporting soil, sand, or other loose material off-site shall be covered. • All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power-vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. • All vehicle speeds on unpaved roads shall be limited to 15 miles per hour. • Idling times shall be minimized either by shutting equipment off when not in use or by reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure, Title 13, Section 2485 of the California Code of Regulations). Clear signage shall be provided for construction workers at all access points.	LTS LTS

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		• All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator. • A publicly visible sign shall be posted at the soil transfer site within BAAQMD, with the telephone number and person at the City of Rohnert Park to contact regarding dust complaints. This person shall respond and take corrective action within 48 hours. BAAQMD's phone number also shall be visible, to ensure compliance with applicable regulations. **Mitigation Measure 3.1-2: Assess Criteria Pollutant Emissions Associated with Site-Specific Construction and Alter Project Details and/or Construction Equipment as Needed** As part of subsequent project-level CEQA analysis, the project applicant shall complete an evaluation of construction air pollutant emissions from individual projects in the plan area. The air pollutant emissions shall be compared to BAAQMD's thresholds of significance for project-level construction impacts to determine potential impacts. If potentially significant project-level construction-related impacts are found (i.e., construction-related emissions would exceed applicable thresholds of significance), additional mitigation measures (beyond those required for all projects by Mitigation Measure 3.1-1) shall be developed and implemented to reduce potential impacts to a less-than-significant level. Mitigation measures could include, but are not limited to the measures listed in Mitigation Measures 3.1-3, 3.1-4, and 3.1-5.	

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		Mitigation Measure 3.1-3: Implement Applicable Site-Specific BAAQMD Additional Construction Control Measures for Exhaust-Related Emissions BAAQMD has developed Additional Construction Mitigation Measures for those projects that will be located near sensitive receptors. Because the plan's construction-related pollutant of most concern is NO_X, the following measures from BAAQMD's Additional Construction Measures with an emphasis on exhaust-related measures shall be implemented during construction if project-level impacts are found to be significant to reduce emissions to a less-than-significant level. Example additional measures that would help reduce exhaust-related NO_X emissions are listed below; however, projects are not limited or confined to the following measures to reduce exhaust-related construction emissions. • The idling time of diesel-powered construction equipment shall be minimized to 2 minutes. • Low–volatile organic compound (i.e., ROG) coatings shall be used, beyond local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings). • All contractors shall be required to use equipment that meets ARB's most recent certification standard for off-road heavy duty diesel engines. • All contractors shall be required to use a selected percentage of higher tier equipment (e.g., Tier 4) or equipment that through retrofits or repowering meet the exhaust emission standards of higher tier emission standards in order to reduce construction impacts to a less-than-significant level. • All contractors shall evaluate the feasibility of using alternatively fueled vehicles and equipment during	

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		construction activities. Alternatively fueled vehicles and equipment shall be used to the highest extent feasible and to reduce construction emissions to a less-than-significant level. **Mitigation Measure 3.1-4: Implement Applicable Site Specific BAAQMD Additional Construction Control Measures for Fugitive Dust Emissions** BAAQMD has developed additional construction mitigation measures for those projects that will include extensive earth-moving activities or will be located near sensitive receptors. Because the plan would consist of infill development with potential sensitive receptors nearby, the following example fugitive dust–related measures shall be considered to minimize exposure to nearby receptors, as applicable, if project-level impacts are found to be significant. However, projects are not limited or confined to the following measures to reduce fugitive dust–related emissions. • All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12 percent. Moisture content can be verified by lab samples or moisture probe. • All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 miles per hour. • Wind breaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks shall have at maximum 50 percent air porosity. • Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and shall be watered appropriately until	

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		vegetation is established. • The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time. • All trucks and equipment, including their tires, shall be washed off before leaving the site. • Site accesses to a distance of 100 feet from the paved road shall be treated with a 6- to 12-inch compacted layer of wood chips, mulch, or gravel. • Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than 1 percent. **Mitigation Measure 3.1-5: Use BAAQMD Carl Moyer Program (CMP) to Offset Project-Specific Regional Emissions** If any project-level air pollutant emissions (i.e., construction or operational) exceed the BAAQMD 2010 thresholds after implementation of applicable mitigation measures, the project applicant shall use BAAQMD's CMP to offset the remaining project-level air pollutant emissions that exceed the BAAQMD 2010 thresholds. The project applicant shall provide funding for emission reduction projects in an amount up to $16,640 per ton of criteria air pollutants (NO_X + ROG + [20*PM]) , which is the current cost-effectiveness limit for emission reduction projects set by the Air Resources Board for the CMP. The range of costs could be anywhere from approximately $5,000 per weighted ton to the upper limit of $16,640 per weighted ton. An administrative fee of 5 percent shall be paid by the project	

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		applicant to BAAQMD to implement the program. The range of costs could be anywhere from approximately $5,000 per weighted ton to the upper limit of $16,640 per weighted ton. An administrative fee of 5 percent shall be paid by the project applicant to BAAQMD to implement the program. The funding will be used for a combination of the following types of projects: • projects eligible for funding under the CMP guidelines that are real, surplus, quantifiable, and enforceable; and • projects to replace older, high-emitting construction equipment operating in the Bay Area with newer, cleaner, retrofitted, or more efficient equipment. **Mitigation Measure 3.1-6: Assess Criteria Pollutant Emissions Associated with Site-Specific Operations and Implement BAAQMD Operational Emissions Mitigation Measures** As part of project-level CEQA analysis the operational impact from projects in the plan area shall be assessed by the project applicant in accordance with the State CEQA Guidelines Appendix G Checklist and compared to BAAQMD's thresholds of significance for project-level impacts. Project-specific mitigation measures for the proposed plan shall be implemented, based on the BAAQMD Mitigation Measures for Operational Emissions found in Appendix A, if necessary to reduce impacts to below a level of significance,.	
3.1b Construction-related NO_X emissions violating an air quality standard through exceedance of the BAAQMD 2010 standard of significance Operational ROG and NO_X emissions contributing	PS PS	Mitigation Measure 3.1-1; Mitigation Measure 3.1-2; Mitigation Measure 3.1-3; Mitigation Measure 3.1-4; Mitigation Measure 3.1-5; Mitigation Measure 3.1-6.	LTS LTS

Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures				
	Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
	substantially to an existing or projected air quality violation through exceedance of the BAAQMD 2010 standard of significance			
3.1c	Potential for construction-related and operational emissions of ozone precursors, criteria air pollutants, TACs, and odors to result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard	PS	Mitigation Measure 3.1-1; Mitigation Measure 3.1-2; Mitigation Measure 3.1-3; Mitigation Measure 3.1-4; Mitigation Measure 3.1-5; Mitigation Measure 3.1-6.	LTS
3.1d	Potential exposure of sensitive receptors to substantial concentrations of construction-related PM and TAC emissions Potential exposure of sensitive receptors to substantial concentrations of operational TAC emissions Potential exposure of sensitive receptors to carbon monoxide hotspot near roadways or intersections	PS PS	**Mitigation Measure 3.1-7: Assess Toxic Air Contaminant Emissions and Health Risks Associated with Site-Specific Construction.** As part of any project-level CEQA analysis, the health risk impacts of construction $PM_{2.5}$ and TAC concentrations from individual projects within the plan area shall be assessed by the project applicant in accordance with BAAQMD's CEQA Guidelines and Recommended Methods for Screening and Modeling Local Risks and Hazards, as necessary. If health risk impacts are determined to exceed BAAQMD thresholds of significance, BAAQMD's exhaust-related additional construction Mitigation Measure 3.1-3 shall be implemented to reduce impacts to a less-than-significant level. **Mitigation Measure 3.1-8: Assess Toxic Air Contaminant Emissions and Health Risks Associated with State-Specific Operations and Implement Applicable BAAQMD Health Risk Mitigation Measures** As part of any project-level CEQA analysis, $PM_{2.5}$ and TAC emission impacts of operational activities from individual projects in the plan area shall be assessed by the project applicant in accordance with BAAQMD's CEQA Guidelines	LTS LTS

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Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		and Recommended Methods for Screening and Modeling Local Risks and Hazards as necessary. If health risks are determined to exceed BAAQMD thresholds of significance, project-specific mitigation measures shall be implemented to reduce health risks to a less-than-significant level. Possible mitigation measures could include but are not limited to change in project land use orientation to locate them farther away from existing sensitive receptors, purchase of retrofits of ventilation systems for existing sensitive receptors, and change in land use type to develop a more compatible land use (i.e., non-TAC source). Mitigation measures shall be developed and implemented for significant operational impacts of PM and TAC emissions. Additional BAAQMD mitigation measures can be found in Appendix A. **Mitigation Measure 3.1-9: Assess Local and Community Hazard Risks Associated with Project-Specific Operation and Implement Applicable BAAQMD Community Risk and Hazard Mitigation** As part of any project-level CEQA analysis, health impacts of siting new receptors from individual projects within the plan area shall be assessed by the project applicant in accordance with BAAQMD's CEQA Guidelines and Recommended Methods for Screening and Modeling Local Risks and Hazards, as necessary. Once exact distances are known between new receptors and existing sources, the BAAQMD Health Risk Screening Tools and Distance Multipliers can be more accurately used to determine cancer risks and $PM_{2.5}$ concentrations. If health risks are determined to exceed BAAQMD thresholds of significance, project-specific mitigation measures shall be implemented to reduce health risks to a less-than-significant level. Possible mitigation measures could include but are not limited to	

Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		change in sensitive land use orientation to locate them farther away from TAC sources; increased ventilation system requirements for sensitive-receptor heating, ventilation, and air conditioning systems; and change in land use type to develop a more compatible land use (i.e., nonsensitive receptor). Appendix A provides a list of BAAQMD $PM_{2.5}$/TAC mitigation measures.	
3.1e Potential for construction activities to expose a substantial number of people to objectionable odors Potential for operational activities to expose a substantial number of people to objectionable odors	LTS PS	**Mitigation Measure 3.1-10: Assess Odors Associated with Project-Specific Operation and Implement Applicable BAAQMD Odor Mitigation Measures** As part of any project-level CEQA analysis, odor impacts from individual projects within the plan area shall be assessed by the project applicant in accordance with BAAQMD's CEQA Guidelines as necessary. Significant odor impacts shall be mitigated using best management practices and odor control technology to less than significant when feasible. The most likely odor sources to be sited within the plan area are restaurants and food services. BAAQMD odor mitigation for food service includes: • integral grease filtration system or grease removal system, • baffle filters, • electrostatic precipitator, • water cooling/cleaning unit, • disposable pleated or bag filters, • activated carbon filters, • oxidizing pellet beds, • incineration, • catalytic conversion, • proper packaging and frequency of food waste disposal,	LTS LTS

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Impacts	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
		and • exhaust stack and vent location with respect to receptors	
3.2 Biological Resources			
3.2a Potential adverse impacts on special-status plant species	PS	**Mitigation Measure 3.2-1: Conduct Site-Specific Botanical Surveys and Implement Protective Actions if Rare Plants are Identified** During the appropriate phenological periods, preconstruction rare plant surveys shall be conducted in areas where special-status plants have the potential to occur in construction areas. Developed areas will not be required to be surveyed, because of the lack of suitable habitat for rare plant species. Before the start of construction, the location of special-status plants shall be identified, then shall be marked or flagged for avoidance; or as appropriate, the limits of construction shall be marked between the plants and the construction area. If impacts on rare plants cannot be avoided, a qualified botanist shall oversee the collection of the upper 4 inches of topsoil in the areas where any identified special-status plant species would be affected. Once construction has been completed, the topsoil shall be stockpiled separately and restored to the general area of disturbance.	LTS
Potential loss of habitat and temporary disturbance of migratory birds	PS	**Mitigation Measure 3.2-2: Conduct Site-Specific Preconstruction Nesting Bird Surveys and Implement Protective Actions if Active Nests Are Detected** A preconstruction survey shall be conducted by a qualified biologist for nesting raptors and other special-status bird species a maximum of 2 weeks before the start of any new construction activities (i.e., ground clearing and grading, staging of equipment, ground disturbance) during the breeding season (February 1–August 31) so that no nesting	LTS

Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures

Impacts	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
		migratory birds are within or adjacent to the construction area. If active nests are found during the preconstruction survey, a no-disturbance buffer zone shall be created around active nests during the breeding season or until a qualified biologist has determined that the young have fledged. The no-disturbance buffer zone shall be a minimum of 250 feet from active raptor nests, 100 feet from special-status species, and 50 feet from non-special-status nesting bird species until the chicks have fledged. Reductions in the size of the buffer zones and or allowances of limited types of construction activities within the buffer zone shall be determined by a qualified biologist and shall be based on existing noise and human disturbance levels in the plan area and observed evidence of disturbance to birds.	
Potential for adverse effects on special-status fish, including mortality, caused by increases in water turbidity from runoff during near-stream construction	PS	**Mitigation Measure 3.2-3: Implement Site-Specific Natural Erosion Control Materials to Reduce the Potential for Entrapment of Special-Status Species** Plastic monofilament netting (e.g., erosion control matting or wattles) shall not be used in special-status species habitat, because wildlife can become trapped in the netting and it leaves plastic particles in the soil and water as it degrades. Appropriate fiber netting or similar natural materials (e.g., coconut coir matting) shall be used for erosion control or other purposes in sensitive areas, to reduce the potential for entrapping wildlife. Mitigation Measure 3.7-1; Mitigation Measure 3.7-2.	LTS
Potential disturbance of aquatic dispersal habitat for special-status amphibian species during construction	PS	**Mitigation Measure 3.2-4: Conduct Site-Specific Preconstruction Surveys and Implement Protective**	LTS

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Impacts		Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
			Actions if Special-Status Species Are Identified Preconstruction surveys for special-status species shall be conducted at active construction areas by a qualified biologist. However, construction areas that have a developed land cover type—including urban, residential, paved, or gravel areas—shall be surveyed at the discretion of a qualified biologist based on the potential for biological resources to be affected. In the event that a special-status species is encountered, all construction activities will stop within 50 feet of the individual. Construction activities will not resume until the individual has left the project area of its own volition. If a special-status species becomes trapped in a construction area, or does not leave the project area of its own volition, the appropriate resource agencies will be contacted to determine a course of action for species relocation.	
	Potential for construction activities to cause injury to the western pond turtle or for project activities to increase water turbidity and pollutants in western pond turtle aquatic habitat	PS	Mitigation Measure 3.2-3; Mitigation Measure 3.7-1; Mitigation Measure 3.7.2	LTS
3.2c	Potential for runoff or accidental spills to increase turbidity and pollutants that could degrade riparian areas	PS	Mitigation Measure 3.7-1; Mitigation Measure 3.7.2	LTS
3.2d	Potential for development to affect the movement of native resident or migratory fish or wildlife species or corridors or impede the use of native wildlife nursery sites	LTS	None required.	LTS

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Impacts		Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
3.2e	Potential construction-related loss of trees meeting the definition of “protected tree” under the City’s Zoning Ordinance and Municipal Code	PS	**Mitigation Measure 3.2-5: Prepare and Implement Site-Specific Tree Mitigation and Replacement Plans** Project applicants seeking to remove protected trees shall prepare a tree mitigation and replacement plan, in accordance with Division D5, “Resource Management,” of the City of Rohnert Park Zoning Ordinance. The plan shall include all of the following elements: (1) An inventory of trees planned for removal and any work planned within the dripline of protected trees; (2) Replacement of trees at a ratio agreed on with the City of Rohnert Park and in accordance with the tree protection ordinance; (3) The specific locations of the tree planting, including a map and planting plan; (4) Schedules and methodologies for maintaining and monitoring the success of the plan; and (5) Performance standards. This plan shall be reviewed and approved by the City before issuance of a site development permit, and the plan shall be implemented throughout project construction.	LTS
3.2f	Conflict with an adopted habitat conservation plan, natural community conservation plan, or other local, regional, or state habitat conservation plan that would apply to the plan	NI	None required.	NI
3.3	**Cultural Resources**			
3.3a	Substantial adverse change in the significance of a historical resource in the plan area	NI	None required.	NI

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	Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
3.3b,e	Potential for a substantial adverse change in the significance of an archaeological resource in the plan area	PS	**Mitigation Measure 3.3-1: Implement Site-Specific Procedures for Inadvertent Discovery of Cultural Resources** All appropriate federal, state, and local regulations regarding cultural resources shall be closely adhered to; these regulations contain measures that safeguard against significant impacts on cultural resources. Because of surface conditions, archaeological pedestrian surveys would be ineffective in most areas. If cultural resources are encountered during project implementation, the applicant shall notify the City of Rohnert Park, and all activity within 100 feet of the find shall halt until it can be evaluated by a qualified archaeologist. Prehistoric archaeological materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil (midden) containing heat-affected rocks, artifacts, or shellfish remains; and stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs); and battered stone tools, such as hammerstones and pitted stones. Historic-period materials might include stone, concrete, or adobe footings and walls; filled wens or privies; and deposits of metal, glass, and/or ceramic refuse. If the resource is Native American in origin and the archaeologist and a Native American representative determine that the resources may be significant and cannot be avoided, they shall notify the City of Rohnert Park and an appropriate treatment plan for the resources shall be developed by the applicant, in consultation with the City of Rohnert Park and the archaeologist. Measures in the treatment plan could include preservation in place (capping) and/or data recovery. The archaeologist shall consult with Native American representatives in determining appropriate treatment for prehistoric or Native American cultural resources. Ground	LTS

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Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
Potential for the inadvertent discovery of buried human remains	PS	disturbance shall not resume within 100 feet of the find until an agreement has been reached as to the appropriate treatment of the find. **Mitigation Measure 3.3-2: Implement Site-Specific Procedures for Inadvertent Discovery of Human Remains** If human remains, including disarticulated or cremated remains, are encountered during construction, all ground-disturbing activities within 100 feet of the discovery must immediately cease. PRC Section 5097.98, and Section 7050.5 of California Health and Safety Code require that the County Coroner be immediately notified when human remains are identified. The project proponent and City of Rohnert Park also must be immediately notified. If the County Coroner determines that the remains are Native American, the NAHC must be contacted within 24 hours, pursuant to Subdivision (c) of §7050.5 of the Health and Safety Code. The City of Rohnert Park shall consult with the Most Likely Descendent, if any, identified by the NAHC regarding excavation and removal of the human remains. The project proponent and appropriate agency should be responsible for approval of any recommended investigation and action, taking into account state law as presented in State CEQA Guidelines 15064.5(e) and PRC 5097.98. Before resumption of ground-disturbing activities within 100 feet of the human remains, all mitigation regarding the human remains shall be implemented. If removal of human remains is determined to be the appropriate mitigation, it shall be conducted by a qualified archaeologist with Native American burial experience.	LTS
3.3c Direct or indirect destruction of a unique	LTS	None required.	NI

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	Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
	paleontological resource or site or unique geologic feature during project-related earthmoving activities			
3.3d	Potential to result in an adverse change in the significance of a tribal cultural resource	NI	None required.	NI
3.4	**Geology, Soils, and Paleontology**			

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Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
3.4a.i. Exposure of people and property to surface fault rupture	LTS	None required.	LTS
3.4a.ii. Exposure of people and property to seismic ground shaking	PS	**Mitigation Measure 3.4-1: Prepare, Submit, and Implement Site-Specific Geotechnical Reports** As part of any project-level CEQA analysis within the plan area, the project applicant(s) of each site-specific project shall retain a licensed geotechnical engineer to prepare a final geotechnical report per California Building Standards Code and City requirements for the proposed facilities that shall be submitted for review and approval to the City of Rohnert Park. The final geotechnical engineering report shall address and make recommendations on the following: • seismic design parameters; • seismic ground shaking; • liquefaction; • expansive/unstable soils; • site preparation; • soil bearing capacity; • structural foundations, including retaining-wall design; • grading practices; and • soil corrosion of concrete and steel. In addition to the recommendations for the conditions listed above, the geotechnical investigation shall include subsurface testing of soil and groundwater conditions (as appropriate), and shall determine appropriate foundation designs that are consistent with the version of the CBC that is applicable at the time building and grading permits are	LTS

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Impacts	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
		applied for. All recommendations contained in the final geotechnical engineering report shall be implemented by the project applicant(s) of each site-specific project. Design and construction of all new project development shall be in accordance with the CBC. The project applicant(s) shall provide for engineering inspection and certification by a qualified geotechnical or civil engineer that earthwork has been performed in conformity with recommendations contained in the geotechnical report. Mitigation Measure 3.4-1.	
3.4a.iii. Exposure of people and property to seismic-related ground failure, including liquefaction	PS	None required.	LTS
3.4a.iv. Exposure of people and property to landslides	NI	None required.	NI
3.4b. Potential soil erosion or loss of topsoil	PS	Mitigation Measure 3.7-1, Mitigation Measure 3.7-2.	LTS
3.4c. Exposure of people and property to subsidence, compression, expansion, and liquefaction of unstable soils	PS	Mitigation Measure 3.4-1.	LTS
3.4d. Exposure of people and property to expansive soils that can result in damage to building foundations, underground utilities, and other subsurface facilities and infrastructure if not designed to resist damage	PS	Mitigation Measure 3.4-1.	LTS
3.4e. Inability of soils to support the use of septic tanks or alternative wastewater disposal during site-specific construction or occupation	NI	None required.	NI

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Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
3.5 Greenhouse Gas Emissions			
3.5a Generation of short-term and temporary exhaust-related GHG emissions during construction	PS	**Mitigation Measure 3.5-1: Assess GHG Emissions Associated with Project-Specific Construction and Alter Project Details and/or Construction Equipment as Needed** As part of any project-level CEQA analysis, project applicants are responsible for and shall assess and compare GHG emission impacts related to the construction of individual projects in the plan area with BAAQMD's thresholds of significance for project-level impacts. Potentially significant GHG impacts shall be mitigated to a less-than-significant level via implementation of all exhaust-related BAAQMD Basic or Additional Construction Mitigation Measures and alteration of project details and/or construction equipment. **Mitigation Measure 3.5-2: Purchase Carbon Offsets to Reduce Emissions** Following implementation of Mitigation Measure 3.5-1 (i.e., project-level analysis and comparison with BAAQMD's thresholds of significance), if construction or operational emissions are determined to continue to exceed BAAQMD's GHG threshold, the project applicant shall purchase carbon offsets to reduce the remaining emissions above the threshold. If at the time of the analysis BAAQMD has not yet developed a construction-related GHG threshold of significance, the project applicant shall coordinate with BAAQMD to determine a surrogate threshold. Any offset of project emissions shall be demonstrated to be real, permanent, verifiable, enforceable, and additional.	LTS

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Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		To the maximum extent feasible, as determined through coordination with BAAQMD, offsets shall be implemented locally. Offsets may include, but are not limited to, the following (in order of preference): (1) On-site offset of project emissions; for example, development of on-site renewable energy generation or a carbon sequestration project. Any on-site offset projects must be registered with the Climate Action Reserve or otherwise approved by BAAQMD to be used to offset project emissions. The number of offset credits produced would then be included in the annual inventory, and the net emissions calculations (i.e., with inclusion of offsets). (2) Funding of local projects, subject to review and approval by BAAQMD that will result in real, permanent, verifiable, enforceable, and additional reduction in GHG emissions. If BAAQMD or the City of Rohnert Park develops a GHG mitigation fund, the project applicant may instead pay into this fund to offset GHG emissions in excess of the significance threshold. (3) Purchase of carbon credits to offset emissions below the significance threshold. Only carbon offset credits that are verified and registered with the Climate Action Reserve, or available through a City-approved local GHG mitigation bank or fund, may be used to offset project emissions.	

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures				
	Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
	Generation of long-term operational emissions associated with the daily operational activities of plan land uses, including transportation, use of electricity and natural gas for lighting, cooling, and heating, and powering of machinery	PS	**Mitigation Measure 3.5-3: Assess GHG Emissions Associated with Project-Specific Operations and Alter Project Details as Needed** As part of any project-level CEQA analysis, project applicants are responsible for and shall assess and compare GHG emission impacts related to the operation of individual projects in the plan area to BAAQMD's thresholds of significance for project-level impacts (i.e., 1,100 MT CO_2e per year). Potentially significant GHG impacts shall be mitigated to a less-than-significant level via alteration of project details. Mitigation Measure 3.5-2.	LTS
3.5b	Conflict with a plan, policy, or regulation to reduce GHG emissions	LTS	None required.	LTS
3.6	**Hazards and Hazardous Materials**			
3.6a,b	Potential exposure to the storage, use, and transport of hazardous materials during project construction activities Potential risks from the storage, use, and transport of hazardous materials by future businesses and residents	LTS	None required.	LTS
3.6c	Hazardous emissions or handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school	LTS	None required.	LTS
3.6d	Off-site project location that is included in the list of hazardous material sites and could include contaminated soil and groundwater that could pose a significant hazard to the public or environment	LTS	None required.	LTS

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures

Impacts	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
On-site project location that is included in the list of hazardous material sites and could expose people (construction workers, future businesses, and employees and the public) to contaminated soil and/or groundwater, including indoor air quality effects from vapor intrusion	PS	**Mitigation Measure 3.6-1: Consult with the North Coast RWQCB and Sonoma County Environmental Health and Safety Prior to Development at Known Contamination Sites and Implement Consultation Recommendations** During the CEQA analysis for each project, the project applicant for any project to redevelop the known hazardous material contamination sites associated with 5600 State Farm Drive, 5750 Commerce Boulevard, and 600 Enterprise Drive shall consult with the North Coast RWQCB and Sonoma County Environmental Health and Safety to determine whether soil and groundwater remediation have been achieved to levels that would be protective of human health during construction and future operational activities at each site. Any applicable tests that may be required by the North Coast RWQCB prior to development, such as vapor intrusion studies related to indoor air quality or soil or groundwater testing, shall be conducted either by the project applicant or by the party responsible for site cleanup activities, as appropriate.	
Potential exposure to asbestos-containing materials or other hazardous materials or situations from the reuse and redevelopment of properties in the plan area, which have been developed with existing structures and may contain asbestos and lead-based paint	PS	**Mitigation Measure 3.6-2: Remove Project-Specific Asbestos-Containing Material and Lead-Based Paint in Accordance with Federal, State, and Local Regulations** The project applicant shall retain a Cal-OSHA certified asbestos consultant before reuse, remodeling, or demolition of any existing on-site buildings *that were constructed prior*	LTS

Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		to 1978 to investigate whether any ACMs or lead-based paints are present, and could become friable or mobile during demolition activities. If any materials containing asbestos or lead-based paints are found, they shall be removed by an accredited contractor in accordance with EPA, Cal-OSHA, and BAAQMD standards. In addition, all activities (construction or demolition) in the vicinity of these materials shall comply with Cal-OSHA asbestos and lead worker construction standards. The materials containing asbestos and lead shall be disposed of properly at an appropriate off-site disposal facility.	
3.6e,f Safety hazard for people residing or working within an airport land use plan or within 2 miles of a public airport or private airstrip	NI	None required.	NI

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures				
Impacts		**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
3.6g	Impaired implementation of or physical interference with an adopted emergency response plan or emergency evacuation plan	PS	**Mitigation Measure 3.6-3: Prepare and Implement Project-Specific Construction Traffic Control Plans.** The project applicant shall prepare and implement a traffic control plan for construction activities that may affect road rights-of-way, to facilitate travel of emergency vehicles on affected roadways. The traffic control plan must follow applicable City of Rohnert Park standards and must be approved and signed by a professional engineer. Measures typically used in traffic control plans include advertising of planned lane closures, warning signage, a flag person to direct traffic flows when needed, and methods to ensure continued access by emergency vehicles. During project construction, access to the existing land uses shall be maintained at all times, with detours used, as necessary, during road closures. The traffic control plan shall be submitted to the City for review and approval before the approval of all site-specific development plans or permits.	LTS
3.6h	Exposure of people or structures to risk of loss, injury, or death from fires, including wildlands adjacent to urban areas	LTS	None required.	LTS

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures				
	Impacts	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
3.7	**Hydrology and Water Quality**			
3.7a,f	Short-term, construction-related effects on water quality caused by erosion and sedimentation	PS	**Mitigation Measure 3.7-1: Prepare and Implement Site-Specific SWPPPs** During construction for any project within the plan area that disturbs 1 acre or more, the applicant or its consultant shall apply to the North Coast RWQCB for coverage under the Construction General Permit and prepare a site-specific SWPPP before any demolition, grading, or construction activities begin. The SWPPP shall cover pre- and post-construction activities and describe site-specific and construction phase-specific activities detailing the following: • activities that may cause pollutant discharge (including sediment); • BMPs, consistent with the requirements of the NPDES permit, to reduce the potential for contaminated runoff, such as limiting ground-disturbing activities during the winter rainfall period, minimizing exposure of disturbed areas and soil stockpiles to rainfall, and minimizing construction activities near or within drainage facilities; • erosion and sedimentation control measures to be implemented, such as soil stabilization, mulching, silt fencing, or temporary desilting basins; good housekeeping practices, such as road sweeping and dust control; and diversion measures, such as the use of berms to prevent clear runoff from contacting disturbed areas; and • hazardous materials spill prevention and response measure requirements, including lists of materials proposed for use, handling and storage practices, identification of spill response equipment, spill containment and cleanup procedures, and identification	LTS

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures

Impacts	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
		of regulatory notification protocols and contact phone numbers to be used in the event of a spill. The applicant shall implement the SWPPP, monitoring all BMPs and the parties responsible for them, in conformance with the guidelines set forth in the Construction General Permit.	
Effects on drainage patterns through conversion of existing undeveloped areas into developed, impervious areas	PS	**Mitigation Measure 3.7-2: Prepare, Submit, and Implement Site-Specific Erosion Control Plans** During any project construction in the plan area that requires a grading permit, the project applicant shall submit a site-specific erosion control plan (ECP) to the City of Rohnert Park City Engineer. All sites that will have grading activities are required to submit an ECP. The ECP shall include the placement of structural and nonstructural stormwater pollution prevention controls that prevent erosion during and after construction. Proper soil stabilization shall be required for all graded areas. A grading permit shall not be issued until all of the required data, including the ECP, have been submitted and approved. City of Rohnert Park Ordinance 798, Section 15.50.090, provides additional detail regarding excavation, grading, and filling regulations.	LTS

Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures				
	Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
3.7b	Potential construction-related reduction in groundwater infiltration and recharge and decrease in groundwater levels	LTS	None required.	LTS
	Potential for illicit discharges to the stormwater drainage system during construction dewatering activities if water is not properly stored and disposed of	PS	**Mitigation Measure 3.7-3: Prepare and Implement Site-Specific Provisions for Dewatering** The applicant for any project associated with the proposed plan, or the project applicant's consultant, shall prepare and implement provisions for dewatering during construction, in accordance with local and North Coast RWQCB requirements, to minimize adverse water quality impacts on surface water and groundwater. Provisions may include preparation of a dewatering plan that details procedures for removing groundwater, methods of temporary water treatment/retention facility, and water disposal procedures.	LTS
	Net gain in impervious surfaces that would interfere with on-site groundwater recharge from implementation of the proposed plan	LTS	None required.	LTS
3.7c	Potential for future development to alter drainage courses and runoff patterns from existing conditions	PS	Implement PDA Plan Policy L.7-1 and Mitigation Measures 3.7-1 and 3.7-2.	LTS
	Potential for plan area development to result in altered drainage patterns that could increase the potential for erosion, siltation, and associated adverse water quality effects on- or off-site	PS	Implement Mitigation Measures 3.7-1 and 3.7-2.	LTS

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures				
	Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
3.7d,e	Potential for grading and soil disturbance for placement of new structures on-site to substantially alter drainage courses and runoff patterns from existing conditions and result in flooding on- or off-site	PS	Implement Mitigation Measure 3.7-1.	LTS
	Net increase of impervious surfaces with implementation of the plan	PS	Implement Mitigation Measures 3.7-1 and 3.7-2.	LTS
3.7g	Placement of housing within a 100-year flood hazard area	NI	None required.	NI
3.7h	Placement of housing within a 100-year flood hazard area structures that would impede or redirect flood flows during construction or operation	NI	None required.	NI
3.7i	Exposure of people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam	NI	None required.	NI
3.7j	Potential for inundation by seiche, tsunami, or mudflow	NI	None required.	NI

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures				
	Impacts	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
3.8	**Noise**			
3.8a	Noise from project construction activities within or adjacent to the plan area	LTS	None required.	LTS
	Operational noise from off-site stationary sources, such as air conditioners, fans, and related equipment	LTS	None required.	LTS
	Noise from off-site traffic operations	LTS	None required.	LTS
	Noise from existing and future traffic on roads surrounding and within the plan area	PS	**Mitigation Measure 3.8-1: Prepare Site-Specific Interior Acoustical Analysis Reports and Implement Report Recommendations** As part of any project-level CEQA analysis, the project applicant shall have an acoustical analysis prepared by a qualified acoustical consultant for all new residential developments that are within 60 dBA Ldn or higher, to document that an acceptable interior noise level of 45 dBA Ldn or below will be achieved with the windows and doors closed. The report shall be submitted at plan check to the City for approval. **Mitigation Measure 3.8-2: Prepare Site-Specific Exterior Acoustical Analysis Reports and Implement Report Recommendations** Before the issuance of grading permits, an acoustical analysis report shall be prepared by a qualified acoustical consultant and submitted to the City Engineer for review.	LTS

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures			
Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
		The report shall indicate that the exterior noise levels at the residential outdoor uses, including outdoor courtyards and outdoor pool decks (except for private balconies), would be 60 dBA CNEL or lower. Methods to reduce the exterior noise may include a sound barrier or earth berms; setback from the roadways (i.e., buffer); or placing the outdoor spaces behind buildings, to reduce the traffic noise from adjacent roadway.	
3.8b Noise from SMART rail and station operation	LTS	None required.	LTS
Vibration from construction activities to off-site residential uses	LTS	None required.	LTS
Vibration from stationary mechanical and electrical equipment in the plan area	LTS	None required.	LTS
3.8c Substantial permanent increase in ambient noise levels in the plan area vicinity above levels existing without the proposed plan	LTS	None required.	LTS

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures				
	Impacts	**Significance Before Mitigation**	**Mitigation Measures**	**Significance After Mitigation**
3.8d	Substantial temporary or periodic increase in ambient noise levels in the plan area vicinity above levels existing without the proposed plan	PS	**Mitigation Measure 3.8-3: Restrict Construction Activity Timing and Construction Equipment Specifications and Location** Construction activities within 500 feet of residential use shall be limited to the hours of 8:00 a.m. to 6:00 p.m., in accordance with the City's Municipal Code. Power construction equipment shall be equipped with state-of-the-art noise shielding and muffling devices. All equipment shall be properly maintained to assure that no additional noise attributable to worn or improperly maintained parts would be generated. Stationary-source construction equipment that may have a flexible specific location on-site (e.g., generators and compressors) shall be located to maintain the greatest distance from sensitive land uses, and unnecessary idling of equipment shall be prohibited.	LTS
3.8e	Exposure of people working or residing in the plan area to excessive noise levels, for projects located within an airport land use plan or located within 2 miles of a public airport	NI	None required.	NI
3.8f	Exposure of people working or residing in the plan area to excessive noise levels, for projects located within the vicinity of a private airstrip	NI	None required.	NI
3.9	**Transportation and Traffic**			
3.9a	Potential for traffic impacts on the plan area street network from construction activities	LTS	None required.	LTS
	Potential impacts on intersection operations in the plan area	PS	Implement the intersection improvements in Table 3.9-6 of Section 3.9, "Transportation and Traffic."	LTS

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Table ES-1: Central Rohnert Park Priority Development Area Plan Summary of Project Impacts and Mitigation Measures

Impacts		Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
	Potential impacts on freeway operations in the plan area	S	No feasible mitigation exists.	SU
3.9b	Conflict with an applicable congestion management program established by the county congestion management agency for designated roads or highways	LTS	None required.	LTS
3.9c	Change in air traffic patterns that results in substantial safety risks	NI	None required.	NI
3.9d	Substantial increase in hazards due to a design feature (e.g., sharp curves or dangerous intersections)	NI	None required.	NI
3.9e	Inadequate emergency access	LTS	None required.	LTS
3.9f	Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities or decrease in the performance or safety of such facilities	LTS	None required.	LTS

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1.0 INTRODUCTION

This environmental impact report (EIR) for the proposed Central Rohnert Park Priority Development Area Plan (plan) has been prepared in accordance with, and complies with, all criteria, standards, and procedures of the California Environmental Quality Act (CEQA) of 1970 as amended (Public Resources Code [PRC] Section 21000 et seq.) and State CEQA Guidelines (California Code of Regulations, Title 14, Section 15000 et seq.). Per Section 21067 of CEQA and Sections 15367 and 15050 through 15053 of the State CEQA Guidelines, the City of Rohnert Park (City) is the lead agency under whose authority this document has been prepared. As an informational document, this EIR is intended for use by the City of Rohnert Park decision makers and members of the general public in evaluating the potential environmental effects of the proposed plan.

1.1 ENVIRONMENTAL REVIEW PROCESS—CEQA COMPLIANCE

An EIR is an informational document used by a lead agency (in this case, the City of Rohnert Park) when considering approval of a project or plan. The purpose of an EIR is to provide public agencies and members of the general public with detailed information concerning the environmental effects associated with the implementation of a project. An EIR should analyze the environmental consequences of a project or plan, identify ways to reduce or avoid potential environmental effects resulting from the project or plan, and identify alternatives to the project or plan that are capable of avoiding or reducing impacts. CEQA requires that all state and local government agencies consider the environmental consequences of projects or plans over which they have discretionary authority. This EIR provides information to be used in the planning and decision-making process. It is not the purpose of an EIR to recommend approval or denial of a project or plan.

Prior to approval of the proposed plan, the City, as lead agency and the decision-making entity, is required to certify that the EIR has been completed in compliance with CEQA, that the information in this EIR has been considered, and that the EIR reflects the independent judgment of the City. CEQA requires decision makers to balance the benefits of a project or plan against its unavoidable environmental consequences. If environmental impacts are identified as significant and unavoidable, the City may still approve the project or plan if it finds that social, economic, or other benefits outweigh the unavoidable impacts. The City would then be required to state in writing the specific reasons for approving a project or plan based on information in the EIR and other information sources in the administrative record. This reasoning is called a “statement of overriding considerations” (PRC Section 21081 and State CEQA Guidelines Section 15093).

In addition, the City as lead agency must adopt a mitigation monitoring and reporting program (MMRP) describing the measures that were made a condition of project approval in order to avoid or mitigate significant effects on the environment (PRC Section 21081.6; State CEQA Guidelines Section 15097). The MMRP is adopted at the time of project or plan approval and is designed to ensure compliance with the project description and mitigation measures of the EIR during and after project or plan implementation. If the City decides to approve the proposed plan, it would be responsible for verifying that implementation of the MMRP for this plan occurs.

The EIR will primarily be used by the City during approval of future discretionary actions and permits.

1.2 PURPOSE AND LEGAL AUTHORITY

Notice of Preparation and Scoping Meeting

Consistent with the requirements of CEQA, a good-faith effort has been made during the preparation of the EIR to contact all responsible and trustee agencies; organizations; persons who may have an interest in the proposed plan; and all government agencies, including the Governor's Office of Planning and Research, State Clearinghouse. This includes the circulation of a Notice of Preparation (NOP) on October 29, 2015, which began a 30-day comment period that ended on November 30, 2015. Two comment letters were received on the NOP from the Sonoma County Permit and Resource Management Department and the California Department of Transportation during this time.

The NOP and the comment letters are included in this document as Appendix I.

A scoping meeting was held on November 18, 2015, starting at 4:00 p.m. at Rohnert Park City Hall, 130 Avram Avenue, Rohnert Park, to inform the public about the proposed plan and receive comments. No individuals provided comments on the content of the Draft EIR at the scoping meeting.

In reviewing the proposed plan, the City determined that it could result in potentially significant environmental impacts. Through this process, the City identified potentially significant environmental impacts associated with the following issues:

- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology/Water Quality
- Noise
- Transportation/Traffic

Public Review

The City filed a Notice of Completion with the State Clearinghouse, indicating that this Draft EIR has been completed and is available for review. A Notice of Availability of the EIR has been published concurrently with distribution of this document. This Draft EIR is being circulated for a 45-day public review and comment period. During this period, comments from the general public, organizations, and agencies regarding environmental issues identified in the EIR and concerning the EIR's accuracy and completeness may be submitted to the lead agency at the following address:

Jeffrey Beiswenger
130 Avram Avenue
Rohnert Park, CA 94928

or

JBeiswenger@rpcity.org

In addition, the Draft EIR and all related technical appendices are available for review during the public review and comment period in the office of the Development Services Department, Planning Division at 130 Avram Avenue, Rohnert Park, CA 94928. Copies of the Draft EIR are also available at the following location:

Rohnert Park–Cotati Regional Library
6250 Lynne Condé Way
Rohnert Park, CA 94928

Comments may be made on the EIR in writing before the end of the comment period. The City will prepare written responses to comments made in writing. Upon completion of the public review and comment period, a Final EIR will be prepared and will include the comments on the Draft EIR received during the formal public review period and responses to those comments.

1.3 PROJECT HISTORY

Rohnert Park was established in 1956 as a master-planned city modeled on the neighborhood unit concept. This concept emphasized the development of the city as a series of neighborhood units, each with single-family residences organized around a centrally located school and park. Commercial areas were planned on the periphery of each neighborhood unit, placing commercial uses farther away from homes and making access to community shopping areas by automobile more convenient. The city was developed without a central downtown; thus, commercial shopping centers within the plan area have served as de facto meeting places for the community.

Before plans for the arrival of Sonoma-Marin Area Rail Transit (SMART) rail service to Rohnert Park, the City was engaged in the planning and development of a city center as a unique community gathering place that would become the heart of Rohnert Park. The City Center concept was identified in the 1995 General Plan for Rohnert Park as a long-term revitalization project, and in 1998, the City hired the firm of Moore Iacofano Goltsman to prepare a concept plan for the City Center. The *Rohnert Park City Center Concept Plan* (Figure 1-1) was adopted in 2002. Since then, the City has worked on the revitalization of the City Center, which now includes a community library, a public safety building, neighborhood commercial uses, a civic plaza, and new affordable live/work housing along City Center Drive and State Farm Drive.

In 2011, the State Farm Insurance campus closed its doors. The sale of the State Farm campus presented the City with a redevelopment opportunity to expand and create a vibrant core for Rohnert Park next to other investments made for its City Center. Thus, in 2012, the City petitioned and was granted the green light to relocate the Rohnert Park SMART rail station from Roberts Lake Road (the site approved and evaluated in the 2005 draft and 2006 final EIR) to an area south of Rohnert Park Expressway, next to the State Farm campus, on the west. In 2012, the Rohnert Park Expressway Station Project CEQA Addendum was prepared to evaluate the potential impacts of this proposed relocation. The next year, the City was awarded a PDA planning grant to prepare the PDA master plan (the PDA Plan) and supporting environmental document for Central Rohnert Park, centered on the SMART rail station, which is expected to begin service in 2016.

The PDA program implements *Plan Bay Area*, the region’s land use and transportation plan and sustainable communities strategy, by supporting the development of a more compact and sustainable land use pattern through support of PDAs in Bay Area comunities as focused locations for housing and job growth. The program focuses on increasing transit ridership, intensifying land uses in existing communities near transit stops and services, and.

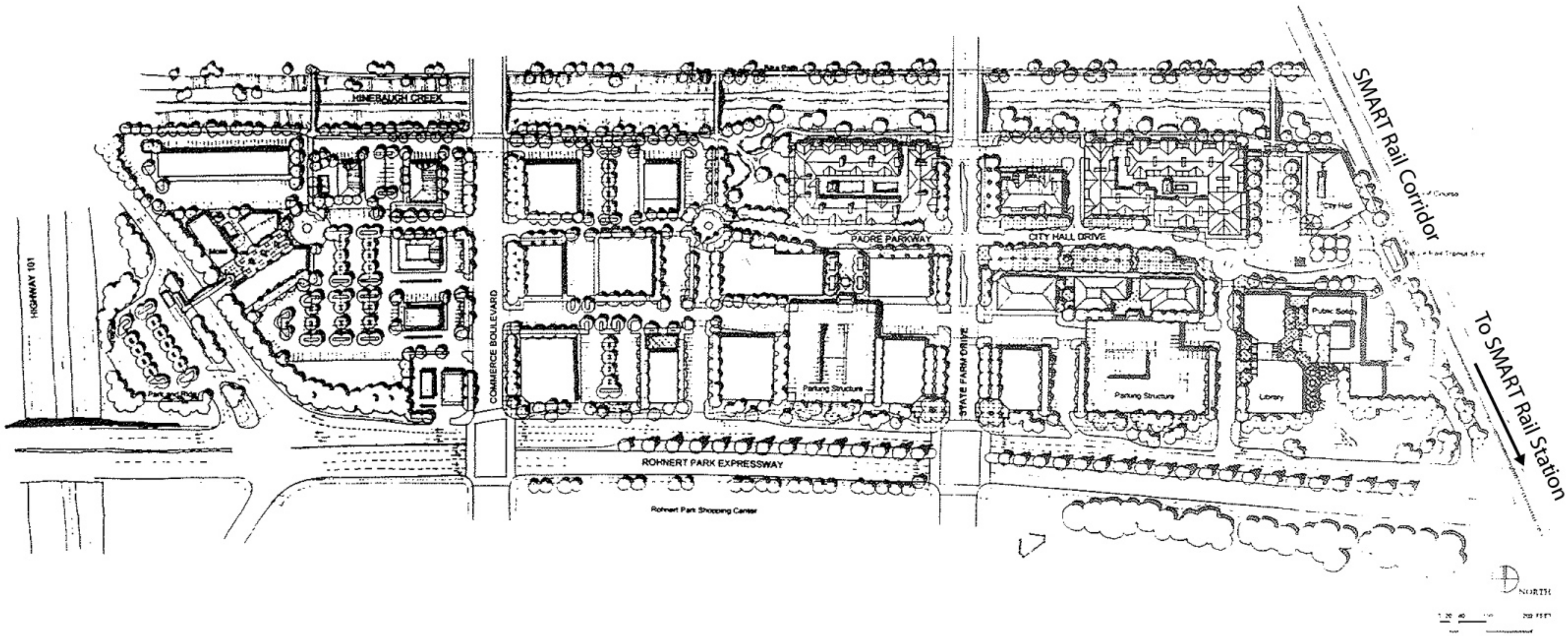

Figure 1-1: Rohnert Park City Center Concept Plan

planning for complete communities that increase the range of housing, jobs, shops and services, and transportation choices, all while supporting development efforts in local Bay Area communities, including the creation of a downtown in Rohnert Park.

The approximately 330-acre Central Rohnert Park plan area embodies such opportunities. This plan area encompasses an existing area rich with housing and services, the SMART rail station, a developing City Center, and opportunities for infill on vacant and underutilized buildings and properties, including the State Farm Insurance campus site. The planning process for Central Rohnert Park began in 2013, with AECOM selected to lead the development of the Central Rohnert Park PDA Plan and the environmental assessment for the proposed plan

1.4 STRUCTURE OF THE EIR

This EIR is divided into the following chapters and appendices:

- Chapter 1.0, “Introduction,” provides introductory information, including the history of the proposed plan, and the lead agency for the proposed plan.
- Chapter 2.0, “Project Description,” presents a detailed discussion of the location, setting, and characteristics of the plan area, the plan objectives, the principal plan features, environmental review requirements, and cumulative projects to be considered.
- Chapter 3.0, “Environmental Setting and Impacts,” contains individual sections for nine environmental resource areas that describe existing conditions, detail the regulatory framework, and assess the potential environmental impacts of the proposed plan. When the analysis identifies potentially significant effects, mitigation measures are presented. Implementing these measures would reduce potentially significant impacts to less-than-significant levels whenever feasible.
- Chapter 4.0, “Other CEQA-Required Sections,” describes the significant and unavoidable environmental impact of the proposed plan, as well as the significant irreversible environmental changes that would result from plan implementation.
- Chapter 5.0, “Effects Found Not To Be Significant,” discusses the nine environmental issue areas for which the City determined during its environmental review that the proposed plan would not cause any potentially significant impacts under CEQA.
- Chapter 6.0, “Alternatives,” presents the objectives of the proposed plan and summarizes its significant effects, describes the alternatives selected for evaluation, and compares the effects of the alternatives to those of the proposed plan. This chapter also identifies the environmentally superior alternative, as required by CEQA.
- Chapter 7.0, “List of Preparers,” identifies City staff and consultants who helped prepare this document.
- Appendices provide additional information regarding multiple issues discussed throughout this document.

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2.0 PROJECT DESCRIPTION

The City of Rohnert Park (City) is proposing the Central Rohnert Park Priority Development Area (PDA) Plan, covering a 330-acre area in the center of Rohnert Park bounded by Golf Course Drive to the north, Avram Avenue to the south, U.S. Highway 101 (U.S. 101) to the west, and the Sonoma-Marin Area Rail Transit (SMART) rail corridor to the east (Figure 2-1). The planned SMART commuter rail station, a segment of the SMART Multi-Use Path (MUP), and the city's developing City Center area are located within the plan area.

The Central Rohnert Park PDA Plan (referred to in this document as the "PDA Plan" or "proposed plan") is funded by the Association of Bay Area Governments' PDA planning grant program and is intended to support transit-oriented and infill development in existing communities, particularly adjacent to transit. The plan area is primarily commercial and light industrial, with multifamily housing along the southern boundary and urban housing in mixed-use buildings within the City Center. The plan area is envisioned as a central business district, urban neighborhood, and new downtown area for the city with new mixed-use infill areas, redevelopment of vacant buildings and sites, and streetscape and other public-realm improvements.

The proposed plan consists of various development types: multifamily residential units; retail/service commercial, public institutional, office, and light industrial uses; public park facilities; and open space. The plan proposes modifications to existing roadways; new roadways at certain key sites to provide greater connectivity; improvements to transit, bicycle, and pedestrian facilities; and corresponding circulation connections. The aim is to improve nonvehicular access in the plan area, connect to and complete regional trails, and support the development of existing and new mixed-use areas of the community, with a particular focus on providing community access to the SMART rail station and MUP.

This chapter provides a detailed description of the proposed plan: the location, setting, and characteristics of the plan area; the objectives of the proposed plan; principal plan features; environmental review requirements; and cumulative projects to be considered. A full copy of the Public Review Draft is on the City's website at: http://www.rpcity.org/index.aspx?page=864.

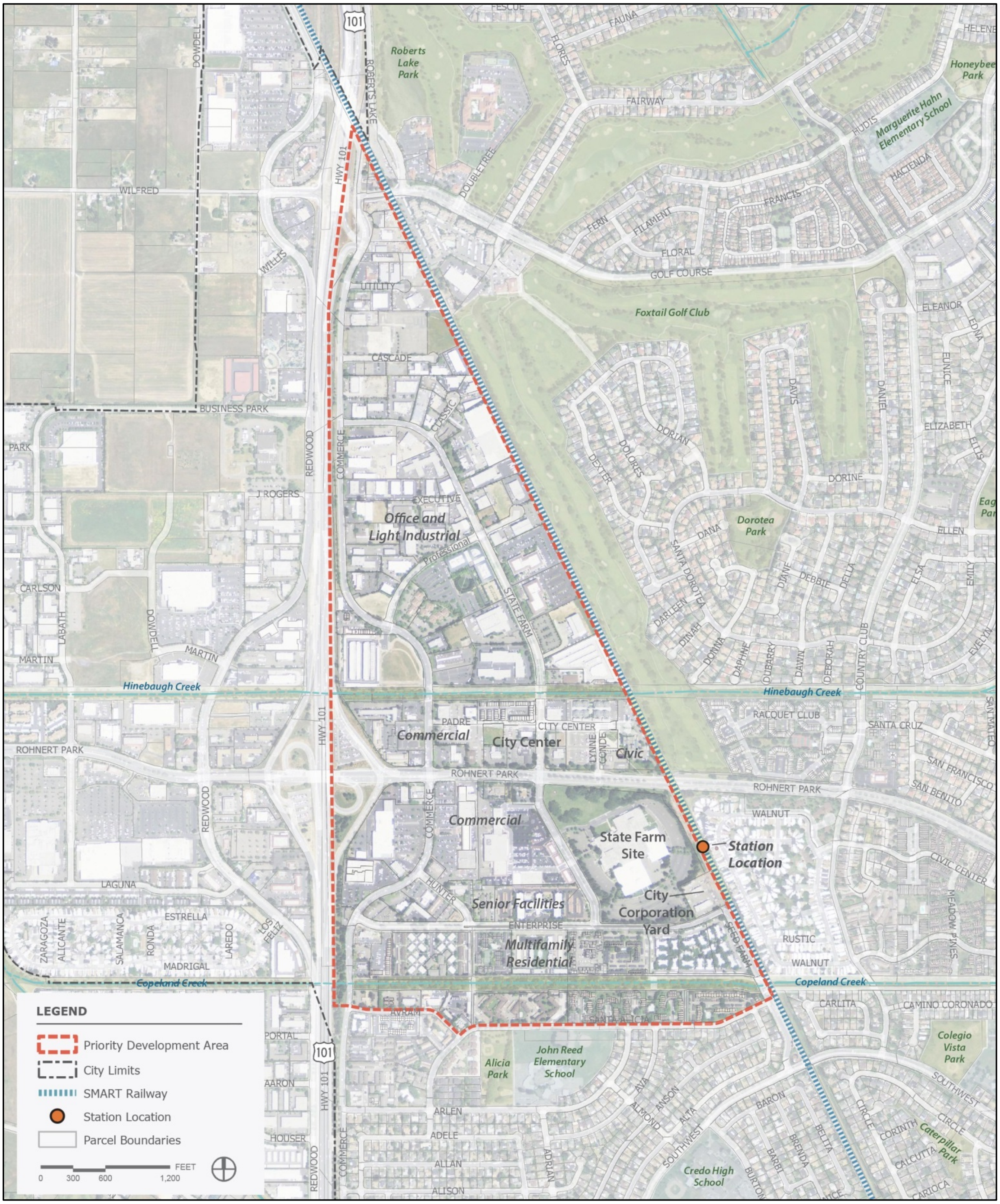
2.1 LOCATION AND SETTING OF THE PLAN AREA

2.1.1 Regional Location

The plan area lies entirely within the Rohnert Park city limits in central Sonoma County, east of U.S. 101. The city is located approximately 50 miles north of San Francisco (Figure 2-2). Regional access to the plan area is provided by U.S. 101, from the Rohnert Park Expressway (RPX) and Golf Course Drive exits. The city is designated as one of 10 Sonoma County stops on the planned SMART rail line and adjacent bicycle/pedestrian MUP, following the historic Northwestern Pacific Railroad line. The SMART rail line and MUP will connect the major cities of Sonoma and Marin Counties, along U.S. 101 from Cloverdale to the Larkspur Ferry Terminal.

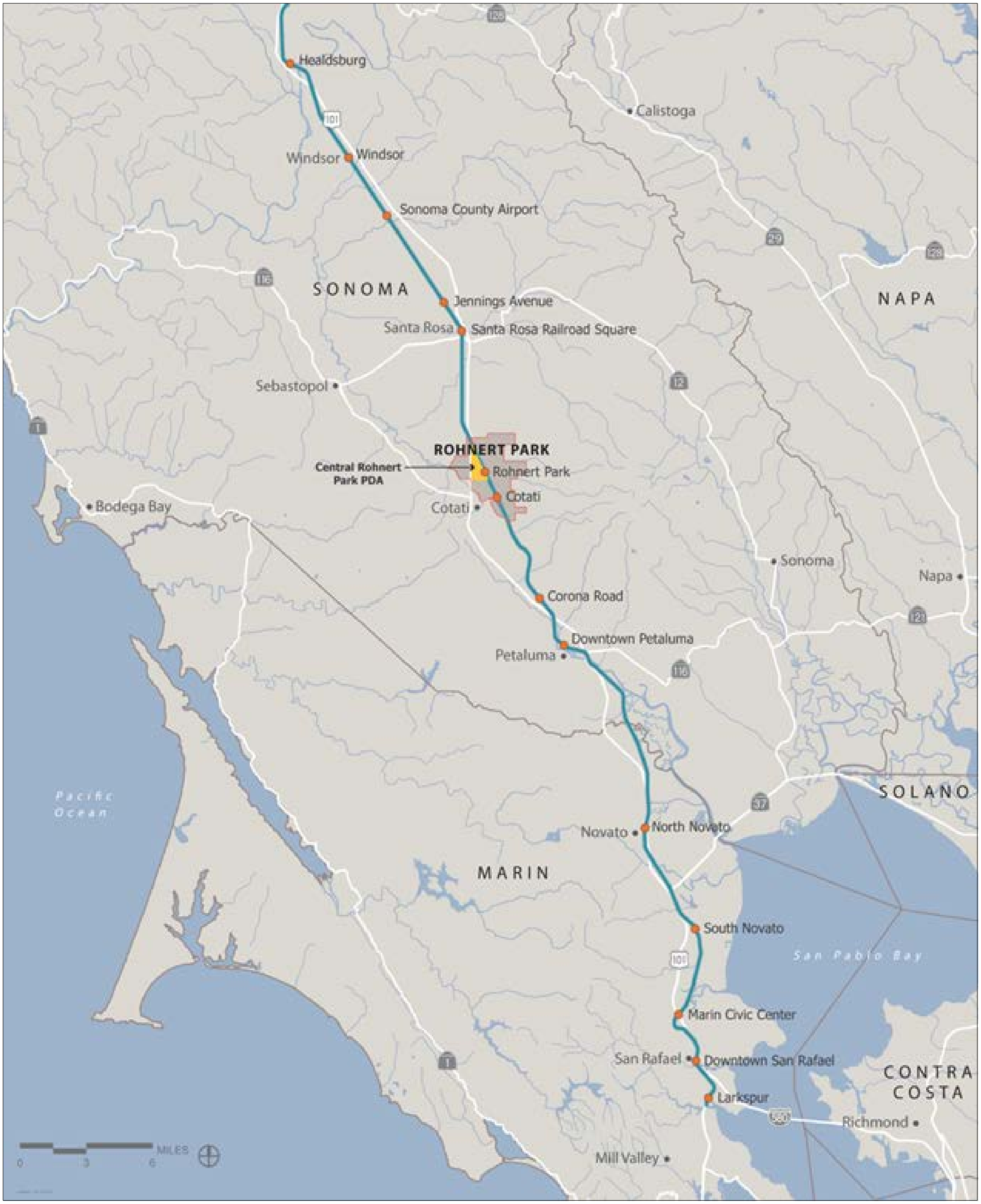
2.1.2 Local Setting

Figure 2-1 shows the plan area and surrounding development. The triangle-shaped plan area is bounded on the west by U.S. 101, on the east by the SMART rail line, and on the south by Avram Avenue/Santa Alicia Drive. Surrounding uses include the Foxtail Golf Course and a mobile home park to the east; an elementary school,



Sources: Data provided by City of Rohnert Park and compiled by AECOM in 2014

Figure 2-1: Local Setting



Sources: Data provided by City of Rohnert Park and compiled by AECOM in 2014

Figure 2-2: **Regional Location**

public park, and combination of single-family and multifamily residential uses to the south; and commercial and light industrial uses to the west.

2.1.3 Plan Area Character

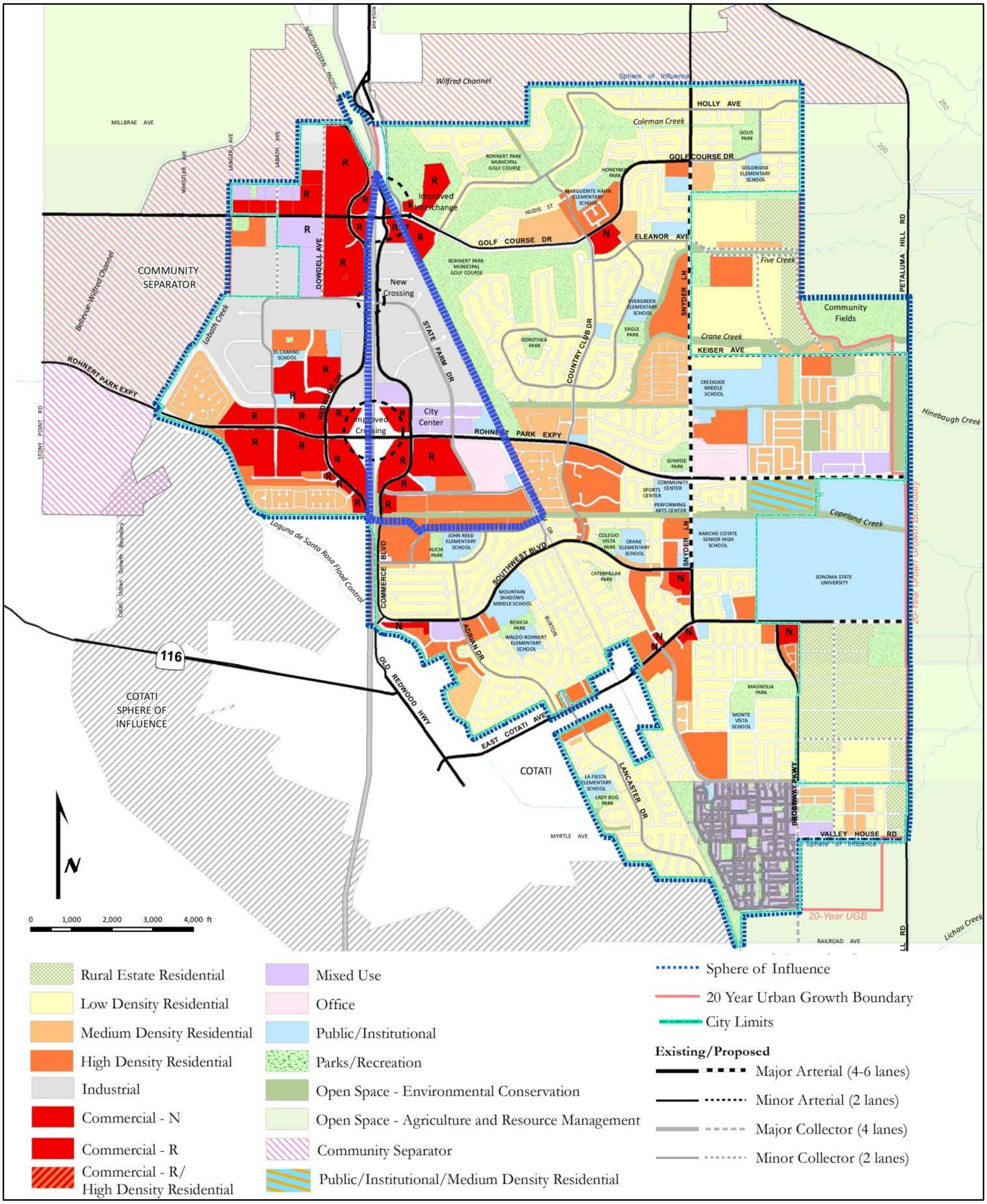
The approximately 330-acre plan area is primarily developed land, containing the existing City Center, multifamily residential uses, office and light industrial uses, and commercial uses, including three large suburban shopping centers with grocery store anchors. In addition, two natural drainages (Hinebaugh Creek and Copeland Creek) run generally east-west through the plan area, near its center and southern portions, respectively. Existing bicycle and pedestrian trails follow these creek corridors. The SMART MUP, when complete, will create a north-south bicycle trail connection through the full length of the plan area. The new SMART rail station is being constructed and when complete, will create a focal point for the plan area. It is anticipated to begin service in late 2016.

The northern portion of the plan area, north of Hinebaugh Creek, contains primarily light industrial and office uses. The central portion, between Copeland and Hinebaugh Creeks, consists mainly of a mix of commercial retail, service, and office uses, with live/work and multifamily residential uses. The southern portion of the plan area, between Enterprise Drive and Avram Avenue/Santa Alicia Drive, is predominantly multifamily residential.

2.1.4 General Plan Land Use Designations

Under the *City of Rohnert Park General Plan* (City of Rohnert Park, 2015 [originally adopted 2000]), the plan area, identified in the blue dashed boundary, includes the following six land use designations (Figure 2-3):

- **High Density Residential**, which permits a wide range of housing types, including single-family attached and multifamily developments at densities ranging from 12.1 to 24 units per gross acre. A 25 percent density bonus is permitted for all residential projects meeting state criteria for affordable housing bonuses.
- **Office**, which includes administrative, financial, business, professional, medical, public, and supporting commercial uses, with a maximum floor area ratio (FAR) of 1.0.
- **Regional Commercial**, which permits shopping centers typically made up of department stores, big-box stores, and other retail operations that attract consumers from outside the city.
- **Mixed-Use**, which accommodates a variety of compatible businesses, stores, institutions, service organizations, and residences in a pedestrian-oriented setting, with a maximum FAR of 1.5 for a mix of nonresidential uses and a maximum FAR of 2.0 for combined residential and nonresidential uses.
- **Public/Institutional**, which provides for schools, government offices, transit sites, religious facilities, and other facilities with a unique public character.
- **Industrial**, which allows for campus-like environments for corporate headquarters, research and development facilities, offices, light manufacturing and assembly, industrial processes, warehousing, storage and distribution, service commercial, and ancillary retail uses, with a maximum FAR of 0.5 but permits up to a 1.0 FAR with discretionary review and approval.



Source: City of Rohnert Park General Plan, 2014

Figure 2-3: Existing General Plan Designations

- **Open Space for Environmental Conservation** includes sites with environmental and/or safety constraints: riparian corridors, sensitive habitats, and wetlands. Development on sites entirely within this designation is limited to one housing unit per existing legal parcel. For parcels partially within this designation, no development is permitted within the Open Space designated area. For parcels that include creekside buffers, development rights that would result if adjacent land uses were to be extended into a buffer can be transferred for land in the buffer, directly accessible to the public, subject to a maximum 10-foot depth, on an acre-for-acre basis, to the developable parts of the parcel.

2.1.5 Zoning

The plan area is currently zoned as shown in Table 2-1.

Table 2-1: Existing General Plan and Zoning Classifications

Zoning Districts	Corresponding General Plan Districts	Maximum Densities (units/acre)/ Intensities (FAR)	Maximum Building Coverage (percent)	Approximate Zoned Area (gross acres)	Percentage of the Plan Area
Office Commercial (C-O)	Office	1.0 FAR	50%	29.9	9.0%
Regional Commercial (C-R)	Regional Commercial	0.4 FAR[1]	60%	60.2	18.1%
Industrial (I-L)	Industrial	0.5 FAR[2]	60%	52.7	15.9%
Industrial with Office Overlay (I-L/O)	Industrial	0.5 FAR[2]	60%	73.1	22.0%
Mixed-Use (M-U)	Mixed-Use	24 units/acre	80%	29.0	8.7%
Open Space–Environmental Conservation (OS-EC)	Open Space–Environmental Conservation	[3]	N/A	16.6	5.0%
Public/Institutional (P-I)	Public/Institutional	0.5 FAR	50%	10.7	3.2%
High Density Residential (R-H)	High Density Residential	24 units/acre[4]; 1.15 FAR	40%	60.3	18.1%
Totals				332.5	100.0%

Notes:
FAR = floor area ratio; N/A = not applicable
1 An FAR of 1.5 is allowed for hotel and motel uses in the C-R district.
2 An FAR of 1.0 is allowed for industrial projects that are approved by the Planning Commission and meet criteria set forth in design guidelines approved by the City of Rohnert Park.
3 A density of 1 unit per acre is allowed in the developable portion of any property in the OS-EC district.
4 General Plan standards permit up to 24 units per acre. The Zoning Ordinance shows a density of 30 units per acre and has not been updated to be consistent with the General Plan maximum permitted density.

Source: Data compiled by AECOM in 2015

2.2 PLAN OBJECTIVES

As part of the PDA planning process, the City has conducted an extensive public outreach program, including numerous public workshops that engaged citizens, property and business owners, developers, outside agencies, all City departments, and decision makers (Planning Commission and City Council). From these meetings, a common voice was heard supporting the creation of a downtown as a priority focus for the City. As part of the PDA Plan, the City is finalizing a vision for a future downtown area that will include a vibrant mix of stores, offices, and housing. In addition to the desire for a downtown, comments were supportive of creating a connected, mixed-use environment throughout the plan area. Out of this outreach process emerged a vision with the following City objectives:

- Support the creation of a Downtown for Rohnert Park. Downtown should have the following features:
  - A distinct character that embraces the community's existing assets (including redwood tree–lined streets, creek trail corridors, neighborhood sections with distinct centers, and rich cultural and recreational amenities).
  - A pedestrian-oriented development pattern, with a walkable street grid, a compact building footprint, and plenty of community open space.
  - A mix of uses, with emphasis on lifestyle and specialty retail, entertainment, urban-style living options, public spaces, and other transit-supportive uses (e.g., jobs, housing, and retail).
  - A variety of public spaces to serve the community.
- Take advantage of the transit-oriented opportunities adjacent to the SMART rail station to establish distinct subareas with unique community roles.
- Focus growth around the one-half mile radius of the SMART rail station, as guided by the transit-oriented development objectives of the PDA, Focusing Our Vision (FOCUS) program and regional guidance provided by the Metropolitan Transportation Commission's *Station Area Planning Manual* (MTC, 2007). The *Station Area Planning Manual* identifies Rohnert Park as a "Transit Town Center" place type, defined as a local-serving economic and community activity center with a mix of single-family and multifamily housing and neighborhood serving retail, employment, and civic uses.
- Create and reinforce a consistent urban design theme and identity for Central Rohnert Park and the Downtown District.
- Support the transition of the Triangle Business subarea from primarily light industrial uses to a mixed-use business environment, with a mix of light office, light industrial, and more retail and service uses.
- Support transit ridership by promoting new infill growth in the plan area, focused within the one-half-mile radius of the SMART rail station.
- Plan for transportation improvements, including bus or other circulation opportunities and additional transit stops, to connect the community to SMART rail service and the plan area centers.
- Support City General Plan Goals TR-I, TR-K, TR-L, and TR-R and Policies TR-24-TR-34, TR-41, and TR-42 to reduce traffic congestion by encouraging transportation demand management programs for businesses and workplaces and parking standards that help reduce automobile trips, and promoting alternative transportation modes.

- Support safe and convenient transit, bicycle, and pedestrian travel modes and connections within the plan area.
- Improve the safety of crossing the railroad tracks and roadways that serve as neighborhood barriers (i.e., the SMART rail line and RPX).
- Continue to improve creek corridors as major east-west travel routes serving the community and support their future connections to the planned SMART MUP.
- Provide a safe and continuous bike and pedestrian trail network, integrated with transit and providing connections to and within the existing shopping centers, commercial areas, and employment centers.
- Support investment in placemaking strategies, such as public plazas, sidewalk and landscape improvements, bike/pedestrian connections, and gateway and district wayfinding signage.

2.3 PLAN CHARACTERISTICS

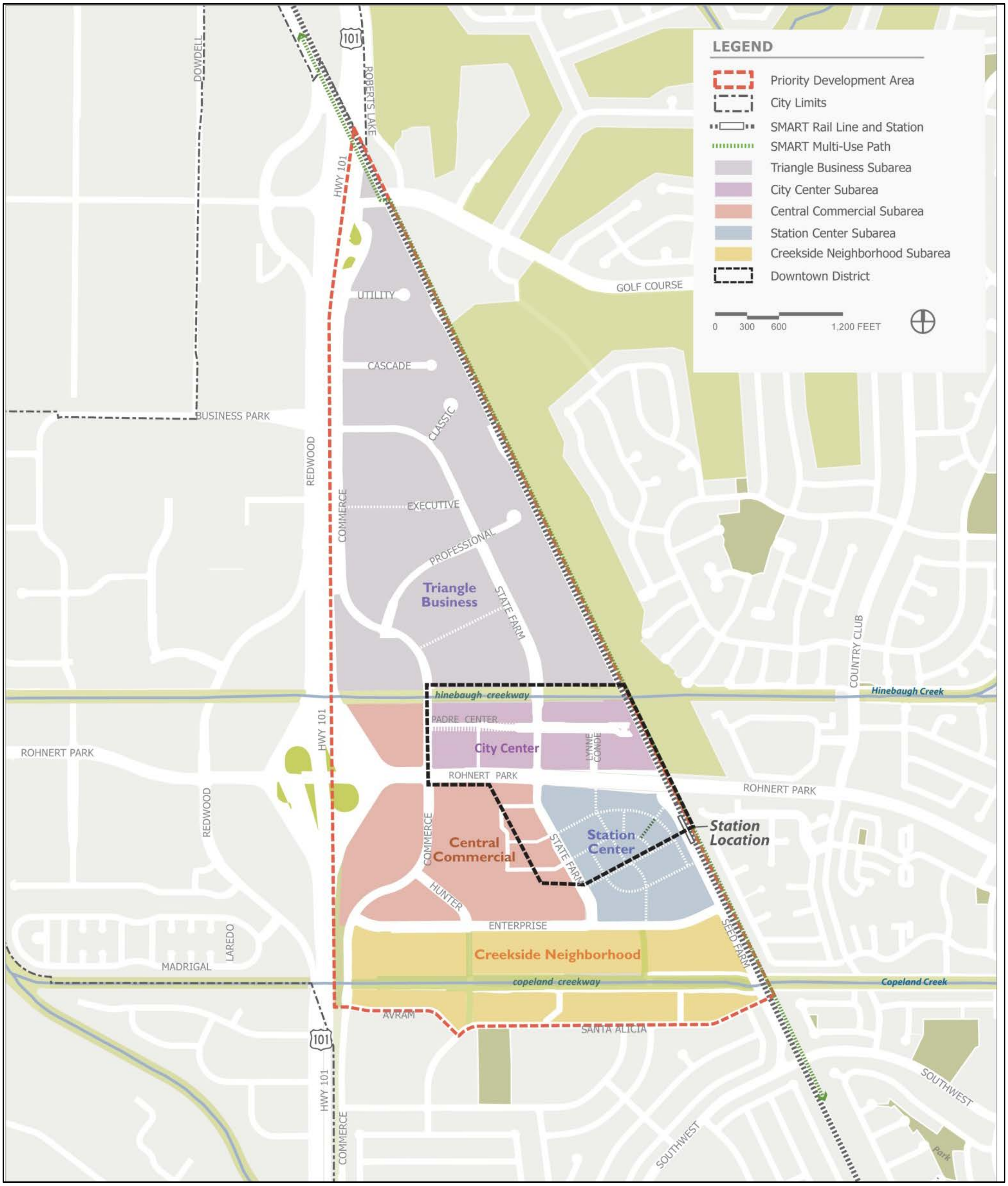
The PDA Plan requires City Council approval as well as General Plan and zoning amendments. Development of the proposed uses would include minimal grading because the plan area is generally flat and mostly developed. Some existing buildings would be demolished to accommodate new infill uses. The existing Copeland Creek and Hinebaugh Creek drainages would not be disturbed as part of plan implementation. The PDA Plan is a programmatic land use master plan; therefore, individual developments that could occur in the future in the plan area would undergo project-level environmental evaluation to determine whether they could result in further impacts specific to the development proposal. Construction-level analyses, if determined necessary, would be conducted at that time.

2.3.1 Proposed General Plan and Zoning Designations

For planning purposes, the plan area is organized into five subareas: Triangle Business, City Center, Station Center, Central Commercial, and Creekside Neighborhood (Figure 2-4). In addition, a downtown district called the Downtown District Amenity Zone (DDAZ), which would encompass several subareas (Figure 2-4), is proposed to implement the community’s vision for a compact, walkable downtown area that is unique to the city. The DDAZ would be the focus of investment in the plan area to support the development of a downtown area that is connected internally across RPX and State Farm Drive and encompasses the SMART rail station.

Creating a downtown environment in the city is recognized as a long-term investment that would occur as properties develop and public- and private-sector investment occurs. To reinforce these priorities, a DDAZ that ties together the subareas in terms of walkability is intended to help focus investments into Downtown, including amenities (e.g., benches, plazas, signage, and lighting). The subareas and DDAZ support the community’s needs for diverse retail experiences, jobs, services, housing, and attractive places to live, work, and play.

The plan area would be zoned as shown in Table 2-2 and Figure 2-5 and described in the following sections. Zoning district changes are not necessary to support the small infill growth and reuse opportunities that may occur in the plan area’s more established community subareas—the Creekside Neighborhood, Central Commercial, and City Center subareas. However, to enhance the potential for future infill growth in the plan area, updates to development standards for the Downtown High Density Residential (DTR-H) and Downtown Mixed-Use (DTM-U) zoning designations specific to the plan area are proposed that allow the following maximum permitted densities:



Source: Data compiled by AECOM in 2015

Figure 2-4: Proposed Priority Development Area Subareas and Downtown District

Table 2-2: Proposed General Plan and Zoning Classifications

Zoning Districts	Corresponding General Plan Districts	Max. Density (units/acre)/ Intensity (FAR)	Assumed Density (units/acre)/ Intensity (FAR)	Max. Building Coverage (percent)	Approx. Zoned Area (acres)	Percentage of the Plan Area
Existing Zoning Districts Within the PDA Plan Area						
Regional Commercial (C-R)	Regional Commercial	0.4 FAR[1]	– / 0.325 FAR	60%	60.2	18.1%
Industrial (I-L)	Industrial	0.5 FAR[2]	– / 0.30 FAR	60%	23.4	7.0%
Industrial with Office Overlay (I-L/O)	Industrial	0.5 FAR[2]	– / 0.325 FAR	60%	72.3	21.7%
Open Space–Environmental Conservation (OS-EC)	Open Space–Environmental Conservation	[3]	–	N/A	18.4	5.5%
Public/Institutional (P-I)	Public/Institutional	0.5 FAR	– / 0.35 FAR	50%	11.2	11.2%
Five Proposed New Zoning Districts						
Downtown Mixed-Use (DTM-U)	Mixed-Use	12.1 to 45 units/acre; 1.5 FAR (CMU); 2.0 FAR (RMU)	35 units/acre/ 0.45 FAR (City Center); 0.35 FAR (Triangle)	80%	26.0	7.8%
Downtown High Density Residential (DTR-H)	High Density Residential	12.1 to 30 units/ acre; 1.15 FAR	30 units/acre / –	40%	60.3	18.1%
Industrial/Regional Commercial Overlay (I-L/CR)	Industrial/Regiona l Commercial	0.5 FAR[2]	– / 0.325 FAR	40%	28.4	8.5%
Downtown District Amenity Zone Overlay (DDAZ)	N/A (overlaps with other zones)	12–75 units/acre; 1.5 FAR (CMU); 2.0 FAR (RMU)	N/A (refer to applicable subarea)	90%	N/A (overlaps with other zones)	N/A (overlaps with other zones)
Station Center Planned Development (SC-PD)	Mixed-Use				32.4	9.7%
Commercial Mixed-Use		1.5 FAR	– / 0.60 FAR	80%		
Residential Mixed-Use		2.0 FAR	30 units/acre/ 1.0 FAR	80%		
High Density Residential		12–75 units/acre	30 units/acre / –	60%		
Office or Civic		1.0 FAR	– / 0.60 FAR	70%		
Park/Open Space		[4]	–			
Totals					332.5	100.0%

Notes: CMU = Commercial Mixed-Use; FAR = floor area ratio; N/A = not applicable; PDA = Priority Development Area; RMU = Residential Mixed-Use

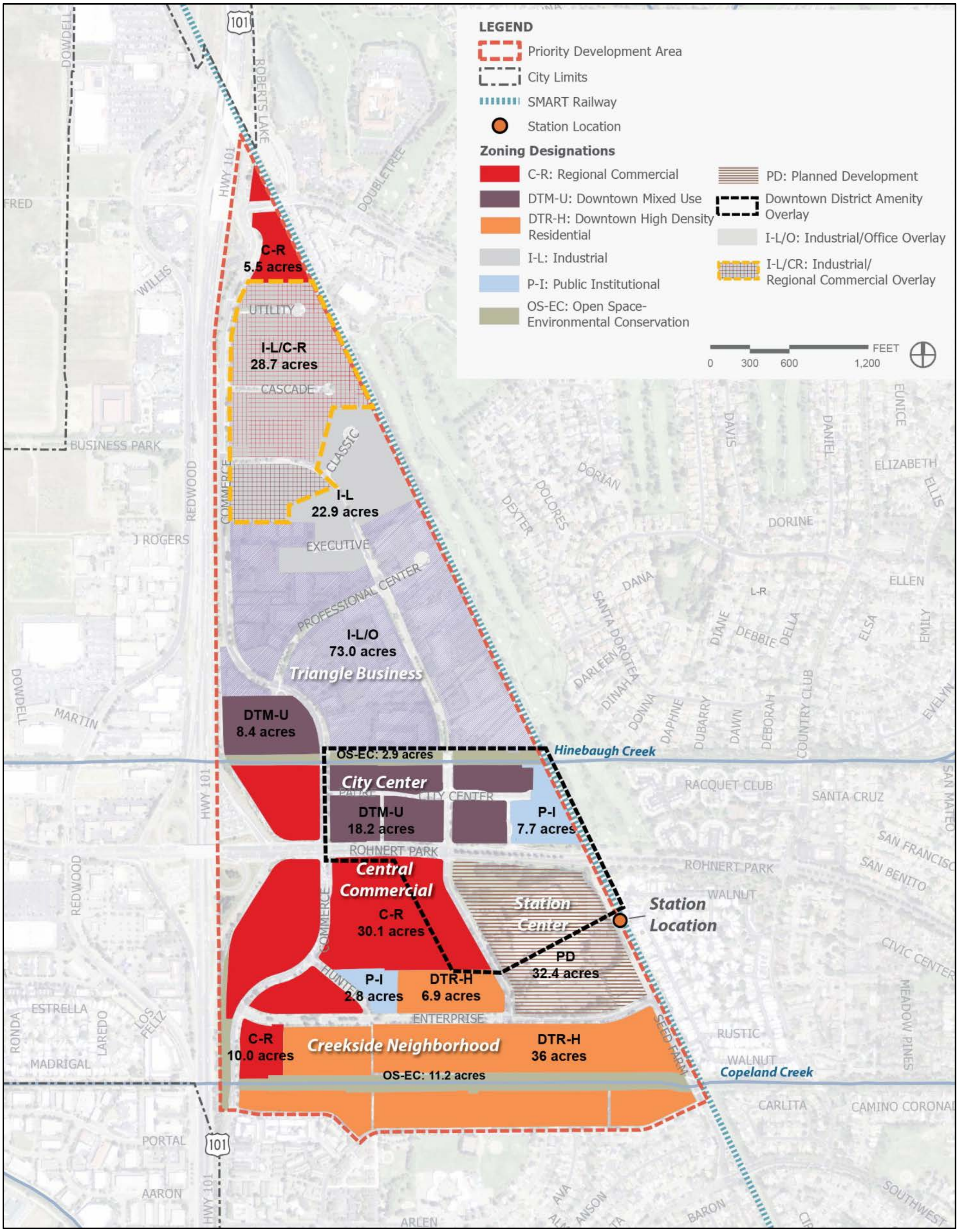
1 An FAR of 1.5 is allowed for hotel and motel uses in the C-R district.

2 An FAR of up to 1.0 is allowed for industrial development that is approved by the Planning Commission and meets criteria set forth in development standards and design guidelines approved by the City of Rohnert Park.

3 A density of 1 unit per acre is allowed in the developable portion of any property in the OS-EC district.

4 Some limited development of commercial kiosks and other small retail buildings would be permitted.

Source: Data compiled by AECOM in 2015



Sources: Data provided by City of Rohnert Park and compiled by AECOM in 2015

Figure 2-5: Proposed Priority Development Area Zoning

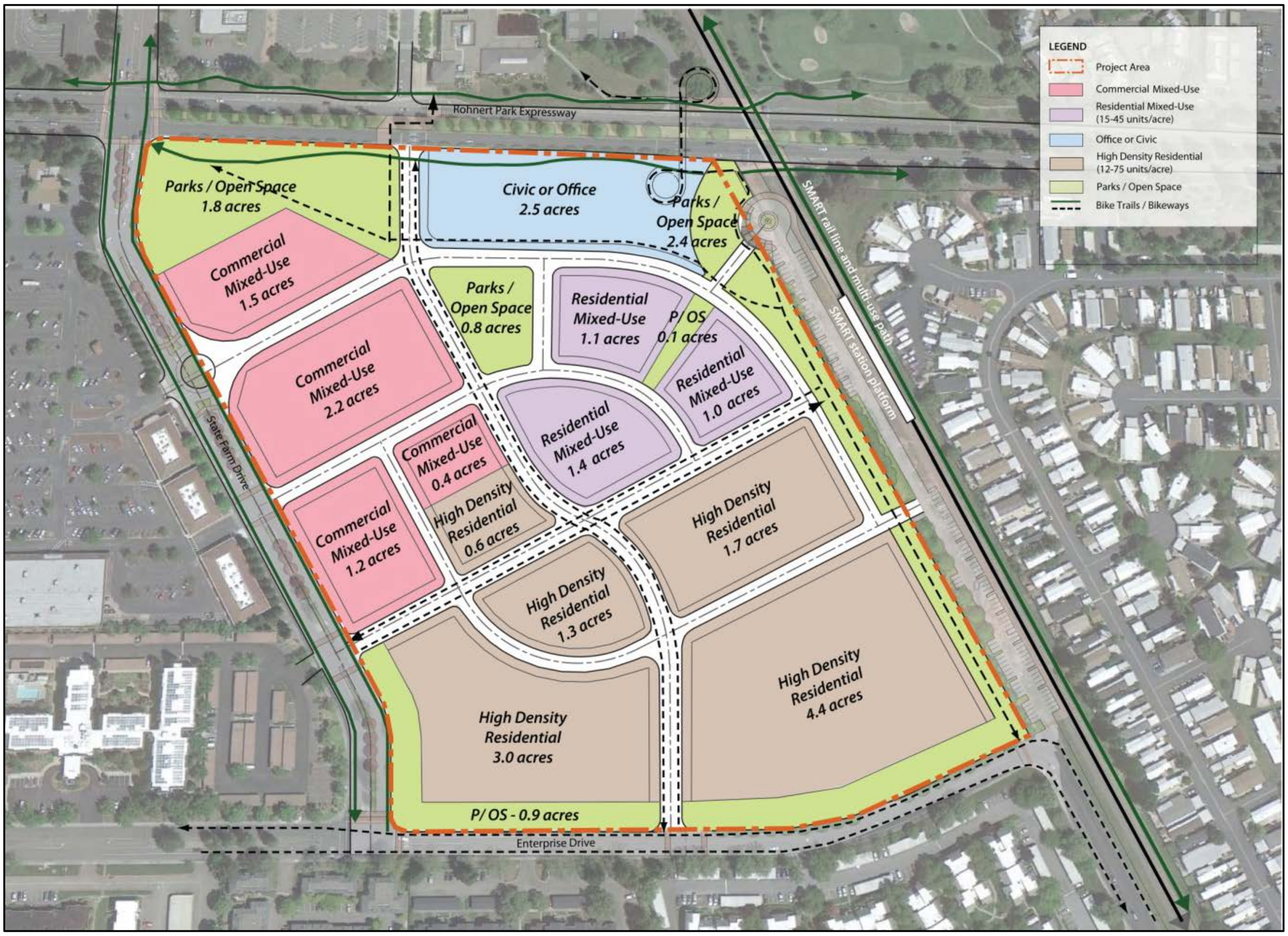
- 30 units per acre in the DTR-H zone
- 45 units per acre in the DTM-U zone

General Plan amendments for the corresponding land use changes in the PDA Plan would be needed to implement the higher densities proposed in the plan.

The Station Center subarea would be rezoned from the Professional/Administrative Office (C-O) and Public/Institutional (P-I) districts to the "Station Center Planned Development" (SC-PD) designation. To support transit-oriented development on the property, the Station Center subarea should be defined by a unique set of land uses, proposed to consist of Commercial Mixed-Use, Residential Mixed-Use, High-Density Residential, Office or Civic, and Parks/Open Space (Figure 2-6). The Triangle Business subarea is envisioned to transition over time from industrial to a mixed-use business area. To support this transition, a new Regional Commercial Overlay zone that allows and captures retail and other commercial activities is proposed for portions of the existing underlying Industrial zone along U.S. 101 (Figure 2-5), adjacent to an existing commercial retail node on the north side of the plan area.

The plan area is located in an existing developed area of the city, with the potential for small, incremental infill development that can be accommodated by current land use standards. Thus, as shown in Figure 2-5, the proposed plan would retain some of the same existing zoning districts in the plan area and update some districts to fully support the vision for a Downtown in Rohnert Park. The density ranges (FAR and maximum permitted density) for high-density residential and mixed-use development would be amended in the Zoning Code and General Plan to implement the PDA Plan. Those development standards to be updated are specific to the plan area and include the Downtown Mixed-Use (DTM-U) and Downtown High Density Residential (DTR-H) districts.

- **Regional-Commercial (C-R) zone** (in the Triangle Business, Creekside Neighborhood, and Central Commercial subareas), which permits shopping centers and other retail uses that attract customers from outside the city. This district permits a maximum FAR of 0.4, with a maximum FAR of 1.5 allowed for hotel and motel uses.
- **Industrial (I-L) and Industrial with Office Overlay (I-L/O) zones**, which allow for campus environments for corporate headquarters, research and development facilities, offices, light manufacturing, assembly, industrial processes, warehousing, storage and distribution, service commercial, and ancillary retail uses. These districts allow a maximum FAR of 0.5. The FAR can be increased to 1.0 if approved by the Planning Commission, subject to the specified criteria in the City-adopted design guidelines.
- In addition to uses permitted in the I-L zone, the I-L/O zone allows all types of administrative, financial, business, professional, medical, public office, and supporting commercial uses (permitted in the Office-Commercial [C-O] zone). As in the I-L zoning district, the maximum FAR in the I-L/O zone is 0.5 and an increase in the FAR to 1.0 is allowed if approved by the Planning Commission, subject to the specified criteria in the City-adopted design guidelines.
- **Downtown Mixed-Use (DTM-U)** zone (located primarily in the City Center subarea), which accommodates compatible businesses, retail stores, service and institutional organizations, and residences, set in a pedestrian-oriented environment. A maximum 1.5 FAR is permitted for a mix of nonresidential uses, while an FAR of up to 2.0 is allowed for a combination of residential and nonresidential uses. Upper densities in this district would be up to 45 units per gross acre to support future growth in the plan area.



Source: Data compiled by AECOM in 2015

Figure 2-6: Proposed Station Center Land Uses

- **Public/Institutional (P-I)** zone (provided primarily in the City Center subarea), which allows schools, government offices, transit sites, religious facilities, and other facilities with a public character, with a maximum FAR of 0.5.
- **Downtown High Density Residential (DTR-H)** zone (within the Creekside Neighborhood), which permits a wide range of detached single-family and attached multifamily housing, at densities ranging from 12.1 to 24 units per gross acre. This zone would allow up to 30 units per acre within the plan area.

The Industrial with Regional Commercial Overlay (I-L/CR) is a newly proposed zoning district in the Triangle Business subarea and would allow for the types of industrial uses and associated development standards that are normally permitted in the I-L zone, but also would allow uses otherwise permitted only in the C-R zone, as described above.

The proposed zoning overlay DDAZ supports the creation of a walkable downtown environment through urban design standards and guidelines that allow buildings to be built to the edge of the sidewalk; allow for wide sidewalks and pedestrian amenities along commercial streets; promotes compact, multistory development and shared and on-street parking and transit use; and may incentivize features and amenities desired in a downtown setting (e.g., benches, plazas, signage, and lighting).

The Station Center subarea would be zoned Station Center Planned Development (SC-PD). Such zoning would allow this area to introduce a new set of land use districts supporting its unique site development potential, adjacent to the SMART rail station, and would encourage the vision for greater density/intensity, mixed-use growth that is supportive of transit (Figure 2-5). Proposed zoning would include the following districts:

- **Station Center–Residential Mixed-Use** zone, which would permit residences organized in a pedestrian-oriented environment, in a horizontal or vertical mixed-use configuration, with residential densities of 15–45 dwelling units per acre and a maximum 2.0 FAR. Compatible businesses, retail, and services would be permitted, preferably at the ground level. Public or open space amenities available to the public and residents also would be encouraged.
- **Station Center–Commercial Mixed-Use** zone, which would support a variety of commercial service, retail, and civic uses organized in a pedestrian-oriented environment, in a horizontal or vertical mixed-use configuration. It would encourage the provision of civic and open space uses. This district would permit a maximum FAR of 1.5 and maximum lot coverage of 80 percent.
- **Station Center–Office** zone, which would allow all types of administrative, financial, business, professional, medical, public office, and/or public institutional uses, such as government or nonprofit offices. This zoning district would permit a maximum 1.0 FAR and a maximum building coverage of 70 percent.
- **Station Center–High Density Residential** zone, which would permit a wide range of single-family to multifamily housing at densities ranging from 12 to 75 units per acre, with an assumed average density in the Station Center of 30 units per acre. Higher densities may be permitted, subject to approval by the Planning Commission and limitations on the number of residential units in the plan area.
- **Station Center–Parks/Open Space** zone, which would permit passive recreational facilities (e.g., lawn areas, plazas, gazebos) and small commercial pavilions that fit in with a park-like setting and/or provide services for the SMART rail station.

2.3.2 Site Plan and Development Program

The proposed plan would include mixed-use infill and redevelopment in an existing mixed-use area of the community, organized into five subareas. By testing opportunity sites for the subareas, included in Appendix A of the PDA Plan and considering reasonable market opportunities, maximum average density and intensity assumptions were established for each subarea, as identified in Table 2-2. Table 2-3 shows a breakdown of the development potential for each subarea. Actual development may vary from these assumptions. The plan area's development potential was calculated solely to estimate the carrying capacity of plan area infrastructure. This should be viewed as the maximum expected development in the plan area and not the expected level of development.

Table 2-3: Proposed Development Potential in Subareas of the Plan Area

Land Use by Subarea							
Subarea[1]	Open Space (acres)	Building Area (net square feet)					
		Residential Units and Area[5]	Retail or Service Commercial	Office	Public-Institutional	Industrial	Total Non-residential
Existing Development[2]							
Triangle Business	2.9	0	76,882	742,540	251	768,429	1,588,102
City Center	2.6	143 units; 170,000 sf	50,500	0	135,005	0	185,505
Station Center	0	0	0	283,230[4]	7,168[4]	0	290,398
Central Commercial	0	240 units; 197,340 sf	544,111	44,410	14,528	0	603,049
Creekside Neighborhood	11.2	1,007 units; 1,106,575 sf	29,235	11,600	11,600	0	50,360
Total	16.7	1,390 units; 1,473,915 sf	700,728	1,081,780	166,477	768,429	2,717,414
Added Development Potential[3]							
Triangle Business[6]	2.5[9]	150	120,881[6]	91,415	0	129,315	341,611
City Center[7]	0	115 units; 103,500 sf	56,581	32,560	50,362	0	139,503
Station Center[8]	6.0[9]	415 units; 415,000 sf	171,626	65,340[4]	0[4]	0	236,966
Central Commercial	0	0	74,264	0	12,445	0	86,709
Creekside Neighborhood	0	155 units; 170,500 sf	17,534	0	0	0	17,534
Total	8.5	835 units; 689,000 sf	440,886	189,315	62,807	129,315	822,324
Total Development Potential[4]							
Triangle Business	5.4	150 units	197,763	833,955	251	897,744	1,929,713
City Center	2.6	258 units; 273,500 sf	107,081	32,560	185,367	0	325,008
Station Center	6.0	415 units; 415,000 sf	171,626	65,340[4]	0[4]	0	236,966
Central Commercial	0	240 units; 197,340 sf	618,375	44,410	26,973	0	689,758
Creekside Neighborhood	11.2	1,162 units; 1,277,075 sf	46,769	11,600	9,525	0	67,894
Total	25.2	2,225 units; 2,312,915 sf	1,141,614	987,865	222,116	897,744	3,249,337

Notes:
sf = square feet
[1] See Table 2-2 for land use assumptions in each subarea.
[2] Existing development is based on assessor’s parcel data, verified through aerial maps, and adjusted where needed.
[3] Total development potential is the sum of existing development plus the assumed additional development potential.
[4] Existing uses in the Station Center subarea are proposed for removal (i.e., the 283,230-square-foot State Farm office and 7,170-square-foot Corporation Yard) and redeveloped with new uses indicated for the Station Center under the “Added Development Potential” column.
[5] Based on the assumption that average unit size in the Creekside Neighborhood is 1,100 square feet per unit. Average unit size is assumed to be 900 square feet per unit in the City Center and 1,000 square feet per unit in the Station Center subarea.
[6] Assumes that added development in the IL/RC zone consists of 50% new retail/service uses and 50% industrial uses; the IL/O zone consists of 50% new office and 50% industrial uses; and the DTM-U zone consists of 50% new retail and 50% office uses.
[7] Assumes that additional Residential Mixed-Use consists of 80% residential and 20% commercial uses.
[8] Assumes that planned Commercial Mixed-Use consists of 100% retail or service uses and Residential Mixed-Use consists of 80% residential and 20% commercial uses.
[9] Identifies dedicated public park/open space, based on proposed land use concepts studied for the plan area. Additional open space to be provided for new development, as required by the Zoning Code, is not reflected in the subarea totals.

Source: Assessor’s parcel data, modified by AECOM in 2015

Residential Uses

Up to 835 units could be constructed in the plan area, focused on the City Center and Station Center subareas, generally located within a half-mile radius of the SMART rail station. The residential unit mix would consist of multifamily homes ranging in size from approximately 600 to 1,200 square feet, with densities of 12–75 units per acre. The units would be built in four of the five subareas (i.e., City Center, Station Center, Triangle Business, and Creekside Neighborhood), as shown in Figure 2-4 and described in Table 2-3.The maximum building height in the DTM-U zone, applicable to the City Center, is 45 feet. This same maximum building height also applies to the DTR-H zone, found in the Creekside Neighborhood. The Station Center subarea is envisioned to support a variety of multifamily residential housing units with densities ranging from 12 to 75 units per acre, including townhomes, mixed-use lofts or flats above neighborhood commercial uses, and podium-style apartments or condominiums. Townhomes and mixed-use lofts in the Station Center subarea are anticipated to be two to three stories high; five- and six-story apartments or condominiums over podium parking are envisioned in the Station Center, as supported by future market conditions. In the Station Center subarea, maximum building heights for high-density residential uses would be 65 feet.

Retail or Service Commercial Uses

The PDA Plan would include a maximum of 440,886 additional square feet of retail and service commercial uses that would be distributed within several subareas of the plan area. The following types of development would occur:

- One- to two-story infill development, with a projected maximum of approximately 74,264 square feet in the commercial centers in the Central Commercial subarea (based on an assumed average maximum FAR of 0.30 in the C-R zone). Maximum building heights permitted in the C-R zone would be 65 feet.
- One- to two-story infill development, with a projected maximum of approximately 17,500 square feet in the existing Creekside Neighborhood, based on an assumed average maximum FAR of 0.325.

- Approximately 56,600 square feet of infill or redevelopment on vacant or aging and underused properties/development in the City Center, based on an assumed average maximum FAR of 0.45 for the mixed-use zone, with a maximum permitted building height in the DTM-U zone of 45 feet.
- Up to 120,880 square feet of new retail or service commercial infill, redevelopment on vacant or underused properties, or reuse of existing buildings in the Triangle Business subarea (based on an assumed average maximum FAR of 0.325 for the C-R and I-L/CR zone and 0.35 for the DTM-U zone). Maximum permitted building heights would be 45 feet in the I-L/CR and DTM-U zones and 65 feet in the C-R zone.
- Up to 171,626 square feet of new retail or service uses in the Station Center subarea (based on an assumed average maximum FAR of 0.60 for the Station Center Commercial Mixed-Use zone and 1.0 for the Residential Mixed-Use zone) to replace the existing State Farm campus mixed-use development with one to two retail and service uses, with supporting parking and landscape improvements. This would form part of a future Downtown area that would also include the City Center area and a portion of the shopping center on the west side of State Farm Drive. Maximum building heights established in the Station Center Commercial Mixed-Use and Residential Mixed-Use zones would be 65 feet. The northern portion of the Station Center subarea would become part of a larger Downtown area that extends across RPX and State Farm Drive.

Public Institutional Uses

Up to 62,807 net new square feet of public institutional facilities are planned in the City Center and Central Commercial subarea; 65,340 square feet of public institutional development would be adjacent to the emerging civic center area, in one- to two-story buildings (based on a maximum FAR of 0.35), with supporting parking and landscape improvements. Another 12,445 square feet of public institutional uses are projected in the Central Commercial subarea, to support expansion of existing public institutional facilities or new infill uses in the subarea. Maximum permitted building heights for public institutional uses in the P-I zone would be 45 feet.

Office Uses

Up to 189,315 net new square feet of office facilities and supporting parking and landscape improvements are projected in various subareas of the plan area, including the following:

- Up to 91,415 square feet of new office development, redevelopment on vacant or underused properties, or reuse of existing buildings in the Triangle Business subarea (based on an assumed average maximum FAR of 0.325 in the I-L/O zone and 0.35 in the DTM-U zone). Maximum permitted building heights in the existing IL/O and DTM-U zones would be 45 feet.
- Infill development on vacant sites or redevelopment of existing properties in the City Center to support up to 32,560 square feet of office uses (based on an average maximum FAR of 0.45 in the DTM-U zone).
- Up to 65,340 square feet of new office uses in two- to three-story standalone or mixed-use buildings (based on an assumed average maximum FAR of 0.60) for the proposed Station Center Office zone. Maximum permitted building heights in the Station Center Office zone would be 65 feet.

Light Industrial Uses

Up to 129,315 net new square feet of new light industrial facilities would be located in the I-L, I-L/CR, and I-L/O zones in the Triangle Business subarea, based on an average maximum FAR of 0.30 in the I-L zone and 0.325 in the I-L/CR and I-L/O zones. This composition assumes 100 percent industrial uses in the I-L zone and 50 percent industrial uses/50 percent office or commercial uses in the I-L/O and I-L/CR zones. Maximum permitted building heights in these existing industrial zones would be 45 feet.

Open Space

Existing public open space is present along the west side of Commerce Boulevard, adjacent to U.S. 101, and along accessible, marked trails in the existing Copeland Creek and Hinebaugh Creek corridors and interconnecting paseos, maintained by the City. The creek corridor open space/trails and connecting paseos would be improved through infill of gaps in the trail network, and through vegetation maintenance, trail signage, and lighting improvements to support the safety and comfort of bicyclists and pedestrians. In addition, trail connectivity improvements along the planned SMART MUP and surrounding public roadways in the city would be provided along the two existing creeks (Figure 2-7). At-grade connections to the SMART MUP are proposed at the Copeland Creek trail crossing of the SMART rail tracks at RPX, Professional Drive, and Golf Course Drive. At Golf Course Drive, the MUP crosses from the east side of the tracks to the west side and under U.S. 101, just north of the plan area. An undercrossing connection from the plan area to the SMART MUP would be added along Hinebaugh Creek.

A total of 8.5 acres of public parks/open space uses are proposed for the plan area. Approximately 6 acres would be part of redevelopment in the Station Center subarea. The other 2.5 acres of open space are suggested for an approximately 25-foot-wide paseo between Professional Drive and Utility Court and for other open space, to improve bike and pedestrian access in the Triangle Business subarea. See Table 2-3 for a summary of proposed park and open space uses in the plan area, based on recommendations from subarea and opportunity-site studies. The table totals do not reflect additional park and open space uses that would be provided with new development as required by the Zoning Code. Other suggested park and open space uses, plazas, and common space areas would be dispersed within the plan area and are shown conceptually in Figure 2-7.

2.3.3 Landscaping

The PDA Plan proposes landscaping throughout the developed portion of the plan area. New trees, from the City's approved list, that grow in a columnar fashion would be considered along major roadways in addition to the existing redwood trees, to enhance the existing corridor effect along roadways in the plan area. Trees and other vertical landscape elements could be used as background plants at community gateway entrances into the plan area or could be planted along roadway medians. Roadways and entrance areas would be lined with a variety of tree species, including species that are compatible with species already found in the plan area, such as Chinese pistache (*Pistachia chinensis*), crape myrtle (*Lagerstroemia fauriei*), eastern redbud (*Cercis canadensis*), Western red cedar (*Thuja plicata*), magnolia (*Magnolioideae* sp.), and European hackberry (*Celtis australis*). Proposed ornamental tree species and smaller trees (suitable for planters) would include Japanese maple (*Acer palmatum*), flowering crab apple (*Malus sylvestris*), and thundercloud flowering plum (*Prunus cerasifera*). Parks, open space, and creek corridors would be planted with larger trees, such as live oak (*Quercus virginiana*), blue oak (*Q. douglasii*), willow oak (*Q. phellos*), American elm (*Ulmus americana*), magnolia, and alder (*Alnus* sp.).

Source: Data compiled by AECOM in 2015

Figure 2-7: Proposed Park and Open Space Features

2.3.4 Circulation

Vehicular access to the plan area would be provided by RPX from the west and east; Commerce Boulevard and State Farm Drive from the north; and Seed Farm Drive and Commerce Boulevard from the south. RPX is the primary roadway providing access between U.S. 101 and the plan area. The proposed plan would include improvements to plan area circulation, which would include roadways, bike/pedestrian facilities, and transit facilities.

Roadway Improvements

Figure 2-8 shows the vehicular circulation plan and proposed roadway improvements for the plan area. The following proposed roadway improvements are listed from north to south and numbered as shown in the figure:

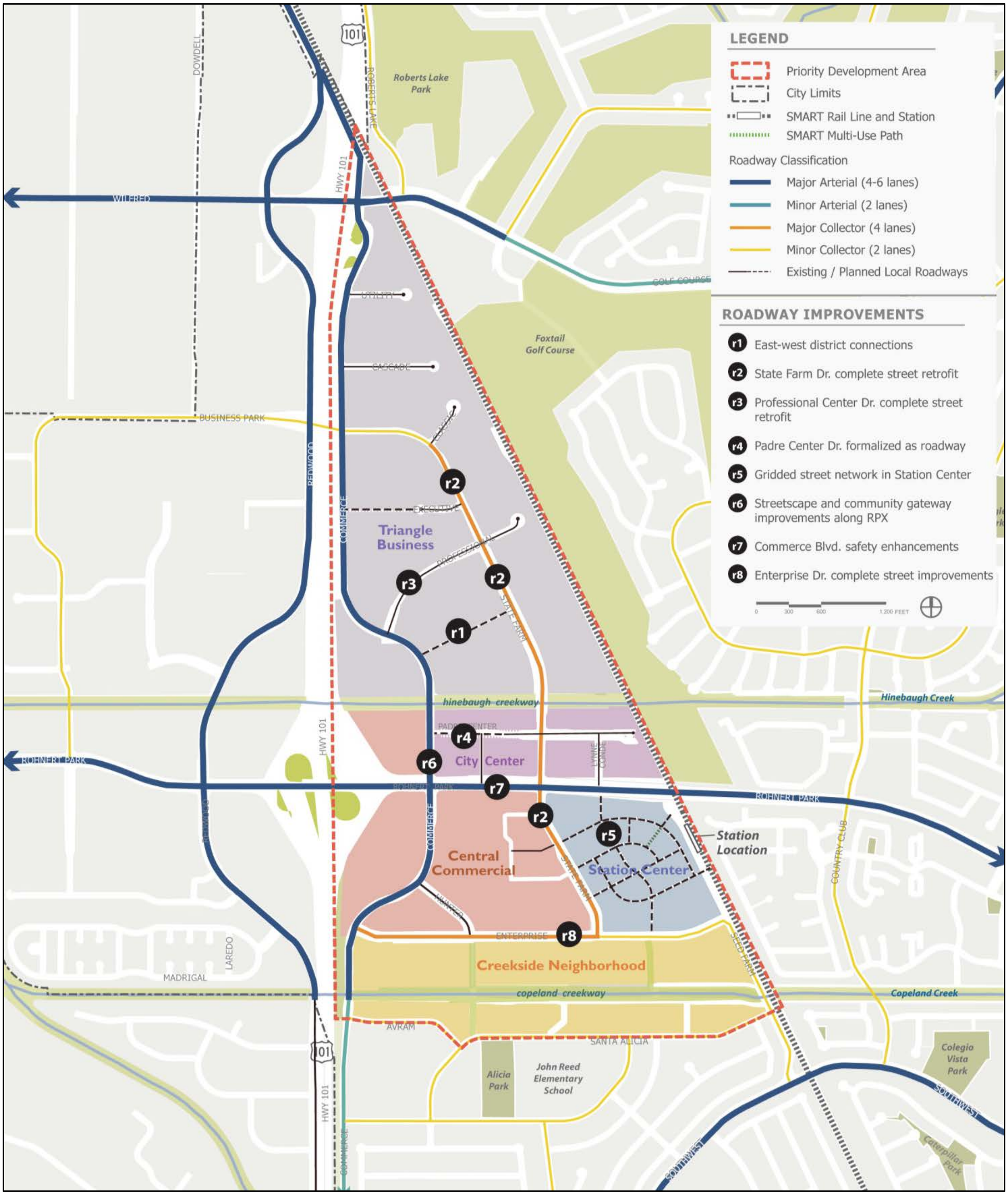
- **r1)** Providing additional east-west roadways or paseos as sites redevelop in the Triangle Business subarea. Additional roadway or bike/pedestrian trail connections would be provided between State Farm Drive and Commerce Boulevard to reduce block sizes and intersection distances, and to support opportunities for new bikeways and landscaping.
- **r2)** Retrofitting State Farm Drive as a complete street, with high-contrast bicycle lanes and the potential to incorporate on-street parking along portions of its length (between Professional Drive and Enterprise Drive).
- **r3)** Retrofitting Professional Center Drive as a complete street with bicycle lanes and the potential to incorporate stormwater curb extensions and parking on one side of the street.
- **r4)** Developing additional local streets, including formalizing Padre Center Drive in the City Center.
- **r5)** Adding a gridded street network in the Station Center subarea, as shown conceptually in Figure 2-8.
- **r6)** Adding roadway improvements to Commerce Boulevard, to support opportunities for improved bicycle facilities; a landscaped median, where feasible, to control and support safe vehicular turning movements; streetscape; and corridor signage enhancements.
- **r7)** Adding streetscape and community gateway improvements along RPX.
- **r8)** Improving Enterprise Drive to be one lane in each direction throughout its length, with the opportunity to support a bike lane on the south side and an MUP and on-street parking along its north side.

Transit Improvements

To support planned new uses in the plan area, an additional transit circulator loop and additional bus stops would connect the Station Center subarea to the existing areas of the community and would support future intermodal connections with the SMART rail station (Figure 2-9). Public transit services and improvements would be expanded in coordination with Sonoma County Transit as new transit demand warrants.

The following transit improvements are proposed for the plan area:

- The addition of a new loop route and three new transit stops and bus pullout areas to serve the Station Center subarea, including a potential bus transfer station stop adjacent to the SMART rail station platform.
- Additional proposed transit stops at the City Center, along RPX, and at the intersection of State Farm Drive and Professional Drive.



Source: Data compiled by AECOM in 2015

Figure 2-8: Proposed Vehicular Circulation Plan

- Opportunities for a shuttle or commuter service during commute hours from the SMART rail station to major community destinations, including Graton Rancheria Casino and Sonoma State University.

Bike and Pedestrian Improvements

Bicycle access would be provided via existing and planned improvements to bicycle facilities in the plan area (Figure 2-10). Class I MUPs exist along the west side of Commerce Boulevard between Cascade Court and Professional Center Drive; along Hinebaugh Creek east of Commerce Boulevard; along Copeland Creek east of Commerce Boulevard; and along two greenway paseos connecting Enterprise Drive to the Copeland Creek trail. Striped Class II, on-street bicycle lanes for bicyclists on either side of the street exist along Golf Course Drive; Commerce Boulevard south of Utility Court; RPX; State Farm Drive south of RPX; Enterprise Drive east of State Farm Drive; and Seed Farm Drive. The following proposed improvements to bicycle facilities in the plan area are listed from north to south and numbered as shown in Figure 2-10:

- **b1)** Upgrading bicycle facilities along Commerce Boulevard by completing the development of Class I bicycle trails on the west side of the street and Class II bicycle lanes on the east side of the street, between Hinebaugh Creek and Golf Course Drive/Wilfred Avenue.
- **b2)** Introducing additional east-west bike access at Cascade Court and between Professional Drive and Hinebaugh Creek.
- **b3)** Introducing a central north-south bike/pedestrian paseo or greenway in the Triangle Business subarea, midway between Commerce Boulevard and State Farm Drive.
- **b4)** Upgrading bike lanes on State Farm Drive between Professional Drive and Enterprise Drive to protected or enhanced bike lanes on both sides of the street, and supporting opportunities for bikeway access on State Farm Drive between Professional Drive and Commerce Boulevard.
- **b5)** Adding east-west bike facilities on Professional Drive, including enhanced bike lanes and the potential for an at-grade rail crossing or undercrossing from Professional Drive to the SMART MUP.
- **b6)** Completing trail gaps along Hinebaugh Creek, including the potential for an undercrossing of the rail tracks to connect to the SMART MUP. **b7)** Upgrading RPX to incorporate high-contrast bike lanes; widening the existing meandering sidewalks on both sides of the street to support development of a Class I MUP; and supporting intersection and mid-block pedestrian crossings, with pedestrian refuges and high-intensity activated crosswalk signals at Lynne Conde Drive and along the SMART MUP.
- **b8)** Continuing the Class I trail connection south of Enterprise Drive, along U.S. 101 and the RPX interchange, between Enterprise Drive and RPX.
- **b9)** Adding east-west and north-south bicycle connections through the Station Center as shown in Figure 2-8. These connections would include opportunities for a bicycle boulevard designation, with striped or enhanced bicycle lanes along planned new roadways or paseos and potentially a Class I trail along the east side of the property, parallel to the SMART rail line, connecting from Seed Farm Drive to the SMART rail station and RPX.
- **b9)** Adding a bike/pedestrian overcrossing of RPX, connecting the City Center and Station Center subareas.
- **b10)** Adding bike lanes on both sides of Hunter Drive.

- **b11)** Upgrading bike facilities on Enterprise Drive with high-contrast bike lanes on the south side and a broad, minimum 12-foot-wide MUP on the north side of Enterprise Drive.

Pedestrian access and circulation would be provided via existing and planned sidewalks, roadways, trails, and paseos in the plan area. In addition to the roadway and bike/pedestrian facility improvements described above, the following priority pedestrian improvements are proposed:

- Establishing north-south bike and pedestrian connections through walkway improvements from City Center destinations to the Hinebaugh Creek trail and MUPs that are proposed along RPX (Figure 2-9).
- Adding pedestrian walkway improvements and landscaping in the Central Commercial subarea (Figure 2-10).

2.3.5 Parking

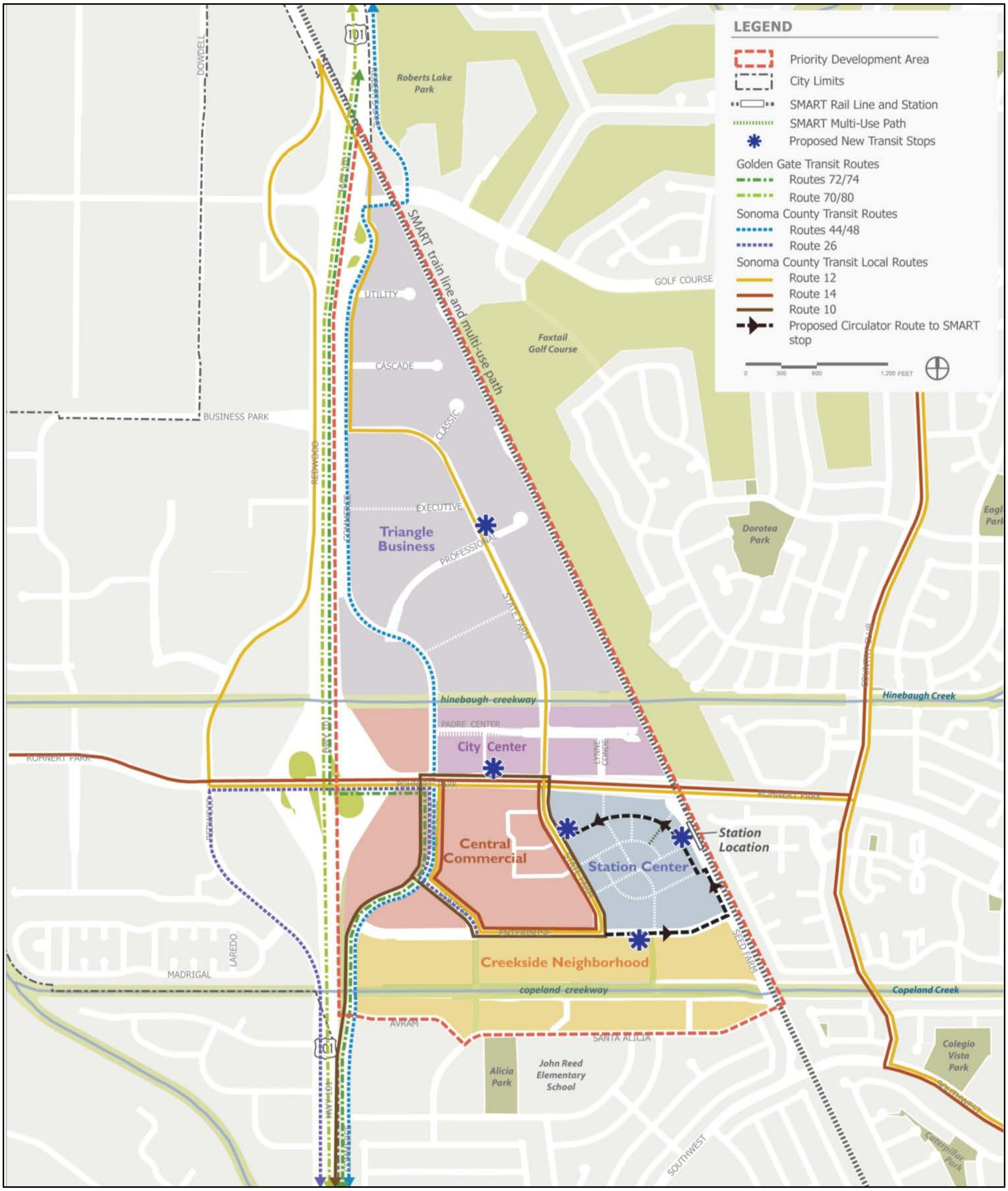
The proposed plan identifies the appropriate number of off-street parking spaces for new residential, mixed-use, light industrial, retail/service, and office uses, as shown by the parking ratios in Table 2-4. For nonresidential uses, on-street parking spaces would be permitted to meet the requirement for off-street parking spaces.

Table 2-4: Development Potential for Proposed Residential Units

Subareas	Units by Land Use
City Center, Station Center	Retail Use: 2.5 spaces per 1,000 gross square feet Office or Civic Use: 3 spaces per 1,000 gross square feet Studio or 1 BR residential: 1 space per unit 2 BR residential: 1.5 spaces per unit 3+ BR residential: 2 spaces per unit 1 guest parking space for every 5 bedrooms
Triangle Business, Central Commercial, and Creekside Neighborhood	Standards for nonresidential uses based on existing Zoning Code standards, except that parking for multifamily residential uses will be provided as follows: Studio or 1 BR residential: 1 space per unit 2 BR residential: 2 spaces per unit 3+ BR residential: 2.5 spaces per unit 1 guest parking space for every 4 bedrooms

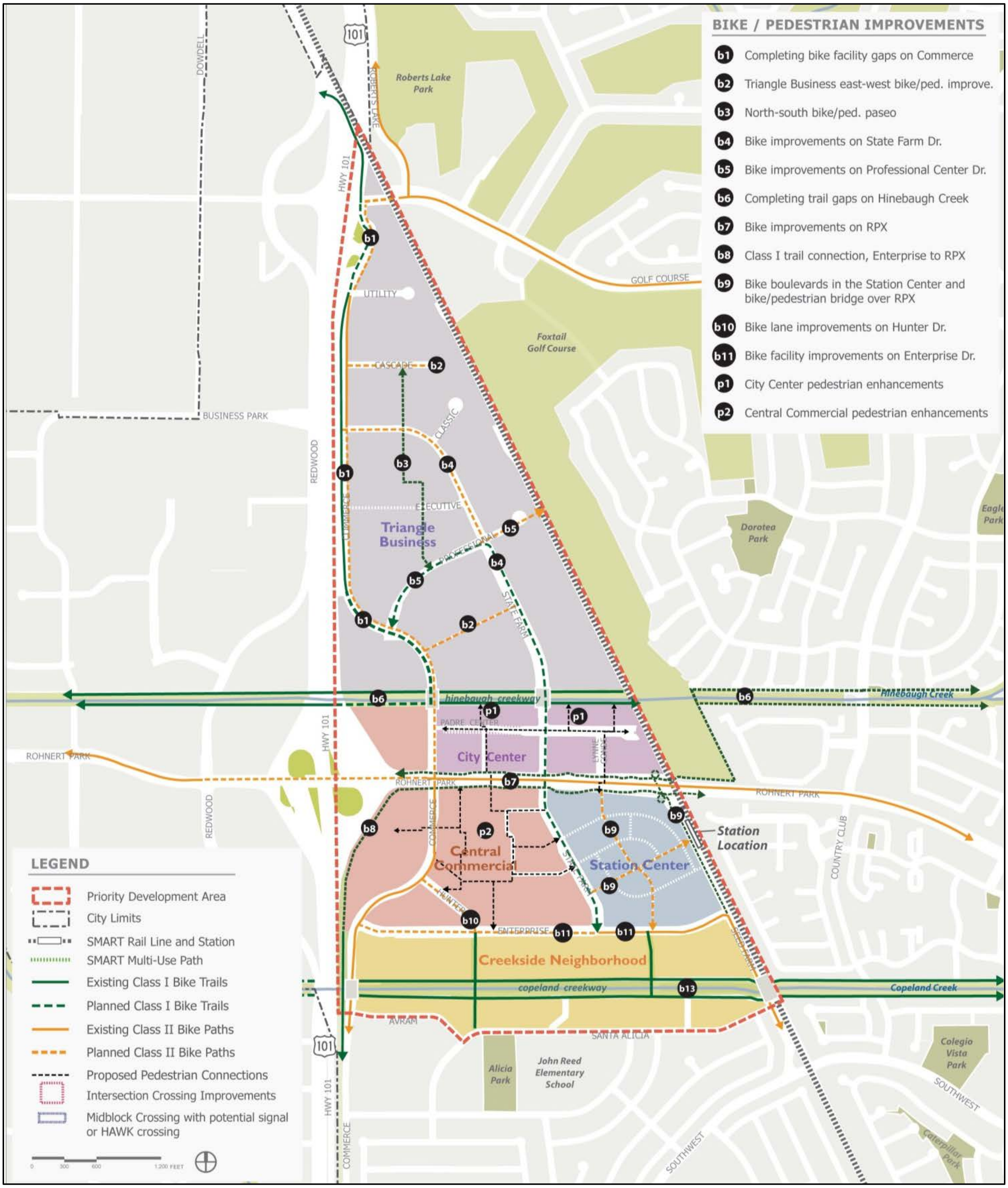
Note: BR = bedroom

Source: Data compiled by AECOM in 2015



Source: Data compiled by AECOM in 2015

Figure 2-9: Proposed Transit Circulation Plan



Source: Data compiled by AECOM in 2015

Figure 2-10: Proposed Bike and Pedestrian Circulation Plan

In addition to the parking standards proposed in Table 2-4, Section 17.16.040 of the City's Zoning Code allows the following parking reductions:

- Up to 25 percent for shared parking, when a combination of uses can demonstrate and make the finding that the uses share a common parking area and demand for parking occurs over different time periods, making the full parking requirement unnecessary.
- Up to 10 percent for providing a rideshare, transit incentive, or other transportation system management program, as permitted by the Planning and Community Development Director or designee.

2.3.6 Utilities

The plan area would receive service from the following existing service providers:

- The City provides retail potable-water service using its groundwater resources and water purchased from Sonoma County Water Agency.
- The City provides retail recycled-water service using tertiary treated recycled water provided by the Santa Rosa subregional system.
- The City provides sanitary sewer collection services and delivers wastewater to the Santa Rosa subregional system's Laguna Treatment Plant for treatment, reuse, and disposal.
- The City provides local stormwater collection service. Flood control channels including Copeland Creek and Hinebaugh Creek are maintained by Sonoma County Water Agency.
- The North Bay Corporation provides curbside solid waste, yard, and recyclable collection and processing.
- AT&T and Comcast provide telecommunications, cable television, and Internet services.
- Pacific Gas and Electric Company supplies gas and electricity.

The proposed plan would include the necessary extensions from the existing infrastructure systems to supply these utilities to future development in the plan area (see Figures 2-11 and 2-12 for the locations of existing water and sewer infrastructure systems).

2.4 DISCRETIONARY ACTIONS AND APPROVALS

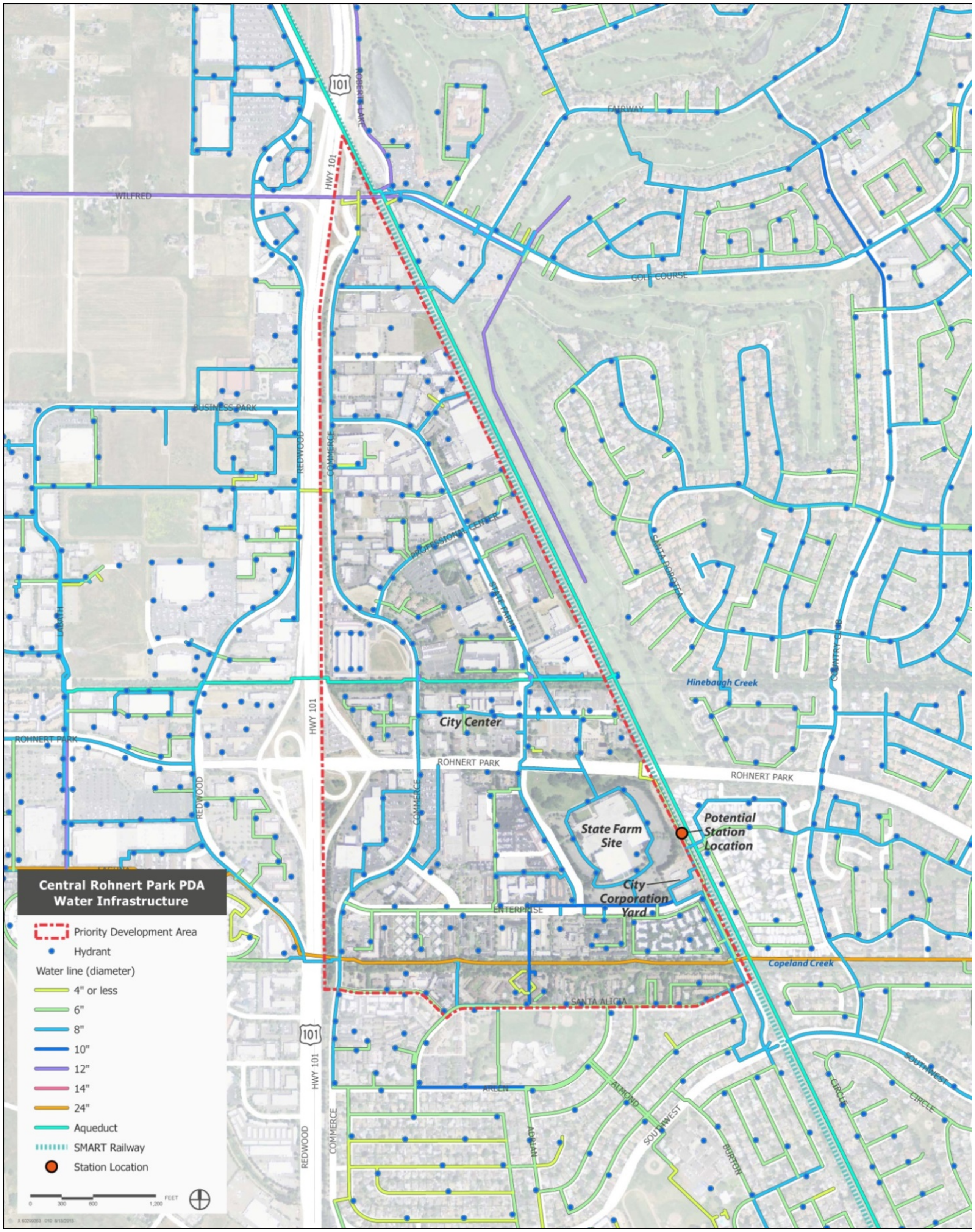
The City must provide the following discretionary actions and approvals to adopt and implement the PDA Plan:

- Certification of this California Environmental Quality Act document
- Approval of the PDA Plan
- Amendments to the General Plan (see detailed description below)
- Amendments to the Zoning Map and Zoning Ordinance (see detailed description below)

2.4.1 General Plan Amendment

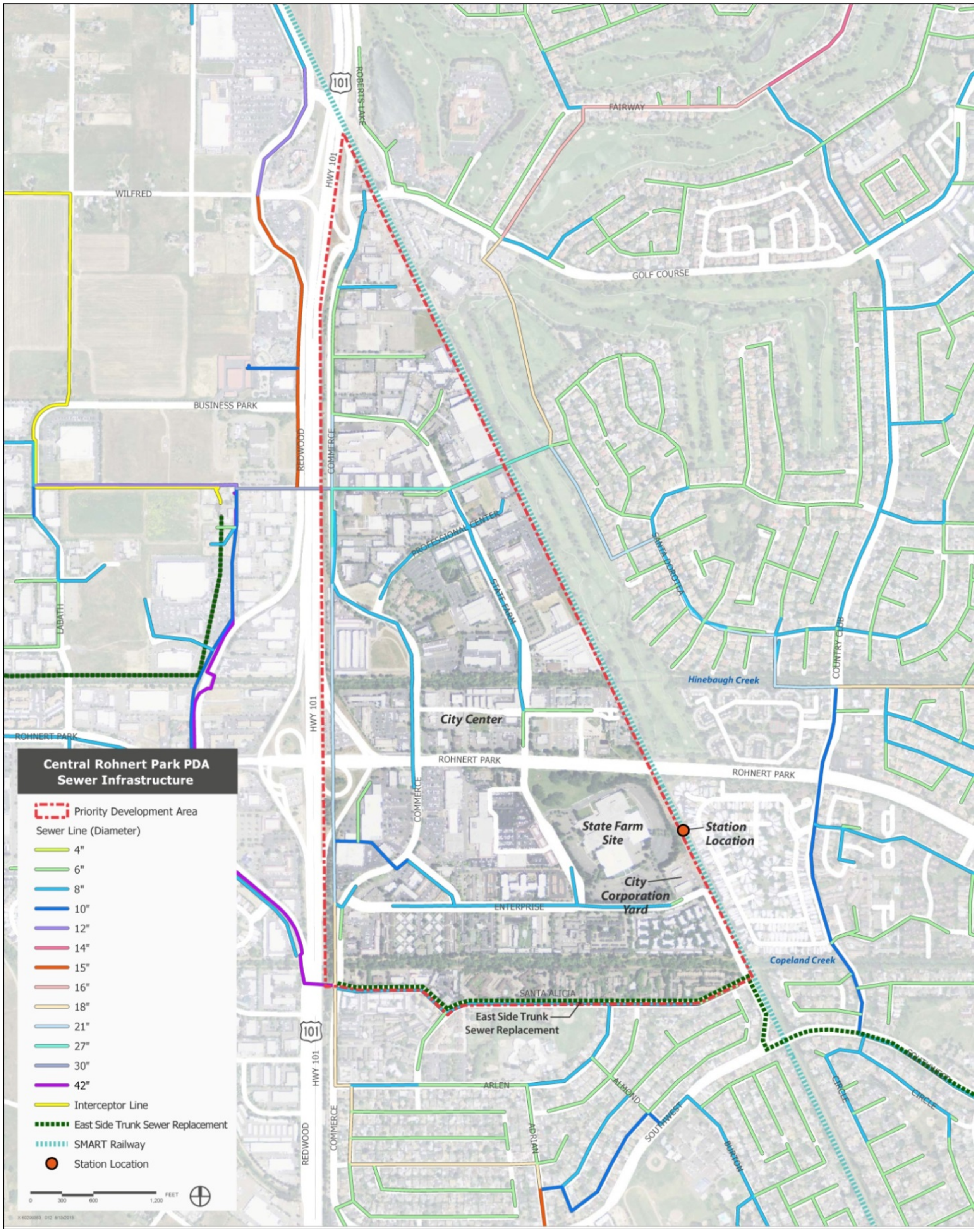
The following General Plan amendments would occur along with PDA adoption:

- Update the description of the planning process. Updates to Section 1.6, "Planning Process," would reference the Central Rohnert PDA with the bullet entitled "Neighborhood and Special Area Plans." The City Center Concept Plan (City of Rohnert Park, 2002) is currently referenced in this location of the General Plan, so some text updates would be needed to describe the City Center as being part of the PDA Plan.
- Update the General Plan Map. The General Plan Map is incorporated into the General Plan as Figure 2.2-1, "General Plan Diagram"). This map would be updated as follows:
  - Replace the "Office" designation for the former State Farm campus property and the "Public/Institutional" designation for the City's Corporation Yard with a "Mixed-Use" designation, similar to the designation currently in place for Sonoma Mountain Village.
  - Change the roadway designation of State Farm Drive to a minor arterial. State Farm Drive is currently considered a major collector, but minor arterial is more appropriate given the traffic volumes analyzed as part of the PDA Plan's traffic impact study.
  - Update the map of specific plans and planned developments. Figure 2.4-1, "Specific Plan and Planned Development Areas," would be amended to add the Station Center Planned Development to the map at the location of the former State Farm office campus. A description of this new planned development would be added in the General Plan.
- Add a description of the Central Rohnert Park PDA (Chapter 2 of the General Plan). The General Plan includes a section on Sonoma Mountain Village (page 2-40). A new section would be added immediately after this, entitled "Central Rohnert Park Priority Development Area." Included in this new section would be a brief description of the Central Rohnert Park PDA Plan and a new Figure 4.1 entitled "Central Rohnert Park Plan Concept." This new section of the document would include the following information:
  - Land use policies. All the land use policies related to the PDA would be added to this section.
  - A description of the Station Center Planned Development. As part of the section on the PDA, a subsection on the Station Center subarea would be added.
  - A relocated discussion of the City Center. The currently provided discussion of the City Center would be moved to become a subsection under the new "Central Rohnert Park Priority Development Area" heading.
  - A description of the regional commercial overlay. This overlay would allow more commercial (retail and services) uses within the industrial classification.
  - A description of the downtown amenity zone. A more complete description of the downtown area would be included in Chapter 3, "Community Design."
- Add community design goals and policies (Chapter 3 of the General Plan). A section entitled "Central Rohnert Park Priority Development Area Plan" would be added to Chapter 3 of the General Plan. The General Plan currently includes a description of the City Center that would be incorporated as a subset of the PDA discussion. All the goals and policies from the Community Design Guidelines chapter of the PDA would be added to the General Plan, including Figure 4.5 from the PDA as one of the General Plan's illustrative diagrams. This chapter of the General Plan includes illustrative diagrams from other locations in the city.



Source: Data compiled by AECOM in 2015

Figure 2-11: Existing Water Infrastructure System



Source: Data compiled by AECOM in 2015

Figure 2-12: Existing Sewer Infrastructure System

- Add a new section entitled “Downtown District.” The current General Plan includes a section entitled “Commercial Centers” (Section 3.3). This section would be amended to include graphics and descriptions from the PDA Plan for the downtown district.
- Amend the master street plan. Chapter 4, “Transportation,” of the General Plan includes Figure 4.1-1, which categorizes State Farm Drive as a four-lane collector. This is inconsistent with the PDA Plan. The PDA Plan recommends a two-lane roadway that would include enhanced lanes for bicycles and on-street parking. Figure 4.1-1, “Master Street Plan,” would be amended to change State Farm Drive from a major collector to a minor arterial. The minor arterial classification would recognize State Farm Drive as a significant roadway, but the number of lanes could be reduced. This lane reduction is supported by information in the PDA’s traffic impact study, provided in Appendix E.
- Amend parking restrictions. Table 4.1-3, “Roadway Classifications,” in the General Plan, restricts on-street parking. This is inconsistent with the PDA Plan, which calls for adding on-street parking in certain locations—particularly in a future downtown area. Table 4.1-2 would be amended to allow on-street parking in the plan area.
- Add circulation and connectivity goals and policies. Chapter 4, “Transportation,” of the General Plan includes goals and policies related to the city’s roadway network. A new section entitled “Central Rohnert Park” would be added and the relevant goals and policies from the PDA Plan would be incorporated.
- Add goals and policies related to parks and utilities. The General Plan has a chapter entitled “Open Space, Parks, and Public Facilities” (Chapter 5). A section entitled “Central Rohnert Park” would be added to this chapter and would include the relevant goals and policies from the PDA Plan.

2.4.2 Zoning Amendments

The Zoning Ordinance is one of the primary implementation documents of the City’s General Plan. Updates to the ordinance would be needed to fully implement the PDA Plan. Both map and text amendments are proposed.

Map Updates

Property designations in the plan area would be rezoned as described below. These changes would be reflected on the City’s official zoning map. Most of the map changes would require complementary text changes.

- **Station Center Property.** Two key properties in the plan area are the former State Farm office campus, which is currently zoned Office Commercial (C-O), and the adjacent City Corporation Yard, which is zoned Public Institutional (P-I)). Both of these zoning designations would be replaced with a Station Center Planned Development (SC-PD) designation. Text updates (as described in the following section) would be needed along with the map updates.
- **Regional Commercial Overlay.** The zoning map would be amended to add a Regional Commercial Overlay Zone (I-L/C) to the industrial properties located at the north end of the plan area. The PDA Plan envisions this area as an emerging commercial area because of the visibility and access afforded to it by U.S. 101 and Commerce Boulevard. The southern boundary of the new I-L/C overlay would be coterminous with the boundaries of the I-L/O overlay zone. The western and eastern boundaries would be U.S. 101 and the railroad tracks, respectively. The northern boundary would be coterminous with the boundary of the Regional

Commercial (C-R) district north of Utility Court. Text updates (as described in the following section) would be needed along with the map updates.

- **Downtown District Overlay (DD).** The zoning map would include this overlay designation, which would modify the development standards.
- **Downtown High Density Residential (DTR-H).** The Downtown High Density Residential (DTR-H) zones in the plan area would be replaced by the DTR-H designation and would include modified development standards, including densities of up to 30 units per acre.
- **Downtown Mixed-Use (DTM-U).** The Downtown Mixed-Use (DTM-U) zones in the plan area would be replaced by the DTM-U designation and would include modified development standards and densities of up to 45 units per acre.

Text Updates

The PDA Plan includes some new zoning concepts that are not included in the existing Zoning Ordinance. This requires some minor reorganization of the existing Zoning Ordinance and the addition of some new chapters and sections. The following is a summary of the proposed changes:

- **Station Center Planned Development (SC-PD).** This new planned development would be created to incorporate both the former State Farm campus and the City's Corporation Yard, and would be added to the Zoning Ordinance as Article XV-B, "Station Center Planned Development District." The map and development standards for this planning district could be adapted from the PDA Plan. Some development standards may also be used or referenced from other parts of the code.
- **Industrial/Commercial Overlay (I-L/C).** This overlay would establish additional retail and service land use types that could be permitted. The overlay would be placed "over" the underlying industrial zoning designation, ensuring that all of the existing development rights of the industrial zone would be left intact, in addition to the range of uses permitted in the industrial district.
- **Downtown District Overlay (DDAZ).** A new overlay would be established for the area identified in the PDA Plan as the Downtown District Amenity Zone (DDAZ). This would include certain development standards (e.g., allowing buildings to be placed at the back of the sidewalk); street cross sections; on-street parking allowances for State Farm Drive; and requirements for internal streets as properties in the downtown district develop or redevelop.
- **Downtown Mixed-Use (DTM-U).** A new zoning district identified in the PDA Plan as Downtown Mixed-Use (DTM-U) would be introduced in the plan area. This zoning district would include updated development standards supporting the creation of a downtown environment.
- **Downtown High Density Residential (DTR-H).** A new zoning district identified in the PDA Plan as Downtown High Density Residential (DTR-H) would be introduced in the plan area. This zoning district would update the maximum density for high-density residential uses in the plan area to 30 dwelling units per acre.

2.5 CUMULATIVE PROJECTS

Build-out of the City's 2000 General Plan has been assumed in the consideration of cumulative projects. The 2000 General Plan anticipates a population of 51,332, labor force of 25,977, and 29,479 jobs at build-out. The 2000 General Plan projects an additional 4,045 residential units at build-out in 2020 (beyond the existing 16,877 residential units estimated in 2012), resulting in a residential build-out of 20,922 residential units.

In the City Center area north of RPX, 132 units have been built, with another 24 units programmed for a vacant site where Commerce Boulevard meets Hinebaugh Creek. No other residential development in the plan area has been approved as of the writing of this document, but more development may come online in the near future.

The City's 2000 General Plan includes approximately 4.6 million square feet of nonresidential land uses. Development of approximately 2 million square feet of nonresidential land uses has been approved, is under way, or is programmed (Table 2-5). Since adoption of the General Plan, many of the shopping centers in the plan area have been remodeled within existing building footprints (no additional square footage added). A few new buildings have included additional retail square footage in the plan area, including a Chipotle, Panera Bread, and Walgreens in the Central Commercial area, and a State Farm Insurance office in the City Center area.

Table 2-5: Build-out Potential of Existing Approved, Underway, or Programmed Plans

Adopted Plans	Year Adopted	Land Area (acres)	Residential (units)	Retail (sf)	Office (sf)	Hotel Rooms	Civic (sf)	Parks/ Recreation (acres)
University District Specific Plan	2014	297	1,645	100,000				20
Stadium Area Master Plan	2008	30	338	140,000				0.5
Sonoma Mountain Village Planned Development	2010	175	1,694	191,801	425,978	100	35,000	27
Southeast Specific Plan	2010	80	475	10,000				
Wilfred Dowdell Village Specific Plan	2012	25		302,114				
Northeast Specific Plan	2008	275	1,114					17
Northwest Specific Plan	2014	100	398	458,700	218,200	100		1
Total		**982**	**5,629**	**1,352,615**	**644,178**	**300**	**35,000**	**87**

Note:
sf = square feet

Source: Data compiled by AECOM in 2015

2.5.1 Utility Projects and Transportation Projects

All utility, infrastructure, and transportation projects included in the PDA Plan were anticipated in the 2000 General Plan, with the exception of a few minor projects and the SMART rail transit line and station and the SMART MUP.

2.6 REFERENCES

City of Rohnert Park. 2002. *Rohnert Park City Center Concept Plan.* Adopted November 12, 2002, Resolution No. 2002-255. Planning Department, Rohnert Park, CA. Prepared by Moore Iacofano Goltsman, Inc., Berkeley, CA.

———. 2015 (May) (originally adopted 2000). *City of Rohnert Park General Plan: Our Place . . . Rohnert Park 2020, A Plan for the Future*. Adopted in July 2000; seventh edition printed May 2015, with amendments through April 8, 2014. Rohnert Park, CA. Prepared by Dyett & Bhatia Urban and Regional Planners.

Metropolitan Transportation Commission. 2007 (October 18). *Station Area Planning Manual.* Prepared by Reconnecting America, Center for Transit-Oriented Development.

MTC. *See* Metropolitan Transportation Commission.

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3.0 ENVIRONMENTAL SETTING AND IMPACTS

This chapter sets forth the physical and regulatory environmental setting and addresses the environmental impacts of the proposed plan with respect to nine environmental resource areas. The discussions of the environmental setting describe the present physical conditions, or the baseline conditions, in the area of the proposed plan. The baseline used for the analysis of environmental impacts under the California Environmental Quality Act (CEQA) reflects the conditions present at the time the EIR Notice of Preparation (NOP) was published.

The potential impacts of the proposed plan are compared against the existing baseline conditions for each environmental resource.

The proposed plan is analyzed from the viewpoint of the following 17 environmental resource areas.

- Aesthetics
- Agriculture and Forestry Resources
- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Transportation and Traffic
- Utilities and Service Systems
- Growth-Inducing Impacts

Indirect impacts are discussed for those resources only where they have the potential to occur (e.g., air quality, biological resources, cultural resources). In addition to plan-level impacts, cumulative impacts are also analyzed. Plan-level impacts are impacts that could result as a result of implementation of the proposed plan, and cumulative impacts are impacts that could result as a result of implementation of the proposed plan in combination with other cumulative projects. As discussed in Section 2.5, "Cumulative Projects," build-out of the City's 2000 General Plan is considered the cumulative scenario for analysis of cumulative impacts.

Impacts are analyzed and the respective conclusions are included in this Draft EIR, applying the following levels of significance:

- Significant and Unavoidable Impact
- Less-than-Significant-with-Mitigation-Incorporated Impact
- Less-than-Significant Impact
- No Impact

Impacts are defined in terms of context and intensity. Context is related to the uniqueness of a resource; intensity refers to the severity of the impact. Best management practices are incorporated into the plan to limit the potential for a significant impact. Where necessary, EIR mitigation measures are identified for significant impacts to limit the degree or magnitude of the impact; rectify the impact by repairing, rehabilitating, or restoring the affected environment; or compensate for the impact by replacing or providing substitute resources or environments. Such impacts are concluded to be Less than Significant with Mitigation Incorporated.

Based on initial environmental review, the City has determined that the proposed plan would not have the potential to cause significant impacts associated with nine of the 17 environmental resource areas identified above. See Chapter 5.0, "Effects Found Not To Be Significant," for a brief discussion of each of those topics.

3.1 AIR QUALITY

This section describes the existing physical and regulatory setting related to air quality and discusses the potential impacts of the proposed plan on air quality.

3.1.1 Existing Conditions

The plan area is located in the city of Rohnert Park in southern Sonoma County, which is part of the San Francisco Bay Area Air Basin (SFBAAB). California's air basins have been created to group together regions that have similar factors that affect air quality. Ambient concentrations of air pollutants are determined by the amount of emissions released by pollutant sources and the atmosphere's ability to transport and dilute such emissions. Natural factors that affect transport, dilution, and generation of air pollutants include terrain, wind, atmospheric stability, and the presence of sunlight. Existing air quality conditions in the plan area are determined by such natural factors as topography, meteorology, and climate, in addition to the amount of emissions released by existing air pollutant sources.

The analysis in this section does not take into account the reduced trips that would result from operation of the Sonoma-Marin Area Rail Transit (SMART) rail line and increased bicycle and pedestrian connectivity within the plan area. The analysis also does not include other measures to reduce air quality that will be implemented as part of the *Sonoma County Community Climate Action Plan* (which includes the SMART rail line).

Topography, Meteorology, and Climate

The SFBAAB includes Alameda, Marin, Napa, San Francisco, San Mateo, and Santa Clara Counties, as well as the southern portion of Sonoma County (including Rohnert Park) and the southwestern portion of Solano County. The plan area is located in the northwestern portion of the SFBAAB.

Meteorological conditions in the SFBAAB are warm and mainly dry in summers, and mild and moderately wet in winters. Marine air has a moderating effect on the climate throughout much of the year. Winds from the west-southwest are most prevalent during spring and summer afternoons. These are the breezes that travel from the Pacific Ocean through gaps in the Coast Ranges. In addition, nighttime drainage flows typically develop. On clear nights with light winds, inversions develop in the coastal valleys, separating the surface wind flow from winds aloft. The drainage flow usually is light and stable.

Criteria Air Pollutant Emissions

The California Air Resources Board (ARB) and U.S. Environmental Protection Agency (EPA) focus on the following air pollutants as indicators of ambient air quality: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM) with aerodynamic diameter less than 10 micrometers (PM_{10}), particular matter with aerodynamic diameter less than 2.5 micrometers ($PM_{2.5}$), and lead. Because these are the most prevalent air pollutants known to be deleterious to human health, and because extensive health effects criteria documentation is available for these pollutants, they are commonly referred to as "criteria air pollutants." Health-based air quality standards have been established for these pollutants by ARB at the state level, and by EPA at the national level. These standards, which include a margin of safety, were established to protect the public from adverse health impacts resulting from exposure to air pollution. California also has established standards for sulfates, visibility-reducing particles, hydrogen sulfide, and vinyl chloride. The California ambient air quality standards (CAAQS) and national ambient air quality standards (NAAQS) are shown in Table 3.1-1.

Existing Criteria Air Pollutant Emissions

Current existing air emission sources in the plan area include natural gas combustion from heating and hot water usage for homes and nonresidential buildings. Other sources of air emissions are tailpipe emissions and PM dust from automobiles, transit buses, and delivery trucks traveling on paved and unpaved roads, and from fuel-powered landscaping equipment. Solid waste produced by households and businesses in the plan area creates volatile organic compounds and other harmful trace emissions. Existing indirect air emission sources in the plan area include fossil fuel–based electricity use from the same locations listed above, in addition to electricity required for traffic lights and street lighting. Other indirect sources include the use of fossil fuels required to pump and treat drinking water and sewage from residential and nonresidential use. Indirect upstream air emissions include the embedded fossil fuel use from the production of food and other products consumed in the plan area.

Local Air Quality Conditions

To determine whether a region's air quality is healthful or unhealthful, contaminant levels in ambient air samples are compared to the CAAQS and NAAQS. Both ARB and EPA monitor ambient air concentrations at various regions throughout the SFBAAB to designate an area's attainment status with respect to the CAAQS and NAAQS, respectively, for criteria air pollutants. The purpose of these designations is to identify areas with air quality problems, and thereby initiate planning efforts for improvement. The three basic designation categories are "nonattainment," "attainment," and "unclassified." The "unclassified" designation is used in an area that cannot be classified based on available information as meeting or not meeting the standards. The most recent attainment designations with respect to the SFBAAB are shown in Table 3.1-1. With respect to the CAAQS, the SFBAAB is designated as a nonattainment area for ozone, PM_{10}, and $PM_{2.5}$ and as an attainment or unclassified area for all other pollutants. With respect to the NAAQS, the SFBAAB is designated as a nonattainment area for the 8-hour ozone standard, nonattainment for the 24-hour $PM_{2.5}$ standard, and as an attainment or unclassified area for all other pollutants (BAAQMD, 2015a).

Table 3.1-1: Ambient Air Quality Standards and SFBAAB Designations

Pollutant	Averaging Time	California1		National Standards2	
		Concentration	Attainment Status	Concentration3	Attainment Status
Ozone	1-Hour	0.09 ppm (180 µg/m^3)	N	–	See footnote #5
	8-Hour	0.07 ppm (137 µg/m^3)	N[9]	0.075 ppm (147 µg/m^3)	N[4]
Carbon Monoxide (CO)	1-Hour	20 ppm (23 mg/m^3)	A	35 ppm (40 mg/m^3)	A[6]
	8-Hour	9 ppm (10 mg/m^3)	A	9 ppm (10 mg/m^3)	A
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.030 ppm (57 µg/m^3)	–	0.053 ppm (100 µg/m^3)	A
	1-Hour	0.18 ppm (339 µg/m^3)	A	0.100 ppm (188 µg/m^3)[11]	U
Sulfur Dioxide (SO_2)[12]	24-Hour	0.04 ppm (105 µg/m^3)	A	0.14 ppm (365 µg/m^3)	A
	1-Hour	0.25 ppm (655 µg/m^3)	A	0.075 ppm (196 µg/m^3)	A
	Annual Arithmetic Mean	–	–	0.030 ppm (80 µg/m^3)	A
Particulate Matter (PM_{10})	Annual Arithmetic Mean	20 µg/m^3	N[7]	–	–
	24-Hour	50 µg/m^3	N	150 µg/m^3	U
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	12 µg/m^3	N[7]	12 µg/m^3	U/A
	24-Hour	–	–	35 µg/m^3 See footnote #10	N
Lead[13]	30-day Average	1.5 µg/m^3	–	–	A
	Calendar Quarter	–	–	1.5 µg/m^3	A
	Rolling 3-Month Average[14]	–	–	0.15 µg/m^3	See footnote #14
Sulfates	24-Hour	25 µg/m^3	A	No National Standards	
Hydrogen Sulfide	1-Hour	0.03 ppm (42 µg/m^3)	U		
Vinyl Chloride	24-Hour	0.01 ppm (26 µg/m^3)	No information available		
Visibility-Reducing Particle Matter	8-Hour (10:00 to 8:00 PST)	See footnote #8	U		

Notes:
µg/m^3 = micrograms per cubic meter; A = Attainment; mg/m^3 = milligrams per cubic meter; N = Nonattainment; ppb = parts per billion; ppm = parts per million; U = Unclassified

Table 3.1-1: Ambient Air Quality Standards and SFBAAB Designations

Pollutant	Averaging Time	California1		National Standards2	
		Concentration	Attainment Status	Concentration3	Attainment Status

1 California standards for ozone, CO, sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter—PM_{10}, and visibility-reducing particles are values that are not to be exceeded. The standards for sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded. If the standard is for a 1-hour, 8-hour, or 24-hour average (i.e., all standards except for lead and the PM_{10} annual standard), then some measurements may be excluded. In particular, measurements are excluded that the California Air Resources Board (ARB) determines would occur less than once per year on the average.

2 National standards shown are the "primary standards" designed to protect public health. National standards other than for ozone, particulates, and those based on annual averages are not to be exceeded more than once a year. The 1-hour ozone standard is attained if, during the most recent 3-year period, the average number of days per year with maximum hourly concentrations above the standard is equal to or less than 1. The 8-hour ozone standard is attained when the 3-year average of the 4th highest daily concentrations is 0.075 ppm (75 ppb) or less. The 24-hour PM_{10} standard is attained when the 3-year average of the 99th percentile of monitored concentrations is less than 150 µg/m^3. The 24-hour $PM_{2.5}$ standard is attained when the 3-year average of 98th percentiles is less than 35 µg/m^3.

Except for the national particulate standards, annual standards are met if the annual average falls below the standard at every site. The national annual particulate standard for PM_{10} is met if the 3-year average falls below the standard at every site. The annual $PM_{2.5}$ standard is met if the 3-year average of annual averages spatially-averaged across officially designed clusters of sites falls below the standard.

3 National air quality standards are set by the U.S. Environmental Protection Agency (EPA) at levels determined to be protective of public health with an adequate margin of safety.

4 Final designations effective July 20, 2012.

5 The national 1-hour ozone standard was revoked by EPA on June 15, 2005.

6 In April 1998, the Bay Area was redesignated to attainment for the national 8-hour CO standard.

7 In June 2002, ARB established new annual standards for $PM_{2.5}$ and PM_{10}.

8 Statewide Visibility Reducing Particulate Standard: Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

9 The 8-hour California ozone standard was approved by ARB on April 28, 2005, and became effective on May 17, 2006.

10 On January 9, 2013, EPA issued a final rule to determine that the Bay Area attains the 24-hour $PM_{2.5}$ national standard. This EPA rule suspends key State Implementation Plan requirements as long as monitoring data continue to show that the Bay Area attains the standard. Despite this EPA action, the Bay Area will continue to be designated as "nonattainment" for the national 24-hour $PM_{2.5}$ standard until the air district submits a "redesignation request" and a "maintenance plan" to EPA, and EPA approves the proposed redesignation.

11 To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).

12 On June 2, 2010, EPA established a new 1-hour SO_2 standard, effective August 23, 2010, which is based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations. The existing 0.030 ppm annual and 0.14 ppm 24-hour SO_2 NAAQS however must continue to be used until 1 year following EPA initial designations of the new 1-hour SO_2 NAAQS. EPA expects to designate areas by July 2016.

13 ARB has identified lead and vinyl chloride as toxic air contaminants with no threshold level of exposure below which there are no adverse health effects determined.

14 National lead standard, rolling 3-month average: final rule signed October 15, 2008. Final designations effective December 31, 2011.

Source: BAAQMD, 2015a

Toxic Air Contaminants

Some air pollutants are identified as toxic air contaminants (TACs) because of their potential to increase the risk of developing cancer or because of their acute or chronic health risks. Individual TACs vary greatly in the health risk they present. For TACs that cause cancer, a unit risk factor can be developed to evaluate cancer risk. For noncancer health risks, a similar factor called a Hazard Index (HI) is used to evaluate risk. An HI of less than 1 indicates that no adverse health effects are expected because of exposure, and an HI greater than 1 indicates that adverse health effects are possible (OEHHA, 2015).

Sensitive receptors may be in close proximity to permitted or nonpermitted sources of TAC emissions associated with implementation of the proposed plan. Potential mobile sources of TAC emissions include U.S. Highway 101 (U.S. 101), which forms the western boundary of the plan area. Table 3.1-4 (presented below under Impact 3.1d in Section 3.1.3, "Impact Discussion") lists the existing TAC emission sources in and within 1,000 feet of the plan area. Elementary schools and public parks also are less than 1,000 feet from the southern and eastern boundaries of the plan area, and a medical facility and a daycare center are located within the plan area boundary. Thus, sensitive receptors could be exposed to diesel PM emissions generated from construction activities associated with the proposed plan. These sources are evaluated in further detail in the impact analysis, using methods and tools provided by the Bay Area Air Quality Management District (BAAQMD), the agency with jurisdiction over the plan area.

Existing Toxic Air Contaminant Emissions

Several existing sources of TACs are located within the plan area such as permitted sources (i.e., generators), gasoline-dispensing facilities, and auto body shops. Diesel generators have the potential to emit diesel particulate, and auto body shops and gas stations attract idling vehicles emitting the smog-forming pollutants reactive organic gases (ROG) and oxides of nitrogen (NO_X), which are considered hazardous to human health and pose a cancer risk.

3.1.2 Regulatory Framework

Federal Clean Air Act

The federal Clean Air Act (CAA) establishes the framework for modern air pollution control. The CAA directs EPA to establish ambient air standards for six pollutants: ozone, CO, lead, NO_2, PM, and SO_2. The standards are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety and the latter to protect environmental values, such as plant and animal life. EPA develops rules and regulations to preserve and improve air quality, and delegates specific responsibilities to State and local agencies.

The CAA requires each state to submit a state implementation plan for areas in nonattainment for federal standards. The plan, which is reviewed and approved by EPA, must demonstrate how the federal standards will be achieved.

California Clean Air Act

The California Clean Air Act of 1988 (CCAA) added substantially to the authority and responsibilities of air districts. The CCAA designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement transportation control measures. The CCAA focuses on attainment of the CAAQS, which are generally more stringent than the comparable NAAQS.

The CCAA requires designation of attainment and nonattainment areas with respect to CAAQS. The CCAA also requires that any local or regional air district that violates CAAQS for CO, SO_2, NO_2, or ozone expeditiously adopt and prepare an air quality attainment plan. These clean air plans are designed specifically to attain these standards, and must be designed to achieve an annual 5 percent reduction in districtwide emissions of each nonattainment pollutant or its precursors. Where an air district is unable to achieve a 5 percent annual reduction, the adoption of “all feasible measures” on an expeditious schedule is acceptable as an alternative strategy (Health and Safety Code Section 40914[b][2]). No locally prepared attainment plans are required for areas that violate the state’s PM_{10} standards.

The CCAA requires that the CAAQS be met as expeditiously as practicable. Unlike the federal CAA, however, the CCAA does not set precise attainment deadlines. Instead, the act establishes increasingly stringent requirements for areas that require more time to achieve the standards.

Bay Area Air Quality Management District CEQA Guidelines

BAAQMD is responsible for maintaining acceptable air quality conditions in the SFBAAB. BAAQMD implements a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues to control and minimize the generation of criteria pollutants, TACs, odors, and greenhouse gas (GHG) emissions. BAAQMD’s clean-air strategy includes preparation of plans for the attainment of ambient air quality standards, adoption and enforcement of rules and regulations regarding sources of air pollution, and issuance of permits for stationary sources of air pollution. BAAQMD also inspects stationary sources of air pollution and responds to citizen complaints, monitors ambient air quality and meteorological conditions, and implements programs and regulations required by the CAA, CAA Amendments, and the CCAA.

The BAAQMD California Environmental Quality Act (CEQA) Guidelines is an advisory document that assists lead agencies and other participants in navigating the CEQA process and evaluating air quality impacts of projects and plans proposed in the SFBAAB (BAAQMD, 2011). In May 2010, BAAQMD updated its 1999 CEQA Guidelines with the 2010 CEQA Guidelines, which include new and more stringent quantitative thresholds for operational and construction-related emissions of criteria air pollutants and precursors, TACs, odors, and GHGs (BAAQMD, 2011).

In March 2012, the Alameda County Superior Court issued a judgment finding that the changes to the BAAQMD CEQA Guidelines qualify as a project under CEQA, and that BAAQMD had not complied with CEQA as part of the adoption process. On August 13, 2013, California’s First District Court of Appeal held that BAAQMD’s adoption of the thresholds was not a project subject to CEQA review, and overturned the decision by the Alameda Superior Court that invalidated the BAAQMD guidelines for assessing air quality impacts under CEQA. However, the Court of Appeal’s decision was then appealed to the California Supreme Court, which granted limited review, and the matter is currently pending (BAAQMD, 2015b). The City of Rohnert Park, as the lead agency for the proposed plan, has decided to use the 2010 CEQA Guidelines and its thresholds; therefore, those thresholds have been used in the impact analysis and discussion below.

BAAQMD adopted the *Bay Area 2010 Clean Air Plan* (BA 2010 CAP), in cooperation with the Metropolitan Transportation Commission and the Association of Bay Area Governments, to set forth a plan to achieve compliance with the state’s 1-hour air quality standard for ozone as expeditiously as practicable. A clean air plan is a comprehensive strategy to reduce air pollution from both stationary sources, such as factories and refineries, and mobile sources, such as cars, trucks, and construction equipment. The goal of a clean air plan is to reduce air pollution to attain air quality standards and protect public health. The plan outlines strategies to reduce ozone precursors, as well as PM, TACs, and GHG emissions, to improve public health and protect the environment and climate.

3.1.3 Impact Discussion

The construction-related and operational plan-level impacts on air quality are analyzed separately in the impact discussions below, as appropriate.

3.1a. Conflict with or obstruct implementation of the applicable air quality plan? Less-than-Significant Impact with Mitigation Incorporated.

The most current regional air quality plan (AQP) is the BA 2010 CAP, which was developed as a multipollutant plan for ozone, PM, TACs, and GHG emissions. Projects that would be consistent with the applicable general plan or emit pollutants at levels less than the applicable thresholds of significance would be anticipated to be accounted for in the emissions projections of the BA 2010 CAP, and therefore would not conflict with or obstruct implementation of the regional AQP. Projects that would be consistent with the principles, strategies, and/or measures of the specific regional AQP also would be considered to be consistent with the AQP (BAAQMD, 2010).

The BAAQMD CEQA Guidelines specify that for a plan-level analysis, area plans such as the proposed plan establish consistency with the BA 2010 CAP. In addition to a threshold comparison, the guidelines ask three key questions for any area plan under review:

1. Does the plan support the primary goals of the BA 2010 CAP?
2. Does the plan include applicable control measures from the BA 2010 CAP?
3. Does the plan disrupt or hinder implementation of any BA 2010 CAP control measures?

In accordance with Policy L-8.4 in Chapter 4, “Land Use,” of the proposed plan, projects in the plan area would be evaluated against BAAQMD’s thresholds of significance and would comply with applicable control measures from BA 2010 CAP before obtaining building permits. With implementation of Policy L-8.4, the proposed plan would be consistent with the BA 2010 CAP. Besides consistency with the BA 2010 CAP, the other prescribed method to evaluate operational impacts is to determine whether the plan’s operational emissions are below the thresholds set by BAAQMD, even if project-level thresholds must be used in the absence of plan-level thresholds.

Construction

The air quality assessment for the proposed plan is a plan-level analysis. The BAAQMD CEQA Guidelines (2012) do not provide construction thresholds of significance for plan-level impacts. Although construction-related thresholds of significance do not exist for plan-level impacts, construction emissions were modeled as a worst-case scenario assuming the most aggressive construction scenario. For example, the Station Center subarea was assumed to be developed over a 15-year period, and such development would occur simultaneously with construction of the remaining land uses that would be developed over a 25-year period.

Construction emissions associated with construction of the plan were modeled using the California Emissions Estimator Model (CalEEMod) Version 2013.2.2 (CAPCOA, 2013). Because this is a proposed plan and not a proposed project, the exact nature of the project-related construction in the plan area could not be determined at the time of this analysis. Thus, construction parameters were obtained using default construction parameters contained in CalEEMod. Using default assumptions typically results in conservative emissions estimates to avoid underestimating emissions when site-specific information is unknown. In addition, to avoid underestimating construction emissions pursuant to guidance from BAAQMD, conservative assumptions were made for construction activities such as overlapping subphases and starting construction activities at the earliest possible year. See Appendix A for detailed modeling assumptions and outputs.

As shown in Table 3.1-2, the proposed plan's daily average construction emissions would exceed BAAQMD's project-level threshold of significance for NO_X. Although construction activities and emissions would be short-term and temporary, emissions could still represent a substantial contribution to regional air quality. Project-level thresholds of significance are developed as limits on allowable emissions that each project can generate without interfering with the region's ability to maintain and attain air quality standards. Projects that generate emissions exceeding applicable thresholds would be considered to generate emissions at a level that could conflict with or obstruct implementation of the applicable AQP. Thus, because the proposed plan's construction-related NO_X emissions would exceed the BAAQMD thresholds of significance and because the region is nonattainment with respect to both state and national ozone standards (NO_X is an ozone precursor), the proposed plan's construction-related emissions have the potential to conflict with or obstruct implementation of the applicable AQP.

Table 3.1-2: Construction Criteria Air Pollutant Emissions Associated with the Proposed Plan

Pollutant	ROG	NO_X	Exhaust PM_{10}	Exhaust $PM_{2.5}$
Station Center (tons)	28.64	85.33	3.46	3.32
Remaining Land Uses (tons)	64.51	219.09	6.21	5.78
Total Construction Emissions (tons)	93.14	304.41	9.67	9.10
Average Daily Emissions (lbs/day) [1]	28.66	93.67	2.98	2.80
BAAQMD Project-Level Thresholds (lb/day)	54	54	82	82
Exceeds Project-Level Threshold?	No	Yes	No	No

Notes: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; BAAQMD = Bay Area Air Quality Management District; lb/day = pounds per day

1 Total construction emissions are averaged over the total 25-year build-out period.

Source: compiled by AECOM in 2015

As noted previously, detailed information for construction activities at the plan level are currently unavailable, so conservative assumptions were used to avoid underestimating potential emissions. As a conservative conclusion, this construction-related impact would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.1-1: Implement BAAQMD Basic Construction Control Measures

BAAQMD recommends that all projects, regardless of significance, implement the Basic Construction Control Measures during construction. Implementing the following measures would effectively minimize and control fugitive dust emissions from the proposed construction-related activities. All building or grading permits issued for projects within the plan area shall include the following Basic Construction Control Measures (BAAQMD, 2011) as a condition of the permit. All contractors selected to construct any component of the project shall implement the following measures:

- *All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.*
- *All haul trucks transporting soil, sand, or other loose material off-site shall be covered.*
- *All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power-vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.*
- *All vehicle speeds on unpaved roads shall be limited to 15 miles per hour.*
- *Idling times shall be minimized either by shutting equipment off when not in use or by reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure, Title 13, Section 2485 of the California Code of Regulations). Clear signage shall be provided for construction workers at all access points.*
- *All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.*
- *A publicly visible sign shall be posted at the soil transfer site within BAAQMD, with the telephone number and person at the City of Rohnert Park to contact regarding dust complaints. This person shall respond and take corrective action within 48 hours. BAAQMD's phone number also shall be visible, to ensure compliance with applicable regulations.*

Mitigation Measure 3.1-2: Assess Criteria Pollutant Emissions Associated with Site-Specific Construction and Alter Project Details and/or Construction Equipment as Needed

As part of subsequent project-level CEQA analysis, the project applicant shall complete an evaluation of construction air pollutant emissions from individual projects in the plan area. The air pollutant emissions shall be compared to BAAQMD's thresholds of significance for project-level construction impacts to determine potential impacts. If potentially significant project-level construction-related impacts are found (i.e., construction-related emissions would exceed applicable thresholds of significance), additional mitigation measures (beyond those required for all projects by Mitigation Measure 3.1-1) shall be developed and implemented to reduce potential impacts to a less-than-significant level. Mitigation measures could include, but are not limited to the measures listed in Mitigation Measures 3.1-3, 3.1-4, and 3.1-5.

Mitigation Measure 3.1-3: Implement Applicable Site-Specific BAAQMD Additional Construction Control Measures for Exhaust-Related Emissions

BAAQMD has developed Additional Construction Mitigation Measures for those projects that will be located near sensitive receptors. Because the plan's construction-related pollutant of most concern is NO_X, the following measures from BAAQMD's Additional Construction Measures with an emphasis on exhaust-related measures shall be implemented during construction if project-level impacts are found to be significant to reduce emissions to a less-than-significant level. Example additional measures that would help reduce exhaust-related NO_X emissions are listed below; however, projects are not limited or confined to the following measures to reduce exhaust-related construction emissions.

- *The idling time of diesel-powered construction equipment shall be minimized to 2 minutes.*
- *Low–volatile organic compound (i.e., ROG) coatings shall be used, beyond local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings).*
- *All contractors shall be required to use equipment that meets ARB's most recent certification standard for off-road heavy duty diesel engines.*
- *All contractors shall be required to use a selected percentage of higher tier equipment (e.g., Tier 4) or equipment that through retrofits or repowering meet the exhaust emission standards of higher tier emission standards in order to reduce construction impacts to a less-than-significant level.*
- *All contractors shall evaluate the feasibility of using alternatively fueled vehicles and equipment during construction activities. Alternatively fueled vehicles and equipment shall be used to the highest extent feasible and to reduce construction emissions to a less-than-significant level.*

Mitigation Measure 3.1-4: Implement Applicable Site-Specific BAAQMD Additional Construction Control Measures for Fugitive Dust Emissions

BAAQMD has developed Additional Construction Mitigation Measures for those projects that will include extensive earth-moving activities or will be located near sensitive receptors. Because the plan would consist of infill development with potential sensitive receptors nearby, the following example fugitive dust–related measures shall be considered to minimize exposure to nearby receptors, as applicable, if project-level impacts are found to be significant. However, projects are not limited or confined to the following measures to reduce fugitive dust–related emissions. .

- *All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12 percent. Moisture content can be verified by lab samples or moisture probe.*
- *All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 miles per hour.*
- *Wind breaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks shall have at maximum 50 percent air porosity.*
- *Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and shall be watered appropriately until vegetation is established.*
- *The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities*

on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time.

- *All trucks and equipment, including their tires, shall be washed off before leaving the site.*
- *Site accesses to a distance of 100 feet from the paved road shall be treated with a 6- to 12-inch compacted layer of wood chips, mulch, or gravel.*
- *Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than 1 percent.*

Mitigation Measure 3.1-5: Use BAAQMD Carl Moyer Program (CMP) to Offset Project-Specific Regional Emissions

*If any project-level air pollutant emissions (i.e., construction or operational) exceed the BAAQMD 2010 thresholds after implementation of applicable mitigation measures, the project applicant shall use BAAQMD's CMP to offset the remaining project-level air pollutant emissions that exceed the BAAQMD 2010 thresholds. The project applicant shall provide funding for emission reduction projects in an amount up to $16,640 per ton of criteria air pollutants (NO_X + ROG + [20*PM]) , which is the current cost-effectiveness limit for emission reduction projects set by the Air Resources Board for the CMP. The range of costs could be anywhere from approximately $5,000 per weighted ton to the upper limit of $16,640 per weighted ton. An administrative fee of 5 percent shall be paid by the project applicant to BAAQMD to implement the program. The funding will be used for a combination of the following types of projects:*

- *projects eligible for funding under the CMP guidelines that are real, surplus, quantifiable, and enforceable; and*
- *projects to replace older, high-emitting construction equipment operating in the Bay Area with newer, cleaner, retrofitted, or more efficient equipment.*

Significance After Mitigation

Before incorporation of mitigation, the proposed plan's construction-related NO_X emissions would exceed BAAQMD maximum annual and daily average project-level thresholds. The exhaust-related mitigation measures from Mitigation Measures 3.1-1 through 3.1-4 have the potential to reduce emissions to less than significant. However, in case implementing Mitigation Measures 3.1-1 through 3.1-4 is insufficient to reduce construction-related emissions to a less-than-significant level, implementing Mitigation Measure 3.1-5 would ensure that all emissions above BAAQMD thresholds of significance are reduced to a less-than-significant level through BAAQMD's CMP offset program. With construction-related emissions mitigated to below the BAAQMD CEQA thresholds of significance, the proposed plan would not conflict with or obstruct implementation of the BA 2010 CAP, and therefore represents a *less-than-significant* impact.

Operation

Although the proposed plan is not specifically cited in the *City of Rohnert Park General Plan 2020* (General Plan), the land use designations in the proposed plan are consistent with the General Plan's land use designations.

The plan will result in some increases in development density and intensity from the existing General Plan designations. The BAAQMD CEQA Guidelines state that to meet the threshold of significance for operational criteria air pollutant and precursor impacts for plans, a proposed plan must satisfy the following criteria:

- The plan is consistent with current AQP control measures (this requirement applies to project-level as well as plan-level analyses).
- A proposed plan's increase in projected vehicle miles traveled or vehicle trips (either measure may be used) is less than or equal to its projected population increase.

As stated under Impact 3.1a and addressed by Policy L-8.4 in the proposed plan, to achieve consistency with the BA 2010 CAP, the proposed plan would include applicable BA 2010 CAP control measures and ensure that individual projects in the plan area would not disrupt or hinder implementation of the BA 2010 CAP. The associated traffic impact study revealed that future development permitted under the proposed land uses contained in the plan area would be expected to result in total of 27,777 added trips per day. The projected population increase is estimated at 1,670 people. The trip increase is an order of magnitude greater than the population increase, which indicates that operational impacts would be *potentially significant*.

In addition to the plan-level analysis criteria described above, the proposed plan's long-term operational emissions were modeled using CalEEMod. Trip generation rates for the proposed land uses were obtained from the traffic study; trip parameters specific to Sonoma County in the SFBAAB were used to model mobile-source emissions. As shown in Table 3.1-3, the proposed plan's long-term daily and annual operational emissions would exceed the BAAQMD thresholds of significance. It should be noted that the BAAQMD operational thresholds of significance were developed to evaluate project-level impacts rather than an entire plan, such as the proposed plan. Therefore, the proposed plan's operational emissions would be anticipated to conflict with or obstruct implementation of the applicable air quality plan. This operational impact would be *potentially significant*.

Table 3.1-3: Operational Criteria Air Pollutant Emissions Associated with the Proposed Plan

Pollutant/Category	ROG	NO_X	PM_{10}	$PM_{2.5}$
Area (tpy)	35.44	0.08	0.17	0.17
Energy (tpy)	0.11	0.97	0.08	0.08
Mobile (tpy)	8.78	13.32	0.30	0.28
Plan-Level Emissions Total (tpy)	44.33	14.37	0.55	0.53
BAAQMD Project-Level Maximum Annual Thresholds (tpy)	10	10	15	10
Exceeds Project-Level Maximum Annual Threshold?	Yes	Yes	No	No
Plan-Level Emissions Total (lb/day)	242.92	78.74	3.01	2.88
BAAQMD Project-Level Thresholds (lb/day)	54	54	82	54
Exceeds Project-Level Daily Average Threshold?	Yes	Yes	No	No

Notes: BAAQMD = Bay Area Air Quality Management District; lb/day = pounds per day; NO_X = oxides of nitrogen; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; ROG = reactive organic gases; tpy = tons per year

Source: Compiled by AECOM in 2015 (see Appendix A)

Mitigation Measures

Mitigation Measure 3.1-5, "Use BAAQMD Carl Moyer Program (CMP) to Offset Project-Specific Regional Emissions" (see full Mitigation Measure 3.1-5 text above)

Mitigation Measure 3.1-6: Assess Criteria Pollutant Emissions Associated with Site-Specific Operations and Implement BAAQMD Operational Emissions Mitigation Measures

As part of project-level CEQA analysis the operational impact from projects in the plan area shall be assessed by the project applicant in accordance with the State CEQA Guidelines Appendix G Checklist and compared to BAAQMD's thresholds of significance for project-level impacts. Project-specific mitigation measures for the proposed plan shall be implemented, based on the BAAQMD Mitigation Measures for Operational Emissions found in Appendix A, if necessary to reduce impacts to below a level of significance.

Significance After Mitigation

Before incorporation of mitigation, the proposed plan's operational ROG and NO_X emissions would exceed BAAQMD's maximum annual and daily average project-level thresholds. However, with implementation of Mitigation Measure 3.1-6 and Policy L-8.4 of the proposed plan, individual project-level operational impacts would be assessed and project-specific mitigation measures implemented to reduce operational ROG and NO_x emissions, which would help reduce operational emissions. However, in case project design features and additional mitigation measures do not reduce operational emissions to a less-than-significant level, Mitigation Measure 3.1-5 would be implemented to use the CMP to offset the proposed plan's regional emissions to ensure that all emissions above BAAQMD thresholds are mitigated to a less-than-significant level. With operational emissions mitigated to below the BAAQMD CEQA thresholds of significance, the proposed plan would not conflict with or obstruct implementation of the BA 2010 CAP, and therefore represents a *less-than-significant* impact.

3.1b. Violate any air quality standard or contribute substantially to an existing or projected air quality violation? Less-than-Significant Impact with Mitigation Incorporated.

Construction

Construction under the proposed plan would result in short-term, temporary emissions of criteria air pollutants from various emission sources. Exhaust- and fugitive dust–related emissions would be generated at varying levels depending on the type of construction activities for a particular day. Fugitive PM dust emissions are among the pollutants of greatest concern with respect to construction activities. These emissions from construction activities can lead to adverse health effects and nuisance concerns, such as reduced visibility and soiling of exposed surfaces. Cut-and-fill operations, along with general site grading operations, are the primary sources of fugitive PM dust emissions from construction activities. Movement of vehicles on unpaved roads also can generate fugitive PM dust emissions by kicking up ground PM dust into the atmosphere. Construction emissions of fugitive PM dust can vary greatly, depending on the level of activity, the specific operations taking place, the number and types of equipment operated, vehicle speeds, local soil conditions, weather conditions, and the amount of earth disturbance (e.g., site grading, excavation, cut and fill).

Emissions of the ozone precursors ROG and NO_X are generated primarily from mobile sources (i.e., delivery vehicles, construction worker vehicles) and off-road construction equipment. Generation of these emissions varies as a function of vehicle trips per day for delivery of construction materials, importing and exporting of soil, vendor trips, and worker commute trips; and by the types and number of heavy-duty, off-road equipment used, and the intensity and frequency of their operation.

Construction-related details of the proposed plan have not yet been determined at the time of this analysis; therefore, a worst-case construction scenario was modeled to determine the plan's construction impacts. The average daily construction emissions associated with the proposed plan are shown in Table 3.1-2.

As shown in Table 3.1-2, the proposed plan's construction-related NO_X emissions would exceed the BAAQMD 2010 threshold of significance. Projects that generate air pollutant emissions exceeding applicable thresholds of significance are considered to cause a substantial contribution to regional air quality. Therefore, construction emissions would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.1-1, "Implement BAAQMD Basic Construction Control Measures" (see full Mitigation Measure 3.1-1 text above)

Mitigation Measure 3.1-2, "Assess Criteria Pollutant Emissions Associated with Site-Specific Construction and Alter Project Details and/or Construction Equipment as Needed" (see full Mitigation Measure 3.1-2 text above)

Mitigation Measure 3.1-3, "Implement Applicable Site-Specific BAAQMD Additional Construction Control Measures for Exhaust-Related Emissions" (see full Mitigation Measure 3.1-3 text above)

Mitigation Measure 3.1-4, "Implement Applicable Site-Specific BAAQMD Additional Construction Control Measures for Fugitive Dust Emissions" (see full Mitigation Measure 3.1-4 text above)

Mitigation Measure 3.1-5, "Use BAAQMD Carl Moyer Program (CMP) to Offset Project-Specific Regional Emissions" (see full Mitigation Measure 3.1-5 text above)

Significance After Mitigation

Implementation of Mitigation Measure 3.1-1 would fulfill the minimum requirements of BAAQMD and would be required for all projects regardless of significance.

Because the schedule and phasing of construction activities in the plan area are unknown at this time, implementing Mitigation Measure 3.1-2 would provide a more reasonable determination of construction impacts because individual projects in the plan area subject to CEQA analysis would be assessed (i.e., project-level analysis) with respect to BAAQMD thresholds of significance. This project-level analysis for individual projects before construction would provide more accurate construction build-out information than an evaluation of the total plan as shown in Table 3.1-2. If potentially significant project-level construction-related impacts are determined, additional mitigation measures (i.e., Mitigation Measures 3.1-3, 3.1-4, and 3.1-5) would be implemented to reduce impacts to a less-than-significant level. Implementation of Mitigation Measure 3.1-3 would reduce construction-related NO_X emissions by restricting idling of construction equipment, using higher-tier equipment, and requiring off-road heavy-duty diesel engines to meet ARB's most recent certification standards, among other potential measures. Similarly, Mitigation Measure 3.1-4 would be implemented to achieve additional on-site emission fugitive dust reductions if the proposed component would include extensive earthmoving activities near sensitive receptors. If all on-site mitigation measures (i.e., Mitigation Measures 3.1-1, 3.1-3, and 3.1-4) cannot reduce emissions to a less-than-significant level, Mitigation Measure 3.1-5 would be implemented to achieve off-site reductions that offset the project's emissions to a less-than-significant level.

Before incorporation of mitigation, the construction-related emissions of NO_X associated with the proposed plan would exceed BAAQMD daily average project-level thresholds. However, with Mitigation Measures 3.1-1 through 3.1-5, assessing individual projects' construction impacts on a project level and implementing mitigation measures (as necessary) would reduce construction-related emissions below BAAQMD's CEQA thresholds of significance. With construction-related emissions mitigated to below BAAQMD CEQA thresholds, the proposed plan would not violate any air quality standard or contribute substantially to an existing or projected air quality violation, and therefore would represent *a less-than-significant* impact.

Operations

After construction under the proposed plan, day-to-day operations would generate long-term emissions. Operational emissions for land use development projects are typically distinguished as mobile-, energy-, and area-source emissions. Mobile-source emissions are those from vehicles arriving at and leaving a project site, which include resident, customer, employee, and delivery vehicles. Area-source emissions are those associated with consumer products, periodic architectural coatings, and landscape maintenance activities. Energy-use emissions are associated with buildings' electricity and natural gas usage (non-hearth).

CalEEMod also can model operational emissions (i.e., from mobile, energy, and area sources) based on user-defined or default parameters. The proposed plan's operational emissions were modeled using trip generation rates from the traffic impact study, and land use types and amounts provided by the City.

As shown in Table 3.1-3, the proposed plan's daily and annual operational emissions would exceed the BAAQMD 2010 project-level thresholds of significance for ROG and NO_X. Both ROG and NO_x are ozone precursors, and the plan area is located in a nonattainment area for both the state and national ozone standards. Therefore, the proposed plan's operational emissions could contribute substantially to an existing or projected air quality violation, and the proposed plan's impact would be *potentially significant*.

Mitigation Measures

> **Mitigation Measure 3.1-5, "Use BAAQMD Carl Moyer Program (CMP) to Offset Project-Specific Regional Emissions" (see full Mitigation Measure 3.1-5 text above)**

Mitigation Measure 3.1-6, "Assess Criteria Pollutant Emissions Associated with Site-Specific Operations and Implement BAAQMD Operational Emissions Mitigation Measures" (see full Mitigation Measure 3.1-6 text above)

Significance After Mitigation

The plan area's operational emissions would be in exceedance of BAAQMD's ROG and NO_X maximum annual and daily average project-level thresholds. However, per Mitigation Measure 3.1-6, assessment of individual project operational impacts and implementation of project-specific mitigation measures to reduce operational ROG and NO_x emissions would likely reduce operational emissions below the BAAQMD thresholds of significance. If project-level operational emissions are still above BAAQMD thresholds, implementation of Mitigation Measure 3.1-5 would offset the proposed plan's regional emissions and reduce impacts to less than significant through the CMP. With operational emissions mitigated to below the BAAQMD CEQA thresholds of significance, the proposed plan would not violate any air quality standard or contribute substantially to an existing or projected air quality violation, and therefore would represent a *less-than-significant* impact.

3.1c. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)? Less-than-Significant Impact with Mitigation Incorporated.

See Section 3.1.4, "Cumulative Impacts," below for a description of the proposed plan's cumulative impacts.

3.1d. Expose sensitive receptors to substantial pollutant concentrations? Less-than-Significant Impact with Mitigation Incorporated.

In addition to contributing to regional air pollutant emissions, the proposed plan's construction-related and operational activities would generate emissions of air pollutants and TACs on a local level, which could potentially expose sensitive receptors. Furthermore, the proposed plan would include sensitive receptors (i.e., residential dwelling units) in the plan area, which is approximately 100 feet from U.S. 101 to the east, and major intersections such as Rohnert Park Expressway (RPX) and Commerce Boulevard, which run directly through the plan area. Localized air pollutants and TACs from U.S. 101 and major vehicle intersections could also affect the proposed sensitive receptors. As discussed previously, there are also several existing sources of TACs. This impact analysis evaluates the proposed plan's potential construction-related and operational impacts on localized sensitive receptors, and the impact of existing sources on the proposed plan's sensitive receptors.

Construction Emissions of Toxic Air Contaminants

The use of off-road diesel equipment, required for construction under the proposed plan, would result in the generation of diesel PM emissions. ARB has classified diesel PM as a TAC; therefore, even short-term exposure could have health impacts. Using a worst-case scenario, construction emissions would occur during the approximate 20-year build-out period, in which all proposed land uses are assumed to be developed simultaneously. Diesel PM emissions would vary depending on the types of construction activities occurring each day. Therefore, during site preparation and grading, which would require large mechanical forces such as large diesel equipment, diesel PM emissions are expected to be greater than emissions during building construction and architectural coatings, which would require more manual labor. After completion of the proposed plan, all construction activities and associated diesel PM emissions would cease.

The dose to which receptors are exposed is the primary factor used to determine health risk, and is a function of concentration and duration of exposure. According to the State Office of Environmental Health Hazard Assessment, health risk assessments that determine the health risks caused by exposure of residential receptors to TAC emissions should be based on a 30-year exposure period, and health risk assessments that address the health risk associated with exposure of children to TAC emissions should be based on a 9-year exposure period (OEHHA, 2015). Children's exposure to TACs is of special concern because children typically metabolize more air per unit of body weight than adults, and they can be more sensitive to toxics during development. However, heath risk assessments should be limited to the period/duration of activities associated with the emissions activity.

A likely construction scenario is the phased construction under the proposed plan over a 20-year build-out period. Although existing residential receptors are located within the plan area, on-site construction emissions would not remain in one location throughout the 20-year period. Rather, construction activities and subsequent diesel PM emissions would move across the plan area. In addition, because of the infill nature of the project, it is not anticipated that most construction activities would require large TAC-generating activities such as cut/fill operations or mass site grading, as is typically required for greenfield development. Therefore, nearby receptors would be exposed to varying levels of TACs throughout the construction schedule. During some phases, construction activities would be located more than 1,000 feet away from the nearest sensitive receptors while some phases may occur within 1,000 feet of existing receptors, but for a limited amount of time. Considering the information above and because exposure would be intermittent, relatively short term, and temporary, it is not anticipated that the proposed plan would expose sensitive receptors to significant levels of diesel PM emissions. For general and area plans to have a less-than-significant impact with respect to TACs for siting new sources and receptors, special overlay zones need to be established around existing and proposed land uses that emit TACs. Because the nature, intensity, size, duration, and locations of the plan area's construction activities with respect to sensitive receptors are currently unknown, performing a health risk analysis would be speculative at this time.

In combination with the dispersive properties of diesel PM (Zhu et al., 2008), and because construction activity would move around the plan area and expose any single sensitive receptor to a fraction of the total construction emissions, short-term construction activities would not result in the exposure of sensitive receptors to levels that would result in a health hazard or exceed applicable standards. In addition, the implementation of idling restrictions, engine tunings, and certifications from Mitigation Measures 3.1-1 and 3.1-3 would further reduce PM and TAC emissions. However, two existing sensitive receptor locations—Pathways Charter School, and Rohnert Park Kinder Care—were identified to be within the plan area, and may require further evaluation if long periods of construction emissions are expected to occur within 1,000 feet of these locations. As a conservative conclusion, this impact would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.1-7: Assess Toxic Air Contaminant Emissions and Health Risks Associated with Site-Specific Construction

As part of any project-level CEQA analysis, the health risk impacts of construction $PM_{2.5}$ and TAC concentrations from individual projects within the plan area shall be assessed by the project applicant in accordance with BAAQMD's CEQA Guidelines and Recommended Methods for Screening and Modeling Local Risks and Hazards, as necessary. If health risk impacts are determined to exceed BAAQMD thresholds of significance, BAAQMD's exhaust-related additional construction Mitigation Measure 3.1-3 shall be implemented to reduce impacts to a less-than-significant level.

Significance After Mitigation

With implementation of Mitigation Measure 3.1-7, the assessment of health impacts related to project-specific construction PM and TAC emissions and implementation of mitigation measures for individual projects associated with the proposed plan to reduce health impacts to a less-than-significant level would ensure that sensitive receptors are not exposed to substantial pollutant concentrations, and therefore would represent a *less-than-significant* impact.

Operational Emissions of Toxic Air Contaminants

The proposed plan would develop commercial, light industrial, civic, multifamily, and single-family land uses. With the exception of the light industrial land use site within the Triangle Business Subarea, the other land uses are not typically the types that generate substantial TAC emissions. The existing industrial-zone area within the Triangle Business Subarea is greater than 1,000 feet from any known sensitive receptor, or any planned residential area that would include sensitive receptors. Other potential sources of operational TACs would include residents or visitors arriving at and departing from the plan area in diesel-fueled vehicles; however, these emissions would be consistent with the current baseline diesel vehicle population, dispersed throughout regional roadways, and the plan area would not substantially increase or attract diesel-fueled vehicles. In addition, a bulk of these emissions would be generated on regional and local roads, and would not be a constant source of TAC emissions for the plan area, as would a stationary source.

The industrial, downtown mixed-use retail, institutional, and commercial land uses could include occasional trips by diesel-fueled material delivery trucks; however, these trips would be infrequent compared to larger regional commercial or industrial land uses (e.g., distribution center), where product turnover is constant. These minimal TAC emissions from the proposed land uses would be intermittent and dispersed throughout the region on local roadways and highways, and would not be concentrated within the plan area. In addition, material delivery trucks would need to comply with ARB's Airborne Toxics Control Measure (ATCM) to Limit Diesel-Fueled Commercial Motor Vehicle Idling to minimize unnecessary diesel PM emissions.

Considering the types of land uses proposed and their relatively low intensity of operations, it is unlikely that the proposed plan's operational activities would generate substantial TAC emissions that would expose nearby sensitive receptors to TAC concentrations that exceed applicable standards. However, as a conservative conclusion, the proposed plan's TAC emissions could expose any sensitive receptors to substantial pollutant concentrations. This impact would be *potentially significant*.

Mitigation Measures

> **Mitigation Measure 3.1-8: Assess Toxic Air Contaminant Emissions and Health Risks Associated with Site-Specific Operation and Implement Applicable BAAQMD Health Risk Mitigation Measures**
>
> *As part of any project-level CEQA analysis, $PM_{2.5}$ and TAC emission impacts of operational activities from individual projects in the plan area shall be assessed by the project applicant in accordance with BAAQMD's CEQA Guidelines and Recommended Methods for Screening and Modeling Local Risks and Hazards as necessary. If health risks are determined to exceed BAAQMD thresholds of significance, project-specific mitigation measures shall be implemented to reduce health risks to a less-than-significant level. Possible mitigation measures could include but are not limited to change in project land use orientation to locate them farther away from existing sensitive receptors, purchase of retrofits of ventilation systems for existing sensitive receptors, and change in land use type to develop a more compatible land use (i.e., non-TAC source). Mitigation measures shall be developed and implemented for significant operational impacts of PM and TAC emissions. Additional BAAQMD mitigation measures can be found in Appendix A.*

Significance After Mitigation

With implementation of Mitigation Measure 3.1-8, the assessment of health impacts related to project-specific operational PM and TAC emissions and implementation of mitigation measures for individual projects associated with the proposed plan would not expose sensitive receptors to substantial pollutant concentrations and thus would represent a *less-than-significant impact*.

Carbon Monoxide Hotspots

The primary mobile-source pollutant of localized concern is CO. Local mobile-source CO emissions and concentrations near roadway intersections are a direct function of traffic volume, speed, and delay. Transport of CO is extremely limited because this pollutant disperses rapidly with distance from the source under normal meteorological conditions. However, under specific meteorological conditions, CO concentrations near roadways and/or intersections may reach unhealthy levels with respect to local sensitive land uses, such as residential units, hospitals, schools, and childcare facilities.

Plan-level CO impacts are not specifically recognized in the BAAQMD CEQA Guidelines; however, this impact is being screened for localized concentrations as a conservative measure. BAAQMD has developed a screening threshold to determine whether a project would cause an intersection to potentially generate a CO hotspot. The screening thresholds have been developed with conservative assumptions to avoid underestimating CO concentrations. Therefore, a project that would not exceed the screening thresholds would be highly unlikely to generate a CO hotspot. According to this methodology, a project would have the potential to generate a CO hotspot if it would contribute a substantial volume of vehicle trips to an intersection that would exceed 44,000 vehicles per hour. For intersections located in areas where vertical and/or horizontal mixing is substantially limited, the screening threshold is 24,000 vehicles per hour.

The traffic impact study evaluated affected intersections under existing and cumulative conditions (2040), with and without the proposed plan. The cumulative plus project intersection volumes were compared with BAAQMD's screening threshold. The 2040 cumulative conditions would account for the maximum traffic volumes from the proposed plan plus regional growth. The plan area would be built out and fully operational in year 2040; therefore, using 2040 to evaluate cumulative traffic impacts would conservatively evaluate a future year with maximally foreseeable traffic volumes. As determined by the traffic study, the highest hourly volume of vehicles at an intersection would occur under p.m. peak-hour cumulative (2040) plus proposed plan conditions at the intersection of RPX and Commerce Boulevard. The maximum hourly volume at this intersection would be 6,278 vehicles per hour, which would be substantially less than the 24,000 and 44,000 vehicles per hour screening thresholds discussed above (BAAQMD, 2011). Therefore, implementing the proposed plan is not expected to have the potential to generate CO hotspots, and this impact would be *less than significant*.

On-Site Community Risk and Hazard

The BAAQMD CEQA Guidelines' thresholds of significance for plans with regard to community risk and hazard impacts require the use of a land use diagram to determine the locations of sources and receptors, along with mitigation measures to reduce health impacts.

1. The land use diagram must identify:

    a. Special overlay zones around existing and planned sources of TACs; and

    b. Special overlay zones of at least 500 feet (or air district–approved modeled distance) on each side of all freeways and high-volume roadways.

2. The plan must also identify goals, policies, and objectives to minimize potential impacts and create overlay zones for sources of TACs and receptors.

The approximate locations of future sources and receptors are not yet known for this plan area; therefore, Google Maps was used as a reference to determine general distances between existing sources and future receptors, and distances between potential future sources and future receptors.

The proposed plan would site sensitive receptors in an area that includes existing land uses and potential TAC and $PM_{2.5}$ sources. Common stationary sources of TAC and $PM_{2.5}$ emissions include gasoline stations, dry cleaners, and diesel backup generators, which are subject to BAAQMD permit requirements. The other, often more important, common source type is on-road motor vehicles on freeways and roads, such as trucks and cars. The plan would also be developed around the Rohnert Park station of the SMART rail line, acting as a local transit hub. The technology to be used as part of the SMART rail line will be self-propelled rail cars known as Diesel Multiple Units. According to a white paper written on SMART's clean-diesel trains (SMART, 2008), a 200-seat SMART train would emit:

- particulate matter equal to that emitted by one automobile and only 1/20th the particulate matter of a 40-seat transit bus;
- smog-producing NO_X equal to the emissions of only 8 automobiles, and only 1/5th the NO_X of one 40-seat transit bus; and
- carbon dioxide (CO_2) equal to that from 12 automobiles, despite carrying many more people, and about the same CO_2 as two 40-seat transit buses.

This clean-diesel technology can transport hundreds of passengers with only a fraction of the emissions from the average single-occupant vehicle or a regular diesel bus. It is expected that the SMART corridor will offset highway travel while introducing a lower-emissions technology. This rail impact would be less than significant on new receptors anticipated by the plan.

This analysis also evaluates the health-risk impacts of nearby gasoline-dispensing facilities, permitted stationary sources, and mobile sources (i.e., freeways and high-volume roadways).

The 2010 BAAQMD CEQA Guidelines state that for area plans to have a less-than-significant impact with respect to potential TACs for siting new sources and new receptors, special overlay zones need to be established around existing and proposed land uses that emit TACs. Google Maps was used to establish these overlay zones, and provided a general reference for the health risk impacts related to sources described immediately above.

U.S. 101 is the nearest highway to the plan area, located approximately 100 feet from its western edge, and could potentially expose the proposed sensitive receptors to substantial TAC concentrations from vehicle traffic. With respect to major roadways, the intersection of RPX and Commerce Boulevard passes directly through the plan area. As determined by the California Environmental Health Tracking Program's traffic volume tool, the section of roadway that has the highest volume within the plan area is Commerce Boulevard, which runs north-south; is approximately 800 feet north of the intersection of RPX; and has 18,900 vehicles per day (CDPH, 2013). This is above the threshold of 10,000 vehicles per day in which a project proponent must evaluate the health risks associated with local surface streets, per BAAQMD's Surface Street Screening Tables for Sonoma County. As a conservative and rough estimate, and because the exact locations of the new receptors within the plan area are unknown, a 50-foot distance was selected from the segment with the highest traffic volume within the buffer of the plan area. This was also selected because it is from the closest current development, Cal Skate of Rohnert Park.

Using BAAQMD's screening tools for permitted stationary sources, BAAQMD-permitted stationary sources were identified within 1,000 feet of the plan area, and within the plan area border. BAAQMD's Stationary Source Screening Analysis Tools were used to identify and obtain the cancer risk, health hazard, and $PM_{2.5}$ concentrations associated with these stationary sources. In addition, the BAAQMD multiplier tool for gasoline-dispensing facilities and internal combustion engines within 1,000 feet of the plan area border were used to adjust stationary sources' cancer risk and $PM_{2.5}$ concentrations based on their actual distances from the plan area. However, for determining distances between sources and receptors within the plan area, the proposed plan has not identified exact distances of new receptors. As a conservative measure, the closest distance of 66 feet (20 meters) was used for gasoline-dispensing facilities, and the closest distance of 82 feet (25 meters) was used for diesel internal combustion engines located in the plan area. Accordingly, this conservative assumption results in the maximum cancer risks and chronic hazard indices for these sources.

Table 3.1-4 shows the adjusted cancer risk, health hazard, and $PM_{2.5}$ concentrations associated with the BAAQMD-permitted stationary sources, major roadways and highways within 1,000 feet of the plan area, and sources within the plan area.

As shown in Table 3.1-4, the proposed plan's sensitive receptors would be exposed to health risks that exceed BAAQMD thresholds from nearby stationary sources, gasoline-dispensing facilities, internal combustion engines, highways, and high-volume roadways that exceed the BAAQMD thresholds of significance. Therefore, the proposed plan's sensitive receptors would likely be exposed to substantial health risks from nearby cumulative sources. This impact would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.1-9: Assess Local and Community Hazard Risks Associated with Project-Specific Operation and Implement Applicable BAAQMD Community Risk and Hazard Mitigation Measures

As part of any project-level CEQA analysis, health impacts of siting new receptors from individual projects within the plan area shall be assessed by the project applicant in accordance with BAAQMD's CEQA Guidelines and Recommended Methods for Screening and Modeling Local Risks and Hazards, as necessary. Once exact distances are known between new receptors and existing sources, the BAAQMD Health Risk Screening Tools and Distance Multipliers can be more accurately used to determine cancer risks and $PM_{2.5}$ *concentrations. If health risks are determined to exceed BAAQMD thresholds of significance, project-specific mitigation measures shall be implemented to reduce health risks to a less-than-significant level. Possible mitigation measures could include but are not limited to change in sensitive land use orientation to locate them farther away from TAC sources; increased ventilation system requirements for sensitive-receptor heating, ventilation, and air conditioning systems; and change in land use type to develop a more compatible land use (i.e., nonsensitive receptor). Appendix A provides a list of BAAQMD* $PM_{2.5}$*/TAC mitigation measures.*

Table 3.1-4: BAAQMD-Permitted Stationary Sources and Major Roadways within 1,000 Feet of and Within the Plan Area[1]

Name of Source	Plant No.	Cancer Risk (in a million)	Chronic Hazard Index [2]	$PM_{2.5}$ Concentration ($\mu g/m^3$) [3]
The Home Depot	16829	.0357	0.00636	0.00371
Chevron	G8516	3.294	0.062	N/A
AT&T	10739	14.96	0.005	0.027
Redwood Shell	G11048	1.076	0.032	N/A
Rohnert Park Tesoro	G11548	23.708	0.022	N/A
Interior Finishing	11689	0	0.001	0
Final Touch Finishing	11815	0	0.002	0
Blake's Auto Body	6408	0	0.001	0.018
Press Democrat	2277	0	0	0.0005

Table 3.1-4: BAAQMD-Permitted Stationary Sources and Major Roadways within 1,000 Feet of and Within the Plan Area[1]

Name of Source	Plant No.	Cancer Risk (in a million)	Chronic Hazard Index [2]	$PM_{2.5}$ Concentration ($\mu g/m^3$) [3]
Downtown Autobody	17823	0	0	0.005
City of Rohnert Park	16435	14.7	0.005	0.026
City of Rohnert Park	16329	7.53	0.003	0.002
Valero Refining Co.	G10595	30.351	0.028	N/A
Chevron USA	G7062	65.857	0.06	N/A
100 feet east of U.S. Highway 101 at 6 feet elevation [2]	N/A	42.373	0.044	0.405
50 feet east of Commerce Boulevard at the highest volume segment	N/A	10.85	N/A	0.278
Cumulative Total Risk	N/A	194.89	0.27	0.76
BAAQMD Individual Source Thresholds	N/A	10	1	0.3
Exceeds Individual Threshold	N/A	Yes	No	Yes
BAAQMD Cumulative Thresholds	N/A	100	10	0.8
Exceeds Cumulative Threshold	N/A	Yes	No	No

Notes: $\mu g/m^3$ = micrograms per cubic meter of air; BAAQMD = Bay Area Air Quality Management District; N/A = not applicable; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns.

1 As a conservative measure, and because the locations of the projects/receptors are unknown at this time, the closest-distance multipliers were used for gasoline-dispensing facilities and diesel generators, which did not reduce the cancer risks and $PM_{2.5}$ concentrations.

2 Cancer risks, health hazards, and $PM_{2.5}$ concentrations have been adjusted, based on the BAAQMD's Distance Adjustment Multiplier for Diesel Internal Combustion Engines and Gasoline-Dispensing Facilities.

3 For purposes of a conservative analysis, the 6-foot exposure value was used rather than the 20-foot value, because it contained higher risk values. The zone used for this portion of the highway allows for single-family homes that would be located on ground level.

Source: BAAQMD, 2015b

Significance After Mitigation

With implementation of Mitigation Measure 3.1-9, the assessment of local and community hazard risks from individual projects in the plan area and implementation of mitigation measures for individual projects associated with the proposed plan would not expose sensitive receptors to substantial pollutant concentrations, and therefore would represent a *less-than-significant impact*.

3.1e. Create objectionable odors affecting a substantial number of people? Less-than-Significant Impact with Mitigation Incorporated.

The occurrence and severity of odor impacts depend on numerous factors, including the nature, frequency, and intensity of the source; wind speed and direction; and the sensitivity of the receptors. Although offensive odors rarely cause any physical harm, they can be very unpleasant, leading to considerable distress among the public, and causing citizens to submit complaints to local governments and regulatory agencies. Projects with the potential to frequently expose individuals to objectionable odors are deemed to have a significant impact. Typical facilities that generate odors include wastewater treatment facilities, sanitary landfills, composting facilities, petroleum refineries, chemical manufacturing plants, and food processing facilities.

Construction

Construction under the proposed plan is not anticipated to expose nearby off-site receptors (existing or future planned) to objectionable odors. Construction activities would generate diesel PM exhaust from heavy-duty trucks and off-road construction equipment, which could be considered offensive by some individuals. However, use of off-road construction equipment would be intermittent throughout the construction period, and it is not anticipated that a constant plume of diesel PM emissions would be generated from construction equipment. Rather, during working hours, varying levels of odor emissions would be generated depending on the types of construction activities. Furthermore, construction emissions would cease each day for the night. Therefore, even during the most equipment-intense phases, odor emissions (i.e., diesel PM) would not be constantly generated from the plan area.

In addition to the factors described above, the source of potential construction-related odor emissions (i.e., diesel PM) would decrease as construction activities continue, as a result of fleet turnover and improved emissions technology. For these reasons and because of the highly dispersive nature of diesel PM, the proposed plan's construction activities are not expected to expose a substantial number of receptors to objectionable odor emissions. Therefore, this impact would be *less than significant*.

Operations

Operation under the proposed plan would generate a minimal amount of odor emissions in the form of diesel PM exhaust generated by some proposed residents and occasional material delivery trucks. These emissions would be dispersed throughout the regional roadway network, and therefore would not be concentrated on the plan area, or any particular site where a receptor could be exposed continuously. As described above, all material delivery trucks would also be required to comply with ARB's ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling. The proposed plan would also include downtown mixed-use commercial land uses, which would site potential odor-producing activities (e.g., food service, light commercial activities) near residents in the same building. Residential and commercial dumpsters could be a potential odor source; however, regular trash collection, which would be provided by the City, would ensure that garbage and refuse that could generate odors would be disposed of regularly and properly. However, because of the proximity of proposed residents to proposed commercial land uses, it is possible that certain commercial land uses could generate odor emissions that expose a substantial number of receptors. Therefore, for purposes of a conservative analysis, the proposed plan's operational activities are assumed to potentially result in significant odor effects on a substantial number of sensitive receptors. This impact would be *potentially significant*.

Mitigation Measures

> **Mitigation Measure 3.1-10: Assess Odors Associated with Project-Specific Operation and Implement Applicable BAAQMD Odor Mitigation Measures**
>
> *As part of any project-level CEQA analysis, odor impacts from individual projects within the plan area shall be assessed by the project applicant in accordance with BAAQMD's CEQA Guidelines as necessary. Significant odor impacts shall be mitigated using best management practices and odor control*

technology to less than significant when feasible. The most likely odor sources to be sited within the plan area are restaurants and food services. BAAQMD odor mitigation for food service includes:

- *integral grease filtration system or grease removal system,*
- *baffle filters,*
- *electrostatic precipitator,*
- *water cooling/cleaning unit,*
- *disposable pleated or bag filters,*
- *activated carbon filters,*
- *oxidizing pellet beds,*
- *incineration,*
- *catalytic conversion,*
- *proper packaging and frequency of food waste disposal, and*
- *exhaust stack and vent location with respect to receptors.*

Significance After Mitigation

With implementation of Mitigation Measure 3.1-10, the assessment of odor impacts from individual projects and implementation of best management practices and odor control technology would prevent objectionable odors from affecting a substantial number of people. This would result in a *less-than-significant impact*.

3.1.4 Cumulative Impacts

Criteria Pollutants

Construction

As shown in Table 3.1-2, construction emissions of NO_X would exceed BAAQMD's project-level threshold of significance, which is the allowable amount of emissions that a single project can generate without conflicting with or obstructing implementation of an air quality plan. In addition, as shown in Table 3.1-1, the plan region is a nonattainment area for both the state and national ozone standards. Therefore, it is anticipated that construction emissions could generate a cumulatively considerable contribution to this cumulative impact.

With implementation of Mitigation Measures 3.1-1, 3.1-2, 3.1-3, and 3.1-4, construction impacts from each project in the plan area would be evaluated and BAAQMD's construction mitigation measures would be incorporated as necessary to reduce fugitive dust and exhaust NO_X emissions to a less-than-significant level. However, in case some projects would not be able to reduce construction-related NO_x emission below BAAQMD's thresholds, Mitigation Measure 3.1-5 would be implemented to offset the proposed plan's regional emissions and ensure that all emissions above BAAQMD thresholds of significance are reduced to a less-than-significant level through BAAQMD's CMP offset program. Therefore, the project's cumulative contribution to this impact would be *less than significant* with incorporation of these mitigation measures.

Operations

Table 3.1-3 presents the thresholds of significance for operational emissions of criteria air pollutants and precursors. The SFBAAB is currently in nonattainment for ozone, PM_{10}, and $PM_{2.5}$. Thresholds of significance represent the levels at which a project's individual emissions of criteria air pollutants or precursors would result in a significant contribution to the SFBAAB's existing air quality conditions. Because the daily average operational emissions of criteria air pollutants and precursors from the proposed plan exceed the threshold of significance for ROG and NO_X, the proposed plan could result in a cumulatively considerable contribution to this cumulative impact. However, when more detailed information is available for each individual project in the plan area, Mitigation Measure 3.1-6 would be implemented to more accurately determine the cumulative operational impacts from each project and implement the BAAQMD Mitigation Measures for Operational Emissions. Furthermore, once project-level information is obtained, compliance with Policy L-8.4 from the proposed plan would allow a proper determination of consistency of those individual projects because BAAQMD would be asked qualifying questions related to the BA 2010 CAP.

It is still possible that some projects would not be able to reduce operational ROG and NO_X emissions below BAAQMD's thresholds. Therefore, cumulative operational ROG and NO_X emissions have the potential to represent a considerable contribution to the cumulative impact. In this case, Mitigation Measure 3.1-5 would reduce individual operational impacts below the BAAQMD thresholds by offsetting the proposed plan's regional emissions from through the CMP. This would reduce the proposed plan's cumulative contribution to this impact to *less than significant* with incorporation of this mitigation measure.

Toxic Air Contaminants and Sensitive Receptors

Construction Toxic Air Contaminants

As determined in Impact 3.1d, the proposed plan's construction-related TAC emissions may expose nearby sensitive receptors to TAC concentrations that would cause significant health-risk impacts. However, construction activities and associated emissions would be short term and temporary, and would cease after build-out of the proposed plan. Because the exact locations of projects in the plan area are unknown, it must be inferred that construction-related TAC emissions would be potentially significant on a project level, but would cease after build-out. Because construction-related TAC emissions would be potentially significant, the cumulative impact also would be potentially significant.

The assessment of health impacts related to project-specific construction $PM_{2.5}$ and TAC emissions from Mitigation Measure 3.1-7, along with implementation of necessary BAAQMD exhaust-related basic and additional construction Mitigation Measures 3.1-1, 3.1-3, and 3.1-4, would reduce health risk impacts on sensitive receptors to a less-than-significant level. Therefore, cumulative construction impacts of $PM_{2.5}$ and TAC emissions would be reduced to a *less-than-significant* level.

Operational Toxic Air Contaminants (Proposed Plan)

After build-out of the proposed plan, the commercial, light industrial, civic, multifamily, and single-family land uses would generate operational emissions. These types of land uses are not typically generators of TAC emissions, with the exception of light industrial land use. However, the light industrial zoned land use is greater than 1,000 feet from the nearest sensitive receptor. Other TAC emissions associated with these land uses would include occasional diesel-fueled vehicles visiting or delivering materials to the proposed land uses. These TAC emissions would be infrequent and dispersed throughout the regional roadway network. Therefore, the proposed plan's operational emissions of TACs would not cause a cumulatively considerable contribution to the cumulative impact, and this cumulative impact would be *less than significant*.

Operational Toxic Air Contaminants (On-Site Community Risk)

The proposed residential receptors would also be exposed to cumulative TAC emissions from nearby land uses. As shown in Table 3.1-4, the cumulative TAC impacts associated with nearby roadways, stationary sources, and gasoline-dispensing facilities would be greater than the BAAQMD health risk thresholds of significance for cancer. Therefore, the cumulative impact of exposing proposed residential receptors to significant TAC emissions would be cumulatively significant.

However, with implementation of Mitigation Measures 3.1-8 and 3.1-9, project-level local and community hazard risks would be assessed and BAAQMD's Community Risk and Hazard Impact Mitigation Measures would be implemented. As a result, sensitive receptors would not be exposed to substantial pollutant concentrations, and cumulative local risk and community impacts would be reduced to a *less-than-significant* level.

Carbon Monoxide Hotspots

Day-to-day operations under the proposed plan would generate vehicle trips that would contribute to congestion at local roadways, which could cause a potential CO hotspot. However, as determined in the traffic analysis, when considering year 2040 cumulative traffic volumes along with the proposed plan, peak hourly volumes at affected intersections would be substantially less than the BAAQMD screening threshold. Therefore, the cumulative impact on localized CO would be *less than significant*.

Odors

Construction

Construction activities would generate odor emissions associated with diesel fuel construction equipment. Construction equipment would operate intermittently throughout the day and would cease operation at night. Therefore, project construction activities would not generate odor emissions continuously throughout the day. In addition, construction-related odor emissions would be dispersed throughout the plan area and would not be concentrated in one specific area. Furthermore, after build-out of the proposed plan, all construction-related odor emissions would cease. Therefore, the cumulative odor impacts would be *less than significant*.

Operations

As discussed above in Impact 3.1e, the proposed plan would include commercial, light industrial, civic, multifamily, and single-family land uses, and the commercial and light industrial uses have the potential to generate substantial odor emissions. Depending on the ultimate land use, odor emissions associated with these types of land uses, especially commercial and residential downtown mixed-use, could colocate restaurants, bakeries, and other common odor-producing sources directly below or adjacent to residential dwelling units. In addition to these sources, garbage dumpsters and trash cans also have the potential to produce odors. However, as described above, Mitigation Measure 3.1-10 would be implemented to assess odor impacts from individual projects and implement odor control technologies as necessary. With regard to solid waste odors, the City would provide regular and frequent (e.g., once a week) garbage collection to prevent garbage from accumulating for long periods of time and forming odors from decomposition.

This would prevent objectionable odors from affecting a substantial number of people. This would reduce cumulative odor impacts to *less than significant*.

3.1.5 References

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3.2 BIOLOGICAL RESOURCES

This section describes the existing physical and regulatory setting related to biological resources and discusses the potential impacts of the proposed plan on biological resources.

3.2.1 Existing Conditions

The plan area is located on approximately 330 acres bordering the northbound lanes of U.S. Highway 101 (U.S. 101). For the purposes of this analysis, the project footprint refers to the total amount of ground disturbance related to the proposed plan—for both grading and development. The use of the construction footprint for the analysis is particularly important because it fully accounts the potential disturbance to biological resources associated with proposed development of the plan area.

Vegetation Communities

The project footprint is composed mainly of developed areas, with small patches of ruderal and ornamental vegetation interspersed between paved areas and structures. Ruderal vegetation also dominates unpaved areas along pedestrian footpaths and the Sonoma-Marin Area Rail Transit (SMART) tracks that run along the eastern border of the project footprint. Two perennial streams (Copeland Creek and Hinebaugh Creek) and associated riparian habitat traverse the project footprint from east to west. Several unnamed ephemeral drainages also are located within the project footprint, running adjacent to and parallel with U.S. 101, and interspersed along the edges of the SMART rail tracks. These drainages run in a straight line and appear to be human-made. All of these ephemeral drainage features were dry during the field survey on March 16, 2015, and no facultative wetland plant species were observed within the dry drainages or low-lying areas. However, a formal wetland delineation was not conducted, and wetland indicators that normally would be expected to be present may have been absent because of the recent drought.

Sonoma County Water Agency (SCWA) conducts extensive landscape and hardscape improvements throughout Sonoma County each year. Copeland Creek and Hinebaugh Creek are both included within Zone 1A of the SCWA Stream Maintenance Program. SCWA primarily removes sediment and garbage from streams, plants trees and creekside plants, and performs other vegetation management activities. One of the purposes of the program is to promote habitat restoration and to maintain stands of mature trees and riparian canopies. Riparian canopies provide shade to combat noxious weeds, and provide refuge for fish, amphibian, reptile, and bird species. In addition, the SCWA Stream Maintenance Program promotes trail building to offer the community access to enjoy streams for recreational activities. Within the plan area boundaries, in the past 5 years alone the program has conducted sediment removal in Hinebaugh Creek (2010 and 2013) and instream basin clearings in Copeland Creek (2010, 2011, 2013, 2014, and 2015).

Developed

The vast majority of the plan area is covered by paved surfaces and structures, both commercial and residential. For the purposes of this document, areas covered by sod, such as parks, school yards, and residential yards, also are considered developed, because they generally do not provide habitat for species.

Ruderal

Areas not covered by pavement, structures, or sod are dominated primarily by ruderal vegetation, composed of nonnative species such as curly dock (*Rumex crispus*), European ivy (*Hedera helix*), Eurasian oats (*Avena* spp.), black mustard (*Brassica nigra*), jubata grass (*Cortaderia jubata*), fennel (*Foeniculum vulgare*), bamboo (*Poaceae* spp.), burr clover (*Medicago polymorpha*), milk thistle (*Silybum marianum*), wild radish (*Raphanus raphanistrum*), snake grass (*equisetum* spp.), and dandelion (*Taraxacum officinale*). Native species also are interspersed in these areas, including California poppy (*Eschscholzia californica*), lupine (*Lupinus* spp.), and blackberry (*Rubus ursinus*).

Riparian/Perennial Stream

Two perennial streams (Copeland Creek and Hinebaugh Creek) traverse the plan area, flowing westward, and both are tributaries to Laguna de Santa Rosa. Overstory species associated with the riparian corridors include coast live oak (*Quercus agrifolia*), Monterey pine (*Pinus radiata*), willow (*Salix* spp.), Eucalyptus (*Eucalyptus* spp.), and numerous species of ornamental trees. The understory is composed of ruderal vegetation, described previously. The riparian habitat is flanked on both north and south banks by paved pedestrian paths and residential and commercial development.

Special-Status Species

Based on a review of the U.S. Fish and Wildlife Service (USFWS) Sacramento Office species list (within U.S. Geological Survey quads 501C Cotati, 501A Kenwood, 501D Glen Ellen, 501B Santa Rosa, 502A Sebastopol, 502D Two Rock, 485A Point Reyes NE, 484B Petaluma, and 484A Petaluma River) and California Natural Diversity Database (CNDDB) records within 5 miles of the plan area, five special-status wildlife species but no special-status plant species were determined to potentially occur in the plan area (Calflora, 2015; CDFW, 2015; CNPS, 2015; USFWS, 2015). These species are identified in Table 3.2-1. A complete list of special-status species reviewed as part of this analysis is provided in Appendix B. For the purposes of this analysis, only species with the potential to occur in the plan area was determined to be “possible” or “likely” are discussed. Species that were determined “unlikely” to be present in the plan area were not analyzed because they would not be affected by the proposed plan. The results of the CNDDB records review are shown in Table 3.2-1. The USFWS species list is also provided in Appendix B.

Critical Habitat

No federally designated critical habitat is present in the project footprint. Critical habitat for California tiger salamander exists immediately west of the project footprint, bordering portions of the southbound lanes of U.S. 101. In addition, California tiger salamander critical habitat occurs less than 1 mile north and 1 mile south of the project footprint. A description of critical habitat designations is provided in Section 3.2.2, “Regulatory Framework.”

Table 3.2-1: Species with Potential to Occur in the Plan Area

Species	Listing Status[1]
Coho salmon *Oncorhynchus kisutch*	FE
Central California Coast steelhead *Oncorhynchus mykiss*	FT
California tiger salamander *Ambystoma californiense*	FT/ST
Foothill yellow-legged frog *Rana boylii*	SSC
Western pond turtle *Emys marmorata*	SSC

Notes:
[1] Species Listing Status

Federal Listing Status:

FE—Federally Listed as Endangered
FT—Federally Listed as Threatened

State Listing Status:

ST—State Listed as Threatened
SSC—Species of Special Concern

Source: CDFW, 2015

3.2.2 Regulatory Framework

Federal Endangered Species Act

The federal Endangered Species Act (ESA) protects plants and wildlife species that are listed as endangered or threatened by USFWS and the National Marine Fisheries Service. Under Section 9, the ESA prohibits take of endangered wildlife, where “take” is defined as to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in such conduct” (Title 16, Sections 1532[19] and 1538 of the U.S. Code [16 USC 1532(19), 1538]). For plants, this statute governs removing, possessing, maliciously damaging, or destroying any listed plant on federal land, and removing, cutting, digging up, damaging, or destroying any listed plant on nonfederal land in knowing violation of state law (16 USC 1538[c]). Take also can include the modification of a species’ habitat. Under the ESA, critical habitat also can be identified as those areas critical for the recovery of a listed species. Critical habitat does not impose development restrictions on an area, but it alerts federal agencies to the importance of some areas to listed species.

The ESA would apply to development in the plan area because of the potential for the area to support endangered species.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 USC 703–711) recognizes international treaties between the U.S. and other countries that have afforded protection to migratory birds and any of their parts, eggs, and nests, from activities such as hunting, pursuing, capturing, killing, selling, and shipping, unless expressly authorized in the regulations or by permit. The Migratory Bird Treaty Act applies to development in the plan area because of the potential for impacts on bird species covered by this act and/or their nests.

Clean Water Act

The purpose of the federal Clean Water Act (CWA) (Sections 401 and 404 [33 USC 1251 et seq.]) is to “restore and maintain the chemical, physical, and biological integrity of the nation’s waters.” The definition of “waters of the United States” encompasses rivers, streams, estuaries, territorial seas, ponds, lakes, and wetlands. Wetlands are defined as those areas “that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions” (Title 33, Section 328.3 7b of the Code of Federal Regulations [33 CFR 328.3 7b]).

The U.S. Army Corps of Engineers (USACE) issues permits for work in wetlands and other waters of the United States, based on guidelines established under Section 404 of the CWA. Section 404 of the CWA prohibits the discharge of dredged or fill material into waters of the United States, including wetlands, without a permit from USACE. The U.S. Environmental Protection Agency also has authority over wetlands and, under Section 404(c), may veto a USACE permit. Depending on the amount of impacts on waters of the United States, a USACE Section 404 permit application can either invoke use of a nationwide permit for any project with minimal adverse effects or require the project proponent to submit an individual permit application if the project does not fall under a nationwide permit. The CWA applies to development in the plan area because of the need to permanently fill features determined to be waters of the United States.

California Endangered Species Act

The California Endangered Species Act (CESA), adopted in 1984, generally parallels the main provisions of the ESA and includes Sections 2050–2098 of the California Fish and Game Code. Section 2080 prohibits the taking, possession, purchase, sale, and import or export of endangered, threatened, or candidate species, unless otherwise authorized by permit or in the regulations. “Take” is defined in Section 86 of the California Fish and Game Code as to “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.” CESA allows for take incidental to otherwise lawful projects. State lead agencies and private entities may consult with the California Department of Fish and Wildlife (CDFW) so that any action undertaken is not likely to jeopardize the continued existence of any species that is state listed as endangered or threatened, or to result in the destruction or adverse modification of essential habitat. The CESA would apply to development in the plan area because of the potential for the area to support endangered species.

California Fish and Game Code

Unlawful Takes

Section 3503 of the California Fish and Game Code states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by the code or any subsequent regulation. Section 3513 makes it unlawful to take, possess, or destroy any birds of prey or to take, possess, or destroy the nest or eggs of any such bird.

Native Plant Protection Act of 1977

The Native Plant Protection Act of 1977 (California Fish and Game Code, Sections 1900–1913) was created with the intent to “preserve, protect, and enhance rare and endangered plants in this state.” A species is rare when, although the species is not threatened with immediate extinction, its numbers are so small throughout its range that it may become endangered if its existing environment declines. The Native Plant Protection Act is administered by CDFW. The California Fish and Game Commission has the authority to designate native plants as “endangered” or “rare” and to protect them from take. The California Native Plant Society has established California Rare Plant Rank (CRPR) categories for vascular plants that are independent of their federal or state listing statuses. (The CRPR system was formerly known as the California Native Plant Society List.) CRPR categories are as follows:

- CRPR 1A: Presumed extinct in California
- CRPR 1B: Rare, threatened, or endangered in California and elsewhere
- CRPR 2: Rare, threatened, or endangered in California but more common elsewhere

Plants ranked CRPR 1A, 1B, or 2 meet the definition of endangered, threatened, or rare under Section 1901 of the Native Plant Protection Act and Sections 2062 and 2067 of the CESA. Therefore, they generally are considered to be “special-status plants” under the California Environmental Quality Act (CEQA).

Title 14, Sections 670.2 and 670.5 of the California Code of Regulations

Title 14, Sections 670.2 and 670.5 of the California Code of Regulations list wildlife designated as threatened or endangered in California. “Species of special concern” is a category conferred by CDFW on those species that are indicators of regional habitat changes or considered potential future protected species. Species of special concern do not have any special legal status; however, Section 15380 of the State CEQA Guidelines indicates that species of special concern should be included in an analysis of project impacts, if they can be shown to meet the criteria of sensitivity outlined there. These regulations would apply to development in the plan area because of the potential for the area to support CDFW-designated species of special concern.

City of Rohnert Park General Plan

The Environmental Conservation—Habitat and Biological Resources section of the City’s General Plan (City of Rohnert Park, 2015 [originally adopted 2000]), outlines guiding and implementing policies to protect and preserve special-status species, special habitat areas, wetlands, native species, vegetation, creeks, and wetlands, while balancing the needs for growth and development. The following goals and policies are applicable to the conservation of sensitive biological resources in the plan area:

Goal EC-B: Protect special status species and supporting habitats within Rohnert Park, including species that are State or federally listed as Endangered, Threatened, or Rare.

Goal EC-C: Protect sensitive habitat areas and wetlands in the following order of protection preference: 1) avoidance, 2) on-site mitigation, and 3) off-site mitigation.

Goal EC-D: Maintain existing native vegetation and encourage planting of native plants and trees.

- **Policy EC-4:** Cooperate with State and federal agencies to ensure that development does not substantially affect special status species appearing on any State or federal list of rare, endangered, or threatened species. Require assessments of biological resources prior to approval of any development within 300 feet of any creeks, high potential wetlands, or habitat areas of identified special status species, as depicted in Figure 6.2-1.
- **Policy EC-5:** Require development in areas with high and moderate wetlands potential and habitat areas delineated in Figure 6.2-1, as well as other areas where wetland or habitat for special-status species is present, to complete assessments of biological resources.
- **Policy EC-7:** Encourage planting of native vegetation in new development sites, parks, public areas, and open space.
- **Policy EC-8:** As part of the City's Park, Recreation, and Open Space Master Plan (see Chapter 5: Open Space, Parks, and Public Facilities), institute an ongoing program to remove and prevent the re-establishment of invasive plant species from ecologically sensitive areas, including City parks and other City-owned open space.
- **Policy EC-12:** Protect oaks and other native trees that are of significant size through the establishment of a Heritage Tree Preservation Ordinance.
- **Policy EC-13:** Maintain creek protection zones extending a minimum of 50 feet (measured from the tops of the banks and a strip of land extending laterally outward from the top of each bank) for creeks, with extended buffers where significant habitat areas or high potential wetlands exist (Figure 6.2-2). Where high potential wetland or other biological resources exist, require appropriately wide buffers to encompass and protect the resource. Development shall not occur within this zone, except as part of greenway enhancement (for example, trails and bikeways). Require City approval for the following activities within the creek protection zones:
  - Construction, alteration, or removal of any structure;
  - Excavation, filling, or grading;
  - Removal or planting of vegetation (except for removal of invasive plant species); or
  - Alteration of any embankment.
- **Policy EC-14:** As part of specific plans, require evaluation and implementation of appropriate measures for creek bank stabilization, and any necessary steps to reduce erosion and sedimentation, but preserve natural creek channels and riparian vegetation

City of Rohnert Park Heritage Tree Preservation Ordinance

In accordance with Measure EC-12 of the *City of Rohnert Park General Plan*, the Heritage Tree Preservation Ordinance applies to any tree within the Rohnert Park city limits, exclusive of acacia (*Acacia* spp.), tree of heaven (*Ailanthus* spp.), *Eucalyptus* spp., privet (*Ligustrum* spp.), liquidambar (*Liquidambar styraciflua*), Monterey pine (*Pinus radiata*), or Lombardy poplar (*Populus nigra*), that has a single trunk diameter of 4 inches or more, or a combination of multiple trunks with a total diameter of 8 inches or more. In addition to the species listed above, the following trees are exempt from this ordinance:

- Trees that are designated as a "street tree" as defined in the Rohnert Park Municipal Code.

- Tree pruning activities that are in conformance with the International Society of Arboriculture standards.
- Trees determined to be an imminent threat to public health, safety, or general welfare.
- Trees growing in inappropriate locations, as determined by the City Arborist.
- Trees located within fully developed residential lots with a detached, single-family residence.
- Trees planted or held for cash crop or commercial purpose (i.e., orchard trees).

The altering, removal, or relocation of any tree that does not fall under any of the exclusions listed above must abide by the codes and regulations set forth in the Heritage Tree Preservation Ordinance.

3.2.1 Impact Discussion

3.2a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service? Less-than-Significant Impact with Mitigation Incorporated.

The plan area is situated on approximately 330 acres. Potential development-related impacts would occur primarily in areas where pavement or structures currently exist; however, development also is proposed in areas identified to have ruderal vegetation. No project activities would be conducted within the two perennial stream features that traverse the plan area.

Special-Status Plants

No special-status plant species were observed during reconnaissance surveys, and desktop research indicates that special-status plants are unlikely to occur in the plan area. In addition, the proposed plan includes Policy L.7-2, which calls for avoidance of adverse impacts on ecologically sensitive habitats. However, no botanical surveys have been performed to date. Therefore, although special-status plant species are unlikely to be present in the plan area because of the prevalence of existing development and ruderal vegetation, it is not possible to completely rule out the presence of special-status plant species in the plan area. Thus, the impact would be *potentially significant*. Implementation of Mitigation Measure 3.2-1 would provide guidance for conducting botanical surveys during the appropriate phonological periods for plants, before the start of construction.

Mitigation Measures

> **Mitigation Measure 3.2-1: Conduct Site-Specific Botanical Surveys and Implement Protective Actions if Rare Plants Are Identified**
>
> *During the appropriate phenological periods, preconstruction rare plant surveys shall be conducted in areas where special-status plants have the potential to occur in construction areas. Developed areas will not be required to be surveyed, because of the lack of suitable habitat for rare plant species. Before the start of construction, the location of special-status plants shall be identified, then shall be marked or flagged for avoidance; or as appropriate, the limits of construction shall be marked between the plants and the construction area. If impacts on rare plants cannot be avoided, a qualified botanist shall oversee*

the collection of the upper 4 inches of topsoil in the areas where any identified special-status plant species would be affected. Once construction has been completed, the topsoil shall be stockpiled separately and restored to the general area of disturbance.

Significance After Mitigation

Implementation of Mitigation Measure 3.2-1 would reduce the impact on special-status plant species to a *less-than-significant* level.

Migratory Birds

Suitable nesting habitat exists on-site for other non-special-status migratory birds and raptors. This habitat exists primarily within the riparian corridors that are located along the two perennial streams traversing the plan area from east to west. In addition, trees throughout the residential and commercial areas may be used by nesting birds. Policy L.7-2 of the proposed plan calls for avoidance of adverse impacts on ecologically sensitive habitats and wildlife in planning, construction, and maintenance of creek corridor paths. However, nesting activities of these birds could be directly affected by habitat/tree removal, which would result in the loss of active nests and indirectly would be affected by adjacent construction noise and vibration, nighttime lighting, or excessive dust creation that would result in nest abandonment or breeding/rearing failure.

Because of this potential loss of habitat and temporary disturbance, this impact on migratory birds would be *potentially significant*. Implementation of Mitigation Measure 3.2-2 would take place before the start of construction.

Mitigation Measures

Mitigation Measure 3.2-2: Conduct Site-Specific Preconstruction Nesting Bird Surveys and Implement Protective Actions if Active Nests Are Detected

A preconstruction survey shall be conducted by a qualified biologist for nesting raptors and other special-status bird species a maximum of 2 weeks before the start of any new construction activities (i.e., ground clearing and grading, staging of equipment, ground disturbance) during the breeding season (February 1–August 31) so that no nesting migratory birds are within or adjacent to the construction area. If active nests are found during the preconstruction survey, a no-disturbance buffer zone shall be created around active nests during the breeding season or until a qualified biologist has determined that the young have fledged. The no-disturbance buffer zone shall be a minimum of 250 feet from active raptor nests, 100 feet from special-status species, and 50 feet from non-special-status nesting bird species until the chicks have fledged. Reductions in the size of the buffer zones and or allowances of limited types of construction activities within the buffer zone shall be determined by a qualified biologist and shall be based on existing noise and human disturbance levels in the plan area and observed evidence of disturbance to birds.

Significance After Mitigation

Implementing Mitigation Measure 3.2-2 would reduce the impact on special-status and migratory bird species to a *less-than-significant* level.

Special-Status Fish Species

Coho Salmon (*Oncorhynchus kisutch*) and Central California Coast Steelhead (*Oncorhynchus mykiss*) have the potential to occur in the plan area, in the two perennial streams that traverse the plan area from east to west (Santos et al., 2014). No construction activities would occur within the streams or associated riparian habits; therefore, habitat loss would not occur and direct mortality of special-status fish species because of the proposed plan would be unlikely to occur. However, near-stream construction activities may result in runoff that could cause temporary increases in water turbidity. High concentrations of suspended sediment could disrupt normal feeding behavior and efficiency (Cordone and Kelly, 1961; Bjornn et al., 1977; Berg and Northcote, 1985), and could reduce growth rates (Crouse et al., 1981). High turbidity concentrations could reduce dissolved oxygen in the water column, resulting in reduced respiratory functions, reduced tolerance to diseases, and also could cause fish mortality (Sigler et al., 1984; Berg and Northcote, 1985; Gregory and Northcote, 1993; Waters, 1995). Even small pulses of turbid water cause salmonids to disperse from established territories (Waters, 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival. Increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juveniles (Alexander and Hansen, 1986, NRDC, 2015).

In addition to increases in water turbidity, equipment refueling, fluid leakage, and equipment maintenance near the stream channels pose some risk of contamination of aquatic habitat and subsequent injury or death to listed salmonids. Because of the developed nature of the plan area, these perennial stream features have existing sources of pollutants and petroleum-based products in the form of runoff from roadways and other sources in the project vicinity. In addition, trash, shopping carts, tires, and other human-made debris are present in both perennial streams.

However, because of this potential disturbance of habitat from turbidity and contamination, this impact on special-status fish species would be *potentially significant*. As discussed in detail in Section 3.7, “Hydrology and Water Quality,” implementing Mitigation Measure 3.7-1, “Prepare and Implement Site-Specific SWPPPs,” and Mitigation Measure 3.7-2, “Prepare, Submit, and Implement Site-Specific Erosion Control Plans” (see Section 3.7 for the full text of these mitigation measures), would reduce impacts from construction-related soil erosion to a less-than-significant level, because these measures entail implementation of a grading and erosion control plan and a SWPPP with site-specific BMPs specifically designed to reduce erosion. Measures that could be implemented to reduce erosion include limiting ground-disturbing activities during the winter rainfall period; minimizing exposure of disturbed areas and soil stockpiles to rainfall; minimizing construction activities near or within drainage facilities; using soil stabilization measures such as mulching, silt fencing, or temporary desilting basins; following good housekeeping practices such as road sweeping and dust control; and using diversion measures such as berms to prevent stormwater runoff from contacting disturbed areas. In addition, implementation of Mitigation Measure 3.2-3 would reduce the potential for the incidental trapping of wildlife.

Mitigation Measures

Mitigation Measure 3.2-3: Implement Site-Specific Natural Erosion Control Materials to Reduce the Potential for Entrapment of Special-Status Species

Plastic monofilament netting (e.g., erosion control matting or wattles) shall not be used in special-status species habitat, because wildlife can become trapped in the netting and it leaves plastic particles in the soil and water as it degrades. Appropriate fiber netting or similar natural materials (e.g., coconut coir matting) shall be used for erosion control or other purposes in sensitive areas, to reduce the potential for entrapping wildlife.

Mitigation Measure 3.7-1, "Prepare and Implement Site-Specific SWPPPs" (see full Mitigation Measure 3.7-1 text in Section 3.7, "Hydrology and Water Quality")

Mitigation Measure 3.7-2, "Prepare, Submit, and Implement Site-Specific Erosion Control Plans" (see full Mitigation Measure 3.7-2 text in Section 3.7, "Hydrology and Water Quality")

Significance After Mitigation

Implementation of Mitigation Measures 3.2-3, 3.7-1, and 3.7-2 would reduce the impact on special-status fish species to a *less-than-significant* level.

Special-Status Amphibians

No breeding habitat or upland habitat for California tiger salamander (*Ambystoma californiense*) or foothill yellow-legged frog (*Rana boylii*) is present in the plan area. However, the potential exists for these species to use perennial creeks and ephemeral drainages in the plan area as aquatic dispersal habitat. In addition, these species may disperse upland, away from aquatic features, into ruderal and developed areas. Therefore, although the proposed plan would not affect special-status amphibian species habitat, the potential for dispersing individuals in the plan area to be affected by the proposed plan cannot be ruled out (USFWS, 2004).

Policy L.7-2 in the proposed plan calls for avoidance of adverse impacts on ecologically sensitive wildlife. However, if special-status amphibian species are present in the project footprint during construction, these species may be affected by crushing, injury from construction-related disturbance, and modifications to behavior resulting from disturbances (e.g., noise). The potential also exists for project activities to increase water turbidity and pollutants, as described above for special-status fish species. The potential for these impacts to occur is very low because of the lack of suitable breeding or upland habitat in the plan area.

However, because of this potential disturbance, this impact on special-status amphibian species would be *potentially significant*. Implementation of Mitigation Measure 3.2-4 would address this potential disturbance to these amphibian species.

Mitigation Measures

Mitigation Measure 3.2-4: Conduct Site-Specific Preconstruction Surveys and Implement Protective Actions if Special-Status Species Are Identified

Preconstruction surveys for special-status species shall be conducted at active construction areas by a qualified biologist. However, construction areas that have a developed land cover type—including urban, residential, paved, or gravel areas—shall be surveyed at the discretion of a qualified biologist based on the potential for biological resources to be affected. In the event that a special-status species is encountered, all construction activities will stop within 50 feet of the individual. Construction activities will not resume until the individual has left the project area of its own volition. If a special-status species becomes trapped in a construction area, or does not leave the project area of its own volition, the appropriate resource agencies will be contacted to determine a course of action for species relocation.

Significance After Mitigation

Implementation of Mitigation Measure 3.2-4 would reduce the impact on special-status amphibian species to a *less-than-significant* level.

Special-Status Reptiles

Marginally suitable aquatic and upland habitat for western pond turtle (*Emys marmorata)* is present in the form of perennial creeks that traverse the plan area. In addition, one occurrence of a western pond turtle was recorded less than 0.15 mile west of the plan area, in the northern of the two perennial creeks. No project activities would occur in these perennial creeks; therefore, removal of western pond turtle habitat would not occur. However, western pond turtle may disperse upland into ruderal areas or, less likely, into developed areas, and could be affected by project activities.

Potential impacts on western pond turtle would be similar to those described previously for special-status amphibians and fish. As discussed previously, Policy L.7-2 in the proposed plan calls for avoidance of adverse impacts on ecologically sensitive wildlife. However, if western pond turtle is present in the project footprint during construction, the species may be affected by crushing, injury from construction-related disturbance, and modifications to behavior resulting from disturbances (e.g., noise). The potential also exists for project activities to increase water turbidity and pollutants in western pond turtle habitat aquatic habitat.

Mitigation Measures

Mitigation Measure 3.2-3, "Implement Site-Specific Natural Erosion Control Materials to Reduce the Potential for Entrapment of Special-Status Species" (see full Mitigation Measure 3.2-3 text above)

Mitigation Measure 3.7-1, "Prepare and Implement Site-Specific SWPPPs" (see full Mitigation Measure 3.7-1 text in Section 3.7, "Hydrology and Water Quality")

Mitigation Measure 3.7-2, "Prepare, Submit, and Implement Site-Specific Erosion Control Plans" (see full Mitigation Measure 3.7-2 text in Section 3.7, "Hydrology and Water Quality")

Significance After Mitigation

Mitigation Measure 3.2-3 would ensure that materials harmful to reptiles would not be used in erosion control devices. In addition, Mitigation Measures 3.7-1 and 3.7-2 require that the project implement a SWPPP as well as a site-specific erosion control plan, to reduce the potential for construction to result in degradation of reptile habitat. Thus, implementation of Mitigation Measures 3.2-3, 3.7-1, and 3.7-2 would reduce the impact on special-status reptile species to a *less-than-significant* level.

3.2b-c. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service? Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means? Less-than-Significant Impact with Mitigation Incorporated

The two riparian/perennial creeks that traverse the plan area from east to west, is located in the plan area. These two perennial creeks also are USACE Section 404 jurisdictional water features. No development activities would occur within these riparian corridors; however, impacts on these areas may occur from runoff or accidental spills entering these waterways. Increased turbidity and increased levels of pollutants could degrade the quality of these riparian areas, and would make them less useful as wildlife corridors and habitat.

Mitigation Measures

Mitigation Measure 3.7-1, "Prepare and Implement Site-Specific SWPPPs" (see full Mitigation Measure 3.7-1 text in Section 3.7, "Hydrology and Water Quality")

Mitigation Measure 3.7-2, "Prepare, Submit, and Implement Site-Specific Erosion Control Plans" (see full Mitigation Measure 3.7-2 text in Section 3.7, "Hydrology and Water Quality")

Significance After Mitigation

Mitigation Measures 3.7-1 and 3.7-2 require that the project implement a SWPPP as well as a site-specific erosion control plan, to reduce the potential for erosion and sedimentation of riparian and wetland habitat as a result of project activities. Thus, implementation of Mitigation Measures 3.7-1 and 3.7-2 would reduce the impact on water features and riparian sensitive natural communities and USACE Section 404 jurisdictional water features to a *less-than-significant* level.

3.2d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites? Less-than-Significant Impact.

The two perennial streams that traverse the plan area are the only wildlife corridors in the area. These two features accommodate the movement of wildlife within the area, from east to west. No development activities would occur within these two features. In addition, with the exception of the two perennial stream features, the remainder of the project footprint does not function as an important corridor between larger open space wildlife areas, because it is composed of dense urban development and is bordered on all sides by dense urban development. Therefore, the impact on wildlife corridors would be *less than significant*.

3.2e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? Less-than-Significant Impact with Mitigation Incorporated.

Implementation of the proposed plan would be likely to require removal of trees meeting the definition of "protected tree" under the City's Zoning Ordinance and Municipal Code to "address tree preservation and protection." Protected trees are found throughout the plan area and are concentrated on large vacant development sites. The impact from loss of these trees during construction would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.2-5: Prepare and Implement Site-Specific Tree Mitigation and Replacement Plans

Project applicants seeking to remove protected trees shall prepare a tree mitigation and replacement plan, in accordance with Division D5, "Resource Management," of the City of Rohnert Park Zoning Ordinance. The plan shall include all of the following elements:

(1) An inventory of trees planned for removal and any work planned within the dripline of protected trees;

(2) Replacement of trees at a ratio agreed on with the City of Rohnert Park and in accordance with the tree protection ordinance;

(3) The specific locations of the tree planting, including a map and planting plan;

(4) Schedules and methodologies for maintaining and monitoring the success of the plan; and

(5) Performance standards.

This plan shall be reviewed and approved by the City before issuance of a site development permit, and the plan shall be implemented throughout project construction.

Significance After Mitigation

Implementation of Mitigation Measure 3.2-5 would reduce the impact to a *less-than-significant* level because it would comply with the City's regulations to secure a tree removal permit.

3.2f. Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan? No Impact.

No drafted or adopted conservation plans are in place that would apply to the proposed plan or affect the plan area. Therefore, *no impact* would occur.

3.2.2 Cumulative Impacts

This section analyzes potential cumulative impacts related to biological resources that could occur from a combination of the proposed plan and other past, present, and reasonably foreseeable projects in the vicinity. The geographic scope of this analysis is defined as the city limits of Rohnert Park. As discussed in Chapter 2.0, "Project Description," the analysis of cumulative impacts assumes build-out of the City's General Plan (City of Rohnert Park, 2015 [originally adopted 2000]). Numerous projects have been approved, are under way, or are programmed within and adjacent to the City Center area. For example, the Sonoma-Marin Area Rail Transit station currently is under construction on the east side of the project footprint. In addition, 24 residential units are programmed for a vacant site at the intersection of Commerce Boulevard and Hinebaugh Creek.

Cumulative projects would be subject to state and federal regulations, the City's General Plan policies, and City ordinances intended to protect and conserve sensitive biological resources. In addition, independent environmental review in accordance with CEQA would be performed for discretionary projects, to examine their potential impacts on biological resources. These projects, like the proposed plan, would be required to comply with applicable City policies and state and federal laws, permit conditions set by resource agencies, and project-specific mitigation measures.

Therefore, the cumulative impacts on biological resources would be *less than significant*.

3.2.3 References

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3.3 CULTURAL RESOURCES

This section describes the existing physical and regulatory setting related to cultural resources and discusses the potential impacts of the proposed plan on cultural resources.

3.3.1 Existing Conditions

Archaeological Resources

Prehistoric Setting

Following Frederickson (1984) and Moratto (1984), a cultural chronology has been developed for the San Francisco Bay Area, based largely on discrete cultural traits observed in the stratigraphic sequence. These periods include the Paleo-Indian, Lower Archaic, Middle Archaic, Upper Archaic, and Emergent Periods. In Sonoma County, there is some evidence of the Paleo-Indian Period at Warm Springs, CA-SON-547 (Moratto, 1984). Later cultural periods have been identified in Sonoma County as well.

Paleo-Indian Period (12,000 to 8,000 Years Before Present [B.P.])

The Paleo-Indian Period has been described in terms of big-game hunters occupying a multitude of environments. However, subsequent data have illustrated that California's Paleo-Indians practiced varied resource exploitation (not just large mammals) and also may have been adept at seafaring (Arnold and Walsh, 2010:20–21). Although this period is marked primarily by a generalized tool kit (chopping tools, core bifaces, and scrapers), more specialized tools (drills, fluted projectile points, and gravers) have been noted from later sites of the period (Chartkoff and Chartkoff, 1984:43). Paleo-Indian sites in California consist of workshops, occupation sites, burials, butcher sites, and isolated finds (Chartkoff and Chartkoff, 1984).

Archaic Period

Although the early years of the Archaic Period are not easily discernible from the preceding Paleo-Indian Period, certain themes began to emerge. These include the use of new ecological niches, specialized technologies and tool kits, and diffuse economies. Archaic groups were highly mobile and practiced seasonal migration. In addition to multiple new tool types and ground stone technology, ritual objects and personal ornamentation developed during the Archaic Period. The period can be further subdivided into the Lower, Middle, and Upper Archaic Periods (Chartkoff and Chartkoff, 1984).

Lower Archaic Period (8,000 to 5,000 B.P.)

The Lower Archaic Period consisted of a few inland sites containing considerable numbers of milling tools, as well as chert and obsidian bifaces. Larger projectile points and crescents were replaced by wide-stemmed points, and the early part of the Lower Archaic is marked by still high residential mobility, with temporary sites located in higher mountain elevations and adjacent to river banks. Artifacts include ground stone slabs, large bifacial knives, scraping tools, core-cobble tools, and large-stemmed projectile points. Sites dating to this period are particularly susceptible to private collecting and "questionable provenance" (Arnold and Walsh, 2010:94), and they may be underrepresented in the cultural sequence. Scant evidence has been found that points to any human presence in the San Francisco Bay Area before 4,000 years ago, and it is likely that such occupation sites have been inundated by rising sea levels (GANDA, 2004; Arnold and Walsh, 2010).

Middle Archaic Period (5,000 to 3,000 B.P.)

The Middle Archaic Period was a continuation of the warming trend that began in the Early Archaic. During this time, oaks thrived, and acorn exploitation flourished. Broad regional subsistence patterns gave way to more intensive procurement practices, and economies became more diversified. Although acorns were an abundant resource, they are labor intensive and likely remained a secondary resource. Middle Archaic sites are marked by increasing quantities of stone milling tools. As the Middle Archaic continued, concave-based, lanceolate, and side-notched forms replaced the wide-stemmed points of the Early archaic (GANDA, 2004; Arnold and Walsh, 2010). During the Borax Lake Pattern (5,000 to 3,000 B.P.) of this period, a variety of tool forms were present, including concave-based, lanceolate, and side-notched types, as well as blades and burins. As populations increased, groups were occupying more diverse settings but still clustered primarily around major waterways (Arnold and Walsh, 2010). Trade networks with local partners were likely active as well (Chartkoff and Chartkoff, 1984).

Upper Archaic Period (3,000 to 1,300 B.P.)

During the Upper Archaic, status distinctions and other indicators of sociopolitical complexity developed. Complex exchange systems were formalized, and regular, sustained trade between groups was practiced. The Berkeley Pattern (4,000 to 2,500 B.P., overlapping portions of the Middle and Lower Archaic) is noted by the presence and expansion of large mound sites located on the bay shores (Arnold and Walsh, 2010). This was a time of a still-increasing use of acorns as a food source, with mortars and pestles observed in the archaeological assemblage, but nearly no manos or metates (Arnold and Walsh, 2010). Distinctive stone and shell artifacts differ from earlier cultural manifestations, and burials were primarily placed in flexed positions and often included red ochre (GANDA, 2004).

Emergent Period (1,300 to 200 B.P.)

The Emergent Period was a time of both technological and social changes. Territorial boundaries between groups become more defined, and it was increasingly common for an individual's social status to be linked with acquired, personal wealth. During the latter portion of the period (500 to 200 B.P.), sophisticated exchange relations were regularized with specialists governing the various aspects of production and exchange. The clamshell disk bead as a monetary unit developed during the late Emergent Period. The Augustine Pattern (1,300 to 200 B.P.) of this period reflected intensive food procurement strategies supporting a population increase. Intergroup trade activities gained in importance, and intensive fishing and hunting practices—as well as complex, regular exchange systems—are hallmarks of this period. A wide variety of mortuary practices have also been noted (GANDA, 2004).

Historic Resources

Sonoma County

Early settlement in Sonoma County resulted from both Spanish and Russian exploration. The Spanish presence was in response to Fort Ross, which was established by the Russians in 1812. Russian settlement spread from the coast to inland areas, and Spanish mission and rancho locations became established in the 1830s (GANDA, 2004:8).

The Russians ceded present-day Sonoma County to Mexican and American rivals in 1841. After the 1846–1848 Mexican War ended and the California Gold Rush ensued, events in the 1850s and 1860s brought the disintegration of ranchos. Towns such as Petaluma, Santa Rosa, and Sonoma developed into regional economic rivals. The region became an agricultural center as production of grapes, fruit, eggs, and other items bolstered the county's economy (GANDA, 2004:8).

The railroad reached north through Marin County and into Sonoma County by the 1870s, increasing the prominence of the logging and dairying industries. Agriculture remained vital to the county's economy into the 1910s, and it persists today. The railroad was important to developing the Sonoma County tourist trade that grew throughout the 20th century (GANDA, 2004:8).

Rohnert Park

Rohnert Park developed from Rancho Cotate, which changed ownership several times in the 19th century until it was purchased in 1849 by Dr. Thomas Page. The Page family owned the land grant for several years, and in 1892, established the Cotati Land Company. The Company subdivided land into parcels ranging from 5 to 20 acres, and gradually sold the parcels well into the 20th century. In 1929, Waldo Emerson Rohnert bought a large piece of Rancho Cotate to the north and east of the city of Cotati. Rohnert operated a successful seed company in Hollister that he started in 1893. Rohnert constructed a large drainage system to reduce the annual flooding. This drainage system allowed him to grow plants for their seeds, which he then sold to other seed companies. After Rohnert died in 1933, the company and the land transferred to his family. His son would continue to run the company from his office in Hollister with a local person on site for the Sonoma County operation (Danisi, 2012:7–8).

In 1955, Paul Golis and Maurice Fredericks, local attorneys, approached Fred Rohnert, Waldo's son, to grant them a purchase-option agreement for the 2,700-acre seed farm for $200 per acre. Golis and Fredericks planned to build a city from the neighborhood concept of planned growth modeled after the success of Levittown, Pennsylvania. Each neighborhood would have a school, swimming pool, and park that would be within a third of a mile of the farthest home. They planned for eight neighborhoods that would surround a city center, for a total population of 30,000 citizens. In 1956, Golis and Fredericks created a special assessment district—the Rohnert Park Community Services District. The district consisted of the Rohnert's family property and the Brian's Ranch, which had recently been sold. By 1957, wells, sewage plant, and some streets were completed and more infrastructure would be built as more financial backing was available (Danisi, 2012:7–8).

In 1960, it was decided that the special district should be an incorporated city; however, voters rejected the incorporation. There was debate about whether Rohnert Park, named after the Rohnert family, and Cotati should incorporate as one city. The citizens of Rohnert Park hired William T. Zion to analyze the incorporation of Rohnert Park, and Zion recommended that incorporation would provide better services than what the county could provide. In 1962, a special election was held, and the City of Rohnert Park was established. It became the fourth largest city in Sonoma County, and the first town to incorporate since 1905 (DeClercq, 1977).

Northwestern Pacific Railroad

Early History

The Northwestern Pacific Railroad (NWP) is an amalgam of 42 separate lines constructed between 1864 and the early 20th century, with the main line that extends through the plan area running between Tiburon and Eureka. The first railroad of significant length in the Bay Area was completed in October 1864 between San Francisco and San Jose, and less than 10 years later the San Rafael & San Quentin Railroad opened. Several other railroads operated in the plan area over the next few years; however, most did not survive for any great length of time (GANDA, 2004:12).

During the late 19th century, Marin and Sonoma County residents demanded a freight and passenger railway, but were divided over the route. Several railroad companies campaigned for the right to building a railroad, and on May 12, 1868, county residents chose the Sonoma County Railroad, which sought to build the railroad through Petaluma. The group had limited success, however, and soon transferred their rights and subsidies to the San Francisco and Humboldt Bay Railroad Company. The San Francisco and Humboldt Bay Railroad Company reorganized under the name San Francisco and North Pacific Railroad (SFNP). Interests in that line were eventually sold to Peter Donahue, the owner of the San Francisco and San Jose Railroad and Union Iron Works. Donahue had started the Union Iron Works, the first Gold Rush–era San Francisco foundry, which evolved into the Bethlehem Shipbuilding Corporation; and also organized the San Francisco Gas Company, which became Pacific Gas and Electric Company (GANDA, 2004:12–13).

By October 1870, regular service was under way between Petaluma and Santa Rosa. In April 1871, Donahue decided to sell his portion of the rail company for a large profit to competitor Milton Latham, owner of the California Pacific Railroad (CPRR). As such, the SFNP became the Petaluma and Humboldt Division of the CPRR. The CPRR soon decided that the Sonoma County line would not figure in its long-range plans. By January 1873, Donahue had purchased the Sonoma County line back for $1 million, and the line became part of the SFNP again (GANDA, 2004:13).

By the mid-1870s, Donahue constructed a line north from Cloverdale to the Landing at Humboldt Bay, as well as a new rail link between Petaluma and San Rafael. By 1884, he had completed track to Tiburon, which became the permanent southern terminus of the SFNP. Donahue died in 1885, and control of the company passed to his son, who died 5 years later. Control of the railroad passed from the younger Donahue estate to the California Northwestern Railway Company (CNW). Although the railroad continued to expand during the 1890s, it also saw severe financial problems that decade. Due to CNW's financial instability, the Southern Pacific Railroad (SPRR) absorbed the CNW in 1900 (GANDA, 2004:13–14).

20th Century

In the early 20th century, the SPRR took control of Marin and Sonoma Counties' rail lines and incorporated a new railroad to compete against the Santa Fe's expanding timber lines. The competing firms joined forces and formed the NWP on January 8, 1907. At that time, the tourist trade became a central business objective for the NWP, because hauling agricultural products was no longer profitable (GANDA, 2004:14).

The NWP became a favorite of Bay Area dwellers seeking the redwood forest experience, and resorts were built to accommodate the tourists. In 1929, the SPRR bought the Santa Fe's interest, and the NWP became a wholly owned subsidiary. The ensuing 1930s and the Great Depression made freight transportation nearly nonexistent, and the company abandoned the branch lines. Passenger service also declined as automobile traffic blossomed. From the mid-1930s on, the automobile replaced the train as America's choice for tourist-related travel. The NWP abandoned more than 138 miles of track during the 1930s Depression (GANDA, 2004:17).

With America's entry into World War II, all the NWP engines and cars were pressed into service hauling lumber and critical war supplies to San Francisco factories. Because of the high number of mercury mines in Napa and Sonoma Counties, the NWP shipped large amounts of this material during World War II (GANDA, 2004:17).

After the war, most of the population altered its mode of transportation from train to vehicle. It quickly became evident that the growth of the automobile, long-range trucking, even buses would have a permanent, nationwide effect on railroading. For the rail companies, passenger service was no longer a priority, and several passenger-oriented branch lines were dropped (GANDA, 2004:17).

Over the next few decades, several branch lines of the NWP were abandoned. Financial troubles during the 1980s forced the SPRR to place the NWP on the market. SPRR purchased the NWP in 1984. In 1996, the SPRR line from the town of Outlet, north of Willits, south to the town of Ignacio, in Marin County, became publicly owned. Today, the North Coast Railroad Authority maintains and operates the line between Healdsburg and Arcata, and the Sonoma-Marin Area Rapid Transit District owns the line from Healdsburg to Larkspur (GANDA, 2004:17).

Paleontological Resources

Based on a review of geologic mapping provided by Fox et al. (1973) and Sowers et al. (1998), the plan area is located within Holocene-age (i.e., 11,700 years B.P. to Present Day) interfluvial, marsh-like basin deposits consisting mainly of poorly sorted dark clay and silty clay. By definition, to be considered a unique paleontological resource, a fossil must be more than 11,700 years old. Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered "unique" paleontological resources. Therefore, this geologic formation is not considered to be paleontologically sensitive.

Records Search

A records search of the plan area was conducted on March 18, 2015, by AECOM at the Northwest Information Center (NWIC) of the California Historical Resources Information System located in Rohnert Park; the records search is listed at the NWIC under IC File Number 14-1225. The records search included the plan area and a half-mile search radius.

There are no reported cultural resources, either archaeological or built environment, in the plan area. There are two previously reported resources within one-half mile of, but outside the plan area: P-21-002834 (Northwestern Pacific Railroad), which runs parallel and outside the eastern boundary of the plan area, and P-21-003763 (a historic-era barn), which is located one-half mile northwest of the plan area.

The records search identified six previous cultural resources studies that included at least a portion of the plan area. However, no more than 20 percent of the plan area has been subject to previous investigation.

AECOM visited and took photo documentation of the plan area on March 16, 2015. No cultural resources were observed within the plan area.

Native American Consultation

AECOM sent a request to the Native American Heritage Commission (NAHC) on July 29, 2015, to search its sacred lands file for any Native American resources in the plan area, and to provide a list of Native American representatives who may have knowledge of Native American cultural resources in the plan area. Because the NAHC did not respond within 2 weeks of the initial request, on August 12, 2015, AECOM sent a second request to the NAHC to search the sacred lands file and to provide a Native American contact list. On August 17, 2015, the NAHC responded stating that the sacred lands file search did not indicate the presence of Native American cultural resources in the immediate plan area. The NAHC also provided a list of three individuals who may have knowledge of cultural resources in the plan area.

On August 25, 2015, AECOM sent informational letters to the individuals listed on the NAHC contact list via certified mail. All letters were received or available for pick-up by August 27, 2015. No responses were received within 90 days. Pursuant to Assembly Bill (AB) 52 (Public Resources Code [PRC] Section 21082.3[d][3]) and Senate Bill (SB) 18 (Government Code Section 65352.3[a][2]), the City of Rohnert Park considers its Native American tribal consultation complete. Copies of Native American correspondence are presented in Appendix C.

3.3.2 Regulatory Framework

National Historic Preservation Act

The National Historic Preservation Act of 1966 established the Advisory Council on Historic Preservation; authorized the Secretary of the Interior to maintain a National Register of Historic Places; directed the Secretary to approve state historic preservation programs that provided for a State Historic Preservation Officer; established a National Historic Preservation Fund program; and codified the National Historic Landmarks program.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act (AIRFA) was enacted by a joint resolution of the Congress in 1978 and is codified at 42 United States Code (USC) Section 1996. AIRFA was enacted to protect and preserve the traditional religious rights and cultural practices of American Indians, Eskimos, Aleuts, and native Hawaiians. AIRFA requires governmental agencies to adjust their policies so as to not interfere with the exercise of Native American religion and to accommodate access to and use of religious sites.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA) were enacted in 1990 and are codified under 25 USC 3001 et seq., 104 Stat. 3048. NAGPRA requires federal agencies and institutions that receive federal funding to return Native American cultural items to lineal descendants and culturally affiliated Indian tribes and Native Hawaiian organizations. NAGPRA also establishes procedures for the inadvertent discovery or planned excavation of Native American cultural items on federal or tribal lands, as well as making it a criminal offense to traffic in Native American remains without right of possession, or in Native American cultural items obtained in violation of the act.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) applies to all discretionary projects undertaken or subject to approval by the state’s public agencies. CEQA states that it is the policy of the State of California to “take all action necessary to provide the people of this State with… historic environmental qualities…and preserve for future generations examples of the major periods of California history” (PRC Sections 21001[b] and 21001[c]). Under the provisions of CEQA, “A project with an effect that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment” (State CEQA Guidelines, Section 15064.5[b]).

Assembly Bill 52

AB 52 was passed in 2014 and amends sections of CEQA relating to Native Americans. AB 52 establishes a new category, named tribal cultural resources, and states that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource may have a significant effect on the environment.

Section 21074 was added to the PRC to define tribal cultural resources, as follows:

> 21074. (a) “Tribal cultural resources” are either of the following:
>
> (1) Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:
>
> (A) Included or determined to be eligible for inclusion in the California Register of Historical Resources.
>
> (B) Included in a local register of historical resources as defined in subdivision (k) of Section 5020.1.
>
> (2) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1. In applying the criteria set forth in subdivision (c) of Section 5024.1 for the purposes of this paragraph, the lead agency shall consider the significance of the resource to a California Native American tribe.
>
> (b) A cultural landscape that meets the criteria of subdivision (a) is a tribal cultural resource to the extent that the landscape is geographically defined in terms of the size and scope of the landscape.

> (c) A historical resource described in Section 21084.1, a unique archaeological resource as defined in subdivision (g) of Section 21083.2, or a "non-unique archaeological resource" as defined in subdivision (h) of Section 21083.2 may also be a tribal cultural resource if it conforms to the criteria of subdivision (a).

AB 52 requires the CEQA lead agency to begin consultation with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of a proposed project if the tribe requests the lead agency to inform it, in writing, of projects in that area, and the tribe requests consultation, before the determination of whether a negative declaration, mitigated negative declaration, or environmental impact report is required. In addition, AB 52 includes time limits for certain responses regarding consultation, as follows:

- within 14 days of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice;
- the California Native American tribe has 30 days to request consultation; and
- the lead agency must begin consultation process within 30 days of receiving a California Native American tribe's request for consultation.

Senate Bill 18

SB 18 (Chapter 905, Statutes of 2004) was signed into law in September 2004 with the main provisions taking effect on March 1, 2005. SB 18 requires local (city and county) governments to consult with California Native American tribes, identified on the NAHC's SB 18 tribal consultation contact list, before adopting or amending a general plan or when designating open space easements. The intent of SB 18 is to establish meaningful government-to-government consultation early in the planning process to protect Native American cultural places, in order to:

- increase protection of Native American cultural places, particularly on tribal lands not covered by policies of tribal government;
- recognize Tribes' continuing cultural ties to the land and to their traditional heritages and those places that are essential elements in tribal cultural traditions, heritages, and identities;
- include information on such resources early in the planning process to avoid potential conflicts; and
- enable tribes to manage and act as caretakers of cultural places.

Local governments are encouraged to consider incorporating policies into the general plans regarding SB 18 and consultation with Tribal governments for the purpose of protecting cultural places. SB 18 includes steps and time limits for certain responses regarding consultation, as follows:

- Local government or applicant makes proposal that involves a general plan/specific plan amendment, update, or adoption.
- Local government contacts the NAHC for list of Tribal contacts.

- Local government contacts Tribes regarding the general plan/specific plan amendment or adoption and offers consultation. (Government Code Section 65352.3.)
- Tribe has 90 days to respond and to request consultation. (Government Code Section 65352.3.) Local governments and tribes can agree on shorter time frames.
- If a Tribe requests consultation, local government and Tribe engage in consultation for the purpose of preserving a cultural place.
- Local government sends notice 45 days before taking action on the general plan/specific plan adoption or amendment. (Government Code Section 65352.)
- Local government sends notice 10 days before public hearing on the general plan/specific plan adoption or amendment. (Government Code Section 65092.) Tribes must request this notice.
- Local government makes decision to approve or deny general plan/specific plan adoption, update, or amendment.

City of Rohnert Park General Plan

The *City of Rohnert Park General Plan* (City of Rohnert Park, 2015 [originally adopted 2000]) contains one goal and three policies relating to historic and archaeological resources.

Goal EC-A: Conserve Historic and archaeological resources for the aesthetic, educational, economic, and scientific contribution they make to Rohnert Park's identify and quality of life.

- **Policy EC-1:** Undertake an inventory of historic resources to determine sites or buildings of federal, State, or local historic significance.

  The State Office of Historic Preservation has determined that buildings or structures 45 years or older have the potential to be historically significant. PRC Sections 5020–5029 address historic resource assessment and protection. Because Rohnert Park was first developed in the mid-1950s, the City should undertake this inventory over the next decade. Identified historic resources should be recorded on the California Department of Parks and Recreation Historic Resources Inventory Form (DPR 523).

- **Policy EC-2:** Insure the protection of known archaeological resources in the city by requiring a records review for any development proposed in areas that are considered archaeologically sensitive for Native American and/or historic remains. Require construction activities and development adjacent to sites of historic or archaeological resources to avoid degradation by:
  - Studying the potential effects of development and construction in the resource;
  - Requiring pre-construction surveys and monitoring during any ground disturbance for all development in areas of historical and archaeological sensitivity; and
  - Implementing appropriate measures to avoid the identified impacts.

  Portions of Rohnert Park's east side are considered to have the potential to contain additional archaeological resources. Because these areas are designated for future development, adequate policies and measures for protection of known and unknown archaeological resources that can supplement CEQA requirements may need to be incorporated into future plans (including the University District Specific Plan) *and development activities. The City should collaborate with Sonoma State University to conduct searches, monitor sites, and take appropriate steps.*

- **Policy EC-3:** In accordance with CEQA and the State Public Resources Code, require the preparation of a resource mitigation plan and monitoring program by a qualified archaeologist, in the event that archaeological resources are discovered.

  CEQA requires assessment of a project's potential impact on archaeological resources. In the event that historical or unique archaeological resources are accidentally discovered during construction, materials and their surroundings shall not be altered or collected. A qualified archaeologist must make an immediate evaluation, and avoidance measures or appropriate mitigation should be completed, according to State CEQA Guidelines Section 15064.5(f). Section 21083.2 includes additional provisions protecting these resources. City involvement in the identification, mitigation, and monitoring of project impacts on these resources will ensure the protection of Rohnert Park's cultural heritage and compliance with state law.

There are no goals or policies in the *City of Rohnert Park General Plan* related to paleontological resources.

Society of Vertebrate Paleontology Guidelines

The Society of Vertebrate Paleontology (SVP, 1995 and 1996), a national scientific organization of professional vertebrate paleontologists, has established standard guidelines and outlined acceptable professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, specimen preparation, analysis, and curation. Most practicing professional paleontologists in the nation adhere to the Society of Vertebrate Paleontology assessment, mitigation, and monitoring requirements, as specifically spelled out in its standard guidelines.

3.3.3 Impact Discussion

Historic Resources

3.3a. Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5? No Impact.

There are currently no known historical resources or no built-environment cultural resources in the plan area. Therefore, *no impact* would occur and no mitigation is required.

3.3b and 3.3e. Cause a substantial adverse change in the significance of an archeological resources pursuant to §15064.5? Disturb any human remains, including those interred outside of formal cemeteries? Less-than-Significant Impact with Mitigation Incorporated.

Archaeological Resources

There are no known archaeological resources in the plan area. Most of the plan area is covered in pavement, structures, and landscaped surfaces, making pedestrian surveys of the plan area ineffective in most areas and causing any archaeological resources that might be buried to be difficult to identify. However, the plan area is located in an area covered in alluvial fans, which in the San Francisco Bay Area have been known to contain buried archaeological resources that tend to be relatively old (Meyer and Rosenthal, 2007:19–22). It is therefore possible that undiscovered, buried archaeological deposits that might be eligible as archaeological resources are present in the plan area. If archaeological resources are encountered during construction activities, this impact would be *significant*.

Mitigation Measures

Mitigation Measure 3.3-1: Implement Site-Specific Procedures for Inadvertent Discovery of Cultural Resources

All appropriate federal, state, and local regulations regarding cultural resources shall be closely adhered to; these regulations contain measures that safeguard against significant impacts on cultural resources. Because of surface conditions, archaeological pedestrian surveys would be ineffective in most areas. If cultural resources are encountered during project implementation, the applicant shall notify the City of Rohnert Park, and all activity within 100 feet of the find shall halt until it can be evaluated by a qualified archaeologist. Prehistoric archaeological materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil (midden) containing heat-affected rocks, artifacts, or shellfish remains; and stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs); and battered stone tools, such as hammerstones and pitted stones. Historic-period materials might include stone, concrete, or adobe footings and walls; filled wens or privies; and deposits of metal, glass, and/or ceramic refuse. If the resource is Native American in origin and the archaeologist and a Native American representative determine that the resources may be significant and cannot be avoided, they shall notify the City of Rohnert Park and an appropriate treatment plan for the resources shall be developed by the applicant, in consultation with the City of Rohnert Park and the archaeologist. Measures in the treatment plan could include preservation in place (capping) and/or data recovery. The archaeologist shall consult with Native American representatives in determining appropriate treatment for prehistoric or Native American cultural resources. Ground disturbance shall not resume within 100 feet of the find until an agreement has been reached as to the appropriate treatment of the find.

Significance After Mitigation

Implementation of Mitigation Measure 3.3-1 would reduce potential impacts to *less than significant*.

Human Remains

No human remains have been previously identified in the plan area. Nevertheless, it is possible that buried human remains are present within the plan area. There are specific state regulations regarding discovery of human remains that must be followed. If human remains are encountered during construction activities, this impact would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.3-2: Implement Site-Specific Procedures for Inadvertent Discovery of Human Remains

If human remains, including disarticulated or cremated remains, are encountered during construction, all ground-disturbing activities within 100 feet of the discovery must immediately cease. PRC Section 5097.98, and Section 7050.5 of California Health and Safety Code require that the County Coroner be immediately notified when human remains are identified. The project proponent and City of Rohnert Park also must be immediately notified. If the County Coroner determines that the remains are Native American, the NAHC must be contacted within 24 hours, pursuant to Subdivision (c) of §7050.5 of the Health and Safety Code. The City of Rohnert Park shall consult with the Most Likely Descendent, if any, identified by the NAHC regarding excavation and removal of the human remains. The project proponent and appropriate agency should be responsible for approval of any recommended investigation and action, taking into account state law as presented in State CEQA Guidelines 15064.5(e) and PRC 5097.98. Before resumption of ground-disturbing activities within 100 feet of the human remains, all mitigation regarding the human remains shall be implemented. If removal of human remains is determined to be the appropriate mitigation, it shall be conducted by a qualified archaeologist with Native American burial experience.

Significance After Mitigation

Implementation of Mitigation Measure 3.3-2 would reduce any potential impacts to *less than significant*.

3.3c. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature? Less-than-Significant Impact.

Geologic mapping prepared by Fox et al. (1973) and Sowers et al. (1998) indicates the plan area is composed of Holocene-age (i.e., 11,700 years B.P. to Present Day) alluvial basin deposits. By definition, to be considered a unique paleontological resource, a fossil must be more than 11,700 years old. Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered “unique” paleontological resources. Therefore, this geologic formation is not considered to be paleontologically sensitive. Furthermore, most of the plan area has already been developed with urban uses, and deep underground excavations (i.e., multistory underground parking garages) that might encounter paleontologically sensitive rock formations are not anticipated. Therefore, project-related earthmoving activities would have a *less-than-significant impact* on unique paleontological resources.

3.3d. Cause a substantive adverse change in the significance of a tribal cultural resource pursuant to §15064.5? No Impact.

The NAHC has stated that the sacred lands file failed to indicate the presence of Native American cultural resources in the immediate plan area. In addition, none of the three individuals identified by NAHC responded to inquiries regarding tribal cultural resources. Because neither the NAHC nor the tribal representatives identified tribal cultural resources in the plan area, the area is not considered sensitive for tribal cultural resources. Thus, *no impact* on tribal cultural resources would occur.

3.3.4 Cumulative Impacts

Historic and Archaeological Resources

Although no known cultural resources are located within the plan area, there is the potential for significant impacts to undiscovered, buried archaeological deposits that may be present in the plan area. These potential impacts would be mitigated to below a level of significance with implementation of Mitigation Measure 3.3-1. Therefore, *no cumulative impacts* to historic or archaeological resources would occur.

Tribal Cultural Resources

Because neither the NAHC nor the tribal representatives identified tribal cultural resources in the plan area, the area is not considered sensitive for tribal cultural resources. Therefore, there would be *no cumulative impact* on tribal cultural resources.

Paleontological Resources

Geologic mapping prepared by Fox et al. (1973) and Sowers et al. (1998) indicates that the plan area and the sites associated with the related projects considered in this cumulative analysis are composed of Holocene-age alluvial basin and alluvial fan deposits. By definition, to be considered a unique paleontological resource, a fossil must be more than 11,700 years old. Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered “unique” paleontological resources. Therefore, these geologic formations are not considered to be paleontologically sensitive. The Holocene basin and fan deposits are underlain by older Pleistocene-age (i.e., approximately 2.6 million to 11,700 years B.P.) alluvial deposits, which are paleontologically sensitive. The proposed plan would not entail excavations that would be deep enough to encounter these deposits (such as underground parking garages). If any of the related projects include excavation deep enough to reach the Pleistocene deposits, a potentially significant impact from inadvertent damage to or destruction of unique paleontological resources could occur. However, because the proposed plan would not entail excavation in Pleistocene-age sediments, the proposed plan would not result in a cumulatively considerable incremental contribution to a potentially significant cumulative impact related to unique paleontological resources. Therefore, there would be *no cumulative impact* on paleontological resources.

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3.4 GEOLOGY AND SOILS

This section describes the existing physical and regulatory setting related to geology and soils and discusses the potential impacts of the proposed plan on geology and soils.

3.4.1 Existing Conditions

The plan area is located in the Santa Rosa Plain, an alluvial-filled valley in the Coast Ranges geomorphic province. Geologic mapping prepared by Fox et al. (1973) indicates that the plan area is composed of Holocene-age (i.e., 11,700 years Before Present to Present Day) Basin Deposits. These Holocene deposits are underlain by older Pleistocene sedimentary alluvial deposits.

Based on a review of U.S. Natural Resources Conservation Service soil survey data, the plan area consists entirely of Clear Lake Clay, sandy substratum, 0 to 2 percent slopes (NRCS, 2014). This soil type has a moderately low permeability and a high shrink-swell potential. Clear Lake Clay is classified as hydrologic soil group D, which means it has a high stormwater runoff potential. However, the soil has a low water erosion hazard (because of its high clay content) and a moderate wind erosion hazard.

The plan area is located approximately 3.5 miles west of the Rodgers Creek Fault Zone, and approximately 16.5 miles east of the San Andreas Fault Zone, North Coast Section (Jennings, 1994). Both faults are classified as "active" by the California Geological Survey (CGS), and both have shown evidence of activity during historic times (i.e., in the last 200 years) (Bryant and Lundburg, 2002; Hart, 1998). WGCEP (2008) projects there is a 63 percent probability that a magnitude 6.3 or greater earthquake will occur in the Bay Area by 2036.

3.4.2 Regulatory Framework

California Building Standards Code

The State of California provides minimum standards for building design through the California Building Standards Code (CBC) (California Code of Regulations Title 24). The CBC applies to building design and construction in the state and is based on the federal Uniform Building Code used widely throughout the country (generally adopted on a state-by-state or district-by-district basis). The CBC has been modified for California conditions with numerous more detailed or more stringent regulations. Structures constructed as part of the proposed plan must comply with the CBC.

The state earthquake protection law (California Health and Safety Code Section 19100 et seq.) requires that structures be designed to resist stresses produced by lateral forces caused by wind and earthquakes. The CBC requires an evaluation of seismic design that falls into Categories A through F (where F requires the most earthquake-resistant design) for structures designed for a project site. The CBC philosophy focuses on "collapse prevention," meaning that structures are designed for prevention of collapse for the maximum level of ground shaking that could reasonably be expected to occur at a site. Chapter 16 of the CBC specifies exactly how each seismic design category is to be determined on a site-specific basis through the site-specific soil characteristics and proximity to potential seismic hazards.

Chapter 18 of the CBC regulates the excavation of foundations and retaining walls. This chapter regulates the preparation of a preliminary soil report, engineering geologic report, geotechnical report, and supplemental ground-response report. Chapter 18 also regulates analysis of expansive soils and the determination of the depth to groundwater table. For Seismic Design Category C, Chapter 18 requires analysis of slope instability, liquefaction, and surface rupture attributable to faulting or lateral spreading. For Seismic Design Categories D, E, and F, Chapter 18 requires these same analyses plus an evaluation of lateral pressures on basement and retaining walls; liquefaction and soil strength loss; and lateral movement or reduction in foundation soil-bearing capacity. It also requires that mitigation measures be considered in structural design. Mitigation measures may include ground stabilization, selection of appropriate foundation type and depths, selection of appropriate structural systems to accommodate anticipated displacements, or any combination of these measures. The potential for liquefaction and soil strength loss must be evaluated for site-specific peak ground acceleration magnitudes and source characteristics consistent with the design earthquake ground motions. Peak ground acceleration must be determined from a site-specific study, the contents of which are specified in CBC Chapter 18.

Where no other building codes apply, Chapter 29 of the CBC regulates excavation, foundations, and retaining walls. Appendix J of the CBC regulates grading activities, including drainage and erosion control and construction on unstable soils, such as expansive soils and areas subject to liquefaction.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) (Public Resources Code [PRC] Sections 2621–2630) requires the establishment of “earthquake fault zones” along known active faults in California. Regulations on development within these zones are enforced to reduce the potential for damage resulting from fault displacement. The main purpose of the law is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The law addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards. Before a project can be permitted in a designated Alquist-Priolo Earthquake Fault Zone, cities and counties must require a geologic investigation to demonstrate that proposed buildings would not be constructed across active faults.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (PRC Sections 2690–2699.6) addresses earthquake hazards from nonsurface fault rupture, including liquefaction and seismically induced landslides. The act established a mapping program for areas that have the potential for liquefaction, landslide, strong ground shaking, or other earthquake and geologic hazards. The act also specifies that the lead agency for a project may withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards associated with seismicity and unstable soils.

National Pollutant Discharge Elimination System and Storm Water Pollution Prevention Plans

As discussed in detail in Section 3.7, “Hydrology and Water Quality,” the State Water Resources Control Board (SWRCB) and North Coast Regional Water Quality Control Board (North Coast RWQCB) have adopted specific National Pollutant Discharge Elimination System (NPDES) permits for a variety of activities that have the potential to discharge wastes (including sediment) to waters of the state. The SWRCB’s statewide stormwater general permit for construction activity (Order 2009-0009-DWQ) is applicable to all land-disturbing construction activities that would disturb 1 acre or more. Compliance with the NPDES permit requires that notices of intent to discharge be submitted to the North Coast RWQCB; and that storm water pollution prevention plans (SWPPPs) that include best management practices (BMPs) be implemented to minimize erosion and subsequent water quality degradation during construction activities.

City of Rohnert Park General Plan

The following goals and policies from the *City of Rohnert Park General Plan* (City of Rohnert Park, 2015 [originally adopted 2000]) related to geology and soils apply to the proposed plan:

Goal HS-A: Minimize the risk to life and property from seismic and geologic hazards in Rohnert Park.

- **Policy HS-1:** Require new construction to utilize site preparation, grading, and foundation designs in accordance with site specific soil conditions. Require submittal of a preliminary soils report, prepared by a registered civil engineer.

  Development should undertake necessary studies and structural precautions to prevent structural damage due to soil expansion and contraction. The existing Subdivision regulations require submission of a soils report. For areas in the city that have a moderate or high liquefaction potential, information is available in the California Division of Mines and Geology Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California.

- **Policy HS-2:** Continue requiring all new buildings in the city to be built under the seismic requirements of the Uniform Building Code and Uniform Plumbing Code.

  The City has adopted the Uniform Building Code and the Uniform Plumbing Code, which mandates earthquake resistant building construction design standards. The City has amended these codes, in part, to address soil conditions. The amendments require added reinforcement of slabs and slab floors, protection of slabs from ground water, use of nonexpansive fill for building pads and beneath footings, and noncorrosive water piping material underground.

Goal HS-C: Control erosion and sedimentation to provide flood protection and protect water quality.

- **Policy HS-4:** Ensure that the City's regulations pertaining to subdivision design, zoning, building, and grading ordinances and policies continue to include measures to minimize erosion and sedimentation.

- **Policy HS-6:** As part of the building permit process, require new development greater than 5 acres in size to prepare and implement a site-specific SWPPP that effectively reduces discharges of stormwater containing sediment and other pollutants resulting from site construction activities. In addition, require all projects, regardless of size, to comply with any other stormwater provisions of the specific plans for their respective areas.

Rohnert Park Municipal Code

Chapter 15.50 of the Rohnert Park Municipal Code regulates excavations, grading, and fills to reduce or eliminate the hazards of earth slides, mud flows, rock falls, undue settlement, erosion, siltation, and flooding. A grading permit must be obtained from the City engineer. The permit application must include grading plans showing topography and cut and fill; and an erosion control plan showing the types and locations of sediment control measures in compliance with Municipal Code Chapter 15.52 (Erosion and Sediment Control).

Grading is designated as “engineered grading” when it is in excess of 5,000 cubic yards; when it is for “large projects” or has cuts/fills greater than 4 feet; or when directed by the City engineer as he/she deems necessary due to site conditions. All projects involving engineered grading require a site-specific geotechnical report, a soils report, and a liquefaction analysis. Inspection by the geotechnical engineer is required during the construction process for each project.

3.4.3 Impact Discussion

3.4a.i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Less-than-Significant Impact.

Construction and Operation

Surface ground rupture along faults is generally limited to a linear zone a few yards wide. The nearest fault zoned under the Alquist-Priolo Act is the Rodgers Creek Fault (CGS, 2012), located approximately 3.5 miles east of the plan area. Because the plan area is not located within an Alquist-Priolo Earthquake Fault Zone (CGS, 2012), nor is it located within or immediately adjacent to the trace of any other known fault, surface fault rupture in the plan area is unlikely. Therefore, this impact is considered *less than significant*.

3.4a.ii. Strong seismic ground shaking? Less-than-Significant Impact with Mitigation Incorporated.

Construction and Operation

The Tolay and Bloomfield Faults are located approximately 1.8 and 4 miles southwest of the plan area, respectively, and there is an unnamed fault 2 miles south of the plan area. However, these faults are not classified as active (Jennings, 1994).

The plan area is located approximately 3.5 miles west of the Rodgers Creek Fault. This fault offsets upper Cenozoic volcanic and sedimentary rock formations along the southwestern flanks of the Sonoma Mountains and unnamed hills to the north. The southern end of the fault connects with the Hayward Fault. Historical slip was demonstrated during studies conducted after the 1969 Santa Rosa earthquakes (magnitudes 5.6 and 5.7), where a continuous zone of seismicity was demonstrated for the northern half of the Rodgers Creek Fault and its stepover to the Maacama Fault (Hart, 1998). The projected maximum moment magnitude for the Rodgers Creek Fault ranges from 6.89 to 7.07 (WGCEP, 2008).

The North Coast Section of the San Andreas Fault is approximately 16.5 miles west of the plan area. WGCEP (2008) estimates there is a 21 percent chance that the Northern San Andreas Fault could generate a magnitude 6.7 earthquake or greater before 2036.

The intensity of ground shaking depends on the distance from the earthquake epicenter to the site, the magnitude of the earthquake, site soil conditions, and the characteristics of the source. Ground motions from seismic activity can be estimated by probabilistic method at specified hazard levels and by site-specific design calculations using a computer model. The CGS Probabilistic Seismic Hazards Assessment ground motion calculator indicates that a minimum horizontal acceleration of 0.488 *g* (where g is the percentage of gravity) could be anticipated at the plan area with a 10 percent probability of earthquake occurrence in a 50-year time frame (also known as the “Design Basis Earthquake”) for use in earthquake-resistant design (CGS, 2008). Stated another way, these calculations indicate there is a 1-in-10 probability that an earthquake will occur within 50 years that would result in a peak horizontal ground acceleration exceeding 0.488 *g*. This indicates that a relatively high level of ground shaking could occur. Therefore, this impact is considered *potentially significant*.

Mitigation Measures

Mitigation Measure 3.4-1: Prepare, Submit, and Implement Site-Specific Geotechnical Reports

As part of any project-level CEQA analysis within the plan area, the project applicant(s) of each site-specific project shall retain a licensed geotechnical engineer to prepare a final geotechnical report per California Building Standards Code and City requirements for the proposed facilities that shall be submitted for review and approval to the City of Rohnert Park. The final geotechnical engineering report shall address and make recommendations on the following:

- *seismic design parameters;*
- *seismic ground shaking;*
- *liquefaction;*
- *expansive/unstable soils;*
- *site preparation;*
- *soil bearing capacity;*
- *structural foundations, including retaining-wall design;*
- *grading practices; and*
- *soil corrosion of concrete and steel.*

In addition to the recommendations for the conditions listed above, the geotechnical investigation shall include subsurface testing of soil and groundwater conditions (as appropriate), and shall determine appropriate foundation designs that are consistent with the version of the CBC that is applicable at the time building and grading permits are applied for. All recommendations contained in the final geotechnical engineering report shall be implemented by the project applicant(s) of each site-specific project. Design and construction of all new project development shall be in accordance with the CBC. The project applicant(s) shall provide for engineering inspection and certification by a qualified *geotechnical or civil engineer that earthwork has been performed in conformity with recommendations contained in the geotechnical report.*

Significance After Mitigation

Implementation of Mitigation Measure 3.4-1 and adherence to the CBC and applicable City building regulations would reduce impacts from strong seismic ground shaking to a *less-than-significant* level, because the design recommendations of a geotechnical engineer to reduce damage from seismic events would be incorporated into buildings, structures, and infrastructure as required by the CBC, and a geotechnical or civil engineer would provide on-site monitoring to ensure that earthwork is performed as specified in the plans. Measures that could be recommended in the geotechnical reports to reduce hazards from strong seismic ground shaking could include structural reinforcement for additional sheer strength such as extra rebar, bolts, and metal straps; soil densification; or construction on pier or pile foundations. The use of specific design techniques would depend on soil type and stratigraphy at each site, which would be determined during final design.

3.4a.iii. Seismic-related ground failure, including liquefaction? Less-than-Significant Impact with Mitigation Incorporated.

Construction and Operation

Soil liquefaction most commonly occurs when ground shaking from an earthquake causes a sediment layer saturated with groundwater to lose strength and take on the characteristics of a fluid, thus becoming similar to quicksand. Liquefaction may also occur in the absence of a seismic event, when unconsolidated soil above a hardpan becomes saturated with water. Factors determining the liquefaction potential are the level and duration of seismic ground motions, the type and consistency of soils, and the depth to groundwater. Loose sands and peat deposits; uncompacted fill and other Holocene materials deposited by sedimentation in rivers and lakes (fluvial or alluvial deposits); and debris or eroded material (colluvial deposits) are the most susceptible to liquefaction. Localities most susceptible to liquefaction-induced damage are underlain by loose, water-saturated, granular sediment within 40 feet of the ground surface. Liquefaction poses a hazard to engineered structures such as buildings, bridges, and underground utility pipelines. The loss of soil strength can result in bearing capacity insufficient to support foundation loads, increased lateral pressure on retaining walls, and slope instability.

The plan area is located in an area of younger, unconsolidated alluvial deposits, and the nearest known active seismic source is only 3.5 miles to the east. Sowers et al. (1998) mapped the plan area in an area of moderate to high liquefaction hazard. Therefore, this impact is considered *potentially significant*.

Mitigation Measures

Mitigation Measure 3.4-1, "Prepare, Submit, and Implement Site-Specific Geotechnical Reports" (see full Mitigation Measure 3.4-1 text above)

Significance After Mitigation

Implementation of Mitigation Measure 3.4-1 would reduce the impact from liquefaction hazards to a *less-than-significant* level, because the site-specific geotechnical recommendations for seismic design parameters—

including a site-specific liquefaction analysis and measures to reduce liquefaction hazards, as required by the CBC—would be incorporated into each proposed plan design. Measures that could be recommended in the geotechnical reports to reduce liquefaction hazards could include replacement of existing soil with engineered, compacted fill or construction on pier or pile foundations installed on deeper, more stable rock strata. The use of specific design techniques would depend on soil type and stratigraphy at each site, which would be determined during final design.

3.4a.iv. Landslides? No Impact.

Construction and Operation

The topography within and adjacent to the plan area is nearly level. Thus, there would be no risk of loss, injury, or death involving landslides, and there would be *no impact*.

3.4b. Result in substantial soil erosion or the loss of topsoil? Less-than-Significant Impact with Mitigation Incorporated.

Construction

A review of U.S. Natural Resources Conservation Service (NRCS) (2014) soil survey data indicates that plan area soils are moderately susceptible to erosion by wind and water. Furthermore, plan area soils are of low permeability and have been classified as hydrologic group D (indicating a high stormwater runoff potential). Implementation of the proposed plan would include grading and construction activities for infrastructure and building foundations. Conducting these activities would result in the temporary disturbance of soil and would expose disturbed areas to winter storm events. Rain of sufficient intensity could dislodge soil particles from the soil surface. If the storm is large enough to generate runoff, localized erosion could occur. In addition, soil disturbance during the summer as a result of construction activities could result in soil loss and loss of topsoil because of wind erosion. Therefore, this impact is considered *potentially significant*.

Mitigation Measures

> **Mitigation Measure 3.7-1, “Prepare and Implement Site-Specific SWPPPs” (see full Mitigation Measure 3.7-1 text in Section 3.7, “Hydrology and Water Quality”)**
>
> **Mitigation Measure 3.7-2, “Prepare, Submit, and Implement Site-Specific Erosion Control Plans” (see full Mitigation Measure 3.7-2 text in Section 3.7, “Hydrology and Water Quality”)**

Significance After Mitigation

Implementation of Mitigation Measures 3.7-1 and 3.7-2 would reduce impacts from construction-related soil erosion to a *less-than-significant* level, because these measures entail implementation of a grading and erosion control plan and a SWPPP with site-specific BMPs specifically designed to reduce erosion. Measures that could be implemented to reduce erosion include limiting ground-disturbing activities during the winter rainfall period; minimizing exposure of disturbed areas and soil stockpiles to rainfall; minimizing construction activities near or within drainage facilities; soil stabilization measures such as mulching, silt fencing, or temporary desilting basins;

good housekeeping practices such as road sweeping and dust control; and diversion measures such as berms to prevent stormwater runoff from contacting disturbed areas.

Operation

Operational effects related to soil erosion are evaluated in Section 3.7, "Hydrology and Water Quality."

3.4c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse? Less-than-Significant Impact with Mitigation Incorporated.

Construction and Operation

The plan area consists partly of recent urban development built on compacted, engineered fill material and partly of undeveloped areas consisting of Holocene-age alluvial basin deposits. The basin deposits are generally loose and unconsolidated; improperly compacted material represents a hazard for building and road foundations. Furthermore, a review of NRCS (2014) soil survey data indicates that the plan area soils are of low bearing strength, and that ponding (i.e., retention of water in shallow depressions during rainstorms) occurs frequently during the winter months. Finally, dynamic compaction or seismic settlement can occur in unsaturated, loose granular material or uncompacted fill soils such as those found within the plan area, particularly given the close proximity of the Rodgers Creek Fault. Therefore, this impact is considered *potentially significant*.

Mitigation Measures

> **Mitigation Measure 3.4-1, "Prepare, Submit, and Implement Site-Specific Geotechnical Reports" (see full Mitigation Measure 3.4-1 text above)**

Significance After Mitigation

Implementation of Mitigation Measure 3.4-1 would reduce the impact from unstable soils to a *less-than-significant* level, because the site-specific geotechnical recommendations required by the CBC and City standards would be incorporated into each proposed plan design. Measures that could be included in the geotechnical reports to reduce settlement hazards and improve soil bearing strength could entail replacement of soil with engineered fill; appropriate compaction and associated soil moisture conditioning; and/or construction on pier or pile foundations installed in deeper, more stable rock strata. The use of specific design techniques would depend on soil type and stratigraphy at each site, which would be determined during final design.

3.4d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property? Less-than-Significant Impact with Mitigation Incorporated.

Construction and Operation

Expansive soils shrink and swell as a result of moisture change. These volume changes can result in damage over time to building foundations, underground utilities, and other subsurface facilities and infrastructure if they are not designed and constructed appropriately to resist the damage associated with changing soil conditions. A review of NRCS (2014) soil survey data indicates that the plan area is composed of Clear Lake Clay, which has a high shrink-swell potential. Therefore, this impact is considered *potentially significant*.

Mitigation Measures

Mitigation Measure 3.4-1, "Prepare, Submit, and Implement Site-Specific Geotechnical Reports" (see full Mitigation Measure 3.4-1 text above)

Significance After Mitigation

Implementation of Mitigation Measure 3.4-1 would reduce the impact from expansive soils to a *less-than-significant* level, because the site-specific geotechnical recommendations required by the CBC and City standards would be incorporated into each proposed plan design. Measures that may be recommended in the site-specific geotechnical reports to address expansive soil could include (1) removal of expansive soil and replacement with select nonexpansive, engineered fill; (2) lime treatment of expansive soil; or (3) placement of structures on drilled piers or foundation elements founded on deeper, nonexpansive bearing rock strata. The use of specific design techniques would depend on soil type and stratigraphy at each site, which would be determined during final design.

3.4e. Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water? No Impact.

Construction

Portable toilets would be provided during site-specific construction projects. Therefore, there would be *no impact*.

Operation

The proposed plan would not require the use of septic systems or other alternative wastewater disposal systems. As discussed in Section 3.17, "Utilities and Service Systems," wastewater treatment in the plan area would be provided via connections with the City's existing wastewater conveyance and treatment system. Therefore, there would be *no impact*.

3.4.4 Cumulative Impacts

The proposed plan and the related projects considered in this cumulative analysis are all within the nearly flat alluvial plain of the Santa Rosa Valley. All of the projects would be constructed in Holocene-age alluvial basin and/or fan deposits, which are generally loose and unconsolidated. The Rodgers Creek Fault and San Andreas Fault Zones are active, and are approximately 3.5 miles east and 16.5 miles west, respectively, of the city center. Therefore, the project region is subject to the potential for seismic hazards associated with strong seismic ground shaking and liquefaction. The plan area, and most of the land area associated with the related projects, is composed of the Clear Lake Clay soil type, which is of low permeability, has a high stormwater runoff potential, and is expansive.

Surface Fault Rupture

Neither the proposed plan nor the related projects considered in this cumulative analysis are located within an Alquist-Priolo Earthquake Fault Zone or within or adjacent to any other known fault. Therefore, a cumulative impact related to surface fault rupture would not occur.

Strong Seismic Ground Shaking

Structures within the plan area could be subject to strong seismic ground shaking from an earthquake on the Rodgers Creek Fault or other regional faults such as the San Andreas. Implementation of Mitigation Measure 3.4-1 would require compliance with the CBC, including preparation of site-specific geotechnical reports to establish the seismic-design response spectrum and incorporate necessary seismic safety features (as specified by the CBC and the City municipal code and building department requirements) into the design of all new structures. Therefore, structures, roads, and utilities would be designed to withstand seismic forces to the maximum extent feasible per CBC requirements. Implementation of the related projects considered in this cumulative analysis could expose structures and people to the same hazards from strong seismic ground shaking. However, each project considered in this cumulative analysis must individually meet CBC requirements as well as the requirements of City building codes and policies. Therefore, implementation of the proposed plan, when considered with the related projects, would not create additional facilities under increased risk of geologic hazards and would not result in a cumulatively considerable incremental contribution to a significant cumulative impact related to strong seismic ground shaking.

Seismically Induced Liquefaction

Structures within the plan area would be built in an area of younger, unconsolidated alluvial basin deposits mapped as moderate–high liquefaction susceptibility (Sowers et al., 1998). Implementation of Mitigation Measure 3.4-1 would require compliance with the CBC, including preparation of site-specific geotechnical reports (including site-specific liquefaction analyses) to establish the seismic-design response spectrum and incorporate necessary seismic safety features (as specified by the CBC and the City municipal code and building department requirements) into the design of all new structures. Therefore, structures, roads, and utilities would be designed to resist liquefaction to the maximum extent feasible per CBC requirements, and/or soils subject to liquefaction would be excavated and replaced with engineered fill. Implementation of the related projects considered in this cumulative analysis would take place in areas mapped as moderate and moderate–high liquefaction susceptibility (Sowers et al., 1998) and therefore could expose structures and people to the same hazards. However, each project considered in this cumulative analysis must individually meet CBC requirements as well as the requirements of City building codes and policies. Therefore, implementation of the proposed plan, when considered with the related projects, would not create additional facilities under increased risk of geologic hazards and would not result in a cumulatively considerable incremental contribution to a significant cumulative impact related to seismically induced liquefaction.

Landslides

The proposed plan and the related projects considered in this cumulative analysis are all located within the flat alluvial plain of the Santa Rosa Valley, and are not adjacent to any steep, mountainous areas where landslides could occur. Therefore, a cumulative impact related to landslides would not occur.

Soil Erosion

Project implementation would entail grading and excavation over approximately 330 acres, including soil removal, trenching, excavation, pipe and footing installation, grading, and landscaping. Construction activities would result in the temporary disturbance of soil and would expose disturbed areas to winter storm events. Rain of sufficient intensity could dislodge soil particles from the soil surface. Once particles are dislodged and the storm is large enough to generate runoff, localized erosion could occur. In addition, soil disturbance during the spring and summer months could result in loss of topsoil because of wind erosion. Implementation of Mitigation Measure 3.7-1 would require each individual project applicant for any project that would disturb 1 acre of land or more to prepare and implement a SWPPP with site-specific erosion control BMPs, as required by the North Coast RWQCB to meet NPDES permit requirements. Mitigation Measure 3.7-2 would require each individual project applicant to obtain a City grading permit, which would include preparation of an erosion control plan and implementation of BMPs designed to control erosion during construction activities. Implementation of the related projects considered in this cumulative analysis could result in construction-related soil erosion similar to that described above. However, each project considered in this cumulative analysis must individually meet North Coast RWQCB NPDES permit requirements (including preparation of a SWPPP and implementation of BMPs) and the requirements of City codes and policies (i.e., grading and erosion control plans). Therefore, implementation of the proposed plan, when considered with the related projects, would not create additional substantial soil erosion and would not result in a cumulatively considerable incremental contribution to a significant cumulative impact from construction-related soil erosion.

Construction in Unstable Soils

Structures within the plan area would be constructed in loose and unconsolidated basin deposits that are unstable and are of low bearing strength. In addition, dynamic compaction or seismic settlement may also result in hazards within the plan area. Implementation of Mitigation Measure 3.4-1 would require compliance with the CBC, including preparation of site-specific geotechnical reports to incorporate necessary features for construction in unstable soils (as specified by the CBC and the City municipal code and building department requirements) into the design of all new structures. Therefore, structures, roads, and utilities would be designed to resist damage from unstable soils to the maximum extent feasible per CBC requirements, and/or unstable soils would be excavated and replaced with engineered fill. Implementation of the related projects considered in this cumulative analysis would take place in areas subject to the same unstable soil hazards as the proposed plan. However, each project considered in this cumulative analysis must individually meet CBC requirements as well as the requirements of City building codes and policies. Therefore, implementation of the proposed plan, when considered with the related projects, would not create additional facilities under increased risk of geologic hazards and would not result in a cumulatively considerable incremental contribution to a significant cumulative impact related to construction in unstable soils.

Construction in Expansive Soils

Structures within the plan area would be constructed in the Clear Lake Clay soil type, which has a high clay content and a high shrink-well potential. Implementation of Mitigation Measure 3.4-1 would require compliance with the CBC, including preparation of site-specific geotechnical reports to incorporate necessary features for construction in expansive soils (as specified by the CBC and the City municipal code and building department requirements) into the design of all new structures. Therefore, structures, roads, and utilities would be designed to resist damage from expansive soils to the maximum extent feasible per CBC requirements, and/or expansive soils would be excavated and replaced with engineered fill. Implementation of the related projects considered in this cumulative analysis would take place in Clear Lake Clay soils subject to the same shrink-swell potential as the proposed plan. However, each project considered in this cumulative analysis must individually meet CBC requirements as well as the requirements of City building codes and policies. Therefore, implementation of the proposed plan, when considered with the related projects, would not create additional facilities under increased risk of geologic hazards and would not result in a cumulatively considerable incremental contribution to a significant cumulative impact related to construction in expansive soils.

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3.5 GREENHOUSE GAS EMISSIONS

This section describes the existing physical and regulatory setting related to greenhouse gas (GHG) emissions and climate and discusses the potential impacts of the proposed plan on GHG emissions and climate.

3.5.1 Existing Conditions

The term "climate" refers to the accumulation of daily and seasonal weather events over a long period of time, whereas "weather" is defined as the condition of the atmosphere at any particular time and place (Ahrens, 2009). The plan area is in a climatic zone that is characterized as dry-summer subtropical or Mediterranean (abbreviated Cs) in the Köppen climate classification system. The Köppen system's classifications are based primarily on annual and monthly averages of temperature and precipitation. See Section 3.1, "Air Quality," for a description of the meteorology of the San Francisco Bay Area Air Basin.

Attributing Climate Change—Physical Scientific Basis

Certain gases in the Earth's atmosphere, classified as GHGs, play a critical role in determining the Earth's surface temperature. When high-frequency solar radiation (e.g., visible light) enters the Earth's atmosphere from space (i.e., the sun), a portion of the radiation is absorbed by the Earth's surface, and a smaller portion of this radiation is reflected back toward space. However, the energy re-radiated by the Earth is not the same high-frequency solar radiation that was received, but is lower frequency infrared radiation (i.e., thermal energy). The frequencies at which bodies emit radiation are proportional to temperature. Therefore, because it has a much lower temperature than the sun, the Earth will emit lower frequency (longer wavelength) radiation (i.e., infrared radiation). When infrared radiation comes into contact with GHGs in the atmosphere, a portion of that thermal energy can be absorbed by the GHG molecule and/or re-radiated back toward the Earth's surface. Both outcomes result in a "trapping" of heat within the Earth's atmosphere. This phenomenon, known as the "greenhouse effect," is responsible for maintaining a habitable climate on Earth.

Prominent GHGs contributing to the Earth's greenhouse effect are carbon dioxide (CO_2), methane, nitrous oxide, water vapor, and high–global warming potential (GWP) GHGs. Although high-GWP gases typically are emitted at lower rates than CO_2, methane, and nitrous oxide, they still can make a significant contribution to climate change because they are more effective at absorbing outgoing infrared radiation than CO_2. The concept of carbon dioxide equivalent (CO_2e) is used to account for the different potentials of GHGs to absorb infrared radiation. This potential, known as the GWP of a GHG, is dependent on the lifetime or persistence of the gas molecule in the atmosphere, its ability to absorb/trap infrared radiation, and the spectrum of light energy (i.e., range of wavelengths and frequencies) absorbed by the gas molecule. Every GHG's GWP is measured relative to CO_2, which has a GWP of 1. High-GWP GHGs include hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Anthropogenic (human-caused) emissions of these GHGs that lead to atmospheric levels of GHGs in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect; they have led to a trend of unnatural warming of the Earth's atmosphere and oceans, with corresponding effects on global circulation patterns and climate (IPCC, 2013). CO_2 emissions associated with fossil fuel combustion for energy-related activities are the primary contributors to human-induced climate change (EPA, 2014).

Climate change is a global problem because GHGs are global pollutants—unlike criteria air pollutants and toxic air contaminants, which are pollutants of regional and local concern. Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (about 1 day), GHGs have long atmospheric lifetimes (1 year to several thousand years). GHGs persist in the atmosphere for a long enough time to be dispersed around the globe, continually contributing to the GHG effect. Although the exact lifetime of any particular GHG molecule depends on multiple variables and cannot be pinpointed, more CO_2 currently is emitted into the atmosphere than is sequestered. CO_2 sinks, or reservoirs, include vegetation and the ocean, which absorb CO_2 through photosynthesis and dissolution, respectively. These are two of the most common processes of CO_2 sequestration. Of the total annual human-caused CO_2 emissions, approximately 54 percent is sequestered through ocean uptake, Northern Hemisphere forest regrowth, and other terrestrial sinks within a year, whereas the remaining 46 percent of human-caused CO_2 emissions remains stored in the atmosphere (Seinfeld and Pandis, 1998:1091).

GHG emissions generated in the United States can contribute to climate change impacts in other countries or continents. The quantity of GHGs that it takes to ultimately result in climate change is not known precisely; it is sufficient to say that the quantity is enormous, and that no single project can be expected to measurably contribute to a noticeable incremental change in the global average temperature, or to global, local, or micro-climate.

Attributing Climate Change—Greenhouse Gas Emissions

Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with the transportation, industrial/manufacturing, utility, residential, commercial, and agricultural emissions sectors. In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation (ARB, 2015).

Emissions of CO_2 are byproducts of fossil fuel combustion. Emissions of methane, a highly potent GHG, result from off-gassing, the release of chemicals from nonmetallic substances under ambient or greater pressure conditions. Such emissions are largely associated with anaerobic conditions (i.e., lack of oxygen) found in natural resources (e.g., wetlands), agricultural practices, and landfills. Nitrous oxide emissions also are largely attributable to agricultural practices and soil management.

Land use decisions and development projects are not themselves GHG emissions sectors; however, land use decisions can affect the generation rate of GHG emissions from several sectors (e.g., transportation, energy consumption, water, and waste). In addition, activities associated with the long-term operation of development projects can result in direct or indirect GHG emissions. Direct emissions are GHG emissions generated at the site of consumption. For example, the use of natural gas for space or water heating generates direct GHG emissions because the natural gas is combusted at the site where the heat is used. Conversely, the use of electricity generates indirect GHG emissions because although the consumer may use the electricity at home, that electricity and the subsequent GHG emissions (if fossil fuel is used for generation) are likely being generated off-site.

Existing Greenhouse Gas Emissions in the Plan Area

Existing direct GHG emissions in the plan area include natural gas combustion from heating and hot water use for homes and nonresidential buildings; and tailpipe emissions from automobiles, transit buses, and delivery trucks. Degradable organic carbon from solid waste produced by households and businesses is another source of direct

GHG emissions. Existing indirect GHG emissions in the plan area include fossil fuel–based electricity use from the same locations listed above, as well as electricity required for traffic lights and street lighting. Other indirect sources include the use of fossil fuels to pump and treat drinking water and sewage from residential and nonresidential use. Indirect upstream emissions include the embedded fossil fuel from the production of food and other products consumed in the plan area.

3.5.2 Regulatory Framework

Massachusetts v. U.S. Environmental Protection Agency et al.

Twelve U.S. states and cities (including California), in conjunction with several environmental organizations, sued to force the U.S. Environmental Protection Agency (EPA) to regulate GHGs as a pollutant pursuant to the Clean Air Act (CAA) (*Massachusetts v. Environmental Protection Agency et al.* [U.S. Supreme Court No. 05-1120, Argued November 29, 2006—Decided April 2, 2007]). The U.S. Supreme Court ruled that the plaintiffs had standing to sue, that GHGs fit within the CAA's definition of a pollutant, and that EPA's reasons for not regulating GHGs were insufficiently grounded in the CAA.

Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act

On December 7, 2009, EPA adopted its *Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act* (Endangerment Finding). The Endangerment Finding is based on Section 202(a) of the CAA, which states that the EPA Administrator should regulate and develop standards for "emission[s] of air pollution from any class of classes of new motor vehicles or new motor vehicle engines, which in [its] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." The rule addresses Section 202(a) in two distinct findings. The first addresses whether the concentrations of the six key GHGs (CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) in the atmosphere threaten the health and welfare of current and future generations. The second addresses whether the combined emissions of GHGs from new motor vehicles and motor vehicle engines contribute to atmospheric concentrations of GHGs, and thus to the threat of climate change.

The EPA Administrator found that atmospheric concentrations of GHGs endanger public health and welfare within the meaning of Section 202(a) of the CAA. The EPA Administrator also found that GHG emissions from new motor vehicles and motor vehicle engines are contributing to air pollution, which is endangering public health and welfare.

Senate Bill 97 (Chapter 185, Statutes of 2007)

Senate Bill 97 requires that the Governor's Office of Planning and Research prepare guidelines to submit to the California Resources Agency regarding feasible mitigation of GHG emissions or the effects of GHG emissions as required by the California Environmental Quality Act (CEQA). The Resources Agency was required to certify and adopt these revisions to the State CEQA Guidelines by January 1, 2010. The California Natural Resources Agency adopted those guidelines on December 30, 2009, and the guidelines became effective March 18, 2010.

Assembly Bill 32 (Chapter 488, Statutes of 2006)

The California Global Warming Solutions Act of 2006, widely known as Assembly Bill (AB) 32, requires the California Air Resources Board (ARB) to develop and enforce regulations for the reporting and verification of statewide GHG emissions. ARB is directed to set a GHG emissions limit, based on 1990 levels, to be achieved by 2020. The bill sets a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.

The heart of the bill is the requirement to reduce statewide GHG emissions to 1990 levels by the year 2020. To achieve this goal, California needs to reduce GHG emissions by approximately 25 percent below business-as-usual predictions of year 2020 GHG emissions. The bill requires ARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions.

Executive Order S-03-05 (2005)

California Executive Order S-03-05, put forth by then-Governor Arnold Schwarzenegger, established the following GHG emissions reduction targets for California's state agencies:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

The order also required the Secretary of the California Environmental Protection Agency to oversee and coordinate emissions reduction efforts with the Secretary of the Business, Transportation, and Housing Agency; the Secretaries of the California Department of Food and Agriculture, and The Resources Agency; the Chairpersons of ARB and the California Energy Commission; and the President of the California Public Utilities Commission. The Secretary of the California Environmental Protection Agency is required to report to the Governor and State Legislature biannually on the impacts of global warming on California, mitigation and adaptation plans, and progress made toward reducing GHG emissions to meet the targets established in this executive order.

Executive orders are directives to state agencies from the Governor of California. They do not govern local agency actions, nor do they affect the State Legislature. Although S-03-05 is an indicator of state policy as interpreted by the Governor, it may or may not reflect the view of the Legislature. It is, however, one of the factors being considered by state agencies such as ARB, the California Energy Commission, and the Building Standards Commission in formulating their GHG reduction strategies.

Executive Order S-1-07

Executive Order S-1-07, which was signed by Governor Schwarzenegger in 2007, proclaims that the transportation sector is the main source of GHG emissions in California, at more than 40 percent of statewide emissions. It establishes a goal to reduce the carbon intensity of transportation fuels sold in California by a minimum of 10 percent by 2020. This order also directed ARB to determine whether this Low Carbon Fuel

Standard (LCFS) could be adopted as a discrete, early-action measure after meeting the mandates in AB 32. ARB adopted the LCFS on April 23, 2009.

Assembly Bill 1493, Chapter 200, Statutes of 2002

AB 1493 (Pavley I) required ARB to adopt regulations by January 1, 2005, to reduce GHG emissions from noncommercial passenger vehicles and light-duty trucks of model year 2009 and thereafter. The bill required the California Climate Action Registry to develop and adopt protocols for the reporting and certification of GHG emissions reductions from mobile sources for use by ARB in granting emission reduction credits. The bill authorized ARB to grant emissions reduction credits for reductions of GHG emissions before the date of enforcement of regulations, using model year 2000 as the baseline for reduction.

In 2004, ARB applied to EPA for a waiver under the federal CAA to authorize these regulations to be implemented. The waiver request was formally denied by EPA in December 2007 after California had filed suit to prompt federal action. In January 2007, the California Attorney General filed a new lawsuit against EPA for denying California's request for a waiver to regulate and limit GHG emissions from these automobiles.

Bay Area Air Quality Management District CEQA Guidelines

In June 2010, the Bay Area Air Quality Management District (BAAQMD) adopted its updated CEQA Air Quality Guidelines, which established quantitative GHG thresholds of significance. The 2010 CEQA Air Quality Guidelines (2010 Guidelines) include separate thresholds of significance for project- and plan-level analyses.

At the plan level, BAAQMD recommends that projects use a qualitative threshold of significance based on the project's consistency with a "qualified greenhouse gas reduction plan," as well as the plan's GHG efficiency (i.e., metric tons [MT] of CO_2e per service population [SP] per year [MT CO_2e/SP/yr]). The SP of a project is defined by the number of employees and residents. Project-level analyses are evaluated using two quantitative thresholds: one based on the project's annual GHG emissions (i.e., MT CO_2e/yr) and the other based on the project's GHG efficiency (MT CO_2e/SP/yr).

In March 2012, the Alameda County Superior Court issued a judgment finding that the changes to the BAAQMD CEQA Guidelines qualify as a project under CEQA, and that BAAQMD had not complied with CEQA as part of the adoption process. However, on August 13, 2013, California's First District Court of Appeal held that BAAQMD's adoption of the thresholds was not a project subject to CEQA review, and overturned the decision by the Alameda Superior Court that invalidated the BAAQMD guidelines for assessing air quality impacts under CEQA. The Court of Appeal's decision was appealed to the California Supreme Court, which granted limited review, and the matter is currently pending. Lead agencies will need to determine appropriate air quality thresholds of significance based on substantial evidence in the record (BAAQMD, 2011). To that end, the City of Rohnert Park, as the lead agency for the proposed plan, has decided to use the 2010 CEQA Guidelines and its thresholds; therefore, those thresholds have been used in the impact analysis and discussion below.

Sonoma County Community Climate Action Plan

In October 2008, the county and all nine cities in Sonoma County, including Rohnert Park, released the *Sonoma County Community Climate Action Plan* (Sonoma County Community CAP), which sets a goal to reduce its GHG emissions by 25 percent below 1990 levels by 2015. This requires a reduction total of 1.4 MT CO_2e, or 37 percent below business as usual for 2015. The plan is broken into four major categories: Energy and Water Efficiency, Smart Transit and Land Use, Local Renewable Energy Economy, and Conservation of Natural Resources and Farmland. The projected investment required to meet these goals by the target date and retain these reductions into the future has been estimated at $3.5 to $4 billion.

Key solutions presented in the Sonoma County Community CAP that are relevant to this environmental document include the build-out of the Sonoma-Marin Area Rail Transit (SMART) rail line; strengthening of all environmental impact reports on proposed projects to promote GHG emission reductions; strengthening of city-centered, transit-oriented development; maintenance of existing or adoption of urban limit lines; facilitation of the increased use of conservation easements through zoning; and dedication of public funds and mitigation fees (Sonoma County, 2008).

Rohnert Park Greenhouse Gas Emissions Reduction Plan

Rohnert Park has also adopted “Plan C” of the GHG Emissions Reduction Plan Analysis, which includes the analysis of GHG-producing activities under direct control of the City. The plan calls for a host of photovoltaic projects, pump upgrades, pool solar water heating, and bio-fueled City fleets. The plan has the potential to reduce citywide operations by 35 percent. Because the proposed plan for Central Rohnert Park includes some zoned government office uses, Plan C can be used to incorporate GHG reduction measures into these land uses. The actual reduction potentials are unknown at this time, but these projects have the potential to reduce operational GHG emissions from the plan area (City of Rohnert Park, 2012).

Rohnert Park City Ordinance No. 782

On July 1, 2007, Rohnert Park instituted Ordinance No. 782, which establishes local green building requirements for building construction. City staff determined that the proposed ordinance itself is exempt from CEQA review, but the impacts of this ordinance may have a significant impact on projects proposed within the city. Compliance thresholds have been established that create tiers applicable to the project’s size, depending on the project type and zoned use. Compliance with the provisions of this ordinance shall be listed as a condition of approval on any design review approval issued by the planning division for a covered project. Although actual reduction potentials are unknown at this time, projects proposed in this area may be subject to the above standards and have the potential to reduce operational GHG emissions from the plan area (City of Rohnert Park, 2007).

3.5.3 Impact Discussion

3.5a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? Less-than-Significant Impact with Mitigation Incorporated.

The following analysis of the proposed plan's GHG impacts is separated into short-term, construction-related emissions and long-term, operational emissions.

Construction

During construction under the proposed plan, a variety of sources would generate short-term and temporary exhaust-related GHG emissions. Construction-related GHG sources include heavy-duty construction equipment, material delivery trucks, material haul trucks, and construction worker vehicles. The amount of GHG emissions generated would vary from day to day, depending on the types of construction activities. The proposed plan's construction-related GHG emissions were modeled using the same "worst-case" scenario and methodology used for air quality, which is described further in the discussion of Impact 3.1a. Table 3.5-1 presents the proposed plan's total and annual average GHG emissions over the entire construction period.

Table 3.5-1: Construction CO2e Emissions Associated with the Proposed Plan

Emission Source	Emissions
Total Proposed Construction Emissions (MT CO_2e)	148,457
Annual Average Construction Emissions [1] (MT CO_2e/year)	5,938
Amortized Construction Emissions [2] (MT CO_2e/yr)	4,949

Notes:
CO_2e = carbon dioxide equivalent; MT CO_2e /year = metric tons of carbon dioxide equivalent per year
[1] Construction activities would occur over a period of approximately 25 years. Total construction-related greenhouse gas emissions were divided by 25 years to calculate the annual average construction emissions.
[2] Construction emissions are amortized over 30 years, which is the assumed lifetime of the proposed plan.
Source: Data compiled by AECOM in 2015.

At the time of this writing, BAAQMD has developed a quantitative threshold of significance for construction-related GHG emissions. Construction-related GHG emissions are short-term and temporary; however, GHG emissions have longer atmospheric lifetimes than criteria air pollutants and can continue to contribute to the GHG effect for longer periods of time (e.g., 100 years). Therefore, it is important to evaluate the total quantity of GHG emissions generated during construction.

Although temporary construction emissions are necessary to develop any new or remodeled project, the land use being developed may operate at a higher GHG efficiency level than existing land uses of a similar type. Therefore, in some cases, construction emissions, though also a source of GHG emissions, can contribute to more GHG-efficient long-term operations that ultimately lower future GHG emissions.

Some air districts, including the South Coast Air Quality Management District and San Luis Obispo County Air Pollution Control District, recommend amortizing construction-related GHG emissions over the lifetime of the project (e.g., 30 years), and adding them to the annual operational emissions for evaluation. Because of the lack of a construction-specific GHG threshold, and the need to evaluate all construction emissions and the way in which construction emissions could contribute to more GHG-efficient land uses, the proposed plan's construction-related GHG emissions were amortized and added to the annual operational emissions for evaluation. See Table 3.5-2 for amortized construction emissions.

BAAQMD encourages lead agencies to incorporate best management practices to reduce GHG emissions during construction, as applicable. Best management practices may include using alternative-fueled (e.g., biodiesel, electric) construction vehicles/equipment in at least 15 percent of the fleet; using at least 10 percent local building materials; and recycling or reusing at least 50 percent of construction waste or demolition materials.

As shown in Table 3.5-1, amortized construction emissions would be approximately 4,949 MT CO_2e/yr. When added to the proposed plan's annual operational emissions (see Table 3.5-2), these emissions would exceed the BAAQMD threshold of significance. Therefore, the impact of the proposed plan's short-term construction GHG emissions would be *potentially significant*.

Table 3.5-2: Operational CO_2e Emissions Associated with the Proposed Plan

Emissions Source	Emissions [1]
Total Operational Mass Emissions[2]	39,672
BAAQMD 2010 Mass Emissions Threshold (MT CO_2e/yr)	1,100
Exceeds BAAQMD 2010 Mass Emissions Threshold?	Yes
Proposed Plan Service Population [3]	3,520
Proposed Plan GHG Efficiency (MT CO_2e/SP/yr)	11.27
BAAQMD GHG Plan-Level Efficiency Threshold (MT CO_2e/SP/yr)	6.6
Exceeds Thresholds?	Yes

Notes:
BAAQMD = Bay Area Air Quality Management District; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; MT CO_2e/SP/yr = metric tons of carbon dioxide equivalent per service population per year; MT CO_2e/year = metric tons of carbon dioxide equivalent per year
1 All emissions shown are in units of MT CO_2e/year unless noted otherwise.
2 Includes construction emissions amortized over 30 years, which is the assumed lifetime of the proposed plan.
3 Service population equals the sum of the projected residents and permanent employees associated with the proposed land uses. .
Source: Data compiled by AECOM in 2015.

Mitigation Measures

Mitigation Measure 3.5-1: Assess GHG Emissions Associated with Project-Specific Construction and Alter Project Details and/or Construction Equipment as Needed

As part of subsequent project-level CEQA analysis, project applicants shall assess and compare GHG emission impacts related to the construction of individual projects in the plan area with BAAQMD's thresholds of significance for project-level impacts. Potentially significant GHG impacts shall be mitigated to a less-than-significant level via implementation of all exhaust-related BAAQMD Basic or Additional Construction Mitigation Measures and alteration of project details and/or construction equipment.

Mitigation Measure 3.5-2: Purchase Carbon Offsets to Reduce Emissions

Following implementation of Mitigation Measure 3.5-1 (i.e., project-level analysis and comparison with BAAQMD's thresholds of significance), if construction or operational emissions are determined to continue to exceed BAAQMD's GHG threshold, the project applicant shall purchase carbon offsets to reduce the remaining emissions to below the threshold. If at the time of the analysis BAAQMD has not yet developed a construction-related GHG threshold of significance, the project applicant shall coordinate with BAAQMD to determine a surrogate threshold. Any offset of project emissions shall be demonstrated to be real, permanent, verifiable, enforceable, and additional. To the maximum extent feasible, as determined through coordination with BAAQMD, offsets shall be implemented locally. Offsets may include, but are not limited to, the following (in order of preference):

(1) On-site offset of project emissions; for example, development of on-site renewable energy generation or a carbon sequestration project. Any on-site offset projects must be registered with the Climate Action Reserve or otherwise approved by BAAQMD to be used to offset project emissions. The number of offset credits produced would then be included in the annual inventory, and the net emissions calculations (i.e., with inclusion of offsets).

(2) Funding of local projects, subject to review and approval by BAAQMD that will result in real, permanent, verifiable, enforceable, and additional reduction in GHG emissions. If BAAQMD or the City of Rohnert Park develops a GHG mitigation fund, the project applicant may instead pay into this fund to offset GHG emissions in excess of the significance threshold.

(3) Purchase of carbon credits to offset emissions below the significance threshold. Only carbon offset credits that are verified and registered with the Climate Action Reserve, or available through a City-approved local GHG mitigation bank or fund, may be used to offset project emissions.

Significance After Mitigation

Implementation of Mitigation Measures 3.5-1 and 3.5-2 would require assessment of construction-related GHG emissions for individual projects within the plan area and implementation of necessary mitigation and offsets that would reduce construction impacts to a *less-than-significant* level.

Operation

After build-out of the proposed plan, long-term operational emissions would be generated by the daily activities associated with the proposed land uses. Operational GHG emissions would be generated by several operational activities: transportation, energy consumption, water consumption, and solid waste generation. Transportation-related GHG emissions would be generated by vehicles arriving at and leaving the proposed land uses (commercial, light industrial, civic, retail, and residential). GHG emissions related to energy consumption would be generated by the use of electricity and natural gas for lighting, cooling, and heating of the proposed buildings, and by the powering of machinery in the light industrial zoned areas. GHG emissions related to water consumption would be generated by the electricity use required for treatment and conveyance of potable water to the plan area. GHG emissions related to solid waste would be those associated with the decomposition of solid waste generated by proposed plan facilities. The

California Emissions Estimator Model (CalEEMod) can calculate GHG emissions associated with all of these sources of operational emissions. Table 3.5-2 presents the proposed plan's total annual operational emissions.

In addition to evaluating a plan's total annual GHG emissions, it is important to evaluate the rate at which a project generates GHG emissions with respect to its land uses. In other words, although a project may be large, it could provide services (e.g., residential or commercial land uses) at a more efficient rate than a smaller project. Therefore, pursuant to BAAQMD's guidance, this analysis also evaluates the proposed plan's GHG efficiency, which is the amount of annual GHG emissions generated per SP. SP is the sum of residents and employees supported by a project. Table 3.5-2 also presents the proposed plan's GHG efficiency at full build-out.

The City would comply with Policy L-8.3 of the proposed plan by including all necessary emission reduction strategies from the Sonoma County Community CAP and the Rohnert Park GHG Emissions Reduction Plan. However, as shown in Table 3.5-2, the proposed plan's annual operational mass emissions and GHG efficiency would exceed BAAQMD's thresholds of significance. Therefore, the impact of the proposed plan's long-term operational GHG emissions would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.5-3: Assess GHG Emissions Associated with Project-Specific Operations and Alter Project Details as Needed

As part of subsequent project-level CEQA analysis, project applicants shall assess and compare GHG emission impacts related to the operation of individual projects in the plan area to BAAQMD's thresholds of significance for project-level impacts (i.e., 1,100 MT CO_2e per year). Potentially significant GHG impacts shall be mitigated to a less-than-significant level via alteration of project details.

Mitigation Measure 3.5-2, "Purchase Carbon Offsets to Reduce Emissions" (see full Mitigation Measure 3.5-2 text above)

Significance After Mitigation

Implementation of Mitigation Measures 3.5-2 and 3.5-3 would require assessment of individual project impacts within the plan area and implementation of necessary mitigation and offsets that would reduce operational GHG emissions impacts to a *less-than-significant* level.

3.5b. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases? Less-than-Significant Impact.

In addition to evaluating a project's GHG emissions, it is equally important to consider a project's design and purpose. In some cases, a project could generate a substantial amount of GHG emissions; however, it could provide amenities and services that are necessary and consistent with long-term GHG reduction plans.

The City of Rohnert Park has a GHG reduction plan that focuses on municipal operations, and thus is not applicable to the proposed plan. The City is currently working with other jurisdictions in Sonoma County to adopt the Sonoma County Community CAP that would serve all of Sonoma County. As noted in Policy L-8.3 of the proposed plan and in Mitigation Measure 3.5-1, all new project development resulting from the proposed plan would be required to comply with the applicable GHG reduction strategies of the Rohnert Park GHG Reduction Plan, Sonoma County Community CAP, and Sonoma County Climate Action 2020, which is still in the development phase. Although the proposed GHG reduction strategies included in the Sonoma County Community CAP would still apply to the proposed plan, the GHG reduction targets (i.e., 25 percent below 1990 levels by 2015) would not align with the build-out of the proposed plan (2040). Therefore, in the absence of a current GHG reduction plan, this analysis evaluates the proposed plan's design and purpose with the AB 32 Scoping Plan Update (Scoping Plan Update), which is the statewide plan for achieving AB 32 GHG reduction targets.

One of the benefits of the new SMART commuter train station, the improvements to the pedestrian network, and the enhancements to bicycle facilities within the plan area will be reductions in vehicle miles traveled and corresponding reductions in GHG emissions (Sonoma-Marin Area Rail Transit District, 2006). The proposed plan is an infill, mixed-use, transit-oriented development that would site residential and commercial land uses near one another. Residents of the plan area would be able to access commercial amenities and potential jobs within reasonable walking and biking distances, thereby eliminating vehicle trips or reducing vehicle trip distances. The Scoping Plan Update states that location-efficient (i.e., live, work, recreation, and commercial land uses near each other) and affordable transit-oriented development has been shown to achieve vehicle miles traveled reductions of 20–40 percent compared with non-transit-oriented-development households (ARB, 2014). In addition, commercial and residential land uses would be developed at a higher density within walking distance of the planned SMART rail station. The Scoping Plan Update cites the need to "encourage transit-oriented development and infill around station locations" as part of supporting planning and market development through targeted investments (ARB, 2014). These types of design measures (i.e., infill, mixed-use, transit-oriented) are necessary to support and serve population growth in the state while achieving the GHG emission reduction goals of AB 32. Therefore, considering the design of the proposed plan, compliance with applicable GHG reduction plan strategies, and that all emissions would be mitigated to a less-than-significance level, the proposed plan would not conflict with any plan, policy, or regulation adopted for the purpose of reducing GHG emissions. This impact would be *less than significant*.

3.5.4 Cumulative Impacts

The topic of GHG emissions is inherently a cumulative impact, because any single project's GHG emissions would contribute to cumulative, global GHG emissions and impacts, especially because this plan-level assessment takes a broad approach to GHG emissions across all sectors represented in the plan area. Therefore, the GHG analysis presented in Section 3.5.3, "Impact Discussion," above, represents the cumulative GHG analysis. A less-than-significant finding for Impact 3.5a and Impact 3.5b essentially means a *less-than-significant* cumulative impact.

3.5.5 References

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3.6 HAZARDS AND HAZARDOUS MATERIALS

This section describes the existing physical and regulatory setting related to hazards and hazardous materials and discusses the potential impacts of the proposed plan on hazards and hazardous materials.

3.6.1 Existing Conditions

Hazardous Materials

Database Searches

AECOM performed a search of several publicly available databases that are maintained under California Public Resources Code (PRC) Section 65962.5 (i.e., the Cortese List) to ascertain whether any known hazardous materials are present either in or within a quarter-mile radius of the plan area.

The GeoTracker database is an information management system related to groundwater that is maintained by the State Water Resources Control Board (SWRCB). Data related to leaking underground storage tanks (USTs) and other types of soil and groundwater contamination, along with associated cleanup activities, are part of the information that the SWRCB is required to maintain under PRC Section 65962.5. Results of the GeoTracker database search (SWRCB, 2015) are presented in Table 3.6-1.

The Hazardous Waste and Substances Site List (i.e., the "EnviroStor" database) is maintained by the California Department of Toxic Substances Control (DTSC) as part of the requirements of PRC Section 65962.5. A search of the EnviroStor database indicated there are no open, active cases of hazardous waste and substances sites either in or within a quarter-mile radius of the plan area (DTSC, 2015).

A search of the U.S. Environmental Protection Agency's (EPA) Envirofacts database (which includes records maintained under the Comprehensive Environmental Response, Compensation, and Liability Act) indicated there are no known open, active cases of hazardous material contamination in Rohnert Park (EPA, 2013).

Lead-Based Paint

The use of lead as an additive to paint was discontinued in 1978 because human exposure to lead was determined by EPA and the U.S. Department of Labor Occupational Safety and Health Administration (OSHA to be an adverse human health risk, particularly to young children. Demolition of structures containing lead-based paint requires specific remediation activities regulated by federal, state, and local laws. Adverse human health effects can occur from ingestion of peeling paint chips (primarily by young children) and inhalation of paint dust (when lead-based paint is scraped, sanded, or heated during repair or demolition activities).

Table 3.6-1: GeoTracker Database Search Results[1]

On-Site or Off-Site	Site Name, Address, Description, Number	Contaminants	Media Affected	Status/Cleanup Actions
On-site	Weyerhaeuser-Commercial Door 5600 State Farm Drive Leaking USTs SWRCB Case No.: T0609700067	Gasoline and VOCs (PCP), PCE, and TCE	Aquifer used for drinking-water supply (direction of groundwater flow is toward the south-southwest)	Groundwater extraction (SVE) and in situ injection of oxygen; groundwater plume is stable and does not extend off the property; contaminated soil is present along the western edge of the property; No Further Action determination issued by the North Coast RWQCB
On-site	Safety Kleen Corporation 5750 Commerce Boulevard Leaking USTs SWRCB Case No.: T0609700186	Petroleum, chlorinated hydrocarbons, Stoddard solvent/mineral spirits/ distillates, VOCs (PCE, TCE, vinyl chloride)	Aquifer used for drinking-water supply (direction of groundwater flow is toward the southwest)	Groundwater extraction and treatment; groundwater monitoring; groundwater plume does not extend off the property; VOCs present in one monitoring well in 2014
On-site	Rohnert Park Corporation Yard 600 Enterprise Drive Leaking USTs SWRCB Case No.: T0609700071	TPH-g, benzene, toluene, ethyl benzene, and xylene	Aquifer used for drinking water supply (direction of groundwater flow is toward the southwest)	High-vacuum dual-phase extraction is proposed; groundwater plume does not extend off the property; subsurface soil contamination is present 10 to 22 feet bgs
Off-site, 475 feet west	Former Rohnert Park Shell 5060 Redwood Drive Leaking USTs SWRCB Case No.: T0609700477	Gasoline and VOCs: TPH-g and methyl tertiary butyl ether	Groundwater used for municipal and domestic supply (direction of groundwater flow is variable depending on subsurface depth)	Groundwater extraction and treatment system operation has concluded; VOC plume is decreasing; request for site closure letter submitted to the SWRCB
Off-site, 300 feet west	Groom Properties 5925/5980/6100 Redwood Drive Cleanup Program Site SWRCB Case No.: SL0609763696	TCE	Aquifer used for drinking-water supply (direction of groundwater flow is toward the southwest)	Interim Remedial Action Plan submitted in 2015. Proposed remediation of contaminated soil via SVE system; duel-phase extraction and anaerobic bioremediation proposed for groundwater; proposed installation of a 100-foot-long cutoff wall near Hinebaugh Creek to prevent plume migration into the creek
Off-site, 300 feet west	101 International 6100 Redwood Drive Leaking USTs SWRCB Case No.: T0609700180	Diesel, gasoline, oil, lubricants (in soil); TCE in groundwater	Aquifer used for drinking-water supply (direction of groundwater flow is toward the southwest)	Case is associated with Groom Properties site listed above; monitoring is ongoing

Notes: bgs = below the ground surface; PCE = tetrachloroethene; PCP = pentachlorophenol; RWQCB = Regional Water Quality Control Board; SVE = soil vapor extraction; SWRCB = State Water Resources Control Board; TCE = trichloroethene; TPH-g = total petroleum hydrocarbons as gasoline; UST = underground storage tank; VOC = volatile organic compound

[1] Includes only open, active sites on or within a quarter-mile radius of the plan area.

Sources: SWRCB, 2015; data compiled by AECOM in 2015

Asbestos

Asbestos is designated as a hazardous substance when the fibers have potential to come in contact with air, because the fibers are small enough to lodge in lung tissue and cause health problems. The presence of asbestos-containing materials (ACMs) in existing buildings poses an inhalation threat only if the ACMs are in a friable state. If the ACMs are not friable, then there is no inhalation hazard because asbestos fibers remain bound in the material matrix. Emissions of asbestos fiber to the ambient air, which can occur during activities such as renovation or demolition of structures made with ACMs (e.g., insulation), are regulated in accordance with Section 112 of the federal Clean Air Act (CAA). People exposed to asbestos may be at elevated risk for lung cancer and mesothelioma.

Schools in the Project Vicinity

The Pathways Charter School (grades K–12) is within the plan area, at 150 Professional Center Drive. The Rancho Bodega School (grades 7–12) is at 6640 Redwood Drive, approximately 300 feet west of the plan area (on the west side of U.S. Highway 101). The John Reed Elementary School is immediately adjacent to the southern portion of the plan area (on the southern side of Santa Alicia Drive). The Mountain Middle School, El Camino High School, and the Technology Middle School are all collocated on a single campus approximately 0.25 mile south of the plan area on Burton Avenue.

Although an on-site proposal for a specific school has not been brought forward at this time, a school would be an allowable future use under the proposed Public/Institutional (P-I) zoning. Of the two sites that would be zoned P-I, only the 7.7-acre site southeast of Hinebaugh Creek would be large enough to accommodate a traditional K–12 school with associated outdoor playfields (see Figure 2-5 in Chapter 2, “Project Description”).

Airports in the Project Vicinity

The closest open, operational airport is the Petaluma Municipal Airport, approximately 7.25 miles southeast of the plan area. There are no airports or airstrips within a 2-mile radius of the plan area.

Wildland Fire Hazard

Wildland fires represent a substantial threat in the state, particularly during the hot, dry summer months in more isolated areas where steep topography, limited access, and heavy fuel loading contribute to hazardous conditions. Wildland fires may be started by natural processes, primarily lightning, or they may be started by human activities. The California Department of Forestry and Fire Protection (CAL FIRE) has established a fire hazard severity classification system to assess the wildland fire potential. The zones depicted on CAL FIRE maps take into account the potential fire intensity and speed, production and spread of embers, fuel loading, topography, and climate (e.g., temperature and the potential for strong winds). According to CAL FIRE (2008), the plan area is in a local responsibility area (LRA) that does not contain any very high fire hazard severity zones.

3.6.2 Regulatory Framework

Hazardous Materials Regulation and Enforcement

At the federal level, the principal agency regulating the generation, transport, and disposal of hazardous substances is EPA, under the authority of the Resource Conservation and Recovery Act (RCRA). RCRA established an all-encompassing federal regulatory program for hazardous substances that is administered by EPA. Under RCRA, EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous substances. RCRA was amended in 1984 by the Hazardous and Solid Waste Amendments of 1984, which specifically prohibit the use of certain techniques for the disposal of various hazardous substances. The federal Emergency Planning and Community Right-to-Know Act of 1986 imposes hazardous materials planning requirements to help protect local communities in the event of accidental release.

Several state agencies regulate the use of hazardous materials to minimize potential risks to public health and safety. The California Environmental Protection Agency (CalEPA) and the California Office of Emergency Services establish rules governing the use of hazardous substances in California. Within CalEPA, DTSC has primary responsibility, with delegation of enforcement to local jurisdictions, for regulating the generation, transport, and disposal of hazardous substances under the authority of the Hazardous Waste Control Law (HWCL). Regulations implementing the HWCL list hazardous chemicals and common substances that may be hazardous; establish criteria for identifying, packaging, and labeling hazardous substances; prescribe management of hazardous substances; establish permit requirements for hazardous substances treatment, storage, disposal, and transportation; and identify hazardous substances prohibited from landfills. The SWRCB is responsible for oversight, regulation, and permitting of underground and above ground storage tanks and implements programs to protect public health and safety and the environment from releases of petroleum and other hazardous substances from tanks. Depending on the quantity and type of materials released, the SWRCB may also be involved in regulatory oversight of cleanup activities where tank releases may result in groundwater contamination.

The Sonoma County Department of Resource Management, Environmental Health and Safety is the lead local regulatory agency (i.e., Certified Unified Program Agency [CUPA]) and is responsible for a variety of tasks related to the storage, handling, and management of hazardous materials. The Environmental Health and Safety Department has a hazardous materials incident response team and responds to incidents involving chemical releases, as well as any other hazardous materials situations. Under a contract with the SWRCB, the Environmental Health and Safety Department conducts a local oversight program to oversee the abatement and cleanup of releases of hazardous substances from USTs. The Environmental Health and Safety Department is also responsible for local implementation and enforcement of regulations related to above-ground petroleum storage tanks pursuant to Chapter 29 of the Sonoma County Municipal Code.

Worker Safety Requirements

OSHA is responsible at the federal level for ensuring worker safety. OSHA sets federal standards for implementation of workplace training, exposure limits, and safety procedures for the handling of hazardous substances (as well as other hazards). OSHA also establishes criteria by which each state can implement its own health and safety program.

At the state level, the California Occupational Safety and Health Administration (Cal-OSHA) assumes primary responsibility for developing and enforcing workplace safety regulations. Cal-OSHA regulations pertaining to the use of hazardous materials at workplaces, as detailed in California Code of Regulations (CCR) Title 8, include requirements for safety training, availability of safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation. Cal-OSHA enforces hazard communication program regulations that contain training and information requirements, including procedures for identifying and labeling hazardous substances, communicating hazard information related to hazardous substances and their handling, and preparing health and safety plans to protect workers and employees at hazardous waste sites. The hazard communication program requires that Material Safety Data Sheets be available to employees, and that employee information and training programs be documented.

Hazardous Materials Transport

State agencies with primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies are the California Highway Patrol and the California Department of Transportation. Together, these agencies determine container types used and license hazardous waste haulers for hazardous waste transportation on public roads. The transport of hazardous materials is regulated under the California Vehicle Code (CCR Title 13) and can only be conducted under a registration issued by DTSC. Identification (ID) numbers are issued by DTSC or EPA for tracking hazardous waste transporters and treatment, storage, and disposal facilities for hazardous materials. The ID number is used to identify the hazardous waste handler and to track waste from point of origin to final disposal, and all material transport takes place under manifest.

California Government Code Section 65962.5 (Cortese List)

The provisions of California Government Code Section 65962.5 are commonly referred to as the “Cortese List” (after the legislator who authored the legislation that enacted it). The Cortese List is a planning document used by the State and local agencies to comply with CEQA requirements in providing information about the location of hazardous materials release sites. California Government Code Section 65962.5 requires CalEPA to develop an updated Cortese List annually, at minimum. DTSC and the SWRCB are responsible for a portion of the information contained in the Cortese List. Other California State and local government agencies are required to provide additional hazardous material release information for the Cortese List.

California Hazardous Materials Release Response Plans and Inventory Law of 1985

The California Hazardous Materials Release Response Plans and Inventory Law of 1985 (Business Plan Act) requires preparation of hazardous materials business plans and disclosure of hazardous materials inventories. A business plan includes an inventory of hazardous materials handled, facility floor plans showing where hazardous materials are stored, an emergency response plan, and provisions for employee training in safety and emergency response procedures (California Health and Safety Code Division 20, Chapter 6.95, Article 1). The business plan program is administered at the state level by the California Emergency Management Agency and locally by Sonoma County Environmental Health and Safety. A business plan is required if a hazardous substance would be stored more than 30 days in any of the following quantities:

- 500 gallons or more of any solid
- 55 gallons or more of any liquid
- 200 cubic feet or more of any compressed gas
- Any acutely hazardous substance or radiological material that meets the federal threshold planning quantities listed in 40 Code of Federal Regulations (CFR) Part 355, Subpart A

Asbestos Regulation and Abatement

The CAA was enacted in 1970 and continues to be periodically updated. The CAA required EPA to establish primary and secondary national ambient air quality standards. The CAA also required each state to prepare an air quality control plan referred to as a State Implementation Plan. Section 112 of the CAA defines hazardous air pollutants and sets threshold limits. ACMs are regulated by EPA under the CAA.

The Bay Area Air Quality Management District (BAAQMD) regulates the demolition and renovation of buildings and structures that may contain asbestos. BAAQMD Regulation 11 Rule 2 requires compliance with the National Emission Standards for Hazardous Air Pollutants regulation, 40 CFR, Part 61, Subpart M developed by EPA.

City of Rohnert Park General Plan

The following goals from the *City of Rohnert Park General Plan* (City of Rohnert Park, 2015 [originally adopted 2000]:7-19 and 7-20) related to hazards and hazardous materials apply to the proposed plan:

Goal HS-E: Minimize the risk to life and property from the generation, storage, and transportation of hazardous materials and waste in Rohnert Park, and assure the proper disposal of all hazardous waste that may be generated in Rohnert Park.

Goal HS-F: Comply with all applicable regulations and provisions for the storage, use and handling of hazardous substances as established by federal (EPA), State (DTSC, RWQCB, Cal-OSHA, Cal EPA), and local (County of Sonoma, City of Rohnert Park) regulations.

Goal HS-G: Protect groundwater and soil from contamination by hazardous materials.

3.6.3 Impact Discussion

3.6a and 3.6b. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment? Less-than-Significant Impact.

Construction

Project construction would include the storage, use, and transport of minor amounts of hazardous materials (e.g., asphalt, fuel, lubricants, paint, and other substances). Regulations governing hazardous materials transport are included in CCR Title 22, the California Vehicle Code (CCR Title 13), and the State Fire Marshal Regulations

(CCR Title 19). Transport of hazardous materials can only be conducted under a registration issued by DTSC. ID numbers are issued by DTSC or EPA for tracking hazardous waste transporters and treatment, storage, and disposal facilities for hazardous materials. The ID number is used to identify the hazardous waste handler and to track waste from its point of origin to final disposal; all material transport takes place under manifest. The project applicant, builders, and contractors would be required to use, store, and transport hazardous materials in compliance with applicable federal, state, and local regulations during project construction and operation.

Project construction contractors and future on-site businesses are required by law to implement and comply with existing hazardous material regulations. Because each of these regulations is specifically designed to protect the public health through improved procedures for handling hazardous materials, improved technology in the equipment used to transport these materials, and quicker, more coordinated response to emergencies, impacts related to the creation of significant hazards to the public through routine transport, use, disposal, and risk of upset during construction would be *less than significant*.

Operation

During project operations, future businesses that handle hazardous materials would be required by law to comply with federal, state, and local laws, regulations, and policies regarding the handling, storage, reporting, tracking, and cleanup (if any accidental spills occurred) of hazardous materials, including preparation of a hazardous materials business plan and disclosure of hazardous materials inventories. Sonoma County Environmental Health and Safety is the CUPA responsible for oversight of local businesses that handle hazardous materials. Residential use, storage, and disposal of hazardous materials (e.g., small quantities of fuel, motor oil, paints, solvents, pesticides, and herbicides) are also regulated primarily by Sonoma County Environmental Health and Safety, but all residents are required to comply with federal and state laws and regulations related to hazardous materials.

Future businesses and residents in the plan area would be required to use, store, and transport hazardous materials in compliance with applicable federal, state, and local regulations during project operation. Each of these regulations is specifically designed to protect the public health through improved procedures for the handling of hazardous materials, better technology in the equipment used to transport these materials, and a more coordinated, quicker response to emergencies. Therefore, impacts related to the creation of significant hazards to the public through routine transport, use, disposal, and risk of upset during project operations would be *less than significant*.

3.6c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school? Less-than-Significant Impact.

Construction and Operation

As discussed previously, there is one existing school in the plan area, and two additional schools are within a quarter-mile radius of the plan area. Furthermore, the proposed plan includes public/institutional land uses that would permit a school to be developed in the plan area in the future. Under PRC Section 21151.4, unless certain conditions are met, EIRs or mitigated negative declarations may not be certified or adopted for projects within a quarter-mile radius of schools that would include constructing or altering facilities that meet any of the following criteria:

- might reasonably be anticipated to emit hazardous air emissions;
- would handle an extremely hazardous substance or a mixture containing extremely hazardous substances in a quantity equal to or greater than the state threshold quantity specified in Section 25532(j) of the Health and Safety Code; or
- may pose a health or safety hazard to persons who would attend or would be employed at the school.

As discussed in detail in Section 3.3, “Air Quality,” construction and operation under the proposed plan would not result in hazardous air emissions. Neither construction nor operation would result in the handling of substances classified as extremely hazardous. The plan area is already developed with commercial, light industrial, civic, and multifamily residential land uses, and these types of land uses would continue under the proposed plan; therefore, implementation of the proposed plan would not subject existing school children or school employees to new hazardous substances, or hazardous substances at locations that are any closer than the current distances. As described in Impacts 3.6a and 3.6b above, small quantities of hazardous materials such as fuels, oils, and lubricants would be used in construction equipment. In addition, materials specific to light industrial land uses are currently used in the plan area, and would continue to be used in the future, subject to permits from appropriate federal, state, and local regulatory authorities. None of these materials are classified as acutely hazardous. Construction contractors and existing and future business operators are required to use, store, and transport hazardous materials in compliance with federal, state, and local regulations. The use of these materials during construction and operation would not represent a safety hazard for persons who would attend or be employed in either the on-site or off-site schools. Therefore, this impact would be *less than significant*.

3.6d. Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment? Less-than-Significant Impact with Mitigation Incorporated.

Construction and Operation

<u>Off-Site Soil and Groundwater Contamination</u>

As shown in Table 3.6-1, the results of a search of the GeoTracker database (SWRCB, 2015) indicate there are three known hazardous materials release sites that are within a quarter-mile radius of the plan area.

- **101 International and Groom Properties—**The 101 International and Groom Properties sites are related to one another and are approximately 300 feet west of the plan area. A leaking UST at these sites resulted in contaminated soil, as well as a contaminated groundwater plume that is migrating west toward Hinebaugh Creek. An Interim Remedial Action Plan has been proposed for site cleanup.
- **Former Rohnert Park Shell**—This site, which is approximately 475 feet west of the plan area, contained a leaking UST that resulted in soil and groundwater contamination. However, remedial activities have been conducted and the responsible party has submitted a request for site closure.

Because the contaminated soil and groundwater at these sites are not located within the plan area, and the direction of groundwater flow is to the west (away from the plan area), neither of these sites would pose a hazard related to future construction or operation under the proposed plan. Therefore, the impacts from these sites would be *less than significant*.

On-Site Soil and Groundwater Contamination

As shown in Table 3.6-1, there are three known sites within the plan area where hazardous materials contamination has occurred. Each site is discussed separately below.

- **Weyerhaeuser-Commercial Door (5600 State Farm Drive)**—Cleanup activities associated with the releases at this property have included removal of all USTs and excavation of 3,200 cubic yards of contaminated soil. Soil and groundwater were treated by various methods, including groundwater extraction, dual-phase vapor and groundwater extraction, SVE, and in situ injection of oxygen. Environmental investigations at this site have concluded that the remaining dissolved concentrations of petroleum hydrocarbons in the groundwater are limited in extent and do not extend off the property. A limited amount of contaminated soil is present underground along the western edge of the property. This property is in an industrial area (SWRCB, 2015).
- **Safety Kleen Corporation (5750 Commerce Boulevard)**—This site contains both a solvent plume and a petroleum plume. The petroleum contamination is related to former leaking USTs that were removed in 2007. Remediation of VOCs and TPH is under way via a multi-phase extraction system that is currently extracting groundwater and soil vapor from two recovery wells. This property is in an industrial area. The groundwater plume does not extend off the property (SWRCB, 2015).
- **Rohnert Park Corporation Yard (600 Enterprise Drive)—**The soil and the groundwater at this site were contaminated with petroleum hydrocarbons from two leaking USTs that were removed in 1990, along with approximately 1,500 cubic yards of contaminated soil. Residual soil contamination is still present at the site approximately 10 to 22 feet bgs. A high-vacuum, dual-phase extraction system has been proposed for site remediation (SWRCB, 2015).

If future redevelopment of these three sites were to occur, construction workers and future site-specific business employees and the general public could be exposed to adverse health effects from contaminated soil and/or groundwater, including indoor air quality effects from vapor intrusion, which would be a *potentially significant* impact.

Asbestos and Lead-Based Paint

The proposed plan includes reuse and redevelopment of some of the properties in the plan area. Most of these properties have been developed with existing structures, some of which may contain asbestos and lead-based paint. Therefore, construction workers and future site-specific business employees and the general public could be exposed to adverse health effects from asbestos and lead-based paint, and this impact is considered *potentially significant.*

Mitigation Measures

Mitigation Measure 3.6-1: Consult with the North Coast RWQCB and Sonoma County Environmental Health and Safety Prior to Development at Known Contamination Sites and Implement Consultation Recommendations

During the CEQA analysis for each project, the project applicant for any project to redevelop the known hazardous material contamination sites associated with 5600 State Farm Drive, 5750 Commerce Boulevard, and 600 Enterprise Drive shall consult with the North Coast RWQCB and Sonoma County Environmental Health and Safety to determine whether soil and groundwater remediation have been achieved to levels that would be protective of human health during construction and future operational activities at each site. Any applicable tests that may be required by the North Coast RWQCB prior to development, such as vapor intrusion studies related to indoor air quality or soil or groundwater testing, shall be conducted either by the project applicant or by the party responsible for site cleanup activities, as appropriate.

Mitigation Measure 3.6-2: Remove Project-Specific Asbestos-Containing Material and Lead-Based Paint in Accordance with Federal, State, and Local Regulations

The project applicant shall retain a Cal-OSHA certified asbestos consultant before reuse, remodeling, or demolition of any existing on-site buildings that were constructed prior to 1978 to investigate whether any ACMs or lead-based paints are present, and could become friable or mobile during demolition activities. If any materials containing asbestos or lead-based paints are found, they shall be removed by an accredited contractor in accordance with EPA Cal-OSHA, and BAAQMD standards. In addition, all activities (construction or demolition) in the vicinity of these materials shall comply with Cal-OSHA asbestos and lead worker construction standards. The materials containing asbestos and lead shall be disposed of properly at an appropriate off-site disposal facility.

Significance After Mitigation

Implementing Mitigation Measures 3.6-1 and 3.6-2 would reduce the impact from construction and operation associated with known hazardous material sites to a *less-than-significant* level. Mitigation Measure 3.6-1 would prohibit construction and operation on these three contamination sites until a determination has been made by the North Coast RWQCB and Sonoma County Environmental Health and Safety that soil and groundwater remediation have been achieved to levels that would be protective of human health during construction and future operational activities at each site. Furthermore, compliance with Policy U-1.9 would not permit new groundwater wells intended for either potable or nonpotable water supply within any areas of contaminated groundwater plumes. Finally, Mitigation Measure 3.6-2 would require investigation for the presence of asbestos and lead-based paint of any buildings slated for remodeling or demolition that were constructed prior to 1978, and any such materials would be removed in accordance with EPA, Cal-OSHA, and BAAQMD standards.

3.6e and 3.6f. For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area? For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area? No Impact.

Construction and Operation

The closest open, operational airport is the Petaluma Municipal Airport, approximately 7.25 miles southeast of the plan area. There are no airports or airstrips within 2 miles of the plan area. Therefore, there would be *no impact*.

3.6g. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? Less-than-Significant Impact with Mitigation Incorporated.

Construction

The plan area contains sufficient land for construction materials, equipment, and personnel to be staged on-site. However, nearby roadways in and near the plan area could be affected intermittently during construction activities. Ongoing construction activities could result in temporary lane closures, increased construction truck traffic, and other roadway effects that could slow or interfere with emergency vehicles, temporarily increasing response times and impeding existing services. Therefore, this impact is considered *potentially significant*.

Mitigation Measures

> **Mitigation Measure 3.6-3: Prepare and Implement Project-Specific Construction Traffic Control Plans.**
>
> *The project applicant shall prepare and implement a traffic control plan for construction activities that may affect road rights-of-way, to facilitate travel of emergency vehicles on affected roadways. The traffic control plan must follow applicable City of Rohnert Park standards and must be approved and signed by a professional engineer. Measures typically used in traffic control plans include advertising of planned lane closures, warning signage, a flag person to direct traffic flows when needed, and methods to ensure continued access by emergency vehicles. During project construction, access to the existing land uses shall be maintained at all times, with detours used, as necessary, during road closures. The traffic control plan shall be submitted to the City for review and approval before the approval of all site-specific development plans or permits.*

Significance After Mitigation

Implementation of Mitigation Measure 3.6-3 would reduce the impact associated with decreased emergency response times during construction to a *less-than-significant* level, by requiring preparation and implementation of a construction traffic control plan that would provide for adequate emergency access during construction activities.

Operation

At the completion of each future site-specific infill, redevelopment, or improvement project, construction traffic would no longer be using city streets for site access, and the potential for lane and roadway closures and detours related to construction traffic would no longer be present. Therefore, no potential for project-related operational activities would exist to result in delays in emergency vehicle response times, or to impede access for emergency vehicles, and there would be *no impact*.

3.6h. Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands? Less-than-Significant Impact.

Construction and Operation

Most of the plan area is already developed with urban land uses. A large shopping center is on the northwestern side of the plan area. A golf course is on the northeastern side of the plan area, with residences east of the golf course. Intensive urban development is present on the western, southern, and eastern sides of the plan area.

In LRAs, CAL FIRE is required to delineate areas of very high fire hazard. The plan area and the surrounding area are within a LRA that is not designated as a fire hazard severity zone (CAL FIRE, 2008). Within an LRA, the financial responsibility of preventing and suppressing fires falls primarily on local fire districts maintained by cities and counties. Fire suppression services to the plan area are currently and would continue to be provided by the City of Rohnert Park.

Because the plan area is not in or near an area of high fire hazard severity, and because adequate fire protection services would be provided by a local fire protection district, this impact would be *less than significant*.

3.6.4 Cumulative Impacts

Hazards and hazardous materials impacts associated with past or current uses of any site usually occur on a site-specific basis; they are generally limited to the specific site, and are not additive in nature in that they generally do not combine to form cumulative impacts that are greater or different than the project-level effect. The cumulative context for impairment of emergency access and for wildland fire hazard is defined as those projects that would entail construction activities in proximity to or concurrently with the activities associated with the proposed plan.

Routine Transport, Use, Disposal, or Accidental Release of Hazardous Materials

The proposed plan would include the storage, use, and transport of hazardous materials (e.g., fuels, oils, lubricants) during construction and operation of future plan area land uses. Transport of hazardous materials on area roadways is regulated by CCR Titles 13, 19, and 22. The future developers or business operators would be required to use, store, and transport hazardous materials in compliance with federal and state regulations during project construction and operation. Specific land uses that would use hazardous materials on-site would be required to obtain permits and comply with appropriate regulatory agency standards designed to avoid accidental releases of hazardous materials. The related projects could also include the storage, use, transport, and accidental release of hazardous materials similar to those described above. However, the proposed plan and the related projects would be legally required to implement and comply with existing hazardous materials regulations (e.g., regulations administered by EPA and DTSC), and these effects are site-specific. Even if multiple hazardous releases were to occur at the same time (which is extremely unlikely, given the highly regulated nature of hazardous materials), the releases would occur in different locations, would likely be small in size given the types of planned land uses, and therefore would not combine to form cumulative impacts that would be worse than any project-specific effect. Therefore, there would be *no cumulative impact* associated with hazardous materials storage, use, transport, or accidental spills.

Exposure to Known and Unknown Hazardous Materials

There are three locations within the plan area that contain contaminated groundwater plumes and contaminated soil. Mitigation Measures 3.6-1 and 3.6-2 would reduce project-specific impacts from construction and operational exposure to known hazardous materials at these three sites to a less-than-significant level because new groundwater wells at these sites would not be permitted, and remediation of existing contamination would occur before future redevelopment at these sites. None of the off-site contaminated groundwater plumes in the immediate project vicinity are migrating toward the plan area, and therefore do not pose a hazard to future on-site residents or businesses. Because there is no possibility of human exposure to the contaminated groundwater plumes or soils following implementation of Mitigation Measure 3.6-1, there would be no project-specific residual effect. Furthermore, there are no other sources of contaminated soil or groundwater in the project vicinity that could combine with the project-specific contamination to result in a cumulatively increased hazard. Therefore, *no cumulatively significant impact* related to contact with existing contaminated groundwater plumes or contaminated soils would occur.

Implementation of the proposed plan could result in possible human health hazards from exposure to asbestos and lead-based paint during future demolition and remodeling activities. Implementation of Mitigation Measure 3.6-2 would reduce the project-specific effects to a less-than-significant level because local, state, and federal regulations for the protection of worker safety and proper disposal of materials would be followed. The potential for asbestos and lead-based paint to occur is specific to each project site and is dependent on the types of building materials present and the age of the buildings. Therefore, asbestos and lead-based paint may or may not be present at the related project sites considered in this cumulative analysis. All projects requiring demolition and remodeling of buildings containing asbestos and lead-based paint are required to follow local, state, and federal regulations for the protection of worker safety and proper disposal. Furthermore, asbestos and lead-based paint effects are specific to the construction work being performed at each site, and do not combine with effects at other sites. Therefore, this effect is not additive in nature and *no cumulative impact* would occur.

Handling of Hazardous Materials within One-Quarter Mile of a School

There is one K-12 school in the plan area and two other existing schools within a one-quarter-mile radius of the plan area. Construction and operation of the proposed plan would not result in hazardous air emissions. Neither construction nor operation of the proposed plan would result in the handling of substances classified as extremely hazardous. The plan area is already developed with commercial, light industrial, civic, and multifamily residential land uses, and these types of land uses would continue under the proposed plan; therefore, project implementation would not subject existing school children or school employees to new hazardous substances or hazardous substances at locations that are any closer than the current distances. The related projects considered in this cumulative analysis could also entail the handling of hazardous materials within one-quarter mile of an existing or planned school. However, any such exposure would be site-specific in nature, and would affect schools other than those considered in this cumulative analysis. Therefore, this impact would not be additive in nature, and there would be *no cumulative impact* associated with handling of hazardous materials within one-quarter mile of a school.

Impairment of Emergency Vehicle Access or Evacuation Routes

Construction of the proposed plan would temporarily increase traffic congestion and could result in the need for temporary lane closures of roads in and near the plan area. Construction of the related projects considered in this cumulative analysis could occur concurrently with the construction of projects on the plan area, thereby increasing construction traffic and the potential for lane closures on roads in the project vicinity, which could increase the frequency or length of impairment of emergency vehicle access. Therefore, the related projects could result in a significant short-term, temporary, cumulatively considerable impact related to impairment of emergency evacuation routes and emergency vehicle access during construction activities; and the proposed plan could result in a cumulatively significant contribution to this impact. Implementation of Mitigation Measure 3.6-3 would reduce the proposed plan's contribution to this cumulatively significant impact to a *less-than-significant* level because a traffic control plan would be prepared by the individual project applicant(s) and approved by the City of Rohnert Park, and detours would be provided to ensure acceptable traffic flow and reduce the risk of impairment to emergency evacuation routes and emergency vehicle access to the maximum extent feasible.

Wildland Fire Hazards

The plan area is in the developed, urban area of the City of Rohnert Park. According to CAL FIRE (2008), the plan area is in an LRA that is not designated as a very high fire hazard severity zone. The related projects are also in an LRA, and are also not in a very high fire hazard severity zone. Fire suppression personnel and equipment are either already available (in the case of the plan area) or are included as part of each related project to serve the plan area and the related projects. Because the proposed plan and the related projects are not within or adjacent to a high fire hazard severity zone, and because adequate fire suppression services are or would be available, a cumulatively significant impact would not occur, and the proposed plan would result in *no cumulatively significant impact* related to wildland fire hazard.

3.6.5 References

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3.7 HYDROLOGY AND WATER QUALITY

This section describes the existing physical and regulatory setting related to hydrology and water quality and discusses the potential impacts of the proposed plan on hydrology and water quality. Please see Section 5.8, “Utilities and Service Systems,” in Chapter 5.0, “Effects Found Not To Be Significant,” for a discussion of the potential impacts of the proposed plan on wastewater, water supply, water delivery infrastructure, and stormwater. Section 5.8.2, “Water Supply,” provides a summary of the water supply assessment that was prepared by the City for this project (included as Appendix F).

3.7.1 Existing Conditions

Hydrologic Region

The hydrologic region of the North Coast covers approximately 19,500 square miles (approximately 12 percent of California’s land cover) and occupies parts of eight counties, extending from Sonoma County along the Pacific Coast to the Oregon border and inland to Siskiyou and Modoc Counties (DWR, 2009). The North Coast Hydrologic Region is divided into two natural drainage basins: the Klamath River Basin and the North Coastal Basin. The plan area lies within the Russian River Hydrologic Unit of the North Coast Basin. Streams in this hydrologic unit flow into the Russian River at the confluence with the Laguna de Santa Rosa, and ultimately into the Pacific Ocean near Jenner. Major water storage components of the Russian River include Lake Sonoma on Dry Creek and Lake Mendocino on the East Fork of the Russian River (DWR, 2009).

Surface Water

The plan area is in the city of Rohnert Park, in the Upper Laguna de Santa Rosa watershed, a 62-square-mile subwatershed within the southern boundary of the larger 1,485-square-mile Russian River watershed (EPA, 2013; SWRCB, 2015). The Upper Laguna de Santa Rosa watershed extends south from near Railroad Avenue in Cotati, north to Santa Rosa near the intersection of U.S. Highway 101 and State Route 12, east to the Coast Ranges ridgeline near Jack London State Historic Park, and west to the western edge of Sebastopol (EPA, 2013).

Copeland Creek and the locally named Hinebaugh Creek (also referred to as the Hinebaugh Flood Control Channel) are located within the plan area, generally running from east to west (EPA, 2013). Copeland Creek is near the southern boundary of the plan area and Hinebaugh Creek bisects the plan area just north of Rohnert Park Expressway. The creeks are channelized to provide flood protection and are intermittent, flowing only part of the year because they receive water from seasonal sources (City of Rohnert Park, 2015a [originally adopted 2000]). Flows in Hinebaugh and Copeland Creeks peak during storm events and are low during the summer months. . Smaller ephemeral drainages in the plan area generally run north and south into Hinebaugh and Copeland Creeks. Most of the flow in the drainages results from winter rain. The creeks have well-defined channels with distinguishable beds and banks; evidence of scour or deposits of rock, sand, gravel, or soil; and evidence of riparian vegetation or aquatic organisms (City of Rohnert Park, 2015a [originally adopted 2000]). Both creeks flow into the Laguna de Santa Rosa, which ultimately joins the Russian River before flowing into the Pacific Ocean.

Groundwater

The plan area is located within the Santa Rosa Plain Subbasin of the larger Santa Rosa Valley Groundwater Basin (City of Rohnert Park, 2015b). The city is at the southern end of the Santa Rosa Plain Subbasin, which drains to the northwest toward the Russian River and on to the Pacific Ocean. The subbasin is in southern Sonoma County, in a broad gentle plain known as the Cotati Valley, in the California Coast Ranges north of San Francisco Bay (City of Rohnert Park, 2005b). The Santa Rosa Plain Subbasin is approximately 22 miles long and 0.2 mile wide at the northern end; approximately 9 miles wide through the Santa Rosa area; and about 6 miles wide at the south end of the valley near the city of Cotati just south of the plan area (DWR, 2004; City of Rohnert Park, 2011).

The city derives its drinking-water supply from a groundwater wellfield consisting of 42 municipal supply wells, of which 29 are active, and connections to the Sonoma County Water Agency (SCWA) Petaluma Aqueduct, which supplies water from the Russian River (City of Rohnert Park, 2011). Groundwater is one of three sources of water used by the City as part of its "conjunctive use strategy"; groundwater is used to meet peak water demands and is estimated to supply 2,577 acre-feet per year (AFY) in all water years (e.g., normal and dry) (City of Rohnert Park, 2015b). The majority of the wells pump from water-bearing zones present in the alluvial fan deposits, Glen Ellen Formation, and Wilson Grove Formation, from 200 to 1,200 feet below ground surface (bgs) (City of Rohnert Park, 2015a [originally adopted 2000]). Most of the City's wells are between 280 and 600 feet deep; however, a few wells go down to 800 feet, and three wells extend to depths up to 1,500 feet (City of Rohnert Park, 2005b and 2015a [originally adopted 2000]). The aquifer is recharged from the mountains around the Cotati Valley. No sites within the existing Rohnert Park city limits use private wells for drinking-water supply.

The City manages its groundwater supply in accordance with its 2004 Water Policy Resolution, which limits groundwater pumping to 2,577 AFY. The City's 2004 City-wide Water Supply Assessment and 2005 and 2010 Urban Water Management Plans provide the technical support for this maximum pumping rate (City of Rohnert Park, 2015b). The City actively participates in the implementation of the Santa Rosa Plain Watershed Groundwater Management Plan (adopted 2014). Modeling and monitoring data collected by the City and others indicate that groundwater levels are generally rising around the City's well field, an indication of stable supply. Over the past 10 years the City has used between 350 and 1,600 AFY of groundwater, which is significantly less than its policy limitation on groundwater use (City of Rohnert Park, 2015b).

Water Quality

Surface Water

According to the 2012 California Integrated Report, which combines the Clean Water Act (CWA) Section 303(d) List and 305(b) Report, the Laguna de Santa Rosa water body (which is located within the larger Russian River Hydrologic Unit, Middle Russian River Hydrologic Area, Laguna Hydrologic Subarea) has been split up into two water bodies for administrative reasons. The former Laguna de Santa Rosa water body is now formally retired and has been replaced with two new water bodies: (1) the mainstem Laguna de Santa Rosa and (2) the tributaries to the Laguna de Santa Rosa (except Santa Rosa Creek and its tributaries) (EPA, 2015a). The plan area is located in the tributaries to the Laguna de Santa Rosa water body. As summarized in Table 3.7-1, the tributaries to the Laguna de Santa Rosa, which include Copeland Creek, Hinebaugh Creek, and on-site ephemeral drainages, are listed under CWA Section 303(d) as impaired for indicator bacteria, sedimentation/siltation, and water temperature (EPA, 2015b). Sources of these impairments, as well as the current status of the total maximum daily loads (TMDLs), are summarized in Table 3.7-1.

Table 3.7-1: Section 303(d) List of Impaired Water Bodies

Water Body Name	Pollutant	Pollutant Sources	Status of TMDL
Tributaries to the Laguna de Santa Rosa	Indicator bacteria	Nonpoint source, other	Estimated 2016
	Sedimentation/siltation	Flow alteration/regulation/modification; removal of riparian vegetation	Estimated 2025
	Water temperature	Flow alteration/regulation/modification; removal of riparian vegetation	Estimated 2025

Source: EPA, 2015b.

Existing and potential beneficial uses of Laguna de Santa Rosa in the Laguna Hydrologic Subarea (114.21), established by the North Coast Regional Water Quality Control Board (RWQCB) in its Basin Plan, include[1] municipal and domestic supply (potential); agricultural supply; industrial service supply; industrial process supply (potential); groundwater recharge; freshwater replenishment; navigation; hydropower generation; water contact recreation; noncontact water recreation; commercial and sport fishing; warm freshwater habitat; cold freshwater habitat; wildlife habitat; rare, threatened, or endangered species; migration of aquatic organisms; spawning, reproduction, and/or early development; shellfish harvesting (potential); and aquaculture (potential) (North Coast RWQCB, 2011).

Groundwater

Groundwater produced from the City's 29 active groundwater wells is tested for a total of 139 constituents and meets primary state drinking water standards (City of Rohnert Park, 2005b and 2011). Groundwater below 150 feet is characterized by sodium and calcium biocarbonate types (DWR, 2004). In 2009, electrical conductivity values representing overall mineral content range from 280 to 610 micromhos per centimeter (µmho/cm) (City of Rohnert Park, 2011), which are below the recommended secondary maximum contaminant level (MCL) of 900 µmho/cm.

Other water quality concerns in the Rohnert Park area include elevated nitrate, arsenic, iron, and manganese concentrations in some wells. Nitrate concentrations in City wells perforated in the intermediate zone or in multiple zones range from nondetect to 35 milligrams per liter (mg/L), which is less than the primary MCL of 45 mg/L (City of Rohnert Park, 2011). Samples collected from five wells in 1997 exceeded secondary MCLs for iron and manganese, which do not pose health hazards but are considered nuisance pollutants. Naturally occurring arsenic levels in City wells range from 2 to 12 micrograms per liter (µg/L) (City of Rohnert Park, 2011). Arsenic concentrations in deeper wells (greater than 600 feet) in the northwestern area of the city were found to have concentrations near or above the federal MCL of 10 µg/L.

[1] Beneficial uses are existing unless otherwise indicated.

Overall, groundwater quality pumped from the City's municipal wells is good, despite aesthetic problems such as high concentrations of iron, manganese, or high hardness (City of Rohnert Park, 2005a). Existing beneficial uses of the groundwater, established by the North Coast RWQCB in its Basin Plan, include municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply (potential) (North Coast RWQCB, 2011).

Flooding

Flooding in the plan area is primarily the result of heavy rainfall, a high percentage of impervious surfaces in the plan area, the presence of some buildings in low-lying areas, extremely high sediment loads, and steep mountains surrounding the Cotati Valley. These factors combined with the short lag times of the region's rivers can cause destructive floods (DWR, 2009). Sonoma County has designated the Russian River, Laguna de Santa Rosa, and Mark West Creek as floodways[2] (DWR, 2009).

The plan area is in a topographically flat area in a previously developed location. The two creeks in the plan area present open channels with potential to flood; however, the plan area is not within a 100-year or 500-year flood zone (City of Rohnert Park, 2015a [originally adopted 2000]: Figure 7.2-2). According to the Federal Emergency Management Agency's (FEMA's) flood insurance rate maps (FIRMs), the majority of the plan area is located within Zone X, defined as "areas determined to be outside the 500-year flood" (FEMA, 2015). SCWA has been working to improve and maintain the flood control channels in the plan area (Copeland and Hinebaugh Creeks) to reduce flooding risk.

Drainage

Stormwater flows in the direction of the natural topography, collecting either underground into one of the storm drainage features or aboveground into one of the ephemeral drainages that flow into one of the two channelized creeks in the plan area, which in turn drain westerly to Laguna de Santa Rosa Creek. There are also three 48-inch and larger stormwater conveyance pipes in the plan area, which direct stormwater south to Copeland Creek (City of Rohnert Park, 2015a [originally adopted 2000]: Figure 7.2-2). Because most of the plan area has been previously developed, existing storm drainage features are already in place to drain water runoff. Localized, relatively minor flooding has occurred in Rohnert Park in recent years, including the streets at the southern end of the plan area (Avram Avenue and Commerce Boulevard) (City of Rohnert Park, 2015a [originally adopted 2000]: Figure 7.2-2).

3.7.2 Regulatory Framework

Clean Water Act

The CWA is the primary federal law promulgated to protect the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. The CWA operates on the principle that all discharges into the nation's waters

[2] The channel of a river or stream and the parts of the floodplain adjoining the channel that are reasonably required to efficiently carry and discharge the flood water or flood flow of a river or stream (Wang and Wang, 2015).

are unlawful unless specifically authorized by a permit; permit review is the CWA's primary regulatory tool. The specific CWA sections discussed below are relevant to the proposed plan.

Section 401 of the CWA requires that state water quality standards be met and that project construction—including dewatering activities, dredging, and disposal—not cause concentrations of chemicals in the water column to exceed state standards. A Section 401 water quality certification from the RWQCB is required for issuance of a Section 404 permit for filling of waters of the United States, described below.

Under the CWA, discharge of any pollutant from a point source into navigable waters is unlawful unless a National Pollutant Discharge Elimination System (NPDES) permit is obtained. In addition, the CWA requires each state to adopt water quality standards for receiving water bodies, and to have those standards approved by EPA. Water quality standards consist of designated beneficial uses for a particular receiving water body (e.g., wildlife habitat, agricultural supply, or fishing), along with water quality objectives necessary to support those uses.

Section 402(p) of the CWA regulates point-source discharges of pollutants under the NPDES program. This section of the CWA was amended in 1987, to require EPA to establish regulations for permitting of municipal and industrial stormwater discharges (including discharges from active construction sites) under the NPDES program. In California, the State Water Resources Control Board (SWRCB) is authorized by EPA to oversee the NPDES program through the nine geographically separated RWQCBs (also see "National Pollutant Discharge Elimination System," below). The NPDES program provides general permits (those that cover a number of similar or related activities) and individual permits.

Section 404 of the CWA prohibits the discharge of dredged or fill material into waters of the United States, including wetlands, without a permit from the U.S. Army Corps of Engineers (USACE). EPA also has authority over wetlands, and under Section 404(c) may veto a USACE permit. Depending on the number of impacts on waters of the United States, a USACE Section 404 permit application can lead to either a nationwide permit for projects with minimal adverse effects, or an individual permit for projects that do not fall under a nationwide permit. Section 3.4, "Biological Resources," provides additional discussion regarding Section 404.

Under Section 303(d) of the CWA, states must develop lists of water bodies that would not attain water quality objectives for specific pollutants after implementation of required levels of treatment by point-source dischargers (municipalities and industries). Section 303(d) requires that the state develop a TMDL for each of the listed pollutants in these water bodies. The TMDL is the amount of loading that the water body can receive and still be in compliance with water quality objectives. The TMDL also can act as a plan to reduce loading of a specific pollutant from various sources, to achieve compliance with water quality objectives. After implementation of the TMDL, the problems that led to placement of a given pollutant on the Section 303(d) list are expected to be remediated. The Laguna de Santa Rosa is listed as a Section 303(d) water body, and is located west of the plan area. Copeland and Hinebaugh Creeks eventually drain into the Laguna de Santa Rosa west of the city limits.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act), also known as the California Water Code, is California's statutory authority for the protection of water quality. Under the Porter-Cologne Act, the state must adopt water quality policies, plans, and objectives that protect the beneficial uses of the state's waters. State law defines beneficial uses as "domestic; municipal; agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050[f]). The Porter-Cologne Act sets forth the obligations of the SWRCB and RWQCBs pertaining to the adoption of water quality control plans (basin plans) and establishment of water quality objectives. Unlike the federal CWA, which regulates only surface water, the Porter-Cologne Act regulates both surface water and groundwater. Water quality objectives and beneficial uses are established by RWQCBs. The North Coast RWQCB, which has jurisdiction over the plan area, addresses regionwide water quality in its Basin Plan, last updated in May 2011.

The SWRCB and RWQCBs establish water quality objectives for surface waters and groundwater, and have permitting and enforcement authority to prevent and control waste discharges that could affect waters of the state through the issuance of NPDES permits and waste discharge requirements. The North Coast RWQCB (Region 1) develops TMDLs for the North Coast area.

National Pollutant Discharge Elimination System

The NPDES permit program was established by the CWA to regulate municipal and industrial discharges to surface waters of the United States from municipal separate storm sewer systems (MS4s). NPDES permits generally identify effluent and receiving water limits on allowable concentrations and/or mass emissions of pollutants contained in the discharge; prohibitions on discharges not specifically allowed under the permit; and provisions that describe required actions by the discharger, including industrial pretreatment, pollution prevention, self-monitoring, and other activities.

The SWRCB and North Coast RWQCB have adopted specific NPDES permits and/or waste discharge requirements for a variety of activities that may discharge wastes to waters of the state or to land. Dischargers must eliminate or reduce nonstormwater discharges to storm sewer systems and other waters.

The SWRCB has adopted a statewide NPDES general permit for discharges associated with construction activities that disturb 1 acre or more (Construction General Permit; SWRCB Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ). Construction activities in the plan area (e.g., clearing, grading, stockpiling, and excavation) would be subject to the Construction General Permit. The NPDES regulations also require implementation of appropriate hazardous materials management practices to reduce the possibility of chemical spills or release of contaminants, including any nonstormwater discharge to drainage channels.

The NPDES permit requires that a notice of intent for discharging stormwater be filed with the RWQCB, and that a storm water pollution prevention plan (SWPPP) be prepared and implemented to control contaminated runoff from temporary construction activities. NPDES permits require implementing erosion and sediment best management practices (BMPs) to reduce the level of contaminant runoff during construction. The permit also requires dischargers to consider implementing permanent postconstruction BMPs that will remain in service to protect water quality throughout the life of the project. Types of BMPs include source controls, treatment controls, and site planning measures. All NPDES permits also have inspection, monitoring, and reporting requirements.

In 2014, the City of Rohnert Park became an MS4 Permit Phase I co-permittee with the City of Santa Rosa. As of 2014, the City of Rohnert Park *Storm Drain Design Standards* reference the City of Santa Rosa and County of Sonoma 2011 *Storm Water Low Impact Development Technical Design Manual* (LID Manual), as required by the City's MS4 permit.

The LID Manual, last revised August 17, 2012, allows for no new net runoff from qualifying development or redevelopment projects (i.e., those creating or replacing a combined total of 1 acre or more of impervious surface) due to hydromodification rules through the use of permanent stormwater BMPs. Low-impact development (LID) aims to mimic the hydraulic function of the undeveloped site by capturing, treating, and infiltrating stormwater as close to the source as possible, using small-scale landscape-based features located throughout the project site. Design requirements include the requirements to treat all runoff generated by the 85th percentile, 24-hour storm and to ensure that the volume of runoff from the site in the 85th percentile, 24-hour storm does not increase as a result of development or redevelopment.

National Flood Insurance Program

The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 were enacted to reduce the need for large, publicly funded flood control structures and disaster relief by restricting development on floodplains. FEMA administers the National Flood Insurance Program to provide subsidized flood insurance to communities that comply with FEMA regulations by limiting development in floodplains. FEMA issues FIRMs to communities participating in the National Flood Insurance Program. These maps delineate flood hazard zones in urbanized areas and in some rural areas. Figure 3.7-1 shows the locations of FEMA-designated floodplains in the plan area.

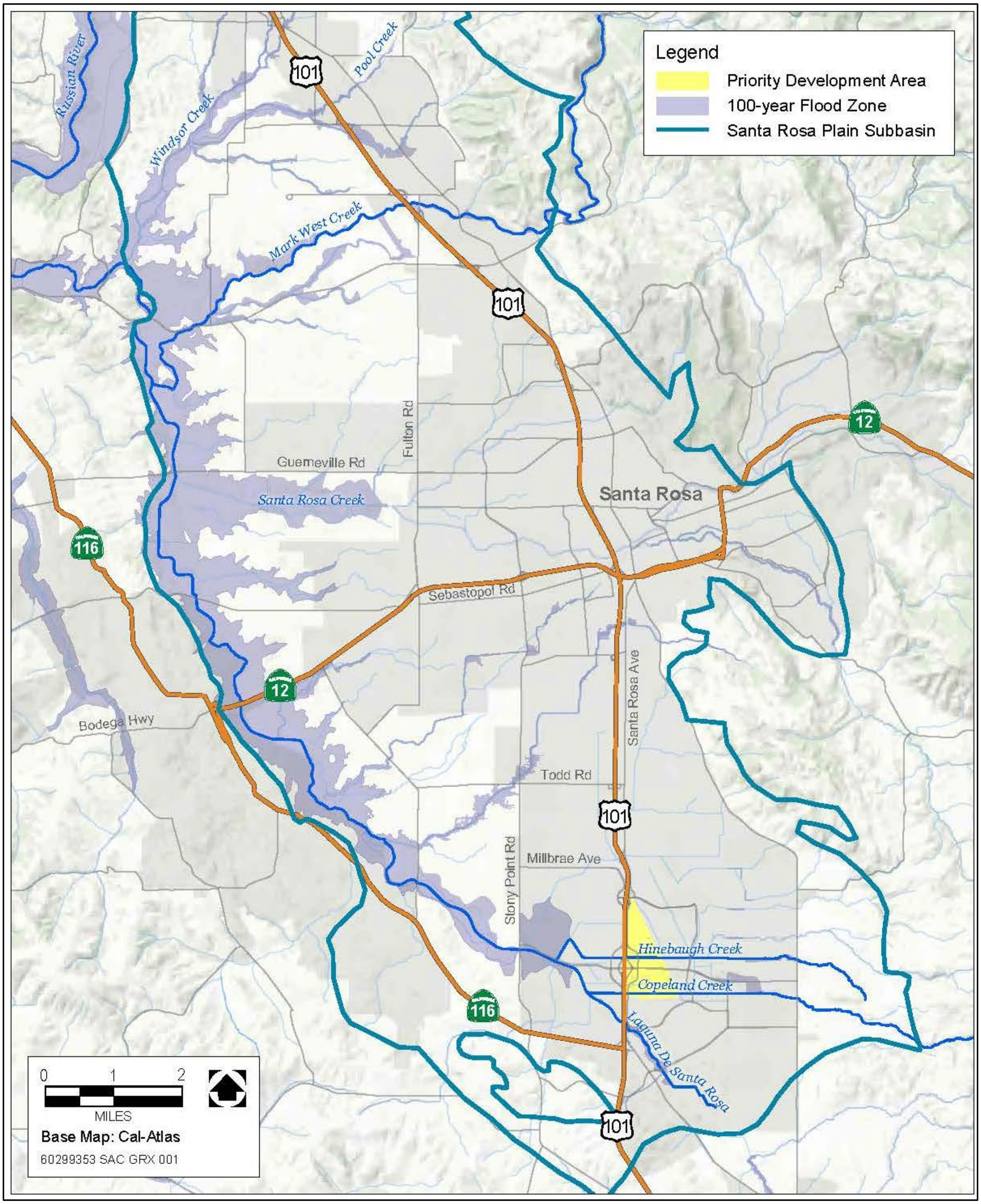
Sonoma County Water Agency

SCWA has a broad range of responsibilities ranging from the management and maintenance of the flood control channels within the plan area to the review of project plans for any proposed on-site or off-site drainage systems required by the City. SCWA reviews projects for conformance with its Flood Control Design Criteria and requires that storm drain improvements be in compliance with these criteria. Culverts and drainage systems must be designed to convey runoff from a 25-year storm. In addition, all structures must be protected from flooding expected to occur during a 100-year storm.

City of Rohnert Park General Plan

The *City of Rohnert Park General Plan* contains the following goals and policies that would be applicable to the proposed plan (City of Rohnert Park, 2015a [originally adopted 2000]):

- **Policy EC-13:** Maintain creek protection zones extending a minimum of 50 feet (measured from the tops of the banks and a strip of land extending laterally outward from the top of each bank) for creeks, with extended buffers where significant habitat areas or high potential wetlands exist (Figure 6.2-2). Where high potential wetland or other biological resources exist, require appropriately wide buffers to encompass and protect the resource. Development shall not occur within this zone, except as part of greenway enhancement (for



Sources: FEMA 2013, CalWater 2004, DWR 2000

Figure 3.7-1: Regional Hydrologic Features and Flood Zone

example, trails and bikeways). Require City approval for the following activities within the creek protection zones: construction, alteration, or removal of any structure; excavation, filling, or grading; removal or planting of vegetation (except for removal of invasive plant species); or alteration of any embankment.

Rohnert Park's creeks are a key part of the city's open space network. They are valuable physical, aesthetic, recreational, and ecological assets. Protection of creeks protects not only surface water quality, but also reduces flood risks, preserves bio-diversity and habitat, minimizes erosion of stream banks, and prevents downstream siltation. The General Plan designates 3.5 miles of creekways in the new growth areas on the city's eastside. Wider buffers—up to about 150 feet from the creek bank—could be required because high potential wetland areas alongside creeks in some areas extend to about a 150-foot width.

- **Policy EC-14:** As part of specific plans, require evaluation and implementation of appropriate measures for creek bank stabilization, and any necessary steps to reduce erosion and sedimentation, but preserve natural creek channels and riparian vegetation.

- **Policy EC-15:** Continue working with the RWQCB to protect water quality.

- **Policy EC-16:** Regularly monitor water quality to maintain high levels of water quality for human consumption and ecosystem health.

- **Policy EC-17:** Work with the relevant agencies to ensure that groundwater supplies are not contaminated in the recharge areas east of the city.

- **Policy EC-18:** Protect waterways by prohibiting the dumping of debris and refuse in and near waterways and storm drains.

- **Policy EC-19:** Require new construction to utilize site preparation, grading, and foundation designs for erosion control to prevent sedimentation and contamination of streams.

  Construction activities such as grading, excavating, and filling, may result in the exposure of bare soil. Rain and wind may erode this soil, transporting soil particles to creeks and storm drain systems and resulting in declining water quality. The sedimentation can reduce the water flow capacity of these waterways, contributing to increased risk of flooding.

Goal HS-B: Minimize the risk to life and property from flooding.

Goal HS-C: Control erosion and sedimentation to provide flood protection and protect water quality.

- **Policy HS-3:** Prepare and implement a Storm Water Management Plan to ensure protection of the surface and groundwater resources.

  The Storm Water Management Plan should include requirements for periodic monitoring of storm water outfalls, public outreach and education, and the implementation of BMPs for a variety of industrial, construction, and municipal activities. Until such time that a Storm Water Management Plan is prepared, the

City should use existing regulations pertaining to subdivision design, zoning, building, and grading ordinances and policies to reduce discharge of nonpoint source pollutants into local streams.

- **Policy HS-5:** As part of the building permit process, require all development projects to comply with hydrology and drainage policies incorporated in the applicable Specific Plans. Require the project proponent to design and construct a storm drain system in accordance with the SCWA Flood Control Design Criteria (latest revision), specific to the project. Encourage the use of environmentally sensitive drainage improvements including flow reduction and flood bypass systems in order to ensure protection of surface water quality and stream integrity.

  Policy LU-10A stipulates that all specific plans shall address hydrology and drainage for their respective areas, as well as practices to be incorporated as part of individual development projects.

  The storm drain system may include:

  – *Street and underground storm drain improvements; and*
  – *New underground storm drainage facilities.*

  The City should recommend the use of high infiltration measures to reduce stormwater discharge into the regional storm drain system. Measures to divert surface runoff into open areas that have high infiltration capabilities could include ponds built into landscapes, unlined runoff channels, and dispersion points into landscaped areas. Where possible and technically feasible, rooftops and paved areas should drain into underground dispersal pipes or vegetated percolation beds. Landscaping in parking lots and around building perimeters should be maximized.

  The City shall review and approve the proposed drainage system requirements prior to construction on the project site.

- **Policy HS-6:** As part of the building permit process, require new development greater than 5 acres in size to prepare and implement a site-specific storm water SWPPP that effectively reduces discharges of stormwater containing sediment and other pollutants resulting from site construction activities. In addition, require all projects, regardless of size, to comply with any other stormwater provisions of the specific plans for their respective areas.

  Policy LU-10A stipulates that all specific plans shall address storm-water pollution for their respective areas, as well as practices to be incorporated as part of individual development projects.

  The proponent shall comply with all requirements set forth in the SWRCB General Construction Activity Storm Water Permit. SWRCB requires site owners of development projects with construction activity resulting in soil disturbance of an area greater than five acres to comply with the California General Permit to Discharge Storm Water Associated with Construction Activity (NPDES General Permit CAS000002). The Permit requires development and implementation of a SWPPP emphasizing BMPs. The RWQCB maintains a list of suggested BMPs, which are schedules of activities, prohibitions of practices, maintenance procedures, and other management procedures to prevent or reduce pollution.

3.7.3 Impact Discussion

3.7a and 3.7f. Violate any water quality standards or waste discharge requirements? Otherwise substantially degrade water quality? Less-than-Significant Impact with Mitigation Incorporated.

Construction

Many construction-related wastes have the potential to degrade existing water quality and beneficial uses by altering the DO content, temperature, pH, suspended-sediment and turbidity levels, or nutrient content, or by causing toxic effects in the aquatic environment. Development planned for the plan area would include earth-disturbing activities (i.e., cut and fill), grading, and trenching that could expose disturbed areas and stockpiled soils to winter rainfall and stormwater runoff. Areas of exposed or stockpiled soils could be subject to sheet erosion during short periods of peak stormwater runoff, allowing temporary discharges of sediment to on-site drainages or creeks that empty into Laguna de Santa Rosa. If not managed properly, water used for dust suppression during construction could also enter drainage systems or creeks and ultimately into Laguna de Santa Rosa. Accidental spills of construction-related contaminants (e.g., fuels, oils, paints, solvents, cleaners, and concrete) could also occur during construction, resulting in releases to nearby surface water, and thereby degrading water quality.

The plan area consists primarily of clayey soils, which would be less susceptible to erosion, and the plan area's slopes are less than 2 percent, thus requiring minimal grading. In addition, Policy L-7.1 in the proposed plan requires that new development use site preparation, grading, and construction techniques that prevent contamination and sedimentation of creeks and streams. Nonetheless, the scale of development is large. Development in the plan area would result in changes in land use over an approximately 330-acre area in the central portion of Rohnert Park, for which ground disturbance is assumed to be associated with the build-out of an additional 835 residential units (839,000 square feet) and 822,324 square feet of nonresidential building area. This level of ground disturbance would pose potentially significant impacts related to erosion and sedimentation, which could result in degradation of waterways and conflict with beneficial uses and water quality objectives and standards established in the Basin Plan. In addition, creeks and drainages in the plan area are located within the tributaries to the Laguna de Santa Rosa water body, which are listed as impaired on the CWA Section 303(d) list for indicator bacteria, sedimentation/siltation, and water temperature. These water bodies would have no remaining assimilative capacity or ability to accommodate increases in the specified pollutants. Therefore, any increases in these constituents would contribute to the impairment. This impact would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.7-1: Prepare and Implement Site-Specific SWPPPs

During construction for any project within the plan area that disturbs 1 acre or more, the applicant or its consultant shall apply to the North Coast RWQCB for coverage under the Construction General Permit and prepare a site-specific SWPPP before any demolition, grading, or construction activities begin. The SWPPP shall cover pre- and postconstruction activities and describe site-specific and construction phase-specific activities detailing the following:

- *activities that may cause pollutant discharge (including sediment);*
- *BMPs, consistent with the requirements of the NPDES permit, to reduce the potential for contaminated runoff, such as limiting ground-disturbing activities during the winter rainfall period, minimizing exposure of disturbed areas and soil stockpiles to rainfall, and minimizing construction activities near or within drainage facilities;*
- *erosion and sedimentation control measures to be implemented, such as soil stabilization, mulching, silt fencing, or temporary desilting basins; good housekeeping practices, such as road sweeping and dust control; and diversion measures, such as the use of berms to prevent clear runoff from contacting disturbed areas; and*
- *hazardous materials spill prevention and response measure requirements, including lists of materials proposed for use, handling and storage practices, identification of spill response equipment, spill containment and cleanup procedures, and identification of regulatory notification protocols and contact phone numbers to be used in the event of a spill.*

The applicant shall implement the SWPPP, monitoring all BMPs and the parties responsible for them, in conformance with the guidelines set forth in the Construction General Permit.

Mitigation Measure 3.7-2: Prepare, Submit, and Implement Site-Specific Erosion Control Plans

During any project construction in the plan area that requires a grading permit, the project applicant shall submit a site-specific erosion control plan (ECP) to the City of Rohnert Park City Engineer. All sites that will have grading activities are required to submit an ECP. The ECP shall include the placement of structural and nonstructural stormwater pollution prevention controls that prevent erosion during and after construction. Proper soil stabilization shall be required for all graded areas. A grading permit shall not be issued until all of the required data, including the ECP, have been submitted and approved. City of Rohnert Park Ordinance 798, Section 15.50.090, provides additional detail regarding excavation, grading, and filling regulations.

Significance After Mitigation

Implementation of Mitigation Measures 3.7-1 and 3.7-2, adherence to applicable local regulations, and compliance with grading plan requirements would adequately avoid violations of water quality standards and would reduce construction-related impacts on water quality to a *less-than-significant* level.

Operation

The proposed plan could affect drainage patterns through conversion of existing undeveloped areas into developed, impervious areas. The conversion and densification of existing developed areas may also result in changes in drainage patterns and water quality associated with the change or intensity of use. However, the proposed plan would not result in a net gain of impervious surfaces. Stormwater that drains these new urban surfaces would also carry different or possibly higher concentrations of pollutants into receiving waters. Urban stormwater runoff can carry a variety of pollutants—including oil, grease, metals, or fuel that collects on local roadways and parking lots—that ultimately can be conveyed to receiving waters. Water used for irrigation of landscaped areas may encounter pesticides, herbicides, and fertilizer. Water that encounters these chemicals but is not absorbed by plants and soil could enter the storm drain system and be conveyed to receiving waters. Even with an overall reduction in impervious surfaces in the plan area (i.e., the Triangle Business subarea would be transitioned from an industrial area that is predominantly pavement to more mixed-use development incorporating stormwater BMPs), the potential discharges of contaminated urban runoff from paved and landscaped areas with implementation of the proposed plan could contribute to adverse effects on aquatic organisms in receiving waters. This impact would be *potentially significant*.

Water quality and stormwater runoff is regulated under an NPDES MS4 stormwater permit with the North Coast RWQCB. The proposed plan includes Policy U-1.7, which requires new development to upgrade or install storm drainage facilities, including on-site facilities, as needed to serve the project. The improvements must be consistent with the City of Rohnert Park *Storm Drain Design Standards.* As of 2014, the *Storm Drain Design Standards* reference the City of Santa Rosa and Sonoma County 2011 Low Impact Development (LID) Manual, as required by the City's MS4 permit. The standards may improve on existing conditions where existing development is present in the plan area.

In addition, Policy U-1.6 in the proposed plan requires new development and capital improvement projects to reduce pollution and runoff affecting plan area creeks by following the adopted LID Manual. The manual provides technical guidance for project designs that require the implementation of permanent LID features and stormwater BMPs. The design goal stated in the LID Manual requires that 100 percent of the design storm event (85th percentile, 24-hour) runoff generated from the developed site be treated on-site, and that any increase in runoff volume caused by development or redevelopment for the design storm be infiltrated and/or reused on-site (City of Santa Rosa and County of Sonoma, 2011). The report that satisfies the project-specific MS4 permit requirements is a project-specific Standard Urban Stormwater Mitigation Plan (SUSMP). Furthermore, the proposed plan would adhere to the City's NPDES Storm Water Management Plan (SWMP). The SWMP identifies BMPs and an overall strategy to minimize stormwater runoff pollution and sediment (City of Rohnert Park, 2005c).

Design and construction of drainage systems per SCWA's *Flood Control Design Criteria* would ensure that storm drainage systems are adequately sized. Implementation of postconstruction BMPs would reduce pollutants in stormwater runoff. With implementation of Mitigation Measures 3.7-1 and 3.7-2, which include postconstruction BMPs, as well as adherence to the City's SWMP and to state and local regulatory requirements, potential water quality and runoff impacts from changes to the plan area's land use and runoff would be reduced to a *less-than-significant* level. The recently adopted SWCA LID Manual does not permit new development to create any new runoff.

3.7b. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)? Less-than-Significant Impact with Mitigation Incorporated.

Construction

Construction of the proposed plan could reduce groundwater infiltration and recharge or result in a decrease in groundwater levels if withdrawal of groundwater is required during construction site dewatering. During project construction, dewatering may be needed because of the possible presence of a shallow water table at the site. Temporary construction dewatering could result in a reduction in groundwater recharge to the Santa Rosa Plain Subbasin, for which beneficial uses have been established by the North Coast RWQCB Basin Plan. The City's wells pump predominantly from the intermediate zone, between 200 and 600 feet bgs; since 1982, water levels in the Santa Rosa Plain Subbasin have remained in balance and have significantly increased in the southern portion of the subbasin where the plan area is located (City of Rohnert Park, 2011). Groundwater recharge occurs primarily in the mountains around the Cotati Valley; however, in the plan area, some shallow groundwater recharge occurs through percolation of rainfall and seepage from streams and ditches. The soil underlying the plan area is primarily Clear Lake Clay, which has very low permeability and infiltration rates. Therefore, construction activities would have a less-than-significant impact on groundwater recharge.

Adverse water quality impacts or illicit discharges to the stormwater drainage system could occur during construction dewatering activities if water is not properly stored and disposed of. As described under Impact 3.7a, the potential discharges could cause or contribute to adverse water quality effects on tributaries to the Laguna de Santa Rosa water body, which are listed under CWA Section 303(d) for a variety of constituents. Accordingly, this impact of project-related construction would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.7-3: Prepare and Implement Site-Specific Provisions for Dewatering

The applicant for any project associated with the proposed plan, or the project applicant's consultant, shall prepare and implement provisions for dewatering during construction, in accordance with local and North Coast RWQCB requirements, to minimize adverse water quality impacts on surface water and groundwater. Provisions may include preparation of a dewatering plan that details procedures for removing groundwater, methods of temporary water treatment/retention facility, and water disposal procedures.

Significance After Mitigation

Implementation of Mitigation Measure 3.7-3, together with adherence to state and local regulatory requirements as part of the NPDES Construction General Permit requirements, would reduce the potential water quality impact from dewatering to a *less-than-significant* level.

Operation

Implementation of the proposed plan would not result in a net gain of impervious surfaces that would interfere with on-site groundwater recharge. New development associated with the plan area would be required to comply with the City's park/open space standards and current stormwater BMPs. Furthermore, all new development would be required to comply with the City's stormwater drainage standards and the City of Santa Rosa and Sonoma County LID Manual. Design requirements include the treatment of all runoff generated by an 85th percentile, 24-hour storm event and specify that new development or redevelopment must not increase the volume of runoff in an 85th percentile, 24-hour storm event. The LID Manual also includes a menu of BMPs that can be used to capture, infiltrate, and/or reuse stormwater on-site; that would be implemented under the proposed plan. Therefore, the impact would be *less than significant*.

3.7c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site? Less-than-Significant Impact with Mitigation Incorporated.

Construction

Future development in the plan area would require vegetation removal, grading, trenching, and soil movement for the placement of new structures on-site, which could alter drainage courses and runoff patterns from existing conditions. Alterations to existing drainage patterns or flow velocities could result in a short-term increase in erosion or siltation that may have substantial adverse effects on water quality. The proposed plan includes Policy L.7-1, which calls for new development to use site preparation, grading, and construction techniques that prevent contamination and sedimentation of creeks and streams. Development would not alter the course of existing creeks, because areas adjacent to creeks would be preserved as open space. However, the impact would be *potentially significant*.

Mitigation Measures

> **Mitigation Measure 3.7-1, "Prepare and Implement Site-Specific SWPPPs" (see full Mitigation Measure 3.7-1 text above)**

> **Mitigation Measure 3.7-2, "Prepare, Submit, and Implement Site-Specific Erosion Control Plans" (see full Mitigation Measure 3.7-2 text above)**

Significance After Mitigation

Grading activities would avoid impacts on hydrologically sensitive areas, including Copeland Creek, Hinebaugh Creek, and drainage courses, to the maximum extent practicable. In addition, implementation of Mitigation Measures 3.7-1 and 3.7-2 would prescribe specific construction BMPs as part of the SWPPP and ECP, which would reduce the effects of ground disturbance at the site during construction, which in turn would reduce the impact on drainage, erosion, and sedimentation during construction to a *less-than-significant* level.

Operation

Development in the plan area would result in altered drainage patterns that could increase the potential for erosion, siltation, and associated adverse water quality effects on- or off-site. Although the plan area is flat and consists primarily of clayey soils that would be less susceptible to erosion, it could potentially drain to the tributaries to the Laguna de Santa Rosa water body, which are listed as impaired on the CWA Section 303(d) list for sedimentation/siltation and require special consideration for that reason. Specifically, the proposed plan would result in placement of new structures and roadways that could cause permanent changes in the existing drainage patterns. The impact would be *potentially significant*.

Mitigation Measures

Mitigation Measure 3.7-1, "Prepare and Implement Site-Specific SWPPPs" (see full Mitigation Measure 3.7-1 text above)

Mitigation Measure 3.7-2, "Prepare, Submit, and Implement Site-Specific Erosion Control Plans" (see full Mitigation Measure 3.7-2 text above)

Significance After Mitigation

As described in Impact 3.7a, the City requires all new development projects to design and construct storm drainage systems in accordance with the City of Rohnert Park *Storm Drain Design Standards,* which includes the City of Santa Rosa and Sonoma County's Manual and associated LID requirements. Adherence to the City's SWMP would provide for compliance with the City's MS4 NPDES stormwater permit requirements through the implementation of site-specific stormwater capture and treatment BMPs, as well as maintenance and inspection requirements for those BMPs. Implementation of Mitigation Measures 3.7-1 and 3.7-2 would also include postconstruction stormwater pollution prevention BMPs. In addition, SCWA reviews project drainage system plans for compliance with its *Flood Control Design Criteria*. Compliance with these regulations would ensure that storm drainage systems are adequately sized to convey postdevelopment runoff. Implementation of Mitigation Measures 3.7-1 and 3.7-2, adherence to the City's SWMP, and compliance with SCWA's design criteria would reduce impacts from erosion and siltation caused by changes in existing drainage patterns to a *less-than-significant* level.

3.7d and 3.7e. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site? Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff? Less-than-Significant Impact with Mitigation Incorporated.

Construction

Future development in the plan area would require grading and soil disturbance for placement of new structures on-site, which could substantially alter drainage courses and runoff patterns from existing conditions, and could result in flooding on- or off-site. The impact would be *potentially significant*.

Mitigation Measures

> **Mitigation Measure 3.7-1, "Prepare and Implement Site-Specific SWPPPs" (see full Mitigation Measure 3.7-1 text above)**

Significance After Mitigation

Implementation of Mitigation Measure 3.7-1 would prescribe specific construction BMPs as part of project-specific SWPPPs, which would reduce the impact of ground disturbance and would reduce the impact on drainage and the rate or amount of surface runoff during construction to a *less-than-significant* level.

Operation

As described in Impacts 3.7a, 3.7c, and 3.7f, the proposed plan would not result in a net increase of impervious surfaces. The City requires all new development projects to design and construct storm drainage systems in accordance with the City of Rohnert Park *Storm Drain Design Standards*, which includes the City of Santa Rosa and Sonoma County's Manual. The design goal stated in the manual requires that any increase in runoff volume from development or redevelopment for the design storm (85th percentile, 24-hour storm event) be infiltrated and/or reused on-site (City of Santa Rosa and County of Sonoma, 2011). Through compliance with the MS4 Permit requirements, which would include adherence to the City's SWMP, the proposed plan would not result in any increase in runoff volume in comparison to existing conditions, because 100 percent of any increase in stormwater volume would be required to be infiltrated and/or reused on-site.[3] The impact would be *potentially significant*.

[3] Projects that cannot achieve the required level of volume capture must use the offset program, with review and approval of the RWQCB.

Mitigation Measures

Mitigation Measure 3.7-1, "Prepare and Implement Site-Specific SWPPPs" (see full Mitigation Measure 3.7-1 text above)

Mitigation Measure 3.7-2, "Prepare, Submit, and Implement Site-Specific Erosion Control Plans" (see full Mitigation Measure 3.7-2 text above)

Significance After Mitigation

In addition, SCWA reviews project drainage system plans for compliance with its *Flood Control Design Criteria*. Compliance with these regulations would ensure that storm drainage systems are adequately sized to convey postdevelopment runoff. With implementation of Mitigation Measures 3.7-1 and 3.7-2 and adherence to the City's SWMP, in addition to compliance with SCWA's design criteria, the proposed plan would not result in flooding or exceed the capacity of existing or planned stormwater drainage systems. This impact would be reduced to a *less-than-significant* level.

3.7g. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map? No Impact.

Based on an evaluation of FEMA's FIRMs, the proposed plan would not place housing within a 100-year flood zone, because there are no 100-year flood zones in the plan area (see Figure 3.7-1). Therefore, *no impact* would occur.

3.7h. Place within a 100-year flood hazard area structures that would impede or redirect flood flows? No Impact.

Construction

Based on an evaluation of FEMA's FIRMs, the proposed plan would not place structures within a 100-year flood zone that would impede or redirect flood flows. Because there are no 100-year flood zones in the plan area (see Figure 3.7-1), *no impact* would occur.

Operation

Project operation would cause no additional alterations to the floodplain that would increase flood hazard risks. Therefore, *no impact* would occur.

3.7i. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam? No Impact.

Based on an evaluation of FEMA's FIRMs, the plan area is not located in an area that is protected by levees or within the 100-year floodplain (Figure 3.7-1). In addition, no reservoirs are located in the plan area, and the plan area is located outside of a dam inundation area, as described in the City of Rohnert Park's draft Local Hazard Mitigation Plan (ABAG, 2011). Therefore, project implementation would not expose people or structures to a significant risk of loss, injury, or death involving flooding as a result of the failure of a levee or dam. *No impact* would occur.

3.7j. Inundation by seiche, tsunami, or mudflow? Less-than-Significant Impact.

The potential for tsunamis or seiches in the plan area would be negligible because of the distance from water bodies that could generate seismically induced tidal phenomena (i.e., the Pacific Ocean is approximately 16 miles west of the plan area at the closest point, and there are no large water bodies [i.e., lakes, reservoirs] near the plan area). Therefore, *no impact* would occur.

The plan area is on flat terrain with a grade of less than 2 percent. Soils are primarily Clear Lake clays, which typically have low erosion potential. In addition, the plan area is located at a distance from hillier areas that could result in landslides and mudflows that could affect the site (ABAG, 2011). Therefore, potential impacts from mudflows would be *less than significant*. For additional discussion of potential mudflows associated with landslides, see Section 3.6, "Geology and Soils."

3.7.4 Cumulative Impacts

The proposed plan and the other projects considered in the cumulative analysis are located within the Laguna de Santa Rosa watershed. The related projects, including the University District Specific Plan, Stadium Area Master Plan, Sonoma Mountain Village Planned Development, Southeast Specific Plan, Wilfred Dowdell Village Specific Plan, Northeast Specific Plan, and Northwest Specific Plan, also may entail earth-disturbing activities, alteration of surface hydrology, and creation of new impervious surfaces that would result in potential water quality impacts and/or increases in stormwater runoff or velocities or flooding potentials.

Construction activities associated with the proposed plan and other projects considered in the cumulative analysis would involve grading, other earthmoving activities, and dewatering that could result in temporary and short-term localized soil erosion, which could affect water quality, including that of the Section 303(d)–listed tributaries to the Laguna de Santa Rosa water body. Cumulative projects would be expected to comply with the NPDES regulations, including construction site SWPPPs[4] and BMPs, which would control erosion and construction-related contaminants at each construction site (Mitigation Measure 3.7-1). Therefore, the cumulative effects on hydrology and water quality from construction erosion would be *less than significant*.

Stormwater from the plan area ultimately drains into Laguna de Santa Rosa, which is listed as an impaired water body. Implementation of the LID design measures required by the MS4 NPDES permit, as well as implementation of Mitigation Measures 3.7-1 through 3.7-2 and adherence to the City's SWMP, would reduce the proposed plan's impact on water quality to a less-than-significant level. The implementation of LID design measures and adherence to the City's SWMP would reduce the proposed plan's impact on stormwater volume and flow compared to existing conditions, and would not contribute to flooding. Similarly, projects considered in the cumulative analysis may be subject to MS4 NPDES stormwater permit requirements that would require their

[4] SWPPP requirements for projects in the Laguna de Santa Rosa Watershed may require particularly stringent BMPs and construction scheduling, as determined by the North Coast RWQCB, in response to the existing impairments for DO, indicator bacteria, mercury, nitrogen, phosphorus, sedimentation/siltation, and water temperature in the receiving waters.

developers to minimize the area of impervious surfaces and infiltrate or reuse storm runoff from project sites so that there would not be an increase in flow volume compared to preproject conditions. This would be documented for approval via a project-specific SUSMP. The treatment component of the MS4 NPDES permit requires that all of the runoff generated by the design storm event (85th percentile, 24-hour) from impermeable surfaces be treated on-site. These requirements would reduce the impact on water quality, stormwater volume, and flooding during operations to a *less-than-significant* level.

3.7.5 References

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3.8 NOISE

This section describes the existing physical and regulatory setting related to noise and discusses the potential impacts of the proposed plan on noise.

3.8.1 Existing Conditions

Fundamentals of Acoustics

Noise is generally defined as unwanted or objectionable sound. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and in the extreme, hearing impairment. Noise effects can be caused by pitch or loudness. Pitch is the height of a tone; higher-pitched sounds are louder to humans than lower-pitched sounds. Loudness is intensity or amplitude of sound. The sound-pressure level is the most common descriptor used to characterize the loudness of a sound level. Because sound pressure can vary enormously within the range of human hearing, the logarithmic decibel scale (dB) is used to quantify sound levels.

The human ear is not equally sensitive to all frequencies within the entire sound spectrum, so noise measurements are weighted more heavily for frequencies to which humans are sensitive; this specific “filtering” of sound is called “A-weighting.” Because humans are less sensitive to low-frequency sound than to high-frequency sound, A-weighted sound levels deemphasize low-frequency sound energy to better represent how humans hear.

Different sound-level measurement descriptors are used to characterize the time-varying nature of sound. Several rating scales have been developed to analyze the adverse effect of community noise on people. Because environmental noise fluctuates over time, these scales consider that the effect of noise is dependent on the total acoustical energy content, as well as the time and duration of occurrence. Table 3.8-1 provides brief definitions of these measurement descriptors and other acoustical terminology used in this section.

In a typical environment, the day-night level (L_{dn}) and community noise equivalent level (CNEL) noise descriptors rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are considered to be equivalent and are treated as such in this section. For a stationary point-source of sound, sound typically attenuates at a rate of 6 dB per doubling of distance (i.e., 6 dB at 50 feet, 12 dB at 100 feet, and 18 dB at 200 feet). For a line source of sound such as free-flowing traffic on a freeway, sound attenuates at a rate of approximately 3 dB per doubling of distance (i.e., 3 dB at 50 feet, 6 dB at 100 feet, and 9 dB at 200 feet). Atmospheric conditions including wind, temperature gradients, and humidity can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound that travels over an acoustically absorptive surface such as grass attenuates at a greater rate than sound that travel over a hard surface such as pavement. The increased attenuation due to ground absorption is typically in the range of 1–2 dB per doubling of distance. Barriers such as building and topography that block the line of sight between a source and receiver also increase the attenuation of sound over distance.

Table 3.8-1: Acoustical Terminology

Term	Definition
Sound	A vibratory disturbance created by a vibrating object that when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
Noise	Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
Ambient Noise	The composite of noise from all sources near and far in a given environment.
Decibel (dB)	A unitless measure of sound on a logarithmic scale, which represents the squared ratio of sound-pressure amplitude to a reference sound pressure. The reference pressure is 20 micro-Pascals, representing the threshold of human hearing (0 dB).
A-Weighted Decibel (dBA)	An overall frequency-weighted sound level that approximates the frequency response of the human ear.
Equivalent Sound Level (L_{eq})	The average sound energy occurring over a specified time period. In effect, L_{eq} is the steady-state sound level that in a stated period would contain the same acoustical energy as the time-varying sound that actually occurs during the same period.
Maximum and Minimum Sound Levels (L_{max} and L_{min})	The maximum or minimum instantaneous sound level measured during a measurement period.
Day-Night Level (L_{dn})	The energy-average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m. (nighttime).
Community Noise Equivalent Level (CNEL)	The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

Source: Data compiled by AECOM in 2015

Fundamentals of Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. The peak particle velocity (PPV) and root-mean-square (RMS) velocity are normally described in inches per second (in/sec). PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is the metric often used to describe blasting vibration and other vibration sources that may result in structural stresses in buildings (FTA, 2006). Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response to ground vibrations. It takes some time for the human body to respond to vibration signals; therefore, average vibration amplitude (RMS) is the best appropriate descriptor to gauge human response to the typical ground vibration. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a period of 1 second. As with airborne sound, the RMS velocity is often expressed in dB notation as vibration dB (VdB), which serves to compress the range of numbers required to describe vibration (FTA, 2006). This VdB scale is based on a reference value of 1 micro-inch per second (μin/sec). The background vibration-velocity level typical of residential areas is approximately 50 VdB (FTA, 2006).

Groundborne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels. Table 3.8-2 summarizes the general human response to different levels of groundborne vibration.

Table 3.8-2: Human Response to Different Levels of Groundborne Vibration

Vibration-Velocity Level (VdB)	Human Reaction
65	Approximate threshold of perception.
75	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85	Vibration acceptable only if there is an infrequent number of events per day.

Note:
VdB = vibration decibels referenced to 1 micro-inch per second and based on the root mean square vibration velocity.
Source: FTA, 2006

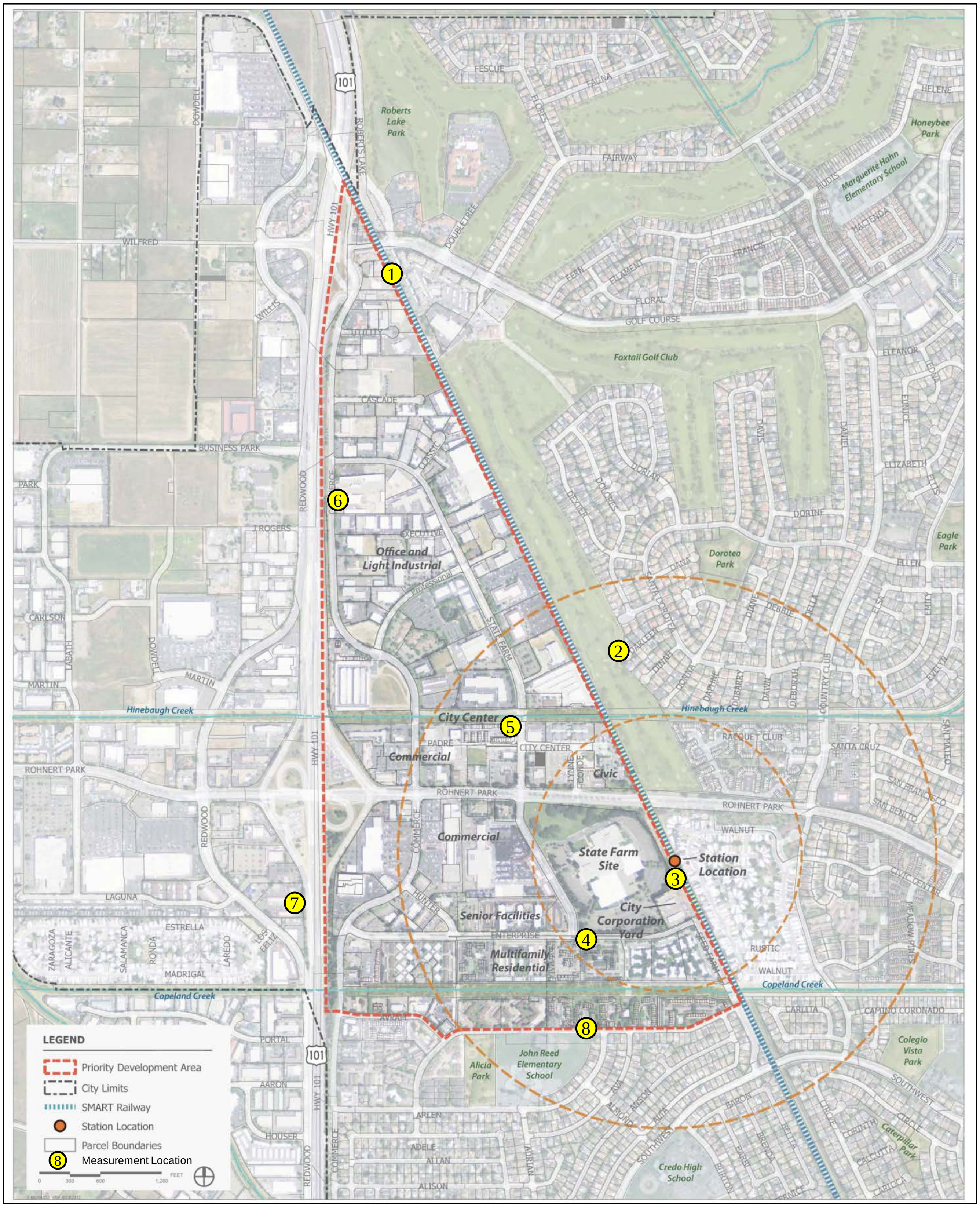
Existing Noise-Sensitive Land Uses

Noise-sensitive land uses generally include those uses where exposure to noise would result in adverse effects, as well as uses where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern, because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Other noise-sensitive land uses include hospitals, convalescent facilities, parks, hotels, churches, libraries, and other uses where low noise levels are essential.

Most noise-sensitive uses (i.e., residential) near the plan area are located east of the existing railroad tracks to be used by Sonoma-Marin Area Rail Transit (SMART), and to the south along and south of Enterprise Drive. There are existing mixed-use buildings (i.e., residential and commercial) in the plan area along State Farm Drive and City Center Drive. In addition, a Motel 6 is located on Commerce Boulevard (north of Rohnert Park Expressway [RPX]).

Noise-Level Measurements

Ambient noise measurements were conducted at eight selected locations that represent the existing nearby land uses in the vicinity of the plan area (Table 3.8-3 and Figure 3.8-1). The ambient noise measurements were performed using a Quest Model 2900 Integrated Sound Level Meter, which is a Type 2 standard instrument as defined in American National Standards Institute S1.4. All instruments were calibrated and operated according to the manufacturer's specifications. The noise sensor device (microphone) was placed 5 feet above the local grade. The noise measurements were made on April 1, 2015, between 10:00 a.m. and 2:00 p.m. The measured ambient noise levels are provided in Table 3.8-3. Based on field observation and measured sound data, the current ambient noise environment in the vicinity of the plan area is controlled primarily by vehicular traffic on local roadways, and other typical urban noise. As indicated in Table 3.8-3, the existing ambient noise levels at Locations 1, 4, 5, 6, and 7 currently exceed the City's daytime presumed ambient noise standard of 55 A-weighted decibels (dBA).



Sources: Compiled by AECOM in 2015

Figure 3.8-1: Noise Measurement Locations

Table 3.8-3: Existing Ambient Noise Levels

Location	Description	Measurement Time	Measured Noise Levels A-Weighted Sound Level (dBA)		
			L_{eq}	L_{min}	L_{max}
1	Multifamily residences on the southern side of Golf Course Drive, east of the plan area.	10:18 a.m.–10:32 a.m.	55.5	47.6	70.9
2	Single-family residences at the cul-de-sac of Darleen Court.	10:55 a.m.–11:10 a.m.	44.6	40.7	54.5
3	Project eastern property line, representing the mobile home park east of the plan area.	11:25 a.m.–11:40 a.m.	49.3	42.3	68.0
4	Multifamily residences on Enterprise Drive, just east of State Farm Drive.	11:45 a.m.–12:00 p.m.	63.8	46.9	76.7
5	Multifamily residences on State Farm Drive, just north of City Center Drive.	1:07 p.m.–1:23 p.m.	66.6	44.8	77.6
6	Commercial use on Commerce Boulevard, south of Transport Avenue.	1:30 p.m.–1:45 p.m.	65.6	60.6	75.1
7	Best Western Inn on Redwood Drive, west of U.S. Highway 101.	1:55 p.m.–2:10 p.m.	62.2	54.0	70.3
8	John Reed Elementary School and single-family residences on Santa Alicia Drive, west of Arlen Drive.	12:26 p.m.–12:41 p.m.	52.7	41.6	68.9

Notes:
dBA = A-weighted decibels; L_{eq} = equivalent noise level; L_{max} = maximum noise level; L_{min} = minimum noise level.
Monitoring locations correspond to those depicted in Figure 3.8-1.

Source: Data collected by AECOM on April 1, 2015

Existing Traffic Noise

In addition to the ambient noise measurements in the vicinity of the plan area, the existing traffic noise on local roadways in the surrounding areas near the plan area was calculated to quantify the 24-hour L_{dn} noise levels, based on the existing traffic volumes as provided in the proposed plan's traffic impact study (WWT, 2015). The noise levels generated by existing traffic on local roadways were calculated using a noise prediction model developed based on calculation methodologies provided in the California Department of Transportation Technical Noise Supplement (TeNS) document. The roadway noise calculation procedures provided in the California Department of Transportation TeNS are consistent with Federal Highway Administration (FHWA) RD-77-108 roadway noise prediction methodologies. This methodology allows for the definition of roadway configurations, barrier information (if any), and receiver locations, in addition to the traffic volumes. To present a simplified analysis consistent with the amount of project-related technical information currently available, the noise model assumes a "hard" site condition and no barriers between the roadway and receivers. (Assuming a hard site condition is a conservative assumption that limits sound attenuation from ground condition to a maximum of 3 dBA per doubling of distance, whereas the "soft" ground condition would provide sound attenuation of 4.5 dBA per doubling of distance.)

Table 3.8-4 provides the calculated traffic noise levels for the analyzed local roadway segments based on existing traffic volumes. As shown, the existing L_{dn} attributable only to surface street traffic volumes ranged from 54.1 dBA L_{dn} along Professional Center Drive (between Commerce Boulevard and State Farm Drive) to 69.0 dBA L_{dn} along RPX (west of U.S. Highway 101).

Table 3.8-4: Predicted Existing Roadway Traffic Noise Levels

Roadway Segment	Calculated Traffic Noise Levels,[1] dBA L_{dn}	Adjacent Land Uses	Existing Noise Exposure Compatibility Category[2]
Golf Course Drive			
- West of U.S. Highway 101	65.7	Residential, Motel, Commercial	Conditionally Acceptable
- East of U.S. Highway 101	64.6	Residential, Commercial	Conditionally Acceptable
RPX			
- West of U.S. Highway 101	69.0	Commercial	Conditionally Acceptable
- Between Commerce Boulevard and State Farm Drive	66.4	Commercial	Normally Acceptable
- East of State Farm Drive	68.1	Residential, Library, Commercial	Conditionally Acceptable
Enterprise Drive			
- Between Commerce Boulevard and Hunter Drive	57.1	Residential, Commercial	Normally Acceptable
- Between Hunter Drive and State Farm Drive	59.8	Residential, School	Normally Acceptable
- Between State Farm Drive and Seed Farm Drive	61.5	Residential, Commercial	Conditionally Acceptable
Commerce Boulevard			
- Between Golf Course Drive and State Farm Drive	64.0	Commercial	Normally Acceptable
- Between State Farm Drive and Professional Drive	61.6	Commercial	Normally Acceptable
- Between Professional Drive and RPX	62.6	Commercial	Normally Acceptable
- Between RPX and Enterprise Drive	64.6	Commercial	Conditionally Acceptable
- South of Enterprise Drive	65.0	Residential	Conditionally Acceptable
State Farm Drive			
- Between Commerce Boulevard and Professional Drive	59.6	Commercial	Normally Acceptable
- Between Professional Drive and RPX	61.8	Residential, Commercial	Conditionally Acceptable
- Between RPX and Enterprise Drive	61.6	Commercial	Normally Acceptable
Professional Drive			
- Between Commerce Boulevard and State Farm Drive	54.1	Commercial	Normally Acceptable
Padre Parkway			
- Between Commerce Boulevard and State Farm Drive	56.7	Residential, Commercial	Normally Acceptable
City Center Drive			
- East of State Farm Drive	54.5	Residential, Commercial	Normally Acceptable
Seed Farm Drive			
- South of Enterprise Drive	61.4	Residential	Conditionally Acceptable

Notes:
dBA = A-weighted decibels; L_{dn} = day-night level
[1] Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.
[2] The indicated noise exposure compatibility is based on the most stringent land use category.
Source: Data modeled by AECOM in 2015

3.8.2 Regulatory Framework

Government agencies have established noise standards and guidelines to protect citizens from potential hearing damage and other adverse physiological and social effects associated with noise. The City of Rohnert Park has adopted regulations and policies that are based in part on federal and state regulations/guidelines, and are intended to control, minimize, or mitigate environmental noise. Standards and guidelines applicable to the proposed plan are discussed below.

City of Rohnert Park General Plan

The *City of Rohnert Park General Plan* (City of Rohnert Park, 2015a [originally adopted 2000]) includes a Noise Element as a planning tool to develop strategies and action programs that address a multitude of noise sources and issues. The overall purpose of the Noise Element is to protect citizens from the harmful and annoying effects of exposure to excessive noise. The following City of Rohnert Park Noise Element policies relate to the proposed plan:

- **Policy PF-1:** During project review and approval, use Figure 8.3-1 [see Table 3.8-5] to determine acceptable uses and analysis and insulation requirements in noise-impacted areas.

Table 3.8-5: City of Rohnert Park Land Use Compatibility for Community Noise Environments

	Exterior Day/Night Noise Levels,[1] DNL or L_{dn}, dB			
Land Use Category	**Normally Acceptable**	**Conditionally Acceptable**	**Normally Unacceptable**	**Clearly Unacceptable**
Residential—Single Family	Up to 60	55 to 70	70 to 75	Greater than 75
Residential—Multiple Family	Up to 65	60 to 70	70 to 75	Greater than 75
Transient Lodging—Motels, Hotels	Up to 65	60 to 70	70 to 80	Greater than 80
Schools, Libraries, Churches, Hospitals*, Nursing Homes	Up to 70	60 to 70	70 to 80	Greater than 80
Auditoriums, Concert Halls, Amphitheaters	–	Up to 70	Greater than 65	–
Sport Arena, Outdoor Spectator Sports	–	Up to 75	Greater than 70	–
Playground, Parks	Up to 70	–	67.5 to 75	Greater than 72.5
Golf Courses, Riding Stables, Water Recreation, Cemeteries	Up to 75	–	70 to 80	Greater than 80
Office Buildings, Business Commercial and Professional	Up to 70	67.5 to 77.5	Greater than 75	–
Industrial, Manufacturing, Utilities, Agriculture	Up to 75	70 to 80	Greater than 75	–

Notes: dB = decibels; L_{dn} = day-night level

1 Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design.
Normally Unacceptable: New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Clearly Unacceptable: New construction or development clearly should not be undertaken.

* Because hospitals are often designed and constructed with high noise insulation properties, it is possible for them to be satisfactorily located in noisier areas.

Source: City of Rohnert Park, 2015a (originally adopted 2000):Figure 8.3-1

- **Policy PF-2:** For all residential uses, establish 45 dB L_{dn} as the standard for interior noise levels and 60 dB L_{dn} as the standard for exterior noise levels. Require appropriate siting of residential uses and/or mitigation measures to meet the standards.
- **Policy PF-6:** Required buffers or site planning techniques for all new development within 65 dB L_{dn} noise contours. However, avoid visible sound walls except along U.S. Highway 101 and along the Northwestern Pacific (NP) Railroad right-of-way.
- **Policy PF-7:** Require new development within existing or projected 65 dB L_{dn} noise contours to undergo a technical acoustical analysis, which shall serve as the basis for designing mitigation measures. Require the technical analysis to be conducted by a professional acoustical engineer.

Rohnert Park Municipal Code (Noise Ordinance)

Chapter 9.44 of the City of Rohnert Park Municipal Code (Noise Ordinance) establishes acceptable ambient sound levels to regulate intrusive noises (e.g., stationary mechanical equipment and vehicles other than those traveling on public streets) within specific land use zones. In accordance with the Noise Ordinance, a noise level increase of 5 dBA over the existing ambient noise level at an adjacent property line is considered a noise violation (City-regulated noise sources).

The baseline ambient noise level (as defined by the Noise Ordinance) is the actual measured ambient noise level or the City's established ambient noise level (as shown in Table 3.8-6), whichever is greater. In cases where the actual measured ambient noise level is not known, the City-provided ambient noise level will be used as the baseline.

Table 3.8-6: City of Rohnert Park Ambient Noise Levels

Zone	Time	Sound Level, dBA Community Environment Classification
R1 and R2	10 p.m. to 7 a.m. (Nighttime)	45
R1 and R2	7 p.m. to 10 p.m. (Evening)	40
R1 and R2	7 a.m. to 7 p.m. (Daytime)	55
R3 and R4	10 p.m. to 7 a.m. (Nighttime)	50
R3 and R4	7 a.m. to 10 p.m. (Daytime)	55
Commercial	10 p.m. to 7 a.m. (Nighttime)	55
Commercial	7 a.m. to 10 p.m. (Daytime)	60
Limited Industrial	Anytime	70
General Industrial	Anytime	75

Note: dBA = A-weighted decibels
Source: City of Rohnert Park, 2015b

With respect to construction, the City's Noise Ordinance states that:

> It is unlawful for any person within a residential zone, or within a radius of five hundred feet therefrom, to operate equipment or perform any outside construction or repair work on buildings, structures, or

projects or to operate any pile driver, power shovel, pneumatic hammer, derrick, power hoist, or any other construction type device between the hours of six p.m. of one day and eight a.m. of the next day in such a manner that a reasonable person of normal sensitiveness residing in the area is caused discomfort or annoyance unless beforehand a permit therefore has been duly obtained from the superintendent of public works.

Groundborne Vibration

The City of Rohnert Park currently does not have any adopted policies or standards for groundborne vibration. Therefore, the groundborne vibration standards and guidelines from the Federal Transit Administration (FTA) are used. FTA has published a technical manual titled *Transit Noise and Vibration Impact Assessment* that provides groundborne vibration impact criteria with respect to building damage during construction activities (FTA, 2006). With respect to potential building damage, FTA provides guidelines for evaluating potential groundborne vibration damage applicable to various building categories. Table 3.8-7 provides the FTA vibration criteria applicable to construction activities. According to FTA guidelines, a vibration damage criterion of 0.20 inch per second PPV should be considered for nonengineered timber and masonry buildings. Furthermore, structures or buildings constructed of reinforced concrete, steel, or timber have vibration damage criteria of 0.50 inch per second pursuant to the FTA guidelines.

Table 3.8-7: Summary of Federal Transit Administration–Recommended Vibration Damage Criteria

Building Category	PPV (in/sec)	Approximate L_v[1]
Reinforced concrete, steel, or timber (no plaster)	0.5	102
Engineered concrete and masonry (no plaster)	0.3	98
Nonengineered timber and masonry buildings	0.2	94
Buildings extremely susceptible to vibration damage	0.12	90

Notes:
in/sec = inches per second; PPV = peak particle velocity
[1] Root mean square velocity in decibels (VdB) referenced to 1 microinch per second.

Source: FTA, 2006

Significance Threshold

Based on the regulatory framework described above and in accordance with significance criteria established by Appendix G of the California Environmental Quality Act (CEQA) Guidelines, the following thresholds of significance were established to evaluate the proposed plan's noise and vibration impacts. Noise from project construction and operation would be considered significant if:

- project construction activity would occur within 500 feet of a residential use between the hours of 6:00 p.m. and 8 a.m.;
- project-related on-site stationary noise sources (i.e., outdoor building mechanical equipment) would increase the ambient noise level by 5 dBA at off-site noise-sensitive uses (i.e., residential use);
- project-related off-site mobile-noise sources (i.e., roadway traffic) would increase the noise levels at noise-sensitive uses (i.e., residential) future conditions by 3 dBA (in L_{dn}), and the resulting noise would fall within

the “normally unacceptable” or “clearly acceptable” category or by 5 dBA, and the resulting noise would fall within “normally acceptable” or “conditionally acceptable”;

- project construction activities would cause the groundborne vibration to exceed 0.5 PPV at the nearest off-site reinforced concrete, steel, or timber building;
- project construction activities would cause groundborne vibration levels to exceed 0.2 in/sec (PPV) at the nearest off-site nonengineered timber and masonry building;
- project construction activities would cause the groundborne vibration to exceed 0.12 PPV at buildings that are extremely susceptible to vibration damage (i.e., old historic buildings); or
- project construction activities would cause groundborne vibration levels to exceed 80 VdB at off-site sensitive uses, including residential and hotel uses.

3.8.3 Impact Discussion

3.8a. Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? Less-than-Significant Impact with Mitigation Incorporated.

Construction Noise

Noise impacts from project construction activities occurring in or adjacent to the plan area would be a function of the noise generated by construction equipment, the location of the equipment, the timing and duration of the noise-generating construction activities, and the distance to noise-sensitive receptors. Construction activities would include site demolition, site grading/excavation, building construction, and finishing. Each stage of construction would include the use of various types of construction equipment, and would therefore have its own distinct noise characteristics. Site demolition generally includes the use of backhoes, front-end loaders, and heavy-duty trucks. Site grading and excavation typically require the use of earth-moving equipment, such as excavators, front-end loaders, and heavy-duty trucks. Building construction typically includes the use of cranes, forklifts, concrete trucks, and delivery trucks. Noise from construction equipment would generate both steady-state and episodic noise that could be heard in and adjacent to the plan area.

Individual pieces of construction equipment that would be used for construction produce maximum noise levels of 75–90 dBA at a reference distance of 50 feet from the noise source (Table 3.8-8). The construction equipment noise levels at 50 feet distance (referenced maximum noise levels) are based on the *FHWA Roadway Construction Noise Model User’s Guide* (FHWA, 2006), which is a technical report containing actual measured noise data for construction equipment. The maximum noise levels would occur when the equipment is operating under full-power conditions. However, because equipment used on construction sites often operates at less than full power, an acoustical usage factor is applied. These acoustical usage factors are estimates and would vary based on the actual construction activities and duration.

Table 3.8-8: Noise Levels Generated by Typical Construction Equipment

Construction Equipment	Acoustical Usage Factor[1] (%)	Maximum Noise Levels at 50 Feet, dBA L_{max}
Air Compressor	40	78
Backhoe	40	78
Compactor	20	83
Concrete Pump	20	79
Concrete Truck	40	81
Concrete Saw	20	90
Crane	16	81
Rubber-Tired Dozer	40	82
Excavator	40	84
Forklift	20	75
Generator	50	81
Grader	40	85
Pneumatic Tools	50	85
Paver/Paving Equipment	50	77
Roller	20	80
Loader	40	79
Dump/Haul/Delivery Truck	40	76
Water Truck	40	76
Welders	40	74

Notes:
dBA = A-weighted decibels; L_{max} = maximum noise level
1 The acoustical usage factor is a percentage of time that a particular piece of equipment is anticipated to be in full-power operation during a typical construction day.
Source: FHWA, 2006.

To more accurately characterize construction-period noise levels, the average (L_{eq}) noise level associated with each construction stage is provided in Table 3.8-9. These average noise levels are based on the quantity, type, and usage factors for each type of equipment that would be used during each construction stage, and are typically attributable to multiple pieces of equipment operating simultaneously. As shown in Table 3.8-9, the average construction-period noise level is expected to range from 74.1 to 86.3 dBA at a reference distance of 50 feet.

Construction activities would temporarily increase the existing ambient noise near the construction site, including the existing residential uses in and to the east and south of the plan area. However, construction activities would be required to comply with the City's allowable hours (i.e., during daytime hours between 8:00 a.m. and 6:00 p.m.) as described above, and construction activities would be temporary. Therefore, construction-related noise would result in a *less-than-significant* noise impact.

Table 3.8-9: Noise Levels Generated by Typical Construction Equipment

Construction Stage	Typical Construction Equipment	Construction Noise Levels at Indicated Distance from the Construction Areas,[1] dBA L_{eq}		
		50 Feet	100 Feet	200 Feet
Site Demolition	Dozer, backhoe, front-end loader, haul trucks	84.4	78.4	72.4
Site Grading/Excavation	Drill rig, excavator, loader, compactor, crane, haul trucks	85.5	79.5	73.5
Building Construction	Crane, forklift, tractor/loader/backhoe, generator, welder, concrete truck, concrete pump, pneumatic tools, delivery truck	86.3	80.3	74.3
Finishing/Landscaping	Cement and mortar mixer, backhoe, paver, roller	74.1	68.1	62.1

Notes:
dBA = A-weighted decibels; L_{eq} = equivalent noise level
[1] Estimated noise levels are based on distance attenuation only.
Source: AECOM, 2015.

Operational Noise

The existing noise environment in the vicinity of the planning area is dominated by traffic noise from adjacent roadways, and from nearby commercial and residential activities. Operational noise generated under the proposed plan would result primarily from typical residential and commercial uses, including normal operation of buildings' mechanical air conditioning and ventilation equipment, outdoor spaces, and off-site traffic.

Off-Site Stationary Sources

The operation of building mechanical equipment such as air conditioners, fans, and related equipment may generate audible noise. Outdoor mechanical equipment would typically be located on the buildings' rooftops or in the interior of the buildings, shielded from nearby noise-sensitive land uses to attenuate noise and avoid conflicts with adjacent uses. In addition, all building mechanical equipment would be designed with appropriate noise control devices, such as sound screen/parapet walls, to comply with City's Noise Ordinance, to not exceed the ambient levels by 5 dBA. Therefore, the noise impact from operation of building mechanical equipment under the proposed plan would be *less than significant*.

Off-Site Roadway Traffic

Based on the proposed plan's traffic impact study, the proposed plan is expected to generate 27,777 net new daily trips (average daily trips) by the proposed plan's anticipated full-occupancy year of 2040. The increase in the traffic volumes was analyzed to determine whether any traffic-related noise impacts would result from the proposed plan. The project-related traffic noise impact is determined by comparing the increase in noise levels from the "future without project" (2040 baseline) to "future with project" (2040 baseline plus project-related traffic) with the proposed plan's significance threshold. Table 3.8-10 provides a summary of the off-site roadway noise analysis. As shown in Table 3.8-10, the proposed plan would result in a maximum 2.3 dBA increase in traffic noise along Professional Drive, between Commerce Drive and State Farm Drive. At all other analyzed roadway segments, the increase attributable to proposed plan–related traffic would be lower (less than 1.7 dBA), because such traffic would disperse to various nearby roadways away from the plan area. The incremental

Table 3.8-10: Roadway Traffic Noise Impacts—Off-Site

Roadway Segment	Calculated Traffic Noise Levels,[1] dBA L_{dn} Future Without Project	Calculated Traffic Noise Levels,[1] dBA L_{dn} Future With Project	Increase in Noise Levels from the Proposed Plan, dBA L_{dn}
Golf Course Drive			
- West of U.S. Highway 101	69.8	69.9	0.1
- East of U.S. Highway 101	68.1	68.2	0.1
RPX			
- West of U.S. Highway 101	70.7	71.0	0.3
- Between Commerce Boulevard and State Farm Drive	67.7	68.7	1.0
- East of State Farm Drive	69.4	69.8	0.4
Enterprise Drive			0.0
- Between Commerce Boulevard and Hunter Drive	58.1	58.7	0.6
- Between Hunter Drive and State Farm Drive	60.4	61.3	0.9
- Between State Farm Drive and Seed Farm Drive	60.0	61.1	1.1
Commerce Boulevard			
- Between Golf Course Drive and State Farm Drive	66.1	66.7	0.6
- Between State Farm Drive and Professional Drive	62.6	63.1	0.5
- Between Professional Drive and RPX	63.6	64.8	1.2
- Between RPX and Enterprise Drive	65.2	65.4	0.2
- South of Enterprise Drive	65.6	65.8	0.2
State Farm Drive			
- Between Commerce Boulevard and Professional Drive	61.5	62.1	0.6
- Between Professional Drive and RPX	63.4	64.3	0.9
- Between RPX and Enterprise Drive	62.7	64.2	1.5
Professional Drive			
- Between Commerce Boulevard and State Farm Drive	54.7	57.0	2.3
Padre Parkway			
- Between Commerce Boulevard and State Farm Drive	58.2	59.0	0.8
City Center Drive			
- East of State Farm Drive	56.8	58.5	1.7
Seed Farm Drive			
- South of Enterprise Drive	62.9	63.9	1.0

Notes:
dBA = A-weighted decibels; L_{dn} = day-night level; RPX = Rohnert Park Expressway
[1] Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures.

Source: Data modeled by AECOM in 2015

changes in traffic noise levels attributable to the proposed plan would be considered negligible in the existing exterior noise environment. In addition, the change would be below the 3 dBA L_{dn} significance threshold. Therefore, off-site traffic noise impacts associated with the proposed plan would be *less than significant*.

Land Use Noise Compatibility

Development under the proposed plan would include residential, commercial/office, public institution, industrial, and public parks/open space, which would be exposed to existing and future ambient noise surrounding the plan area.

Roadway Traffic Noise

Existing and future traffic on roads surrounding and within the plan area would affect the plan area. Table 3.8-11 provides the projected traffic noise levels for roadway segments adjacent to the proposed development areas. Figure 3.8-2 presents the future plus project traffic noise contours in the proposed development area. Also included in Table 3.8-11 are the calculated distances from the edge of the roadway at which the traffic noise level would meet the City's normally acceptable exterior noise standard of 60 and 70 dBA L_{dn} for residential and commercial/retail/office/park uses, respectively. The noise model assumes straight-line attenuations/reductions in noise levels of 3 dBA per doubling of distance from a road centerline, with no noise attenuation allowances for intervening structures.

The proposed additional residential development would be located in the City Center and Station Center subareas. As indicated in Table 3.8-11, the traffic noise levels within the City Center and Station Center would be up to 69.8 dBA L_{dn} at 100 feet from the adjacent roadways' centerline (i.e., RPX), which exceed the City's land use compatibility guidelines of 60 dBA L_{dn} for residential uses. Therefore, this impact would be *potentially significant.*

Mitigation Measures

Mitigation Measure 3.8-1: Prepare Site-Specific Interior Acoustical Analysis Reports and Implement Report Recommendations

As part of any project-level CEQA analysis, for all residential projects, the project applicant shall have an acoustical analysis prepared by a qualified acoustical consultant for all new residential developments that are within 60 dBA L_{dn} or higher, to document that an acceptable interior noise level of 45 dBA L_{dn} or below will be achieved with the windows and doors closed. The report shall be submitted at plan check to the City for approval.

Mitigation Measure 3.8-2: Prepare Site-Specific Exterior Acoustical Analysis Reports and Implement Report Recommendations

Before the issuance of grading permits, or any project-level CEQA analysis, an acoustical analysis report shall be prepared by a qualified acoustical consultant and submitted to the City Engineer for review. The report shall indicate that the exterior noise levels at the residential outdoor uses, including outdoor courtyards and outdoor pool decks (except for private balconies), would be 60 dBA CNEL or lower. Methods to reduce the exterior noise may include a sound barrier or earth berms; setback from the roadways (i.e., buffer); or placing the outdoor spaces behind buildings, to reduce the traffic noise from adjacent roadways.

Table 3.8-11: Roadway Traffic Noise Impacts—On-Site Uses

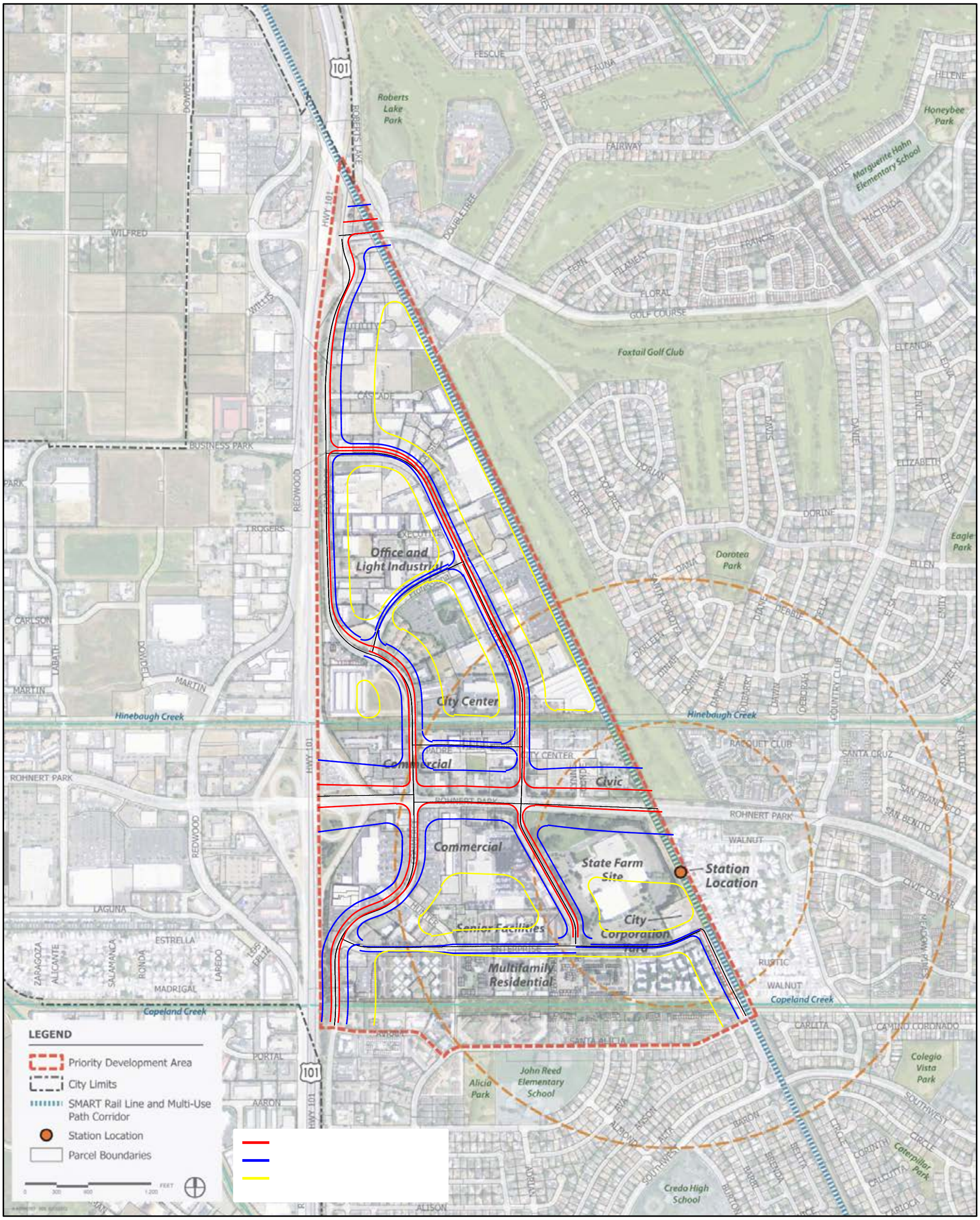
Roadway Segment (Within Plan Area)	Adjacent Proposed Development (Subarea)	Calculated Traffic Noise Levels,[1] dBA L_{dn}	Calculated Distance from the Center of the Roadway to the L_{dn} Noise Contour, feet	
			70 L_{dn}	60 L_{dn}
RPX				
- Between Commerce Boulevard and State Farm Drive	City Center, Central Commercial	68.7	75	745
- East of State Farm Drive	City Center, Station Center	69.8	95	950
Enterprise Drive				
- Between Commerce Boulevard and Hunter Drive	Central Commercial	58.7	–[2]	74
- Between Hunter Drive and State Farm Drive	Central Commercial	61.3	–[2]	133
- Between State Farm Drive and Seed Farm Drive	Station Center	61.1	–[2]	129
Commerce Boulevard				
- Between Golf Course Drive and State Farm Drive	Triangle Business	66.7	47	468
- Between State Farm Drive and Professional Drive	Triangle Business	63.1	–[2]	203
- Between Professional Drive and RPX	Triangle Business, City Center, Central Commercial	64.8	–[2]	303
- Between RPX and Enterprise Drive	Central Commercial	65.4	–[2]	346
State Farm Drive				
- Between Commerce Boulevard and Professional Drive	Triangle Business	62.1	–[2]	162
- Between Professional Drive and RPX	Triangle Business, City Center Subarea	64.3	–[2]	269
- Between RPX and Enterprise Drive	Central Commercial, Station Center	64.2	–[2]	263
Professional Drive				
- Between Commerce Boulevard and State Farm Drive	Triangle Business	57.0	–[2]	50
Padre Parkway				
- Between Commerce Boulevard and State Farm Drive	City Center Subarea	59.0	–[2]	79
City Center Drive				
- East of State Farm Drive	City Center Subarea	58.5	–[2]	70

Notes: RPX = Rohnert Park Expressway

1 Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.

2 Noise contour is met at the edge of the roadway.

Source: Data modeled by AECOM in 2015 (see Appendix D)



Sources: Compiled by AECOM in 2015

Figure 3.8-2: Future Plus Project Noise Contours

Significance After Mitigation

Incorporation of Mitigation Measures 3.8-1 and 3.8-2 would reduce potential impacts to a less-than-significant level for the proposed residential developments. The traffic noise levels along the roadways in the plan area would fall within normally acceptable (i.e., less than 70 dBA L_{dn}) for commercial/retail/office/park uses. Therefore, noise impacts on future on-site developments would be *less than significant* with implementation of the mitigation measures listed above. Implementation of Mitigation Measure 3.8-1 would ensure that the interior noise levels at the future residential use (attributable to exterior noise) would meet the City's interior noise requirement of 45 dBA L_{dn}. Implementation of Mitigation Measure 3.8-2 would ensure that the exterior noise levels at the residential outdoor uses do not exceed 60 dBA L_{dn}. Therefore, noise impacts on the future noise-sensitive uses would be reduced to a *less-than-significant* level.

3.8b. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels? Less-than-Significant Impact.

SMART Rail Noise

The proposed residential development in the Station Center subarea would be located near the future SMART rail station. Based on review of the RPX Station Project CEQA Addendum to the 2006 Final Environmental Impact Report (SMART, 2012), the noise level from SMART station operation would not exceed the FTA criteria. In addition, the predicted noise from the rail operations at distances of greater than 25 feet from the tracks would be less than 60 dBA L_{dn}, which would meet the City's land use standard for residential use (SMART, 2005). The proposed residential development would be located greater than 25 feet from SMART rail tracks. In addition, noise from the train horns/warning devices would generate high noise levels at the at-grade crossings. Noise from train pass-bys and horns/warning devices would be limited to 12 round trips per day and would occur between 5:00 a.m. and 8:00 p.m. (SMART, 2005). The nearest at-grade crossing would be at RPX (crossing the rail tracks). The train horns, as described in the SMART draft environmental impact report, are not regulated by local ordinance because they are safety-warning devices. Therefore, noise impacts from the SMART operation onto the future residential development would be *less than significant*.

Construction Vibration

Construction activities can generate varying degrees of ground vibration, depending on the construction procedures and the construction equipment used. FTA has published standard vibration velocities for construction equipment operations. The vibration levels generated by typical construction equipment anticipated to be used during project construction are listed in Table 3.8-12. The groundborne vibration levels would be well below the most stringent building damage threshold of 0.12 PPV (Table 3.8-12). With respect to human annoyance, the groundborne vibration levels at 50 feet from heavy equipment (i.e., large bulldozer, caisson drilling, and loaded trucks) would be approximately 78 VdB, which would be below the 80 VdB significance threshold. Existing off-site residential uses to the east and south of the plan area would be a minimum of 100 feet from construction activities associated with the proposed plan. Therefore, groundborne vibration impacts would be *less than significant* at off-site residential uses.

Table 3.8-12: Vibration Levels Generated by Typical Construction Equipment

Construction Equipment	Vibration Levels in PPV at 25 Feet (in/sec)	Vibration Levels in VdB	
		At 25 Feet	At 50 Feet
Large Bulldozer	0.089	87	78
Caisson Drilling	0.089	87	78
Loaded Trucks	0.076	86	77
Jackhammer	0.035	79	70
Small Bulldozer	0.003	58	49

Note: in/sec = inches per second; PPV = peak particle velocity; VdB = vibration decibels
Sources: FHWA, 2006; data compiled by AECOM in 2015.

There are existing on-site residential uses that could be exposed to groundborne vibration up to 87 VdB when the heavy construction equipment is operating within 25 feet of the residential uses. The groundborne vibration levels, however, would dissipate below the 80 VdB threshold when the heavy construction equipment is operating at a distance of 50 feet or more. Furthermore, in accordance with the City's allowable construction hours, construction activities would be limited to the daytime hours (i.e., 8:00 a.m. to 6:00 p.m.), thereby avoiding the typical normal sleeping hours (i.e., nighttime hours). Therefore, construction-related vibration impacts would be *less than significant*.

Operational Vibration

The proposed plan would include typical residential and commercial-grade stationary mechanical and electrical equipment such as air-handling units, condenser units, exhaust fans, and electrical emergency power generators, which would produce vibration. However, groundborne vibration generated by each of the above-mentioned activities would be limited to areas near the equipment, and would not expect to exceed the 80 VdB vibration significance threshold. Therefore, vibration impacts associated with operation under the proposed plan would be *less than significant*.

3.8c. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project? Less-than-Significant Impact.

The existing noise environment in the plan area is dominated by traffic noise from nearby roadways, as well as nearby commercial, industrial, and residential activities. Long-term operation under the proposed plan would not have a significant effect on the community noise environment near the plan area. Noise sources that would have potential noise impacts include outdoor mounted mechanical (i.e., air conditioning) equipment and off-site automobile traffic. The noise levels associated with on-site operations (e.g., parking and mechanical equipment), as discussed in Impact 3.8a above, would have a less-than-significant impact. In addition, off-site traffic noise on local roadways attributable to the proposed plan are also considered less than significant, as discussed in Impact 3.8a. Therefore, this noise impact would be *less than significant*.

3.8d. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project? Less-than-Significant Impact with Mitigation Incorporated.

Construction activities associated with the proposed plan would generate noise on a temporary basis and would increase the existing ambient noise in the immediate vicinity of the plan area, including the existing residential uses in the plan area and to the east and south of the plan area. Construction-related noise impacts are presented in the discussion of Impact 3.8a above. As described therein, noise generated by on-site construction activities would temporarily increase the existing ambient noise close to the plan area. Construction activities would be required to comply with the City's allowable construction hours, which limit construction activities to the daytime hours, avoiding the typical sleeping hours for residents. Nevertheless, construction activities associated with the proposed plan would increase the ambient noise in the vicinity of the plan area, on a temporary basis. Therefore, this impact would be *potentially significant*. The following mitigation measure is recommended to minimize the construction-related noise.

Mitigation Measures

> **Mitigation Measure 3.8-3: Restrict Construction Activity Timing and Construction Equipment Specifications and Location**
>
> *Construction activities within 500 feet of residential use shall be limited to the hours of 8:00 a.m. to 6:00 p.m., in accordance with the City's Municipal Code.*
>
> *Power construction equipment shall be equipped with state-of-the-art noise shielding and muffling devices. All equipment shall be properly maintained to assure that no additional noise attributable to worn or improperly maintained parts would be generated.*
>
> *Stationary-source construction equipment that may have a flexible specific location on-site (e.g., generators and compressors) shall be located to maintain the greatest distance from sensitive land uses, and unnecessary idling of equipment shall be prohibited.*

Significance After Mitigation

Implementation of Mitigation Measure 3.8-3 would reduce the construction noise impacts to a *less-than-significant* level.

3.8e. For a project located within an airport land use plan, or where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? No Impact.

3.8f. For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels? No Impact.

The plan area is not located within 2 miles of a public airport or public use airport. The nearest airport to the plan area is Petaluma Municipal Airport, which is located approximately 7.4 miles to the southeast. Furthermore, the plan area is not located in the vicinity of a private airstrip. Therefore, the proposed plan would not expose people to excessive noise levels associated with aircraft operation. Therefore, *no impact* would occur with respect to airport operation.

3.8.4 Cumulative Impacts

The proposed plan, together with the other related projects, could contribute to cumulative noise impacts. The related projects include full build-out of the Graton Rancheria Resort and Casino, Wilfred-Dowdell Specific Plan, Stadium Area Master Plan, Northeast Area Specific Plan, University District Specific Plan, Southeast Area Specific Plan, Sonoma Mountain Village Development, and Northwest Area Specific Plan. The potential for cumulative noise impacts to occur is specific to the distance between each related project and its stationary noise sources, including the cumulative traffic that these projects would add to the surrounding roadway network.

Construction Noise

Noise from on-site construction activities is typically localized and would normally affect the areas immediately adjacent to the plan area, less than 500 feet from the construction sites, because of the sound attenuation provided by the distance and the intervening buildings between the construction sites and the noise-sensitive receptors. The nearest related project to the plan area is the Wilfred-Dowdell Specific Plan, which is approximately 900 feet west of the plan area (west of U.S. Highway 101). Because the timing of the construction activities for these related projects cannot be defined, any quantitative analysis that assumes multiple, concurrent construction projects would be entirely speculative. Construction activities from the cumulative projects would generate noise at each project site, and cumulative construction noise could exceed ambient noise levels at the nearest residences. However, those noise levels would be intermittent and temporary, would cease at the end of the construction phase, and would comply with time restrictions and other relevant provisions in the City's Municipal Code. Because construction activities would be required to comply with the City's allowable hours as described above and would be temporary, cumulative construction-related noise would result in a *less-than-significant* noise impact.

Construction Vibration

Groundborne vibration decreases rapidly with distance. Potential vibration impacts caused by construction activities are generally limited to buildings/structures that are located close to the construction site (i.e., less than 25 feet). As described above, the nearest related project is approximately 900 feet away from the plan area. Therefore, because of the rapid attenuation characteristics of groundborne vibration, there is no potential for a cumulative construction impact with respect to groundborne vibration.

Operational Noise

Once developed, the plan area, along with overall development in the surrounding area, would generate noise that would contribute to cumulative noise from a number of community noise sources, including vehicle travel and mechanical equipment (e.g., heating, ventilating, and air conditioning systems). Noise levels from stationary sources would be less than significant at the property line for each related project because of the City's requirements that limit noise from on-site stationary sources such as outdoor air conditioning equipment. Because the impacts of the proposed plan's on-site stationary sources (i.e., building mechanical equipment, parking facility, and outdoor services) would be less than significant, stationary-source noise impacts attributable to cumulative development of the related projects and the proposed plan would also result in *less-than-significant* impacts.

The proposed plan and other related projects would generate traffic volumes that would contribute to off-site roadway noise. Cumulative noise impacts from off-site traffic were analyzed by comparing the projected increase in traffic noise levels from "existing" conditions to "future cumulative" conditions to the applicable significance criteria. Future cumulative conditions include traffic volumes from future ambient growth, related projects, and the proposed plan. The calculated traffic noise levels under "existing" and "future cumulative" conditions are presented in Table 3.8-13. Cumulative traffic volumes would result in a maximum increase of 3.6 to 4.2 dBA L_{dn} along Golf Course Drive east and west of U.S. Highway 101 and City Center Drive east of State Farm Drive (Table 3.8-13). The maximum increase at the Golf Course Drive (east and west of U.S. Highway 101) and City Center Drive roadway segments would be below the 5 dBA significance threshold. Therefore, the future traffic noise levels remain within the "conditionally acceptable" land use category. At all other analyzed roadway segments, the increase in cumulative traffic noise would be less than 3 dBA L_{dn}, which would be below the more stringent 3 dBA significance threshold. Therefore, cumulative traffic noise impacts would be *less than significant*.

Table 3.8-13: Off-Site Roadway Traffic Noise Impacts—Cumulative

Roadway Segment	Calculated Traffic Noise Levels,[1] dBA L_{dn}		Cumulative Increase in Noise Levels due to Project, dBA L_{dn}	Project Contribution Cumulative Increase, dBA L_{dn}
	Existing	Future Cumulative With Project		
Golf Course Drive				
- West of U.S. Highway 101	65.7	69.9	4.2	0.1
- East of U.S. Highway 101	64.6	68.2	3.6	0.1
Rohnert Park Expressway				
- West of U.S. Highway 101	69.0	71.0	2.0	0.3
- Between Commerce Boulevard and State Farm Drive	66.4	68.7	2.3	1.0
- East of State Farm Drive	68.1	69.8	1.7	0.4
Enterprise Drive				
- Between Commerce Boulevard and Hunter Drive	57.1	58.7	1.6	0.6
- Between Hunter Drive and State Farm Drive	59.8	61.3	1.5	0.9
- Between State Farm Drive and Seed Farm Drive	61.5	61.1	-0.4	1.1
Commerce Boulevard				
- Between Golf Course Drive and State Farm Drive	64.0	66.7	2.7	0.6
- Between State Farm Drive and Professional Drive	61.6	63.1	1.5	0.5
- Between Professional Drive and RPX	62.6	64.8	2.2	1.2
- Between RPX and Enterprise Drive	64.6	65.4	0.8	0.2

Table 3.8-13: Off-Site Roadway Traffic Noise Impacts—Cumulative

Roadway Segment	Calculated Traffic Noise Levels,[1] dBA L_{dn} Existing	Calculated Traffic Noise Levels,[1] dBA L_{dn} Future Cumulative With Project	Cumulative Increase in Noise Levels due to Project, dBA L_{dn}	Project Contribution Cumulative Increase, dBA L_{dn}
- South of Enterprise Drive	65.0	65.8	0.8	0.2
State Farm Drive				
- Between Commerce Boulevard and Professional Drive	59.6	62.1	2.5	0.6
- Between Professional Drive and RPX	61.8	64.3	2.5	0.9
- Between RPX and Enterprise Drive	61.6	64.2	2.6	1.5
Professional Drive				
- Between Commerce Boulevard and State Farm Drive	54.1	57.0	2.9	2.3
Padre Parkway				
- Between Commerce Boulevard and State Farm Drive	56.7	59.0	2.3	0.8
City Center Drive				
- East of State Farm Drive	54.5	58.5	4.0	1.7
Seed Farm Drive				
- South of Enterprise Drive	61.4	63.9	2.5	1.0

Notes:
1 Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures.

Source: Data modeled by AECOM in 2015

3.8.5 References

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3.9 TRANSPORTATION AND TRAFFIC

This section describes the existing physical and regulatory setting related to transportation and traffic and discusses the potential impacts of the proposed plan on transportation and traffic.

3.9.1 Existing Conditions

The following description of the transportation network and potential traffic impacts in the plan area vicinity is based on the *Central Rohnert Park Priority Development Area Plan Transportation Impact Study* (W-Trans, 2015), which is included as Appendix E.

Roadway System

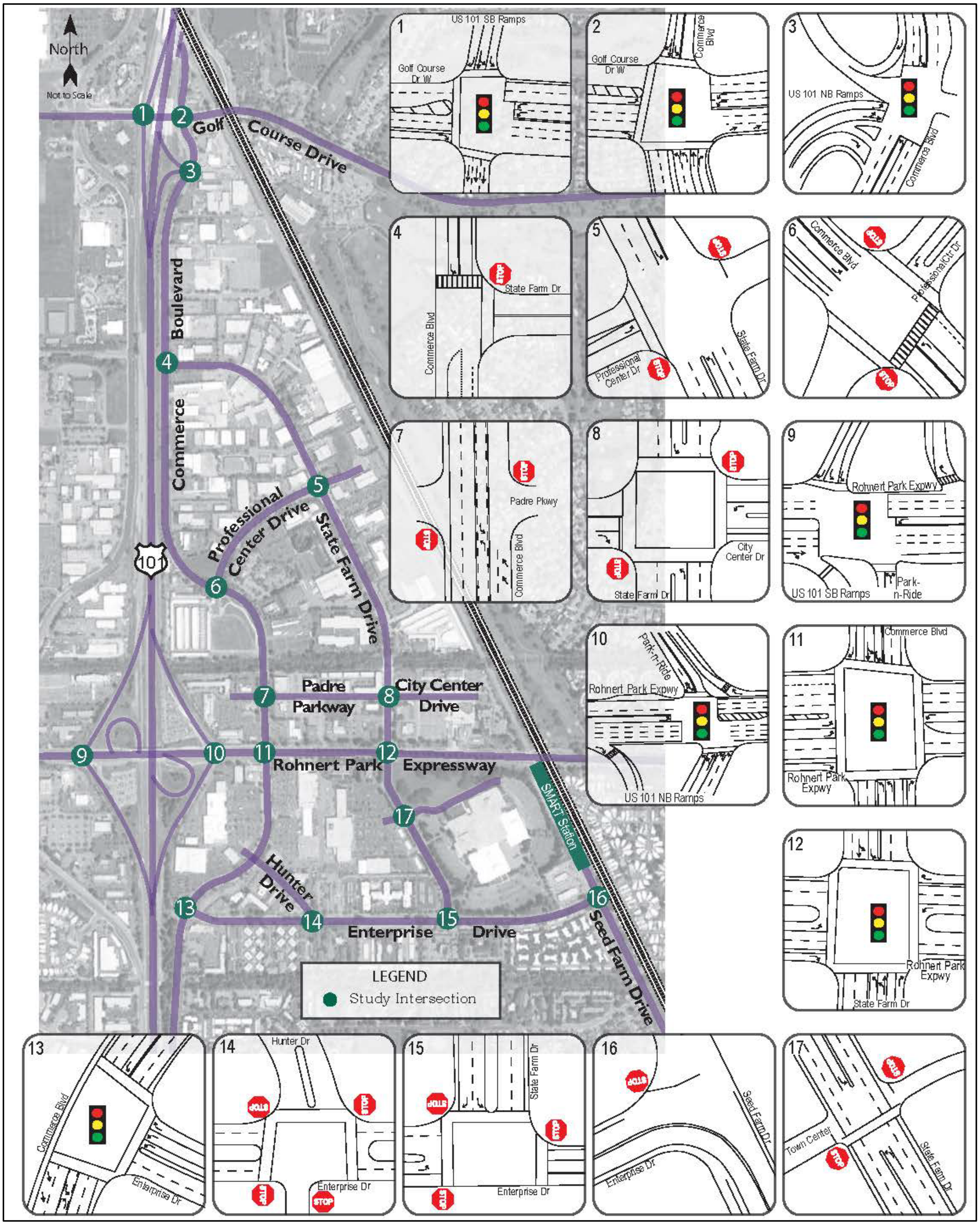
The plan area is composed of commercial development throughout the area and is generally fully developed, with few undeveloped parcels. The local circulation system serving the plan area is shown in Figure 3.9-1.

Regional access to the plan area is provided by U.S. Highway 101 (U.S. 101). Local access to the plan area is provided via Golf Course Drive, Commerce Boulevard, State Farm Drive, Rohnert Park Expressway (RPX), and Enterprise Drive.

Intersections

Seventeen study intersections in and adjacent to the plan area were selected for analysis (see Figure 3.9-1):

1. Golf Course Drive West/U.S. 101 South Ramps
2. Golf Course Drive/Commerce Boulevard
3. Commerce Boulevard/U.S. 101 North Ramps
4. Commerce Boulevard/State Farm Drive
5. State Farm Drive/Professional Center Drive
6. Commerce Boulevard/Professional Center Drive
7. Commerce Boulevard/Padre Parkway
8. State Farm Drive/City Center Drive
9. RPX/U.S. 101 South Ramps
10. RPX/U.S. 101 North Ramps
11. RPX/Commerce Boulevard
12. RPX/State Farm Drive
13. Commerce Boulevard/Enterprise Drive
14. Enterprise Drive/Hunter Drive
15. Enterprise Drive/State Farm Drive
16. Enterprise Drive/Seed Farm Drive
17. State Farm Drive/Town Center



Source: W-Trans, 2015

Figure 3.9-1: Study Intersections and Lane Configurations

Traffic counts were obtained at the study intersections in September 2013 and March 2014.[1] All counts were obtained while area schools, including Sonoma State University, were in session. Existing traffic volumes are shown in Figure 3.9-2.

Intersection Operations

Methodology

Level of service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity, using a series of letter designations ranging from A to F. Generally, LOS A represents free-flow conditions and LOS F represents forced-flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation. The study intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM) (TRB, 2000) for intersections with signal control, two-way stop control, and all-way stop control intersections.

- *Signal Control.* This methodology is based on factors including traffic volumes, green time for each movement, phasing, coordination or lack of coordination of signals, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology.
- *Two-Way Stop Control.* This methodology determines LOS for each minor turning movement by estimating the level of average delay in seconds per vehicle. Results are presented for individual movements, together with the weighted overall average delay for the intersection.
- *One-Way Stop Control.* This methodology evaluates delay for each approach based on turning movements, opposing and conflicting traffic volumes, and the number of lanes. Average vehicle delay is computed for the intersection as a whole, and is then related to LOS.

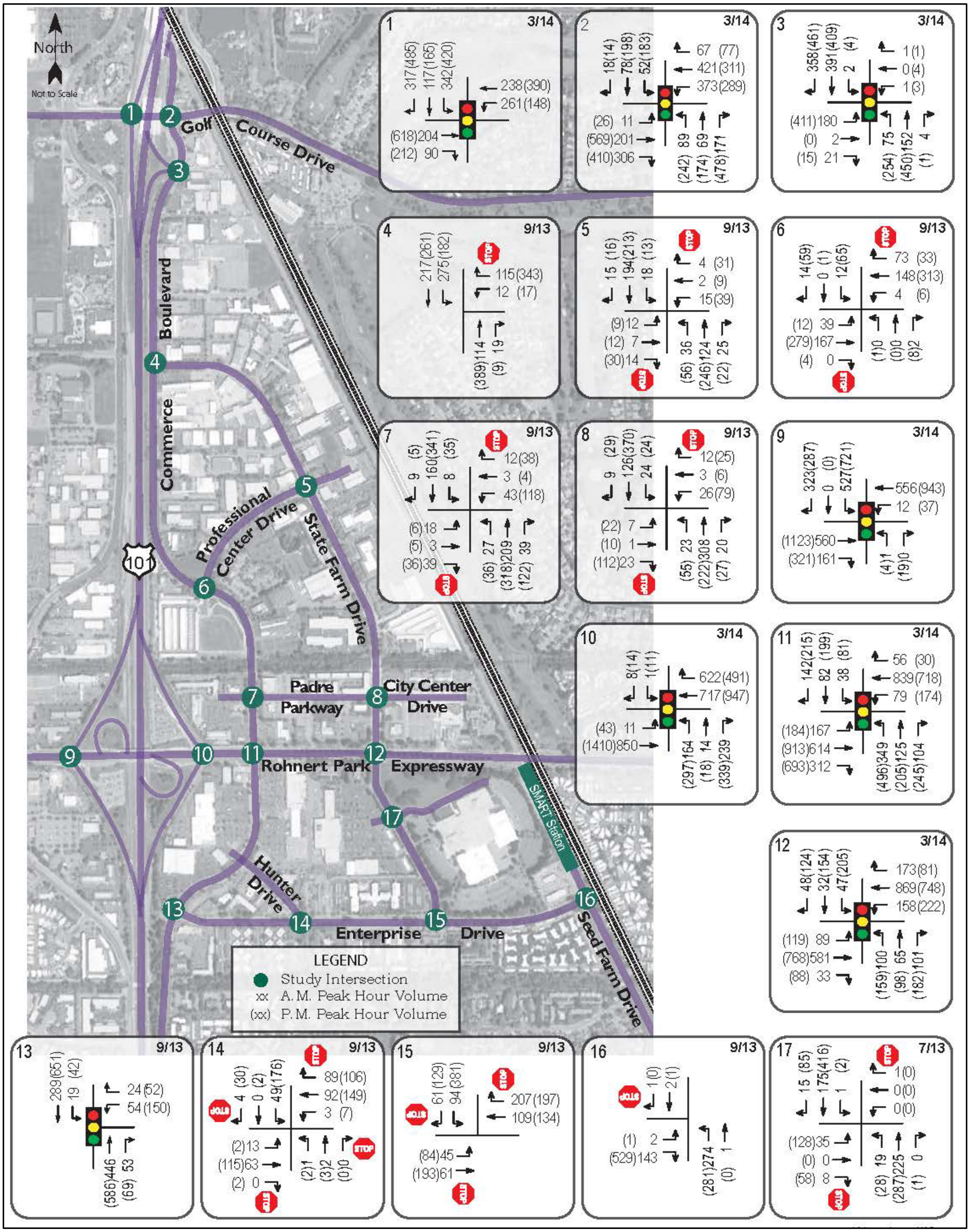
The ranges of delay associated with the various LOS are indicated in Table 3.9-1.

Table 3.9-1: Intersection Level of Service Criteria

LOS	Delay		
	Signalized	**Two-Way Stop-Controlled**	**All-Way Stop-Controlled**
A	0 to 10 seconds	0 to 10 seconds	0 to 10 seconds
B	10 to 20 seconds	10 to 15 seconds	10 to 15 seconds
C	20 to 35 seconds	15 to 25 seconds	15 to 25 seconds
D	35 to 55 seconds	25 to 30 seconds	25 to 30 seconds
E	55 to 80 seconds	35 to 50 seconds	35 to 50 seconds
F	More than 80 seconds	More than 50 seconds	More than 50 seconds

Notes:
LOS = level of service
Source: TRB, 2000

1 Traffic counts were obtained at intersections 1–3 and 9–12 in March 2014, and at intersections 4–8 and 13–17 in September 2013.



Source: W-Trans, 2015

Figure 3.9-2: Existing Traffic Volumes

Results

The existing-conditions LOS results for the 17 study intersections are summarized in Table 3.9-2. The LOS calculation worksheets are provided in Appendix E.

Table 3.9-2: Existing Peak-Hour Intersection Levels of Service

Study Intersection *Approach*	**a.m. Peak**		**p.m. Peak**	
	Delay	**LOS**	**Delay**	**LOS**
1. Golf Course Drive West/U.S. 101 South Ramps	29.8	C	22.1	C
2. Golf Course Drive/Commerce Boulevard	20.1	C	24.7	C
3. Commerce Boulevard/U.S. 101 North Ramps	7.7	A	12.5	B
4. Commerce Boulevard/State Farm Drive	5.0	A	9.9	A
Westbound Approach	*11.9*	*B*	*28.5*	*D*
5. State Farm Drive/Professional Center Drive	2.2	A	3.6	A
Eastbound Approach	*11.3*	*B*	*12.7*	*B*
Westbound Approach	*11.9*	*B*	*16.4*	*C*
6. Commerce Boulevard/Professional Center Drive	1.4	A	2.3	A
Southbound (Professional Center) Approach	*10.2*	*B*	*12.5*	*B*
7. Commerce Boulevard/Padre Parkway	2.7	A	3.6	A
Eastbound Approach	*10.1*	*B*	*10.9*	*B*
Westbound Approach	*11.7*	*B*	*17.3*	*C*
8. State Farm Drive/City Center Drive	2.1	A	5.4	A
Eastbound Approach	*9.9*	*A*	*12.8*	*B*
Westbound Approach	*13.0*	*B*	*25.8*	*D*
9. RPX/U.S. 101 South Ramps	20.1	C	27.3	C
10. RPX/U.S. 101 North Ramps	24.0	C	23.2	C
11. RPX/Commerce Boulevard	32.5	C	**41.7**	**D**
12. RPX/State Farm Drive	33.4	C	**41.0**	**D**
13. Commerce Boulevard/Enterprise Drive	9.5	A	8.8	A
14. Enterprise Drive/Hunter Drive	7.2	A	8.8	A
15. Enterprise Drive/State Farm Drive	8.4	A	17.7	C
16. Enterprise Drive/Seed Farm Drive	0.1	A	0.0	A
Southbound Approach	*11.1*	*B*	*16.4*	*C*
17. State Farm Drive/Town Center	1.4	A	4.9	A
Eastbound Approach	*11.5*	*B*	*25.2*	*D*
Westbound Approach	*9.0*	*A*	*0.0*	*A*

Notes:
LOS = level of service; U.S. 101 = U.S. Highway 101
Delay is measured in average seconds per vehicle. Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*; ** = delay greater than 120 seconds; **Bold** text = deficient operation

Source: W-Trans, 2015

Under existing conditions, 15 of the 17 study intersections are operating acceptably within the established LOS criteria. The intersections at RPX/Commerce Boulevard and RPX/State Farm Drive are currently operating at LOS D during the p.m. peak hour, which is considered unacceptable because the City's standard for these locations is LOS C.

Freeways

Traffic volumes on mainline U.S. 101 were obtained from raw 2013 data supplied by the California Department of Transportation (Caltrans), updated to reflect conditions after opening of the casino portion of the Graton Rancheria Resort and Casino. Seventeen freeway segments were selected for analysis:

Northbound

1. State Route (SR) 116 off-ramp to on-ramp (basic segment)
2. SR 116 on-ramp to RPX off-ramp (weaving)
3. RPX off-ramp to RPX eastbound (EB) on-ramp (basic segment)
4. RPX EB on-ramp (on-ramp)
5. RPX EB on-ramp to RPX westbound (WB) on-ramp (basic segment)
6. RPX WB on-ramp to Golf Course Drive off-ramp (weaving)
7. Golf Course Drive off-ramp to on-ramp (basic segment)
8. Golf Course Drive on ramp to Santa Rosa Avenue off-ramp (weaving)
9. Santa Rosa Avenue off-ramp to Todd Road off-ramp (basic segment)

Southbound

10. Todd Road on-ramp to Golf Course Drive off-ramp (basic segment)
11. Golf Course Drive off-ramp (off-ramp)
12. Golf Course Drive off-ramp to on-ramp (basic segment)
13. Golf Course Drive on-ramp to RPX off-ramp (weaving)
14. RPX off-ramp to RPX WB on-ramp (basic segment)
15. RPX WB on-ramp (on-ramp)
16. RPX EB on-ramp to SR 116 off-ramp (weaving)
17. SR 116 off-ramp to SR 116 on-ramp (basic segment)

Freeway Operations

Methodology

The freeway analysis methodology contained in Chapter 10 of the HCM, "Freeway Facilities," was used to determine LOSs on U.S. 101. The method analyzes extended lengths of freeway composed of continuously connected basic freeway, weaving, merge, and diverge segments, which are collectively referred to as a freeway facility. For each individual segment, the analysis used methodologies from the relevant chapters of the HCM: Chapter 11, "Basic Freeway Segments"; Chapter 12, "Freeway Weaving Segments"; and Chapter 13, "Freeway

Merge and Diverge Segments." The method uses variables such as traffic volumes, geometric configuration of the freeway (i.e., number of lanes, presence of auxiliary lanes, distance between merges and diverges, widths of lanes and shoulders), topography, the percentage of heavy vehicles, and free-flow speeds. These data are used to determine the density of the segment, which is the criterion used for determining freeway LOS. Density is indicative of the travel speed service flow rates and travel demand on a freeway facility, and is measured in the number of passenger cars per mile per lane. The ranges of vehicle density associated with the various LOSs are presented in Table 3.9-3.

Table 3.9-3: Freeway Level of Service Criteria

Level of Service (LOS)	Basic Freeway Segment Density (pc/mi/ln)	Weaving, Merge, and Diverge Segment Density (pc/mi/ln)
A	≤ 11	≤ 10
B	> 11–18	> 10–20
C	> 18–26	> 20–28
D	> 26–35	> 28–35
E	> 35–45	> 35
F	> 45 or any component with v/c ratio > 1.00	Demand exceeds capacity

Notes: pc/mi/ln = passenger cars per mile per lane; v/c = volume-to-capacity
Source: TRB, 2000

Results

Existing freeway facilities including mainline, merge-diverge, and weaving segments operations were evaluated between the SR 116 and Todd Road freeway interchanges. All of the freeway facilities are currently operating acceptably at LOS E or better. Summaries of freeway facility LOSs are shown for the a.m. and p.m. peak hours in Table 3.9-4 and Table 3.9-5, respectively. Detailed calculation worksheets are provided in Appendix E.

Bicycle and Pedestrian Facilities

Bicycle Facilities

The Caltrans *Highway Design Manual* (2012) classifies bikeways into three categories:

- *Class I Multi-Use Path:* A completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- *Class II Bicycle Lane:* A striped and signed lane for one-way bicycle travel on a street or highway.
- *Class III Bicycle Route:* Signing only for shared use with motor vehicles within the same travel lane on a street or highway.

Class II on-street bicycle lanes are provided along Golf Course Drive, Commerce Boulevard south of Utility Court, RPX, State Farm Drive south of RPX, Enterprise Drive east of State Farm Drive, and Seed Farm Drive. In addition, Class I multiuse paths exist along the west side of Commerce Boulevard between Cascade Court and

Table 3.9-4: Existing a.m. Peak Hour Freeway Levels of Service

U.S. 101 Freeway Segment *Direction*	Segment Type	v/c Ratio	Density	LOS
Northbound				
SR 116 off-ramp to on-ramp	Basic Segment	0.47	16.0	B
SR 116 on-ramp to RPX off-ramp	Weaving	0.49	17.8	B
RPX off-ramp to RPX EB on-ramp	Basic Segment	0.56	19.1	C
RPX EB on-ramp	On Ramp	0.60	23.8	C
RPX EB on-ramp to RPX WB on-ramp	Basic Segment	0.60	21.3	C
RPX WB on-ramp to Golf Course Drive off-ramp	Weaving	0.55	20.1	C
Golf Course Drive off-ramp to on-ramp	Basic Segment	0.70	24.8	C
Golf Course Drive on ramp to Santa Rosa Avenue off-ramp	Weaving	0.55	21.2	C
Santa Rosa Avenue off-ramp to Todd Road off-ramp	Basic Segment	0.74	26.7	D
Southbound				
Todd Road on-ramp to Golf Course Drive off-ramp	Basic Segment	0.79	29.2	D
Golf Course Drive off-ramp	Off Ramp	0.79	30.5	D
Golf Course Drive off-ramp to on-ramp	Basic Segment	0.65	22.6	C
Golf Course Drive on-ramp to RPX off-ramp	Weaving	0.55	21.1	C
RPX off-ramp to RPX WB on-ramp	Basic Segment	0.57	19.5	C
RPX WB on-ramp	On Ramp	0.63	25.7	C
RPX EB on-ramp to SR 116 off-ramp	Weaving	0.52	18.4	B
SR 116 off-ramp to SR 116 on-ramp	Basic Segment	0.57	19.5	C

Notes: Density is measured in pc/mi/ln.
EB = eastbound; LOS = level of service; pc/mi/ln = passenger cars per mile per lane; RPX = Rohnert Park Expressway; SR = State Route; U.S. 101 = U.S. Highway 101; v/c = volume-to-capacity; WB = westbound

Source: W-Trans, 2015.

Professional Center Drive; along Hinebaugh Creek east of Commerce Boulevard; along Copeland Creek east of Commerce Boulevard; and south of Enterprise Drive/Hunter Drive, connecting the intersection to the Copeland Creek Class I multiuse path.

Pedestrian Facilities

Pedestrian facilities include sidewalks, paths, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting and benches. Continuous sidewalks are provided on the east side of Commerce Boulevard north of Utility Court, and on both sides of the street elsewhere except along the frontage of two undeveloped parcels: one on Commerce Boulevard west of Professional Center Drive, and one on State Farm Drive north of Professional Center Drive. Marked crosswalks crossing the major street are generally provided at unsignalized intersections, with the exception of State Farm Drive/Professional Center Drive, where the State Farm Drive crossings are unmarked. All of the signalized study intersections include marked crosswalks and pedestrian signal heads.

Table 3.9-5: Existing p.m. Peak Hour Freeway Levels of Service

U.S. 101 Freeway Segment *Direction*	Segment Type	v/c Ratio	Density	LOS
Northbound				
SR 116 off-ramp to on-ramp	Basic Segment	0.79	29.5	D
SR 116 on-ramp to RPX off-ramp	Weaving	0.67	27.0	C
RPX off-ramp to RPX EB on-ramp	Basic Segment	0.75	27.4	D
RPX EB on-ramp	On Ramp	0.83	34.8	D
RPX EB on-ramp to RPX WB on-ramp	Basic Segment	0.83	31.6	D
RPX WB on-ramp to Golf Course Drive off-ramp	Weaving	0.70	27.1	C
Golf Course Drive off-ramp to on-ramp	Basic Segment	0.81	30.5	D
Golf Course Drive on ramp to Santa Rosa Avenue off-ramp	Weaving	0.72	29.2	D
Santa Rosa Avenue off-ramp to Todd Road off-ramp	Basic Segment	0.94	39.3	E
Southbound				
Todd Road on-ramp to Golf Course Drive off-ramp	Basic Segment	0.79	29.3	D
Golf Course Drive off-ramp	Off Ramp	0.79	30.7	D
Golf Course Drive off-ramp to on-ramp	Basic Segment	0.63	21.8	C
Golf Course Drive on-ramp to RPX off-ramp	Weaving	0.68	22.2	C
RPX off-ramp to RPX WB on-ramp	Basic Segment	0.55	18.9	C
RPX WB on-ramp	On Ramp	0.59	23.9	C
RPX EB on-ramp to SR 116 off-ramp	Weaving	0.57	21.1	C
SR 116 off-ramp to SR 116 on-ramp	Basic Segment	0.53	18.2	C

Notes: Density is measured in pc/mi/ln.
EB = eastbound; LOS = level of service; pc/mi/ln = passenger cars per mile per lane; RPX = Rohnert Park Expressway; SR = State Route; U.S. 101 = U.S. Highway 101; v/c = volume-to-capacity; WB = westbound

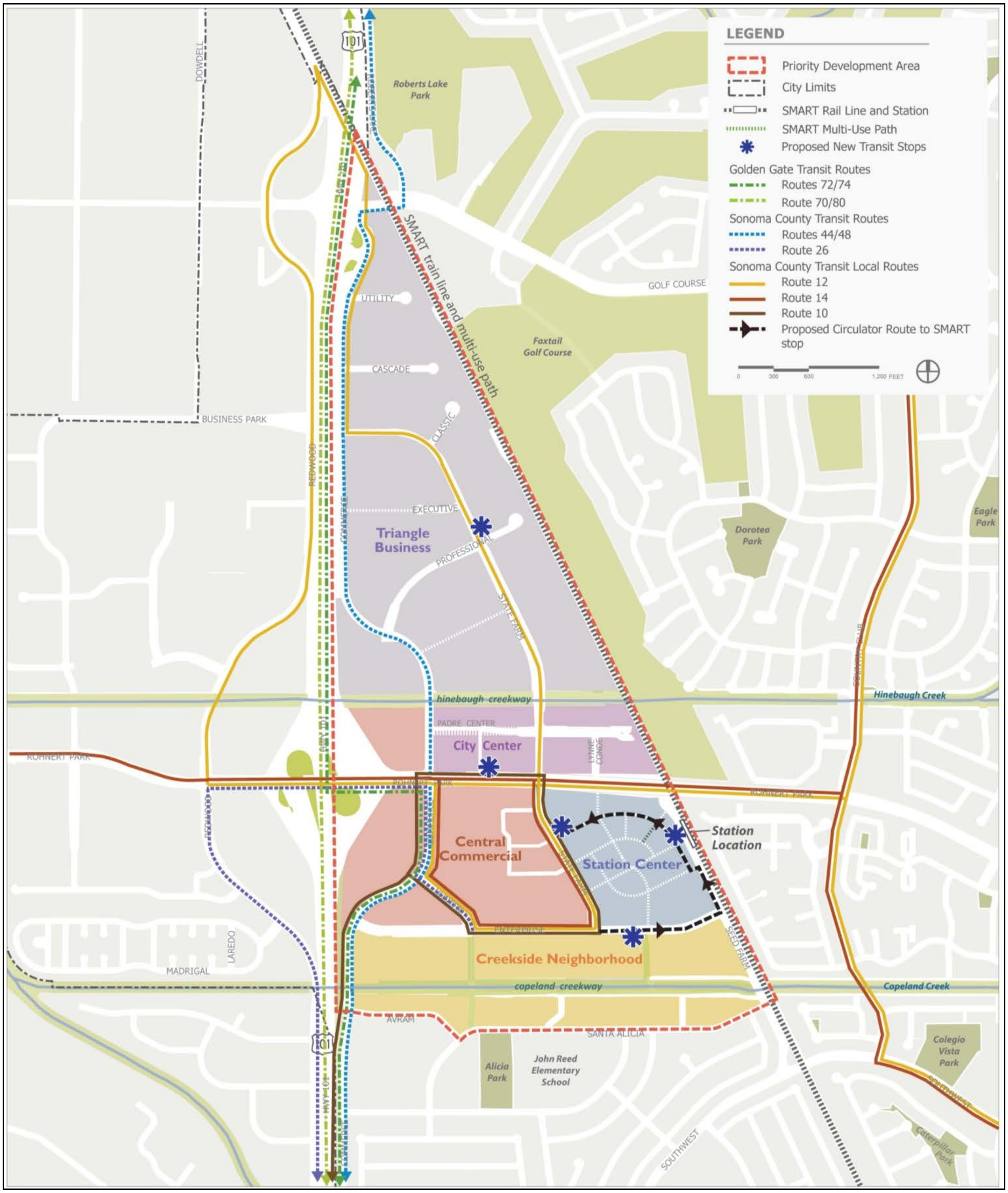
Source: W-Trans, 2015.

Transit Facilities

Existing transit service in the vicinity of the plan area is provided by Sonoma County Transit (SCT), Golden Gate Transit (GGT), and Dial-a-Ride. Existing transit service are described in this section and illustrated within Figure 3.16-3. Refer to Chapter 2.0, “Project Description,” for proposed plan transit improvements.

Sonoma County Transit

SCT is the principal transit service in Rohnert Park, providing daily local and intercity service. SCT local Routes 10, 12, and 14 operate together to provide transit access to destinations on both the east and west sides of U.S. 101. Each local route operates with approximately 90- to 120-minute headways between 6:00 a.m. and 6:00 p.m. on weekdays and between 9:30 a.m. and 3:00 p.m. on Saturdays; no local service is provided on Sundays.



Source: AECOM, 2015

Figure 3.9-3: Existing and Planned Transit Service

The nearest SCT bus stops serving the plan area are at RPX and Commerce Boulevard; Raleys Towne Centre on State Farm Drive between RPX and Enterprise Drive; the Senior Center on Hunter Drive; and Chase Bank on RPX between Commerce Boulevard and State Farm Drive. On weekdays, the plan area is served by SCT Routes 10, 12/14, 26, and 44/48. On weekends, the plan area is served by SCT Routes 10/12 and 44/48.

All SCT buses are wheelchair lift–equipped and can transport two wheelchair passengers at a time. SCT allows bicycles on all of its buses. Buses are equipped with a front-loading bicycle rack that accommodates either two or three bicycles. When the front-loading rack is full, bus drivers may allow up to two bicycles inside the bus.

Golden Gate Transit

GGT provides daily interregional service along the U.S. 101 corridor between Santa Rosa and San Francisco. Route 72 provides weekday commuter service between Santa Rosa and San Francisco, with a southbound stop at RPX and one northbound at U.S. 101 and RPX. Route 72 operates with 20- to 30-minute headways on weekdays only, with southbound service into San Francisco between 4:00 a.m. and 7:00 a.m. and northbound service out of San Francisco between 3:30 p.m. and 7:30 p.m. GGT Route 101 operates daily along the U.S. 101 corridor between Santa Rosa and San Francisco, with a stop on Commerce Boulevard at RPX. Southbound Route 101 service in Rohnert Park begins around 4:00 a.m., with approximately 1-hour headways until 10 p.m. In the northbound direction, Route 101 operates at approximately 1-hour headways between 7:30 a.m. and 2:00 a.m. All GGT buses are wheelchair-accessible and equipped with a front-loading bicycle rack that accommodates either two or three bicycles. On express buses, storage space for bicycles is provided under the coach.

Dial-a-Ride

Dial-a-Ride, also known as paratransit or door-to-door service, is available for those who are unable to independently use the transit system because of a physical or mental disability. Sonoma County Paratransit is designed to serve the needs of individuals with disabilities in Sonoma County. Service days are Monday through Friday from 5:00 a.m. to 11:00 p.m., and Saturday and Sunday from 7:00 a.m. to 9:00 p.m.

Sonoma-Marin Area Rail Transit

The Sonoma-Marin Area Rail Transit (SMART) commuter rail system is a 70-mile rail line that is planned to run from Cloverdale, at the north end of Sonoma County, to Larkspur, where the Golden Gate Ferry connects Marin County with San Francisco. Along the way, SMART will have stations at the major population and job centers of the North Bay, including the Downtown Rohnert Park station, which is just south of RPX in the core of the plan area. Train service will be provided by an estimated 14 round-trip trains on weekdays and four round-trip trains on weekends. Headways during the morning and evening commute periods will be 30 minutes, with longer headways during midday, evening, and weekend periods. SMART plans to initiate rail service between Airport Boulevard in northern Santa Rosa and downtown San Rafael in 2016.

3.9.2 Regulatory Framework

California Department of Transportation

Caltrans is the primary state agency responsible for approving the planning, design, and construction of improvements for all state-controlled facilities, including U.S. 101 and the associated interchanges for these facilities in the plan area. The following Caltrans procedures and directives are relevant to the transportation analysis conducted for the proposed plan:

- *LOS Target:* Caltrans has established a LOS target of LOS E[2] on mainline U.S. 101 through Rohnert Park and LOS D for freeway ramp intersections. Where a facility is operating at less than these thresholds without the project, the existing measure of effectiveness (MOE) should be maintained.
- *Caltrans Director's Policy 22:* This policy establishes support for balancing transportation needs with community goals. Caltrans seeks to involve and integrate community goals in the planning, design, construction, and maintenance and operations processes, including accommodating the needs of bicyclists and pedestrians.

Sonoma County Transportation Authority Congestion Management Program

In November 1990, the Sonoma County Transportation Authority (SCTA) was designated as the congestion management agency (CMA) for Sonoma County. In 1997, the SCTA relinquished its position as the CMA under new state legislation that made this function optional. SCTA now serves as the coordinating and advocacy agency for transportation funding for Sonoma County.

The *2009 Comprehensive Transportation Plan for Sonoma County* (2009 CTP) is the latest countywide planning document approved by SCTA. The 2009 CTP includes goals, objectives, and policies for improving mobility on Sonoma County's streets, highways, and transit system and bicycle/pedestrian facilities, and outlines the regional improvements needed to reduce transportation-related impacts over the next 25 years. SCTA also oversees Measure M, the Traffic Relief Act for Sonoma County, which is a sales tax measure that was passed by Sonoma County voters in November 2004. Completion of the Golf Course Drive interchange at U.S. 101 and widening of U.S. 101 with high-occupancy vehicle and auxiliary lanes are recent Measure M projects overseen by SCTA that have improved circulation in Rohnert Park.

Sonoma County General Plan 2020

The *Sonoma County General Plan 2020* is a long-range planning document that carries forward Sonoma County's major goals and policy framework, focused on specific issues of importance to the community. The plan states that there is growing support to move beyond a transportation system based solely on automobile travel. Public opinion has shown that county residents think that:

- highway expansion leads to greater traffic volumes, and, in the long run, more congestion;

[2] Caltrans LOS thresholds for Rohnert Park obtained from Graton Rancheria Casino and Hotel Project—Draft Environmental Impact Statement scoping comments written by Caltrans, April 2004.

- county and city land use policies favoring city-centered growth suggest that a firm commitment to a convenient transit system will be more effective in reducing congestion over time;
- road capacity improvements that would be needed to provide high mobility will likely cause disruption of some communities, businesses, and neighborhoods;
- lack of convenient public transit and safe bicycle and pedestrian facilities is a major barrier to reducing dependence on automobiles; and
- an automobile-dependent transportation network is unsustainable and has a significant impact on public health.

Following is a list of the county's general plan goals, objectives, and policies related to transportation and traffic that are applicable to the proposed plan, and future development that would be allowed under the *Sonoma County General Plan*.

Goal CT-1: Provide a well-integrated and sustainable circulation and transit system that supports a city- and community-centered growth philosophy through a collaborative effort of all the cities and counties.

- **Objective CT-1.4:** Reduce the need for future automobile use by a combination of improvements and land development policies that give equal favor to alternate modes as to automobile use.
- **Objective CT-1.5:** Reduce greenhouse gas emissions by minimizing future increase in vehicle miles traveled (VMT), with an emphasis on shifting short trips by automobile to walking and bicycling trips.
- **Objective CT-1.8:** Improve demand for transit by development of a growth management strategy encouraging projects in urbanized areas that decrease distance between jobs and housing, increase the stock of affordable housing, and increase density.
  - **Policy CT-1k:** Encourage development that reduces VMT, decreases distances between jobs and housing, reduces traffic impacts, and improves housing affordability.

Goal CT-2: Increase the opportunities, where appropriate, for transit systems, pedestrians, bicycling, and other alternative modes to reduce the demand for automobile travel.

Goal CT-3: Establish a viable transportation alternative to the automobile for residents of Sonoma County through a safe and convenient bicycle and pedestrian transportation network, well integrated with transit, which will reduce greenhouse gas emissions, increase outdoor recreational opportunities, and improve public health.

- **Objective CT-3.3:** Encourage pedestrian, bicycle, and transit oriented development.
- **Objective CT-3.8:** Increase the safety, convenience, and comfort of all pedestrians and bicyclists, by eliminating the potential obstacles to this mode choice that is associated with the lack of continuous and well-connected pedestrian walkways and bicycle facilities, and the lack of safe crossing facilities, especially focusing on short trips that could result in a decrease in automobile travel.
  - **Policy CT-3g:** Revise County Traffic Guidelines to require that traffic studies identify impacts on existing and planned bicycle and pedestrian facilities. Consider development of bicycle and pedestrian facilities as mitigation measures for congestion and greenhouse gas emission impacts.

- **Policy CT-3h:** Develop a LOS standard for identifying performance of the bicycle and pedestrian transportation network that takes into consideration travel distance, potential bicycle and pedestrian transportation needs, potential for improved mode split with improved facilities, and existing network deficiencies.
- **Policy CT-3i:** Use the LOS standard developed by Policy CT-3h to evaluate impacts on bicycle and pedestrian facilities that may result from discretionary projects, and identify corrections and/or improvements necessary to mitigate those impacts.

Goal CT-4: Provide and maintain a highway system capacity that serves projected highway travel demand at acceptable LOSs in keeping with the character of rural and urban communities.

- **Objective CT-4.1:** Maintain LOS C or better on roadway segments unless a lower LOS has been adopted.
- **Objective CT-4.2:** Maintain LOS D or better at roadway intersections
- **Objective CT-4.3:** Allow the above LOSs to be exceeded if it is determined to be acceptable due to environmental or community values, or if the project(s) has an overriding public benefit that outweighs lower LOSs and increased congestion.

Sonoma County Community Climate Action Plan

The *Sonoma County Community Climate Action Plan*, established in 2005, has a goal of reducing Sonoma County's greenhouse gas emissions by 25 percent below 1990 levels by 2015. The plan calls for increased use of alternatives methods of transportation, improvements in energy and water efficiency, investments in locally sourced renewable energy projects, and the conservation of forests and farmland while converting waste into energy.

City of Rohnert Park General Plan

The *City of Rohnert Park General Plan* outlines a vision of long-range physical and economic development and resource conservation that reflect the aspirations of the community. The Transportation Element contains goals and policies to encourage the conservation and proper management of the community's resources. Following is a list of the City's general plan policies related to transportation and traffic that are applicable to the proposed plan and future development that would be allowed under the *City of Rohnert Park General Plan*.

- **Policy TR-1:** Establish LOS C as the minimum standard for all arterial and collector roadway segments ("segments") and intersections, except for (1) specified segments and intersections for which allowable LOS standards are otherwise established [these are referenced in Table 4.1-2 of the General Plan and include the intersections at Golf Course Drive/U.S. 101 South Ramps, Commerce Boulevard/Golf Course Drive, and Commerce Boulevard/U.S. 101 Northbound Ramps]; and (2) segments and intersections that are operating at LOS D or lower at the time an application for a development project or a specified plan is submitted if no feasible improvements exist to improve the LOS. The then-existing LOS may be permitted to be the standard for those segments and intersections in category (2), provided that the LOS not be permitted to deteriorate further due to the proposed development project or specific plan.

- **Policy TR-2:** Require mitigation measures, as needed, for new development that increases traffic such that LOS levels fall below the established minimum standard. Ensure that mitigation measures are coordinated with roadway improvements programmed for funding through transportation-related impact fees.

Goal TR-J: Reduce peak-hour traffic congestion and associated impacts, including air pollution, energy consumption, and noise.

Goal TR-K: Reduce the need for roadway improvements by making more efficient use of existing roads, bikeways, transit service, and other transportation facilities and services.

- **Policy TR-21A:** Work with Sonoma County, the City of Santa Rosa, the City of Cotati, and the City of Petaluma ("Contributing Jurisdictions") and the SCTA to plan and implement selected improvements necessary to mitigate impacts of increased traffic congestion on major roads and intersections in Penngrove ("Regional Mitigation Plan"). The Regional Mitigation Plan shall include those roadways and other improvements necessary to mitigate the impacts of increased traffic congestion on major roads and intersections in Penngrove ("Regional Mitigation Projects"), and a financing plan that explains how those improvements will be funded and that determines each Contributing Jurisdiction's proportional share. The City shall contribute its proportional share of the total cost of the Regional Mitigation Plan provided that the City's participation is roughly proportional to the traffic impacts from new development in Rohnert Park.

  The City's payment or other contribution of its proportional share shall be provided when all of the following occur: (1) A Regional Mitigation Project is approved by the Sonoma County Board of Supervisors, and each of the Contributing Jurisdictions; (2) a financing plan for the Regional Mitigation Project has been approved by the Sonoma County Board of Supervisors, and each of the Contributing Jurisdictions; (3) new development that contributes to the traffic impacts to be mitigated by the project receives final approval by the City; and (4) each of the Contributing Jurisdictions has appropriated its proportional share to the Regional Mitigation Project. In the event that other jurisdictions do not contribute their proportional share to the Regional Mitigation Project, and funding for their proportional share is provided by some other means to ensure implementation of the Regional Mitigation Project, the City will contribute and be limited to its proportional share.

- **Policy TR-22:** In cooperation with the Chamber of Commerce, adopt a nonmandatory employer based transportation demand management (TDM) program for Rohnert Park businesses.
- **Policy TR-23:** Allow reductions in transportation impact fees on new nonresidential development commensurate with provision of TDM measures, and develop reduction parameters.

Goal TR-L: Promote local and regional public transit serving Rohnert Park and facilitate transfers between transit routes and operators.

- **Policy TR-27:** Work with SCT and GGT to develop an expanded bus route system, in order to serve areas of new development in Rohnert Park.
- **Policy TR-30**: In consultation with GGT and SCT, determine appropriate locations of new bus stops, in conjunction with increased service and expanded routes.

- **Policy TR-31:** Require project proponents to provide bus stops and shelters in conjunction with new development.
- **Policy TR-32:** Work with SCT, GGT, and private developers to ensure that bus stops and shelters adhere to the following standards:
  - Bus pull-outs shall be required at bus stop locations, in order to prevent stopping buses from interfering with traffic flow;
  - Bus stop locations shall allow direct, convenient pedestrian access to adjacent development;
  - Pedestrian access to bus stops shall be safe and comfortable;
  - Bus shelters shall provide adequate protection from sun, wind, and rain;
  - Bus stops and shelters shall display schedules and routes; and
  - Bus shelters shall be adequately designed and sized to accommodate waiting passengers during inclement weather.

3.9.3 Impact Discussion

The applied thresholds of significance for intersection impacts are based on those included in Policy TR-1 of the *City of Rohnert Park General Plan*. The proposed plan would create a significant circulation impact if it would:

- fail to maintain LOS C as the minimum standard for signalized intersections in Rohnert Park, except for the following three intersections where LOS D operation is allowed: Golf Course Drive West/U.S. 101 Southbound Ramps, Golf Course Drive/Commerce Boulevard, and Commerce Boulevard/U.S. 101 Northbound Ramps; or
- add traffic to an unsignalized intersection where individual movements are projected to operate at LOS F and the peak-hour signal warrant criteria in the *California Manual on Uniform Traffic Control Devices*, 2012, would be met.

The applied threshold of significance for the U.S. 101 freeway segments is based on the *Caltrans Guide for the Preparation of Traffic Impact Studies* (Caltrans, 2002). A project would create a significant impact on freeway facilities if it would:

- fail to maintain operation on U.S. 101 at or above the LOS E threshold, or in cases where the freeway is already projected to operate deficiently at LOS F without the project, fail to maintain the existing MOEs. For such instances where the freeway is anticipated to operate at LOS F, the freeway volume-to-capacity (v/c) ratio is calculated and used as the MOE. A project-attributable increase in the v/c ratio of 0.01 or greater is considered to be a cumulatively significant impact.

3.9a. Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and nonmotorized travel and relevant components of the circulation system, including but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit? Significant and Unavoidable Impact.

Construction

The proposed plan would allow for construction of approximately 835 new residential units and approximately 823,000 square feet of additional nonresidential uses including commercial, office, and light industrial among five subareas. The proposed plan is a programmatic land use master plan. Therefore, individual developments that could occur in the future under this proposed plan would undergo project-level environmental evaluation to determine whether they could result in further impacts specific to the development proposal. At that time, construction-level analyses would be conducted. Accordingly, the following environmental analysis is conducted at a programmatic level.

Construction of the future development permitted under the proposed land use master plan would generate temporary construction-related truck and automobile traffic on the adjacent and internal street network. This traffic includes construction workers traveling to and from the plan area, as well as trucks hauling construction materials to the site and evacuation material away from the site. Because the truck trips would be spread throughout the day and would generally occur during nonpeak hours, the level of construction-related traffic would result in a *less-than-significant* impact on the plan area street network.

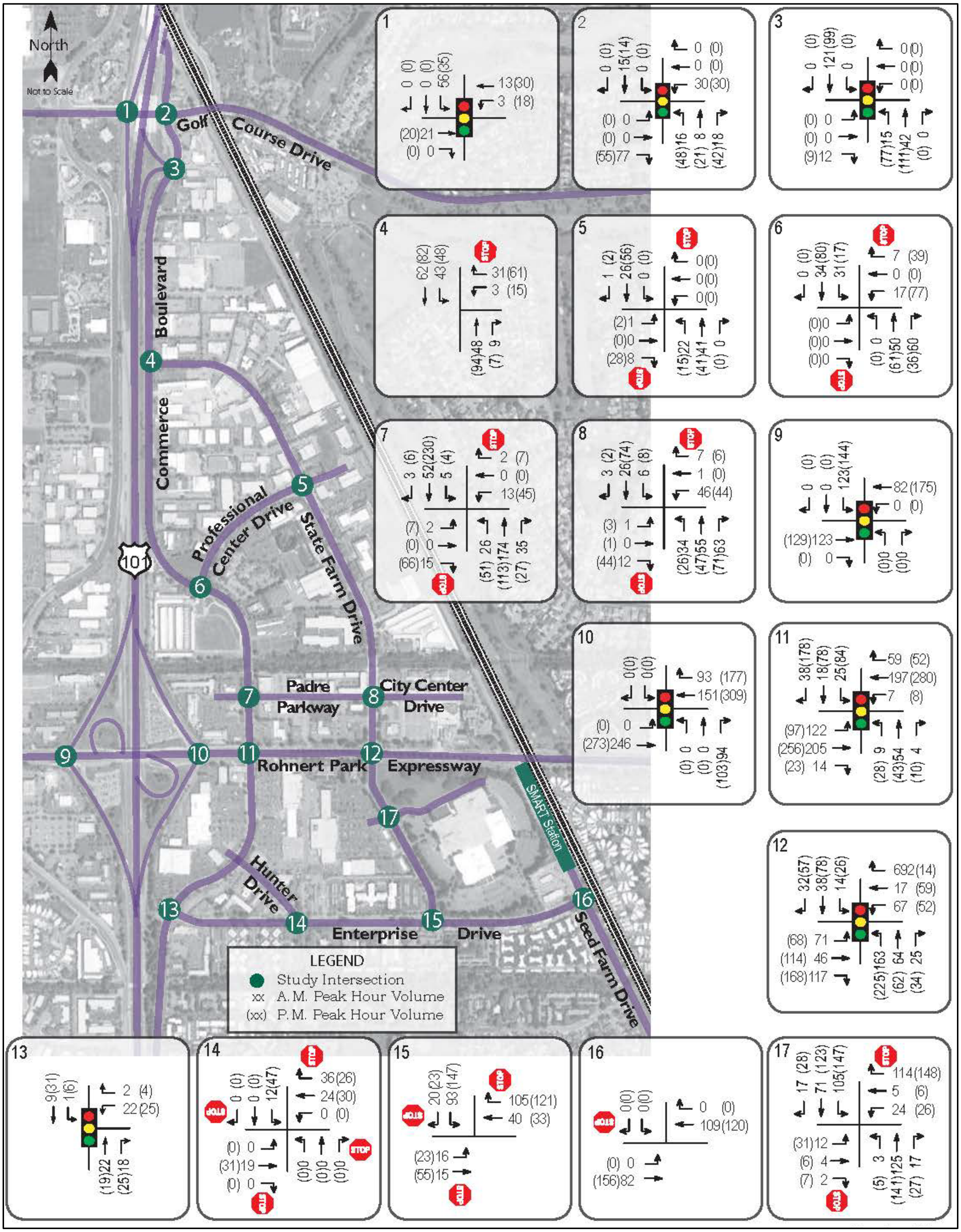
Operation

Future development permitted under the proposed land uses in the plan area would be expected to generate a total of 27,777 added vehicle-trips per day, including 1,352 during the a.m. peak hour and 1,973 during the p.m. peak hour. Project-added traffic volumes are illustrated in Figure 3.9-4. A summary of the trip generation estimates by plan area subarea is shown in Table 11 of Appendix E.

The vehicle-trip distribution pattern used to allocate trips to and from uses within the plan area to the surrounding local and regional street network was based on two “select zone” model runs conducted in the Sonoma County Travel Model (SCTM/10), one of which is based on residential uses and the other of which assumes a mix of employment-based nonresidential uses. The resulting trip distribution estimates were then refined further to reflect local street and travel patterns. The trip distribution estimates are shown in Table 12 of Appendix E.

Traffic analyses evaluating potential impacts on the surrounding circulation network were completed during development of the proposed plan. This was done to test alternative roadway and intersection configurations, and ultimately to determine the circulation improvements that should be included in the plan itself to “self-mitigate” potential impacts to the degree possible. A list of the intersection-related improvements included in the proposed plan is shown in Table 3.9-6.

With the addition of plan-generated vehicle traffic to existing traffic volumes and completion of the intersection improvements identified in the proposed plan (see Table 3.9-6), the intersections at RPX/Commerce Boulevard and RPX/State Farm Drive are expected to continue to operate at unacceptable conditions (LOS D or worse). However, because these two intersections already operate at LOS D without the proposed plan, and the proposed plan would not further degrade LOS, this is considered to be acceptable per *City of Rohnert Park General Plan* Policy TR-1. At an additional five intersections (Commerce Boulevard/State Farm Drive, Commerce Boulevard/Padre Parkway, State Farm Drive/City Center Drive, Enterprise Drive/State Farm Drive, and State Farm Drive/Town Center), plan-generated vehicle traffic would cause the intersection to degrade to unacceptable



Source: W-Trans, 2015

Figure 3.9-4: Project Traffic Volumes

Table 3.9-6 Intersection Improvements Included in the Proposed Plan

Intersection	Improvements
Commerce Boulevard/State Farm Drive	Signalize with SB left-turn protected phasing and WB right-turn overlap; add WB right-turn pocket.
State Farm Drive/Professional Center Drive	Modify NB and SB from L-T-TR to L-TR.
Commerce Boulevard/Padre Parkway	Signalize with protected phasing NB/SB and permitted phasing EB/WB; modify NB from L-T-TR to L-T-R and SB from L-T-TR to L-TR
State Farm Drive/City Center Drive	Signalize with protected phasing NB/SB and permitted phasing EB/WB; modify NB from L-T-TR to L-T-R and SB from L-T-TR to L-TR.
RPX/Commerce Boulevard	Convert Commerce Boulevard to protected phasing and add NB right-turn overlap; modify SB from L-LT-T-R to L-T-T-R; add bulbout NW corner; extend EB left lanes to 350 feet and WB left lane to 225 feet.
RPX/State Farm Drive	Convert State Farm Drive to protected phasing; add right-turn overlaps all approaches; modify SB from L-LT-R to L-L-T-R and NB from L-LT-T-R to L-L-T-R.
Enterprise Drive/Hunter Drive	Convert EB from LT-TR to L-TR and WB from LT-TR to LT-R.
Enterprise Drive/State Farm Drive	Signalize with two-phase operation; modify WB from T-TR to T-R.
State Farm Drive/Town Center	Signalize with protected phasing NB/SB and permitted phasing EB/WB; modify NB and SB from L-T-TR to L-T-R; modify EB/WB from LTR to LT-R.
RPX/Lynne Conde Way	Add protected pedestrian crossing on RPX (pedestrian signal or HAWK signal); continue to restrict side street movements to right turns on/off of RPX.
RPX/SMART multi-use path	Add protected pedestrian crossing on RPX (pedestrian signal or HAWK signal).

Notes:
EB = eastbound; NB = northbound; RPX = Rohnert Park Expressway; SB = southbound; WB = westbound
L = left-turn lane; R = right-turn lane; T = through lane; lanes shown as grouped (example: L-T-TR is a 3-lane approach with one left-turn lane, one through lane, and a shared through-right-turn lane).

Source: AECOM, 2015.

conditions, but the intersection improvements under the proposed plan would improve operations to acceptable conditions. All of the other 10 study intersections are projected to continue operating at acceptable LOS according to the City’s standards. Therefore, the proposed plan would result in a *less-than-significant* impact related to intersection LOS. A summary of intersection LOS is shown in Table 16 of Appendix E.

The addition of traffic associated with build-out of the proposed plan would lead to further degradation of three freeway segments already projected to operate at LOS F without the proposed plan. On the remaining freeway segments, the proposed plan would increase the v/c ratio, but would not be expected to cause operation to fall below LOS E during either peak hour. A summary of freeway segment LOS is shown in Table 17 and Table 18 of Appendix E.

Specifically, the proposed plan would increase the v/c ratio on northbound U.S. 101 between Golf Course Drive and Santa Rosa Avenue, and between Santa Rosa Avenue and Todd Road by 0.04 during the p.m. peak hour, and on southbound U.S. 101 between Todd Road and Golf Course Drive by 0.04 during the a.m. peak hour and 0.03 during the p.m. peak hour. According to Caltrans’ thresholds of significance for U.S. 101 freeway segments, the proposed plan's contribution to unacceptable LOS conditions (from LOS E to LOS F) at these three locations is considered a *significant* impact.

While the proposed plan would increase v/c ratios on segments of U.S. 101, the Metropolitan Transportation Commission, Sonoma County, the City of Rohnert Park, and SCTA recognize that U.S. 101 will experience congestion into the foreseeable future, and that there will be no further major capacity enhancements such as expansions or new freeways. All four agencies concur in various planning and policy documents that long-range solutions to regional mobility must focus on better land use planning that supports transit and alternative transportation modes; stronger jobs-housing balances; and increased support of transportation demand measures.

The creation of designated plan areas by the Metropolitan Transportation Commission and the Association of Bay Area Governments, including the plan area that is the subject of this analysis, is intended to further these goals and minimize impacts created by regional traffic demands. Policies included in the *Sonoma County General Plan 2020* and *City of Rohnert Park General Plan* to increase transit and travel demand management would also help reduce congestion.

The proposed plan would also be consistent with Caltrans Director's Policy 22, which establishes support for balancing transportation needs with community goals, including accommodating the needs of bicyclists and pedestrians.

The projected unacceptable operation on U.S. 101 could be mitigated by widening the freeway to include additional through lanes in each direction. Further widening of U.S. 101 is not included in SCTA's Comprehensive Transportation Plan, nor do any financing mechanisms currently exist to fund such a widening project. Widening the freeway would require major reconstruction of multiple freeway structures, right-of-way acquisition including many homes and businesses, potential relocation of city streets paralleling the freeway corridor (including Redwood Drive and Commerce Boulevard), and the likely creation of additional secondary environmental impacts. The environmental, social, and financial impacts render such a widening project infeasible. Therefore, no feasible mitigation is available to reduce this impact to a less-than-significant level, and this impact would be *significant and unavoidable.*

3.9b. Conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways? Less-than-Significant Impact.

Development within the plan area would be subject to the circulation and connectivity goals and policies detailed in Section 5.2 of the proposed plan—specifically, Policies C-1.2 and C-1.3 related to LOS. Policy C.1-2 would allow for lower LOS standards (than the current LOS C standard) for specified arterial and collector roadway intersections in the plan area where no other feasible improvements exist to improve LOS, as guided by Policy TR-1 of the General Plan. Policy C.1-1 recognizes that future development of the plan area would contribute to unacceptable operation on U.S. 101, where no further capacity enhancements are considered feasible, while also acknowledging that the type of development pattern envisioned by the proposed plan plays an important role in reducing regional traffic impacts through smart growth.

The proposed plan would not conflict with an applicable congestion management program for designated roads or highways. Therefore, this impact would be *less than significant*.

3.9c. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks? No Impact.

The proposed plan would not result in a change in air traffic patterns, including either an increase in air traffic levels or a change in location that would result in substantial safety risks during construction or operation. The closest airports are the Sonoma County Airport and Petaluma Municipal Airport, both more than 10 miles from the plan area. There would be no safety risks associated with proximity to airports; therefore, *no impact* would occur.

3.9d. Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e. g. farm equipment)? No Impact.

The proposed plan does not include any hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses, and would not alter design features developed to mitigate such hazards during construction or operations. Therefore, *no impact* would occur.

3.9e. Result in inadequate emergency access? Less-than-Significant Impact.

The proposed plan would not interfere with emergency access or result in inadequate emergency access. The proposed plan would be designed consistent with City and Caltrans standards as required to ensure that adequate emergency access is provided. Therefore, the proposed plan would result in a *less-than-significant* impact.

3.9f. Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities? Less-than-Significant Impact.

The proposed plan identifies several locations where new transit stops would be beneficial, and identifies a potential new bus circulator route serving the SMART rail station via new streets in the Station Center subarea. The circulator route could be used by diverting existing routes once the SMART rail station and development in the Station Center subarea are complete. The street network depicted for the Station Center subarea allows considerable flexibility for transit operators in determining routing, including the ability to continue serving existing stops in the vicinity. The proposed plan would support and encourage the use of transit by concentrating development around existing bus facilities and the planned SMART rail station, and by accommodating new or diverted bus routes, as guided by Policy C-4.1, that directly interface with the station.

A major goal of the proposed plan is to enhance pedestrian and bicycle circulation, expanding and improving current networks that make walking and bicycling a preferred mode of travel for residents, employees, and visitors to Central Rohnert Park. The proposed plan includes guiding policies with this goal in mind. Implementation of Policy C-2.1 would result in the retrofitting of existing streets in the plan area to support safe and continuous bike and pedestrian facilities. Policy C-3.1 would ensure expanded bike and pedestrian connections. The pedestrian and bicycle enhancements identified in the proposed plan have also been crafted to create convenient connections to the SMART rail station and SMART corridor regional multiuse path. The new and enhanced on- and off-street pedestrian and bicycle improvements identified in the proposed plan build on and are consistent with facilities identified in existing plans, specifically, the *Rohnert Park Bicycle and Pedestrian Master Plan*. The pedestrian and bicycle facilities identified in the proposed plan would encourage travel by nonauto modes and help to support future growth in Central Rohnert Park. The new pedestrian and bicycle crossings identified in the proposed plan can be designed to enhance pedestrian and bicycle circulation in a manner that does not adversely affect traffic flow or safety at the SMART rail crossing.

The proposed plan, including transit and bicycle and pedestrian improvements, are consistent with the goals and policies identified in Section 3.9.2, "Regulatory Framework." Implementation of the proposed plan would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities. Therefore, the proposed plan would result in a *less-than-significant* impact.

3.9.4 Cumulative Impacts

The traffic analysis of the proposed plan, described above, addresses cumulative impacts to the transportation network in the plan area and its surroundings. Future traffic volume projections were obtained from the Sonoma County Travel Model (SCTM/10), which is maintained by the SCTA. The SCTM/10 model includes traffic projections anticipated to occur upon build-out of all development anticipated to take place by the year 2040 throughout Sonoma County. As such, cumulative impacts would be the same as plan-specific impacts. Impact 3.9a related to unacceptable LOS F operation on U.S. 101 would remain significant and unavoidable, as discussed, and would constitute a *significant and unavoidable* cumulative impact.

3.9.5 References

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4.0 OTHER CEQA-REQUIRED SECTIONS

4.1 SIGNIFICANT ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED

Based on the environmental analyses in this EIR, the City has determined that the proposed plan in conjunction with cumulative development within the City of Rohnert Park would result in a significant and unavoidable impact associated with the following issue area, with this specific significant and unavoidable impact discussed briefly below.

- **Transportation and Traffic:** Significant and unavoidable impact related to level of service along U.S. Highway 101

The proposed plan in conjunction with cumulative development within the City of Rohnert Park would result in worsened level of service for a.m. and p.m. peak hour traffic along a segment of U.S. Highway 101 immediately north of the plan area. This impact would be significant. No mitigation is available to reduce this significant impact to a less-than-significant level. Therefore, this impact would be significant and unavoidable.

4.2 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES

CEQA and the State CEQA Guidelines (Section 151826[c]) require that an EIR address “significant irreversible environmental changes which would be involved in the Project, should it be implemented.”

If the proposed plan is implemented, redevelopment of the plan area would involve the use of nonrenewable resources during the construction phase. Construction would include the use of building materials, such as petroleum-based products and metals that cannot reasonably be recreated. Construction also would involve significant consumption of energy, usually petroleum-based fuels that deplete supplies of nonrenewable resources. Construction of structures and infrastructure would consume energy and water; however, because of its temporary and one-time nature, construction under the proposed plan would not represent a significant irreversible use of resources.

Once construction is complete, the land uses associated with the proposed plan would use some nonrenewable fuels to heat and light structures and consume water. Plan elements would be built to current codes, including the California Green Building Standards Code, which requires insulation and support designs that minimize wasteful energy consumption. Specific projects under the proposed plan would be as energy efficient as possible and would be located in an area that is served by public transportation, including bus service and, in the near future, the Sonoma-Marin Area Rail Transit commuter rail service. Finally, because the land uses associated with the proposed plan would consume less energy for heat and light and water for irrigation and plumbing than the existing land uses in the plan area, operation under the proposed plan would represent a decreased use in resources, and thus would not represent a significant irreversible use of resources.

4.3 GROWTH-INDUCING IMPACTS

Section 15126.2(d) of the State CEQA Guidelines requires that an EIR discuss the ways in which a proposed project or plan could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Typical growth inducing factors might be the extension of urban services or transportation infrastructure to a previously unserved or underserved area, or the removal of major barriers to development. This section evaluates the proposed plan's potential to create such growth inducements. Not all aspects of growth inducements are negative; rather, negative impacts associated with growth inducement occur only where the projected growth would cause adverse environmental impacts.

Growth-inducing impacts fall into two general categories: direct or indirect. Direct growth-inducing impacts are generally associated with providing urban services to an undeveloped area. Indirect, or secondary growth-inducing impacts consist of growth induced in the region by additional demands for housing, goods, and services associated with population increase caused by or attracted to, a new project.

The State CEQA Guidelines, as interpreted by the City, state that a significant growth-inducing impact may result if the proposed plan would:

(1) induce substantial population growth in an area (for example, by proposing new homes and commercial or industrial businesses beyond the land use density/intensity envisioned in the community plan);
(2) substantially alter the planned location, distribution, density, or growth rate of the population of an area; or
(3) include extensions of roads or other infrastructure not assumed in the community plan or adopted Capital Improvements Project list, when such infrastructure exceeds the needs of the project and could accommodate future developments.

The plan area is located within an existing developed area of the City. Implementation of the proposed plan would directly induce growth within the City, but not propose it in a manner that is beyond the city-wide land use densities/intensities envisioned in the General Plan. According to City's General Plan (City of Rohnert Park, 2015 [originally adopted 2000]), the year 2020 build-out for the City is estimated at 51,332[1] (as of September 2010). According to the U.S. Census Bureau (2013), as of 2013, the City's population was 41,039 people. According to the Association of Bay Area Governments (ABAG), the City's population is expected to increase by 6,861 from the 2013 population estimates by 2020 (ABAG, 2009), resulting in a total anticipated population of 47,900 by 2020. Implementation of the proposed plan would include the construction of up to 835 residential units, which would increase the population of the plan area and the City by 1,670 residents. The population growth that could be accommodated by the proposed plan would be consistent with growth projections for the City.

Direct growth from the proposed plan would include a maximum of 440,886 square feet of retail and service commercial facilities; up to 62,807 square feet of public institutional facilities; up to 189,315 net square feet of office facilities; up to 129,315 net square feet of new light industrial facilities; and improvements to plan area circulation, which would include roadways, bike/pedestrian facilities, and transit facilities. Some planned infill development is not factored into the City's General Plan, particularly the new residential and retail development proposed in the Station Center subarea at higher densities/intensities than the site's current zoning for commercial office and public-institutional uses and the potential new commercial uses in the Triangle Business subarea.

Indirect growth as a result of nonresidential development included in the proposed plan would create approximately 1,900 jobs and could increase housing demand. For a conservative analysis, it is assumed that all

1 From Table 2.3-3 of the General Plan (page 2-26). It is noted in the table that the total build-out of the General Plan is neither anticipated by nor specified in the General Plan, nor guided by City policy.

1,900 employees would relocate to the area, introducing 1,900 employee-related residents to the city. In combination with the 1,670 permanent residents added by new residential development, the service area population would be 3,570, which would constitute approximately 52 percent of the growth anticipated in 2020 ABAG projections for Rohnert Park. This level of indirect growth would be consistent with ABAG's projection for Rohnert Park by 2020.

Construction of future development is anticipated to generate temporary construction-related jobs. The addition of construction jobs associated with development allowed under the proposed plan could be supported by the skill sets available in the Rohnert Park area's labor pool. Construction employment often has no regular place of business and requires commuting to job sites that change several times a year. Many construction workers are specialized, which limits the duration of a construction worker to a project, and some construction workers are likely to be drawn from the preexisting Rohnert Park labor pool. Consequently, project-related construction workers would not be likely to relocate their place of residence as a result of working on future developments under the proposed plan. This impact associated with temporary jobs would be less than significant, as discussed further in Section 5.5, "Population and Housing," of Chapter 5.0, "Effects Found Not To Be Significant."

The plan area currently consists of existing development and associated infrastructure (i.e., water, sewage, and electricity; see Chapter 2.0, "Project Description," for a more details on the existing plan area setting). Implementation of the proposed plan would include the utilization of existing backbone infrastructure systems (see Figure 2-11, "Existing Water Infrastructure System," and Figure 2-12 "Existing Sewer Infrastructure System," in Chapter 2.0) to accommodate future development proposed in the plan area. Implementation of the proposed plan would not require the extension of existing infrastructure systems that could induce growth in other areas. Therefore, the proposed plan would not include any significant infrastructure expansion that would facilitate growth in other areas of the city. In addition, the proposed plan would be compatible with the surrounding residential and commercial land uses and would not pressure adjacent properties to redevelop with new or different land uses. As a result, it is not anticipated that nearby residents would relocate.

The proposed plan would also not significantly affect the permanent jobs/housing balance. As discussed above, nonresidential development included in the proposed plan would create approximately 1,900 jobs, which would increase housing demand above what would otherwise occur in the City. The proposed plan would also include for up to 835 new residential units. According to the City's person per household rate,[2] the number of units associated with the proposed plan would provide for 1,670 new residents. This is nearly a 1:1 ratio of new jobs/housing (1,900 new jobs/1,670 new residents).

According to the General Plan, the City expects a 25 percent increase in employment located within the City at General Plan build-out from the time the General Plan was initially approved (July 2000). The City estimated a total of 21,900 existing jobs within the City in 1999, with a City build-out of 29,479 total jobs (City of Rohnert Park, 2015). The number of jobs created by the proposed plan would represent 25 percent of the total available new jobs projected for the City's build-out.

Although the General Plan did not anticipate some of the land use changes in the proposed plan, the direct population growth created by implementation of the proposed plan would still be consistent with the General

[2] The City's persons-per-household rate is 2 people per unit, is based on City Municipal Code Section 17.19.040, "Phasing and Pace of Development—Facts and Assumption" (City Ordinance 755 § 4, 2006; Ord. 711 § 2[part], 2004; Ord. 695 §3, 2003).

Plan's future growth projections. Development associated with the proposed plan would occur within the City boundaries in an existing area of the City that is envisioned for future growth, which already provides the existing infrastructure capacity to serve the plan area. Furthermore, the indirect growth associated with 1,900 jobs would not alter the existing jobs/housing balance; nor would it be inconsistent with the City's build-out job projections. Therefore, implementation of the proposed plan would be considered to have a *less than significant* growth-inducing impact.

4.4 REFERENCES

Association of Bay Area Governments and Metropolitan Transportation Commission (ABAG and MTC). 2009. Rohnert Park Subregional Study Area Table, Sonoma County, *Projections and Priorities 2009: Building Momentum, Projections through 2035*. Available: https://store.abag.ca.gov/projections.asp#pro13. Accessed July 30, 2015.

City of Rohnert Park. 2015 (originally adopted 2000). *City of Rohnert Park General Plan: Our Place . . . Rohnert Park 2020, A Plan for the Future*. Adopted in July 2000; seventh edition printed May 2015. Rohnert Park, CA. Prepared by Dyett & Bhatia Urban and Regional Planners.

U.S. Census Bureau. Selected Housing Characteristics. 2009–2013 American Community Survey 5-Year Estimates. Available: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF. Accessed July 15, 2015.

5.0 EFFECTS FOUND NOT TO BE SIGNIFICANT

Based on initial environmental review, the City has determined that the proposed plan would not have the potential to cause significant impacts associated with the following issue areas. These topics are addressed briefly below.

- Aesthetics
- Agriculture and Forestry Resources
- Land Use and Planning
- Mineral Resources
- Population and Housing
- Public Services
- Recreation
- Utilities and Service Systems
- Growth-Inducing Impacts

5.1 AESTHETICS

State CEQA Guidelines Appendix G states that a significant impact on aesthetics may result if the proposed plan would:

- have a substantial adverse effect on a scenic vista;
- substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway;
- substantially degrade the existing visual character or quality of the site and its surroundings; or
- create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

Scenic vistas are visibly prominent landscapes containing scenic resources. Because of the relatively flat topography of the plan area and existing built environment that includes buildings and mature trees, no scenic vistas occur in the plan area. The distant Sonoma Mountains or other ridgeline features may be visible from some locations. However, these views generally are determined by a viewer's position relative to nearby buildings and the height of the nearby tree canopy.

The proposed plan would include infill development within an existing urban built environment, which would not substantially alter the quality of existing scenic views from the plan area. Furthermore, as discussed in Section 2.3.2, "Site Plan and Development Program," maximum building height associated with all new development in the plan area would not exceed 65 feet, and in some subareas, maximum building height would be no greater than 45 feet. The proposed maximum building heights would be consistent with existing conditions and would not substantially alter the visibility of scenic resources surrounding Rohnert Park from within the plan area. Therefore, the impact on scenic vistas would be *less than significant*.

U.S. Highway 101 (U.S. 101) is the western boundary of the plan area. U.S. 101 is a designated Sonoma County Scenic Corridor (Caltrans, 2008). This segment of the scenic highway is partially lined by tall deciduous and conifer trees that provide a visual barrier between the highway and the built-environment features of the city. Gaps in tree coverage allow the built environment in the plan area to be visible. The proposed plan would involve development of multifamily residential units, retail/service commercial uses, public institutional uses, office uses, light industrial uses, public park facilities, and open space. Underused sites would be improved and key areas such as the Station Center would undergo redevelopment. The proposed plan would not substantially alter the quality of scenic views of the plan area from U.S. 101. Therefore, the proposed plan would not substantially damage scenic resources within a state scenic highway, and the impact would be *less than significant*.

As shown in the site photos (Appendix G), the entire plan area consists of a built urban environment. Visibility in the plan area is mostly limited to existing urban features and vegetation (including the tree canopy), but distant ridgelines are also visible from some locations. Viewer perception and related visual sensitivity are influenced by viewer location, the specific activities in which the viewer is engaged, the personal degree of awareness, and individual values and goals. Although scenic resources are present in the city and Sonoma County, impacts on local aesthetic features, such as parks, trails, or architecture, may be more perceptible to local residents and workers. In particular, impacts on these resources may result from conversion of open space to development, building height increases, or new lighting sources.

Development of the proposed subareas would require only minimal grading because the plan area's topography is generally level. Some existing buildings would be demolished to accommodate proposed infill. Impacts on specific development areas are described separately below.

5.1.1 Triangle Business Subarea

The Triangle Business subarea is occupied by commercial and light industrial or office park uses. The proposed plan would support the development of an additional 129,315 square feet for industrial use, 91,415 square feet of office use, 120,880 square feet for retail or service commercial use, and 2.0 acres of open space uses. A maximum building height of 45 feet would be permitted in the Industrial/Regional Commercial Overlay (I-L/CR) and Downtown Mixed-Use (DTM-U) zones, and 65 feet in the Regional Commercial (C-R) zone. Some vacant lots, such as those shown in site photos 8 and 10 in Appendix G, may be used to achieve this development potential.

These proposed developments would not contrast substantially with the existing industrial and commercial landscape, nor would they provide a substantial contrast to adjacent areas in views of this portion of the plan area. Furthermore, the proposed plan would comply with the City's design guidelines, design guidelines included in the proposed plan, and the City's review processes. The additional development would not differ substantially from the area's existing visual character or alter its existing scenic quality. Therefore, this impact would be *less than significant*.

5.1.2 City Center Subarea

The City Center is characterized by existing commercial and mixed-use developments and by City public facilities, such as the Public Safety Department and the Rohnert Park–Cotati Regional Library. The proposed plan would include the development in the City Center of 115 units or 103,500 square feet for residential use, 56,581 square feet for retail or service commercial use, 32,560 square feet for office use, and 50,360 square feet of public-institutional use. The residential unit mix would consist of multifamily homes with densities of 12–45 units per acre. With implementation of the proposed plan, upper densities for the DTM-U zone in this subarea would increase from 30 units per acre to 45 units per acre, to support future infill growth. Residential uses in the City Center could support townhouses or two- to three-story lofts above neighborhood commercial uses, with tuck-under or garage parking. Currently, the maximum building height in the DTM-U zones, applicable to the City Center, is 45 feet. Public institutional facilities would be located adjacent to the Civic Center. The maximum permitted building height for public institutional uses in the Public/Institutional (P-I) zone would be 45 feet.

As in the Triangle Business subarea, the proposed plan features associated with the City Center subarea would not provide a substantial contrast to adjacent areas in views of this portion of the plan area. Any new developments would comply with the City's design guidelines, design guidelines included in the proposed plan, and the City's review processes. The additional development would not differ substantially from the area's existing visual character or alter its existing scenic quality. Therefore, this impact would be *less than significant*.

5.1.3 Central Commercial Subarea

The Central Commercial subarea consists primarily of retail business and restaurants. A senior living facility is located near the intersection of Enterprise Drive and State Farm Drive. The proposed plan would include the development of 74,264 square feet for retail or service commercial uses and 12,445 square feet for public institutional uses. The commercial uses would be one- to two- story infill development, consistent with the scale of buildings in this subarea and allowing a maximum building height in the C-R zone of 65 feet. Public institutional uses would consist of one- to two-story buildings with supporting parking and landscape improvements, to support expansion of existing public institutional facilities or new infill development in the subarea. Maximum permitted building heights for public-institutional uses in the P-I zone would be 45 feet.

As in the previously discussed subareas, the proposed plan features associated with the Central Commercial subarea would not provide a substantial contrast to adjacent subareas in views of this portion of the plan area. As in the Triangle Business and City Center subareas, proposed developments would comply with the City's design guidelines, design guidelines contained in the proposed plan, and the City's review processes. The additional development would not differ substantially from the area's existing visual character or alter its existing scenic quality. Therefore, this impact would be *less than significant*.

5.1.4 Station Center Subarea

The Station Center subarea currently consists of vacant areas, formerly used as the State Farm campus and the Rohnert Park Corporation Yard. Implementation of the proposed plan would involve redeveloping the site. The proposed Station Center subarea would include the development of an additional 415 units or 415,000 square feet for residential uses, 171,626 square feet for retail or service commercial uses, and 65,340 square feet for office uses. New office uses would consist of two- to three-story standalone or mixed-use buildings where maximum building heights, as established for the Station Center Office zone, would be 65 feet. Commercial development would replace the existing development downtown, including one to two retail and service uses, with supporting parking and landscape improvements. Maximum building heights established in the Station Center Commercial Mixed-Use and Station Center Residential Mixed-Use zones also would be 65 feet.

The Station Center is envisioned to support a variety of multifamily residential housing units with densities ranging from 12 to 75 units per acre, including townhouses, mixed-use lofts or flats above neighborhood commercial uses, and podium-style apartments or condominiums. Townhouses and mixed-use lofts in the Station Center subarea are anticipated to be two to three stories high and five- and six-story apartments or condominiums over podium parking are envisioned in this subarea, as supported by market conditions in the future. Maximum building heights for high-density residential uses would be 65 feet. Changes to existing views of the site would be most perceptible from the surrounding Central Commercial, City Center, and Creekside Neighborhood subareas.

The Station Center, with its conversion of the State Farm campus, would undergo the most visual change in the plan area. The existing buildings are set back approximately 200 feet or more from the property boundaries. The proposed Station Center subarea would reduce setbacks and encourage denser site development. However, open space would still be included along the southern and eastern edges of this subarea and in the northwest corner to preserve the redwood trees on-site. In addition, with heights of up to 65 feet, the proposed developments would not exceed the height of existing features, such as trees, on the State Farm campus. Approximately 6 acres of open space would be included in redevelopment of the Station Center. Proposed landscaping would include native trees, planted in a columnar fashion along major roadways, to enhance the existing corridor. Trees and other vertical landscape elements also could be used as background plants at community gateway entrances or could be planted along roadway medians.

The proposed plan would comply with the City's design guidelines, design guidelines contained in the proposed plan, and the City's review processes. The additional development would not differ substantially from the area's existing visual character or alter its existing scenic quality. Therefore, this impact would be *less than significant*.

5.1.5 Creekside Neighborhood Subarea

This subarea is characterized by multifamily residential development connected by local roads. The maximum building height currently permitted in the Downtown High Density Residential (DTR-H) zone of the Creekside Neighborhood is 45 feet. The development of this subarea would add 155 units or 170,500 square feet of residential use and 17,534 square feet of retail or service commercial use. The existing DTR-H zone in the Creekside Neighborhood subarea permits a wide range of detached single-family and attached multifamily housing, at densities ranging from 12.1 to 30 units per gross acre. A few vacant sites along Avram Avenue may accommodate some of this proposed development. The retail and service commercial uses in the plan area would accommodate one- to two- story infill development, consistent with the scale of buildings existing in shopping centers in this subarea.

Development of underused sites in the Creekside Neighborhood would not differ substantially from the existing aesthetic quality of multifamily residences in this area. Furthermore, the proposed development would comply with the City's design guidelines; design guidelines contained in the proposed plan; and associated city review processes. The additional development would not differ substantially from the area's existing visual character or alter its existing scenic quality. Therefore, this impact would be *less than significant*.

The plan area is located in a built urban environment that consists of developed commercial, industrial, and residential units where light and glare already are evident. Light and glare associated with the proposed plan would be similar to light and glare from typical residential, commercial, and mixed-use developments. All site and building lighting would be installed in conformance with the City's lighting and glare performance standards, as set forth in Section 17.12.050 of the Municipal Code (Municode, 2015). All lighting, reflective surfaces or any other sources of illumination would be used in a manner to minimize glare on public streets or other parcels. Lighting would be directed downward and away from adjacent residences. Therefore, the proposed plan would not create significant new light or glare in the plan area. This impact would be *less than significant.*

5.2 AGRICULTURE AND FORESTRY RESOURCES

State CEQA Guidelines Appendix G states that a significant impact on agricultural resources may result if the proposed plan would:

- convert a substantial amount of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use;
- conflict with existing zoning for agricultural use, or a Williamson Act contract; or
- involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to nonagricultural use.

State CEQA Guidelines Appendix G states that a significant impact on forestry resources may result if the proposed plan would:

- conflict with existing zoning for, or cause rezoning of, forest land (as defined in California Public Resources Code [PRC] Section 12220[g]), timberland (as defined by PRC Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104[g]);
- result in the loss of forest land or conversion of forest land to nonforest use; or
- involve other changes in the existing environment which, due to their location or nature, could result in conversion of forest land to nonforest use.

The plan area is currently the location of existing residential, commercial, office, and light industrial development with associated paved parking areas. The plan area does not contain land that is designated as prime agricultural soils by the U.S. Soil Conservation Service (now Natural Resources Conservation Service), nor does it contain Prime Farmland, Unique Farmland, or Farmland of Statewide Importance as designated by the California Department of Conservation, or any forest land or timberland (DOC, 2012). The proposed plan is not subject to, nor is the plan area located near, a Williamson Act contract site pursuant to Sections 51200–51207 of the California Government Code (Sonoma County, 2013).

In addition, the plan area is designated as developed land and not designated as farmland under the Farmland Mapping and Monitoring Program of the California Department of Conservation or the *City of Rohnert Park General Plan* (General Plan) (City of Rohnert Park, 2015a [originally adopted 2000]). No portion of the plan area could be considered forest land as defined in PRC Section 12220(g). Timberland (as defined by PRC Section 4526) or timberland-zoned timberland production (as defined by Section 51104[g] of the Government Code) is not present on-site, nor are any active or potential commercial timber operations present in the area. Therefore, *no impact* associated with agriculture and forestry resources would result from implementation of the proposed plan.

5.3 LAND USE AND PLANNING

State CEQA Guidelines Appendix G states that a significant impact on land use and planning may result if the proposed plan would:

- physically divide an established community;
- conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect; or
- conflict with any applicable habitat conservation plan or natural community conservation plan.

The plan area is an established and developed urban environment with open space, public institutions (i.e., the city's public safety building and a regional library), industrial, office, retail, and residential uses. Implementation of the proposed plan would build on the existing urban framework to support greater mixed-use areas in the five designated subareas discussed in Chapter 2.0, "Project Description"; this would include identifying areas for infill redevelopment and improving existing development. Existing roadways that provide connections to and from the plan area—such as Golf Course Drive, Rohnert Park Expressway, Commerce Boulevard, and Seed Farm Drive—would continue to connect the plan area with adjacent roadways and developments/residences. The existing street grid would remain, and roadway, bicycle, and pedestrian facilities and corresponding circulation connections would be improved (see Section 2.3.4, "Circulation"). These improvements would provide greater connectivity within the site and to the adjacent areas. Furthermore, the proposed plan would not involve the construction of a physical barrier that would restrict access through the plan area. The proposed plan therefore would not divide an established community and this impact would be *less than significant*.

Implementation of the proposed plan would have a significant impact if it would conflict with an adopted plan, policies, or regulations. The table in Appendix H provides a consistency analysis of the proposed plan relative to the General Plan. General Plan policies not included were determined to have no relationship to the proposed plan and/or plan area. As shown in the table in Appendix H, implementation of the proposed plan would be consistent with the applicable listed policies. The City would enact conditions of approval on a project-specific basis to maintain consistency and enforcement of the future development under the proposed plan.

As shown in Figure H-1 in Appendix H, the proposed plan would retain most of the current zoning designations for the plan area, including Regional Commercial (C-R), Industrial (I-L), Industrial with Office Overlay (I-L/O), and Public/Institutional (P-I) shown in the September 2014 zoning map (City of Rohnert Park, 2014). Current uses and development standards would remain in place for areas with no change in zoning.

The proposed plan incorporates the new Downtown High Density Residential (DTR-H) and Downtown Mixed-Use (DTM-U) zoning designations that update development standards for mixed-use and high density residential uses in the plan area, permitting a maximum density of 30 units per acre in DTR-H zone and 45 units per acre in the DTM-U zone. Addition of the new DTR-H and DTM-U would require an amendment to the Zoning Ordinance, including associated text updates and updates to the City's official zoning map as well as, related updates to the General Plan.

The proposed plan adds an Industrial with Regional Commercial Overlay (I-L/CR) in the northern portion of the Triangle Business subarea. The new I-L/CR zone allows for the types of industrial uses and associated development standards that are normally permitted in the I-L zone, but also would allow uses otherwise permitted only in the C-R zone. The proposed new I-L/CR zoning designation is currently within an Industrial land use designation, zoned Industrial (I-L), and would require an amendment to the Zoning Ordinance, requiring associated text updates and updates to the City's official Zoning Map.

A new Downtown District Amenity (DDAZ) Overlay is proposed to implement the community's vision for a compact, walkable downtown area. This area, to be the primary focus of downtown investment in the plan area, encompasses several subareas of PDA, connected internally across Rohnert Park Expressway and State Farm Drive (as shown in Figure 2-4 in Chapter 2.0, "Project Description"). The proposed DDAZ overlay would incorporate urban design standards and guidelines that allow buildings to be built to the edge of the sidewalk; allows for wide sidewalks and pedestrian amenities along commercial streets; promotes compact, multistory development, shared and on-street parking, and use of transit; and may incentivize amenities desired in a downtown setting (e.g., benches, plazas, signage, and lighting). Implementation of this overlay zone would require Zoning Ordinance amendments, including updates to the official Zoning Map. Updates to the General Plan would also be required.

The proposed plan would also rezone the Station Center subarea to Planned Development (PD). The PD zone would introduce a new set of zoning districts in this subarea to support its site conditions (see the figure in Appendix H). The proposed PD zoning district is currently within an Office and Public/Institutional land use designation, zoned Office Commercial (C-O) and P-I, and would require both General Plan and Zoning Ordinance amendments, including an update to the General Plan Map to designate this area as a "mixed-use" and an update to the Zoning Map to reflect the new PD designation for this subarea.

The proposed plan would be required to comply with the policies of the General Plan, per Section 65454 of the California Government Code. The proposed plan would retain the C-R, I-L, I-L/O, and P-I zoning (see the figure in Appendix H). If the proposed plan is adopted, the City would amend the General Plan and Zoning Ordinance to match the proposed plan, as summarized above and further described in the Section 2.4, "Discretionary Actions and Approvals" in Chapter 2 of the plan. Adoption of the proposed plan would include development standards and provisions to include the design guidelines of the proposed plan in the City's development review process. These specific standards and design guidelines would enhance future development of the plan area. Therefore, once changes have been made to the General Plan and Zoning Ordinance, the proposed plan would be consistent with the General Plan and Zoning Ordinance. As a result, the proposed plan would not conflict with any applicable land use plans, policies, or regulations and impacts would be *less than significant*.

The proposed plan would not conflict with any habitat conservation plans or natural community conservation plans because no approved plans apply to the plan area. *No impact* would occur.

5.4 MINERAL RESOURCES

State CEQA Guidelines Appendix G states that a significant impact on mineral resources may result if the proposed plan would:

- result in the loss of availability of a significant mineral resource (e.g., sand or gravel) as identified in Open File Report 96-04, *Update of Mineral Land Classification: Aggregate Materials in the Western San Diego County Production-Consumption Region*, 1996, by the California Geological Survey.

Based on a review of the mineral land classification maps prepared by Stinson et al. (1987) and the updated classification maps prepared by Miller et al. (2005), the plan area is designated as a Mineral Resource Zone (MRZ) 1 classification area by the California Geological Survey. MRZ-1 areas are defined as areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence. The plan area is urban, currently the location of existing development; is not designated as a locally important mineral resource recovery site; and does not have an operating mine, sampling area, or available known mineral resource that would be of value to the region and the residents of the state (City of Rohnert Park, 2015a [originally adopted 2000]). Therefore, *no impact* associated with mineral resources would result from implementation of the proposed plan.

5.5 POPULATION AND HOUSING

State CEQA Guidelines Appendix G states that a significant impact related to population and housing may result if the proposed plan would:

- induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure);
- displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; or
- displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

Implementation of the proposed plan would result in construction of up to an additional 835 residential units on a total of approximately 20 acres in the City Center and Station Center subareas and within a half-mile radius of the Sonoma-Marin Area Rail Transit (SMART) rail station, as shown in Table 2-3 and Figure 2-4. The existing population of the plan area is an estimated 3,187 people (U.S. Census Bureau, 2013a).With construction of up to 835 residential units, the population of the plan area and the city would increase by 1,670 residents. Rohnert Park is expected to grow by approximately 6,861 people between 2013 and 2020. The proposed plan represents approximately 24.3 percent of anticipated population growth in the city between 2013 and 2020, and 6 percent of the projected total 2020 population in the city, which is estimated at 47,900 residences (ABAG and MTC, 2009). Because the Association of Bay Area Governments (ABAG) projects the population of Rohnert Park to increase by 6,861 from the 2013 population estimates by 2020, 1,670 additional residents in the area from implementation of the proposed plan would be consistent with population projections for the city and would not be considered substantial unplanned growth in the area.

Indirect population growth can be attributed to nonresidential development or the extension of roads or other infrastructure. The proposed plan would include a maximum of 440,886 square feet of retail and service commercial facilities; up to 62,807 square feet of public institutional facilities; up to 189,315 net square feet of office facilities; up to 129,315 net square feet of new light industrial facilities; and improvements to plan area circulation, which would include roadways, bike/pedestrian facilities, and transit facilities. Nonresidential development included in the proposed plan would create approximately 1,900[1] jobs and could increase housing demand. For a conservative analysis, it is assumed that all 1,900 employees would relocate to the area, introducing 1,900 employee-related residents to Rohnert Park. In combination with the 1,670 permanent residents added by new residential development, 3,570 additional residents would constitute approximately 52 percent of the growth anticipated in 2020 ABAG projections for the City. This level of indirect growth would be consistent with ABAG's projection for Rohnert Park by 2020. Therefore, the impact associated with population growth resulting from permanent jobs would be *less than significant*.

Construction of future development is anticipated to generate temporary construction-related jobs. However, construction-related employment opportunities would be unlikely to cause construction workers to relocate their households to the plan area vicinity for various reasons:

- Construction employment has no regular place of business; rather, construction workers commute to job sites that may change several times a year.
- Many construction workers are highly specialized (e.g., crane operators, steelworkers, masons) and move from job site to job site, as dictated by the demand for their skills.
- The work requirements of most construction projects also are highly specialized, and workers are employed on a job site only as long as their skills are needed to complete a particular phase of the construction process.
- Some construction workers are likely to be drawn from the construction employment labor force already present in Rohnert Park and surrounding communities.

Consequently, project-related construction workers would not be likely to relocate their place of residence as a result of working on future developments under the proposed plan. The impact associated with population growth resulting from temporary jobs would be *less than significant*.

Overall, the amount of new development projected under the proposed plan would not exceed ABAG's most recent projections or other planning efforts for population or housing in the city. No housing units would be demolished; thus, no replacement housing units would be needed. The State Farm campus site and the City Corporation Yard would be removed and redeveloped as part of the Station Center subarea, which would permit commercial, residential, and park/open space uses. The proposed plan would not displace substantial numbers of people, necessitating the construction of replacement housing elsewhere. Therefore, the impact on population and housing from implementation of the proposed plan would be *less than significant*.

5.6 PUBLIC SERVICES

State CEQA Guidelines Appendix G states that a significant impact related to public services may result if the proposed plan would:

- result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered governmental facilities, the construction of which

[1] This employment total is based on assumed employment factors, representing average totals in the San Francisco Bay Area region from data collected by ABAG and assumes 450 square feet per employee for commercial retail/service uses; 350 square feet per employee for office and public-institutional uses; and 650 square feet per employee for industrial uses.

could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services.

Implementing the proposed plan would add 835 new residential units and 822,324 square feet of nonresidential development (retail or service commercial, office, public-institutional, and industrial) to the plan area. Under existing conditions the plan area accommodates 1,390 residential units for an estimated population of 2,780 people[2] and includes a total of 2,717,414 square feet of nonresidential development. The total development potential of the proposed plan would result in a total population of 4,450 people and 3,249,337 square feet of total nonresidential development in the plan area at build-out. Build-out of the plan area would represent an increase of approximately 40 percent in the total existing residential population of the plan area, and an increase of approximately 30 percent over the nonresidential development currently existing in the plan area.

5.6.1 Fire Protection

The Rohnert Park Department of Public Safety currently adheres to National Fire Protection Agency standards, which are a recommended 4-minute response time, with 67 percent of calls having an average response time of 4 minutes, 23 seconds. In addition, the City's Fire Division has two fire stations in the vicinity of the plan area, with travel time to the plan area of approximately 2 minutes for the first responder (Southern Station). This would meet the Fire Division's response time goal of 4 minutes, 23 seconds to 67 percent of calls (City of Rohnert Park, 2014a). In addition, the backup responder (Northern Station) has a travel time to the plan area of approximately 4 minutes, which would also meet the Fire Division's response time goal.

Furthermore, facilities in the plan area would be required to comply with applicable building and fire safety codes, including availability of water for fire suppression, emergency vehicle access, and fire safety regulations for various building types in the plan area. The Fire Division also would be notified of any temporary and short-term impacts on fire protection services resulting from construction activities, such as street closures. In addition, General Plan Policy HS-26 requires that new development in the northwest portion of the city (north of Business Park Drive and west of U.S. 101) contribute funds to the public facilities financing plan associated with the Wilfred-Dowdell Village development for construction of a fire station facility, as such new development would benefit from the additional fire protection services. Development of the plan area may require additional staff and equipment. However, stipulations in the General Plan require that new development contribute to the cost of service needs, including fire protection.

In summary, the response times to the plan area of the Southern Station and backup Northern Station are within the Fire Division's adopted response time standard of 4 minutes, 23 seconds to 67 percent of calls and no new fire station facilities are required to serve the plan area. General Plan build-out includes development of the plan area in a quantity that would surpass the planned build-out of the proposed plan. Therefore, the impact related to fire protection would be *less than significant.*

[2] The anticipated buildout year for the proposed plan, with an estimated 2.0 persons per household. The City's person per household rate of 2 people per unit is based on City Municipal Code Section 17.19.040, "Phasing and Pace of Development—Facts and Assumption" (City Ordinance 755 § 4, 2006; Ord. 711 § 2[part], 2004; Ord. 695 §3, 2003).

5.6.2 Police Protection

The City's Police Division is headquartered at 500 City Center Drive, within the northeastern segment of the plan area. Development of the plan area may require additional police protection services as the implementation of the proposed plan would include up to 1,670 new residences, 1,900 new jobs, and an unquantifiable number of visitors associated with correlated new businesses and services. Additional police protection services associated with the city's build-out is anticipated in the General Plan. New development projects located within the city limits are required to contribute to the cost of service needs, including police protection and related facilities to ensure the City provides adequate police protection services, consistent with stipulated General Plan Policy HO-18.8 (provide equitable public services throughout the city). The City's public safety building was recently constructed in the City Center subarea and is within the plan area. With this existing facility, no additional facilities for police protection services would be needed to serve the plan area. Therefore, the impact related to police protection would be *less than significant*.

5.6.3 Schools

Implementation of the proposed plan would include up to 1,670 new residences and 1,900 new jobs for new residents expected to relocate to the City as a result. This would increase the demand for school services, provided by the Cotati–Rohnert Park Unified School District (CRPUSD). As of the 2013–2014 school year, CRPUSD schools (which provide elementary, middle, and high school education), except for Lawrence Jones Middle School and Technology High School, were operating below maximum student capacity (CRPUSD, 2014). Additional school services associated with the city's build-out is anticipated in the General Plan. All development in the plan area associated with the proposed plan would comply with General Plan Policy PF-2 (work with CRPUSD to provide adequate high school sites) by complying with General Plan Policy PF-3 (requiring developers to help dedicated any necessary new school sites). Development (residential and commercial) associated with the proposed plan would generate school impact fees to be collected by CRPUSD in compliance with General Plan Policies PF-2 and PF-3 (City of Rohnert Park, 2014a). In accordance with Section 65996 of the California Government Code, payment of such school impact fees would mitigate the impact of the proposed plan area development on school services. Furthermore, according to the *City of Rohnert Park General Plan Revised Draft Environmental Impact Report*, elementary school enrollment is expected to decline and middle school enrollment is expected to stagnate in the future (City of Rohnert Park, 2000). No new schools are needed to serve the plan area; therefore, the impact related to schools for the plan area would be *less than significant*.

5.6.4 Parks

The population increase that would result from plan area build-out (1,670 new residents) would require 8.4 acres[3] of new parkland to meet the standard outlined in the General Plan and Municipal Code[4] of 5 acres per 1,000 residents. A total of 8.5 acres of public parks/open space uses are included in the proposed plan. Approximately 6 acres would be part of redevelopment in the Station Center subarea. The other 2.5 acres of open space would be provided for open space and bike and pedestrian access in the Triangle Business subarea. Therefore, the proposed

[3] Acreage was calculated by multiplying the projected number of persons by the required acreage percentage. For example, 5 acres of City park per 1,000 persons is equivalent to 0.0005 acre per person, and 0.0005 person x 1,670 (population increase from the implementation of the plan area) = 8.4.

[4] Park dedication requirements are stipulated in Municipal Code Section 16.14.020(D)(2), "Park Dedication" (Ord. 787 §§ 1-3, 2007; Ord. 744 § 1 [part], 2005).

plan would include dedicated parkland that exceeds City requirements and the impact on parks would be *less than significant*.

5.6.5 Libraries

The Rohnert Park–Cotati Library is located in the City Center subarea, within the plan area. Designed to serve up to 73,463 people by 2025, the library currently serves a total of approximately 54,654 people; thus, it can accommodate an additional 18,809 people by 2025 (SCL, 2015). Furthermore, the library was designed for and is intended to accommodate future expansion onto the second floor, so that it could serve a larger population in the future. The library has the available capacity to serve the estimated 1,670 new residents projected to live within the plan area at build-out of the proposed plan. Therefore, the impact related to libraries would be *less than significant*.

5.7 RECREATION

State CEQA Guidelines Appendix G states that a significant impact related to recreation may result if the proposed plan would:

- increase the use of existing neighborhood or regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; or
- include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

Along the west side of Commerce Boulevard, the City maintains 16.7 acres of existing public open space adjacent to U.S. 101 along accessible, marked trails in the existing Copeland Creek and Hinebaugh Creek corridors and interconnecting paseos. The proposed plan would generate an additional estimated 1,670 residents, and thus would likely increase the use of existing recreational facilities. A total of 8.5 additional acres of public parks, open space, and recreational uses have been identified in the plan area. Approximately 6 acres have been identified as part of redevelopment in the Station Center subarea and 2.5 acres of open space are suggested for an approximately 25-foot-wide paseo between Professional Drive and Utility Court and for other open space, to improve bike and pedestrian access in the Triangle Business subarea.

Additionally, the proposed plan would require new development in the plan area to comply with park, open space, and facility standards in the General Plan and Municipal Code. SMART will construct a multiuse pathway along the eastern edge of the plan area. The proposed plan would include trail connectivity improvements, such as along the creek corridors and paseos, to fill the gaps in the City's regional bicycle trail network and connect to the SMART multiuse pathway. Parks, plazas, open space, or other recreational facilities would be provided and dispersed within the plan area, as shown in the Park and Open Space concept (see Figure 2-7).

Therefore, a total of 25.2 acres of public parks/open space uses (including the existing 16.7 acres of open space) are proposed in the plan area, based on site studies for the plan area. Additional parks/open space uses that would be required to be provided for new development in compliance with City standards are not factored into the park/ open space totals for the plan area. Furthermore, trail connectivity improvements along the planned SMART multiuse path and surrounding public roadways in the city would be provided along the two existing creeks (see Figure 2-7).

The proposed plan would accommodate an estimated increase of 1,670 new residents in the plan area at build-out (based on a total of 835 units multiplied by two people per household[5]). Based on the City's goal of 5 acres of parkland per 1,000 residents, build-out of the proposed plan would generate a demand for 8.4 additional acres of park/open space in the plan area. The proposed plan would provide a minimum of 8.5 acres of parkland acreage and increased trail connectivity and access, as discussed in Chapter 2.0, "Project Description." With additional parks and open space uses required for new development in the plan area, the proposed plan would be able to satisfy the parkland target for the plan area. Furthermore, it is not expected that future residents in the plan area would substantially increase demand on other City facilities and cause deterioration of those facilities.

The proposed plan also includes Policy CS-1.1, which requires new development to provide park and open space facilities in accordance with City parkland requirements. The additional 8.5 acres of public parks/open space and trail system would be constructed using low-impact development design components discussed in Chapter 2.0, "Project Description," as guided by the *City of Santa Rosa and County of Sonoma Stormwater Low Impact Development Technical Design Manual*. These design components would reduce construction-related and operational impacts by managing stormwater runoff and preserving natural hydrologic regimes in the plan area. Other potential effects associated with construction and operation of the proposed recreational facilities are covered as part of the overall plan, and are evaluated under each individual topic in this environmental impact report. Therefore, the recreation impacts of implementing the proposed plan would be *less than significant*.

5.8 UTILITIES AND SERVICE SYSTEMS

State CEQA Guidelines Appendix G states that a significant impact on utilities and service systems may result if the proposed plan would:

- exceed wastewater treatment requirements of the applicable regional water quality control board (RWQCB);
- require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;
- fail to have sufficient water supplies available to serve the project from existing entitlements and resources, or require new or expanded entitlements;
- fail to result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments;
- require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;
- be served by a landfill without sufficient permitted capacity to accommodate the project's solid waste disposal needs;
- fail to comply with federal, state, and local statutes and regulations related to solid waste; or

[5] The City's person per-household rate of two people per unit is based on City Municipal Code Section 17.19.040, "Phasing and Pace of Development—Facts and Assumption" (City Ordinance 755 § 4, 2006; Ord. 711 § 2[part], 2004; Ord. 695 §3, 2003).

- create demand for electricity or natural gas service that would require facility improvements or additional energy infrastructure, the construction or operation of which would cause significant environmental impacts.

State CEQA Guidelines Appendix F states that a significant impact on utilities and service systems may result if the proposed plan would:

- encourage activities that would result in large amounts of fuel, water, or energy use, or use of these in a wasteful manner; or
- conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing energy use, particularly nonrenewable energy use (often referred to as energy efficiency standards, and can be applicable to projects, buildings, appliances, etc.).

5.8.1 Wastewater

Build-out of the proposed plan would result in the treatment and disposal of an additional 0.18 million gallons per day (gpd) of wastewater. Wastewater generated by developments associated with the proposed plan would not contain hazardous materials or other constituents that would require pretreatment and potentially cause violations of established water quality standards. As such, wastewater generated by build-out of the proposed plan could be safely discharged to the City's existing sanitary sewer system.

The plan area is currently served by the City's sewer collection system. This system consists of 77 miles of gravity sewers, 7.5 miles of force mains, 16 inverted siphons, and three pump stations that convey sewage to the treatment facility. Most facilities were installed between 1956 and 1980 and the average age is estimated to be 30 years (City of Rohnert Park, 2014b). Pipe sizes in the plan area range from 6 inches to 42 inches (see Figure 2-12 in Chapter 2.0, "Project Description"). The City's two main interceptor sewers cross the plan area. In the northerly portion of the plan area, the 27-inch College Trunk Sewer crosses through the Triangle Business subarea near Executive Court, collects effluent on the east side of U.S. 101 at Commerce Boulevard, and continues west under the freeway and follows the road alignment of J Rogers Lane. At the southern edge of the plan area, the 27- to 42-inch Eastside Trunk Sewer traverses Santa Alicia Drive and Avram Avenue, collects effluent at the east side of U.S. 101 at Commerce Boulevard, continues west under the freeway, and follows Redwood Boulevard to the terminal pump station. The Eastside Trunk Sewer was designed both to provide capacity for new development in eastern part of the city and to resolve capacity problems in the College Trunk Sewer and other portions of the collection system. The construction of the Eastside Trunk Sewer rerouted some flow that historically drained to the 27-inch-diameter sewer that parallels U.S. 101 along the western border of the plan area, resolving the plan area's only known capacity problem. Together, the two trunk sewers provide a high degree of capacity and flexibility for serving development in the plan area, although localized collection system infrastructure may require improvements to serve specific development proposals.

Wastewater treatment and disposal is provided by the Santa Rosa Subregional Water Reclamation System, which also serves the cities of Santa Rosa, Sebastopol, and Cotati. Wastewater from the Subregional System is treated at the Laguna Water Reclamation Plant, located about 2 miles northwest of Rohnert Park. The City owns capacity rights to 3.43 million gallons per day (MGD) at the Laguna Water Reclamation Plant and has an agreement with the City of Santa Rosa to use up to 4.46 MGD of capacity rights. Under the Subregional System's approved Incremental Recycled Water Program, the City can acquire up to 5.15 MGD of capacity (City of Santa Rosa, 2008). The City's current capacity needs are approximately 3.0 MGD, meaning that up to 2.15 MGD of capacity is available to serve new development. As discussed above, build-out of the plan area would generate up to 0.18 MGD of additional wastewater flow or 8 percent of the available build-out capacity. Because the capacity required to serve the plan area can be accommodated by the City's existing approved wastewater capacity and would not result in the need for any new off-site wastewater system expansions that are not already documented in the approved Incremental Recycled Water System Program EIR, the impacts of implementing the proposed plan would be *less than significant*.

5.8.2 Water Supply

As required by state law, the City has prepared a water supply assessment (WSA) to evaluate the impacts of the plan (City of Rohnert Park, 2015b). This WSA, included as Appendix F, documents that build-out of the plan area would generate demand for an additional 213 acre-feet per year (AFY) of water above the demand generated by General Plan build-out. The discussion below summarizes the information and analysis included in the WSA.

The City has three water sources: Sonoma County Water Agency (SCWA) supply, local groundwater, and recycled water. The City manages these supplies using a "conjunctive use" strategy, drawing on SCWA and recycled-water supplies first and using its local groundwater to manage peak demands. The total supply available to the City through these three sources is 11,427 AFY, including 10,077 AFY of potable water and 1,350 AFY of recycled water (City of Rohnert Park, 2015b).

The City's contract for water supply with SCWA is the Restructured Agreement for Water Supply. Under this contract, the City has access to as much as 7,500 AFY, although a number of conditions can limit the SCWA supply. Because of these limitations, the City uses 6,372 AFY as its reliable supply from SCWA under all hydrologic conditions. Over the past 10 years, the City has used between 2,500 and 5,000 AFY of SCWA supply, which is significantly less than its maximum allocation (City of Rohnert Park, 2015b).

The City's local groundwater supply is from the Santa Rosa Plain Subbasin of the Santa Rosa Valley Groundwater Basin. The City manages its groundwater supply in accordance with its 2004 Water Policy Resolution, which limits groundwater pumping to 2,577 AFY. The City's 2004 City-wide Water Supply Assessment provides the technical support for this maximum pumping rate. The City participates actively in the implementation of the *Santa Rosa Plain Watershed Groundwater Management Plan* and is currently working with other water suppliers in the basin to implement the requirements of the Groundwater Sustainability Act of 2014. Modeling and monitoring data collected by the City and others indicate that groundwater levels are generally rising around the City's well field, an indication of stable supply. Over the past 10 years the City has used between 350 and 1,600 AFY of groundwater, significantly less than its policy limitation on groundwater use (City of Rohnert Park, 2015b).

The City's tertiary-treated recycled-water supply is produced by the Santa Rosa Subregional Water Reclamation System (Subregional System). The City and the Subregional System have recently entered into a producer/distributor agreement that provides the City with access to 1,350 AFY of recycled water. The City uses recycled water primarily for irrigation purposes; demand for recycled water has varied between 800 and 1,100 AFY over the past 10 years (City of Rohnert Park, 2015b).

The City has recently completed its 2015 Urban Water Management Plan Water Demand and Water Conservation Measures Update. This analysis, which is based on ABAG population and job projections, including projections for both the plan area and the Sonoma Mountain Village Priority Development Area, projects the City's potable water demands through 2040. This demand is expected to range between 5,600 and 6,100 AFY, depending on the level of water conservation undertaken by the City. This projected demand is significantly less than the City's available water supplies. This analysis also indicates that the City has the potential to secure approximately 500 AFY (the difference between 5,600 and 6,100 AFY) by undertaking more aggressive water conservation activities (City of Rohnert Park, 2015b).

Water Delivery Infrastructure

The City's SCWA water supply is delivered through 13 turnout connections from the SCWA aqueduct system. There are five aqueduct turnouts in the plan area and a City-owned, 12-inch aqueduct pressure transmission main runs along the Hinebaugh Creek channel through the plan area. The City's groundwater is supplied by a well field consisting of 42 municipal supply wells, 29 of which are active. The City's wells are connected directly to the distribution system (City of Rohnert Park, 2015b).

In the plan area, the water distribution system consists primarily of 6- and 8-inch water mains (see Figure 2-11 in Chapter 2.0, "Project Description"). The City has a planned capital improvement project that will parallel the 4-inch distribution mains at the north end of the plan area with an 8-inch distribution main to improve the overall performance of the distribution system.

Recycled water is delivered through the City's high-pressure system, which consists of a 24-inch backbone transmission pipe running along the Copeland Creek channel. Two turnouts from the recycled-water system are located in the plan area. One turnout runs south to serve City Hall (located in the Creekside Neighborhood subarea) and the second turnout runs north, parallel to the SMART rail line right-of-way, and serves the City Center subarea. Recycled-water service was historically provided to the Station Center subarea, but this service is no longer active.

In general, the existing water supply sources and facilities are expected to be sufficient to provide an adequate supply of water to meet the plan area's current and future demands. A planned capital improvement project will remove the one restriction in the distribution system that serves the plan area. The proposed plan alone would not result in the need for new water treatment or storage facilities, other than the on-site facilities included as part of the plan. In addition, the proposed plan alone would not require SCWA to increase its existing water entitlements; as discussed above, SCWA has an adequate supply to meet the demands associated with the plan area. Furthermore, the proposed plan's impacts on water would be reduced further with implementation of policies included in the General Plan, including use of reclaimed water, discharge reduction programs, and water metering. Additionally, the proposed plan includes Policy U-1.1, which requires ensuring that an adequate water supply is available to serve the plan area. With the implementation of water conservation programs implemented by the City, reducing the City's demand by 384–556 AFY by build-out of the proposed plan, the City would effectively offset the potential increase in demand from the proposed plan. Therefore, the water supply and related facility impacts would be *less than significant.*

5.8.3 Stormwater

The plan area is served by the City's existing storm drainage system, which conveys stormwater through closed conduits (pipes) to SCWA's system of open channels, which in turn divert major drainage flows west toward the Laguna de Santa Rosa. In the plan area, Hinebaugh and Copeland Creeks convey storm drainage from east to west. The existing storm drainage infrastructure in the plan area is operating within its design capacity, although the system's design does allow street flooding (but not building flooding) near Commerce Boulevard, Avram Avenue, and Enterprise Drive in severe storm events.

No portions of any parcel in the plan area have been designated as being located in a Federal Emergency Management Agency Flood Hazard Zone that may be subject to localized flooding during a 100-year or 500-year storm event (FEMA, 2008). The May 29, 2009, technical memorandum "Storm Water System Model Study–Phase IV" recommended improving the Copeland Creek culverts and channel to reduce modeled flooding for a 100-year storm event. As an option to culvert and channel improvements, the memorandum also suggested reducing the peak 100-year discharge by constructing a detention pond in the upper reach of the watershed. The City is currently partnering with SCWA on the design and implementation of the upstream detention basin.

Although some of the land in the plan area is currently underused, the area is largely developed and paved, and implementing the proposed plan would not result in significant changes in runoff volume or velocity. However, all new development or site redevelopment of any scale would need to comply with the City's storm drain standards, including the City of Santa Rosa and County of Sonoma's *Low Impact Development Technical Design Manual* (LID Manual). Design requirements include the requirements to treat all runoff generated by the 85th percentile, 24-hour storm and to ensure that the volume of runoff from the site in the 85th percentile, 24-hour storm does not increase as a result of development or redevelopment. The LID Manual includes a menu of best management practices that can be used to capture, infiltrate, and/or reuse stormwater on-site. Some of the LID Manual's best management practices are also incorporated in the design guidelines for the plan area. Because the existing stormwater system provides adequate protection to the plan area and because existing design requirements and plan policies will minimize any increases in stormwater runoff or changes in stormwater quality, the stormwater-related impacts would be *less than significant.*

5.8.4 Solid Waste

The North Bay Corporation provides solid waste disposal and composting of organic materials in the city. Build-out of the plan area would result in an additional 1,670 residents and 1,900 employees.[6] Using the 2011 daily per capita disposal rate from Sonoma County Waste Management Agency (SCWMA), uses associated with the proposed plan would generate approximately 12.696 tons of solid waste per day. This amount represents 0.5 percent of the Central Disposal Landfill's maximum daily throughput of 2,500 tons per day. Long term, it is speculative as to whether wastes would be disposed at the Central Disposal Landfill; however, any future waste export agreement between the City and the SCWMA would be subject to its own environmental review. Furthermore, the proposed plan includes Policy U-1.5 to ensure that existing solid disposal services could meet the demand from the existing and proposed development in the plan area. Based on the available information, the

[6] 1,670 residents multiplied by 3.6 pounds per person per day equals 6,012 pounds per day. 1,900 employees multiplied by 10.2 pounds per person per day equals 19,380 pounds per day. (6,012 plus 19,380 pounds per day) divided by 2,000 pounds per ton equals 12.696 tons per day.

impact of the proposed plan related to an increase in demand for solid waste collection and disposal in the city would be *less than significant*.

Assembly Bill (AB) 939 requires the City to develop and implement a solid waste management program. PRC Section 41780(a)(2) also requires cities and counties to divert 50 percent of the solid waste produced within their respective jurisdictions through source reduction, recycling, and/or composting activities. Since 2007, Senate Bill 1016 has required cities to report to the California Integrated Waste Management Board (now known as CalRecycle) the amount of garbage disposed in the landfill per person per day. According to CalRecycle's jurisdiction/disposal rate detail for SCWMA for the 2011 reporting year (CalRecycle, 2013), SCWMA's residential disposal target is 7.1 pounds per person per day. Rohnert Park's annual residential disposal rate of 3.6 pounds per person per day met this target in 2014. The employee disposal target (18.3 pounds per employee per day) was also met, with an actual employee disposal rate of 10.2 pounds per employee per day. Waste reduction and disposal framework developed by the City and SCWMA would guide any future development in the plan area. The plan area would not contain features that would generate waste flows at rates that would exceed typical disposal rates for the City (City of Rohnert Park, 2014a); therefore, this impact would be *less than significant*.

5.8.5 Electricity and Natural Gas

Equipment used during construction under the proposed plan would run on diesel fuel. Therefore, demand for electricity and natural gas resources would not increase. Furthermore, Tier 3 (energy-efficient) construction equipment would be used whenever possible, and diesel-fueled equipment would not be left idling. The plan area would be served by Pacific Gas and Electric Company (PG&E) for both electricity and natural gas service. Using the Energy Consumption Data Management System for total energy and natural gas demand from Sonoma County, residential uses in the plan area would demand approximately 0.98 kilowatt-hour of electricity per person each day (U.S. Census Bureau, 2013b). In addition, implementing the proposed plan would generate demand for residential, commercial, and industrial consumption of natural gas. The City is served by PG&E, which allocates its existing supply of natural gas based on demand. Therefore, increased demand for electricity and natural gas attributable to the proposed plan would not exceed the capacity of existing or planned PG&E service systems. Therefore, the impact related to electricity and natural gas consumption would be *less than significant*.

Because the proposed plan would follow applicable Title 24 standards related to energy efficiency, implementing the proposed plan would not encourage or result in activities that consume large amounts of fuel, water, or energy in an inefficient manner. Furthermore, the proposed plan includes Policy CD-2.2, promoting sustainable development practices that result in more energy- and water-efficient development. Therefore, the impact would be *less than significant*.

The *Sonoma County Community Climate Action Plan*, along with *the Rohnert Park Greenhouse Gas Emissions Reduction Plan*, reflects the City's primary strategies for ensuring that build-out of the General Plan would not conflict with implementation of AB 32. The proposed plan would not conflict with this or any other applicable plan, policy, or regulation adopted for the purpose of reducing energy use, particularly nonrenewable energy use. Therefore, the impact would be *less than significant*.

5.9 REFERENCES

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6.0 ALTERNATIVES

This chapter presents the objectives of the proposed plan, summarizes its significant impacts, and describes the alternatives selected for evaluation. This chapter also analyzes the comparative effects of the alternatives relative to the proposed plan. As required by Section 15126.6(e) of the California Environmental Quality Act (CEQA) Guidelines (State CEQA Guidelines), the environmentally superior alternative is identified.

6.1 INTRODUCTION

The purpose of the alternatives evaluation in an environmental impact report (EIR), as stated in Section 15126.6(c) of the State CEQA Guidelines, is to ensure that “the range of potential alternatives to the proposed project shall include those that could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects” identified under the proposed plan.

An EIR need not evaluate the environmental effects of alternatives in the same level of detail as the proposed project, but must include enough information to allow meaningful evaluation, analysis, and comparison with the proposed project. Pursuant to Section 15126.6 of the State CEQA Guidelines, an analysis of alternatives to the plan is presented in this EIR to provide the public and decision makers with a range of possible alternatives to consider.

6.1.1 Focus of Alternatives

Section 15126.6[a] of the State CEQA Guidelines requires that an EIR (1) describe a range of reasonable alternatives to a proposed project, or to the location of the project, that would feasibly attain most of the basic project objectives but would avoid or substantially lessen any of the significant effects of the project; and (2) evaluate the comparative merits of the alternatives. Therefore, a key goal of the alternatives analysis included in an EIR is to consider alternatives with the potential to “avoid or substantially lessen one or more of the significant effects” of the proposed project (State CEQA Guidelines, Section 15126.6[c]).

Chapter 3 of this EIR has found that potentially significant impacts of the proposed plan can be mitigated to a less than significant level, excepting the significant and unavoidable impacts associated with a projected increase in traffic volumes along U.S. Highway 101 (U.S. 101). As discussed below as part of the alternatives analysis, it is not possible to develop an alternative with the potential to avoid or substantially lessen this significant and unavoidable traffic impact of the proposed plan and meet the plan’s key objectives to support transit-oriented development while creating and achieving the community’s vision for a Downtown for Rohnert Park. Therefore, notwithstanding Sections 21159.28(a) and 21094.5(b)(1) of the California Public Resources Code, alternatives that avoid or substantially lessen the significant impact of the proposed plan on traffic and transportation (the proposed plan’s key significant and unavoidable impact) are addressed in this chapter for informational purposes.

The State CEQA Guidelines (Section 15126.6[c]) recommend that an EIR briefly describe the rationale for selecting the alternatives to be discussed, identify any alternatives that were considered by the lead agency but rejected as infeasible, and briefly explain the reasons underlying the lead agency’s determination.

6.1.2 Reasonable Range of Alternatives

The State CEQA Guidelines state that an EIR shall describe a reasonable range of alternatives that would avoid or substantially lessen any significant effects of the project, but need not consider every conceivable alternative. The range of alternatives required to be evaluated in an EIR is governed by a “rule of reason” that requires the EIR to set forth only those alternatives necessary to permit a reasoned choice.

The EIR need examine in detail only those alternatives that the lead agency determines could feasibly attain most of the basic project objectives, taking into account factors that include site suitability; economic viability; availability of infrastructure; general plan consistency; other plans or regulatory limitations; jurisdictional boundaries; and control or access to alternative sites (State CEQA Guidelines, Section 15126.6[f]). The State CEQA Guidelines further state that “the discussion of alternatives shall focus on alternatives to the project or its location [that] are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly” (Section 15126.6[b]).

An EIR also must evaluate a “no-project” alternative, which represents “what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services” (State CEQA Guidelines, Section 15126.6[e][2]). For the proposed plan, the plan area is already developed, and the No Project/No Development Alternative analyzed in this EIR assumes that existing uses would continue in the plan area, with no new development.

6.1.3 Feasibility of Alternatives

Alternatives in an EIR must be potentially feasible (State CEQA Guidelines, Section 15126.6[a]). The feasibility of an alternative may be determined based on a variety of factors (State CEQA Guidelines, Section 15126.6[f][1]). Under CEQA, “feasible” is defined as “capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors” (State CEQA Guidelines, Section 15364). The concept of feasibility also encompasses the question of whether a particular alternative promotes the underlying goals and objectives of a project. Moreover, “feasibility” under CEQA encompasses “desirability” to the extent that desirability is based on a reasonable balancing of the relevant economic, environmental, social, legal, and technological factors.

6.1.4 Consideration of Alternatives

The lead agency’s decision-making body—in this case, the Rohnert Park City Council—has the discretion to select a project alternative in lieu of the proposed plan. Approval of any alternative, however, cannot occur unless the alternative has received sufficient review regarding planning and infrastructure issues, and has been subjected to adequate CEQA review. The required CEQA Findings of Fact, including a mitigation monitoring plan, must be prepared, and must identify the alternative as the project selected for approval.

6.1.5 Project Objectives

The selection of alternatives also takes into account the proposed plan objectives provided in Chapter 2, "Project Description," of this EIR. The objectives of the proposed plan, provided below, were factored into the development and evaluation of the alternatives presented in this chapter:

- Support the creation of a Downtown for Rohnert Park. Downtown should have the following features:
  - A distinct character building upon the community's existing assets (including redwood tree–lined streets, creek trail corridors, neighborhood sections with distinct centers, and rich cultural and recreational amenities).
  - A pedestrian-oriented development pattern, with a walkable street grid, a compact building footprint, and plenty of community open space.
  - A mix of uses, with emphasis on lifestyle and specialty retail, entertainment, urban-style living options, public spaces, and other transit-supportive uses (e.g., jobs, housing, and services).
  - A variety of public spaces to serve the community.
- Take advantage of the transit-oriented opportunities adjacent to the Sonoma-Marin Area Rail Transit (SMART) rail station to establish distinct subareas with unique community roles.
- Focus growth within the one-half mile radius of the SMART rail station, as guided by the transit-oriented development objectives of the Priority Development Area, (PDA) Focusing Our Vision (FOCUS) program and regional guidance provided by the Metropolitan Transportation Commission's *Station Area Planning Manual* (MTC, 2007). The *Station Area Planning Manual* identifies Rohnert Park as a "Transit Town Center" place type, defined as a local-serving economic and community activity center offering a mix of single-family and multifamily housing and neighborhood serving retail, employment, and civic uses.
- Create and reinforce a consistent urban design theme and identity for Central Rohnert Park and the Downtown District.
- Support the transition of the Triangle Business subarea from primarily light industrial uses to a mixed-use business environment, with a mix of light office, light industrial, and more retail and service uses.
- Support transit ridership by promoting new infill growth in the plan area, focused within the one-half-mile radius of the SMART rail station.
- Plan for transportation improvements, including bus or other circulation opportunities and additional transit stops, to connect the community to SMART rail service and the plan area centers.
- Support City General Plan Goals TR-I, TR-K, TR-L, and TR-R and Policies TR-24-TR-34, TR-41, and TR-42 to reduce traffic congestion by encouraging transportation demand management programs for businesses and workplaces and parking standards that help reduce automobile trips, and promoting alternative transportation modes.
  - Support safe and convenient transit, bicycle, and pedestrian travel modes and connections within the plan area.
  - Improve the safety of crossing the railroad tracks and roadways that serve as neighborhood barriers (i.e., the SMART rail line and Rohnert Park Expressway [RPX]).

- Continue to improve creek corridors as major east-west travel routes, serving the community and support their future connections to the planned SMART Multi-Use Path (MUP).
- Provide a safe and continuous bike and pedestrian trail network, integrated with transit and providing connections to and within the existing shopping centers, commercial areas, and employment centers.
- Support investment in placemaking strategies, such as public plazas, sidewalk and landscape improvements, bike/pedestrian connections, and gateway and district wayfinding signage.

6.1.6 Significant Effects of the Proposed Plan

The environmental effects associated with implementation of the proposed plan are discussed in detail throughout Chapter 3, "Environmental Setting and Impacts," of this EIR. As discussed in this EIR, the proposed plan would result in the following significant and unavoidable adverse impact:

- Under future baseline conditions without the proposed plan, three freeway segments are projected to operate at level of service (LOS) F at peak hours. The addition of plan-generated vehicular traffic would lead to further degradation of operation on these segments. In particular, the proposed plan would be responsible for increasing the volume-to-capacity (v/c) ratio by 0.04 on northbound U.S. 101 between Golf Course Drive and Santa Rosa Avenue during the p.m. peak hour; by 0.06 on northbound U.S. 101 during the p.m. peak hour; and by 0.04 during the a.m. peak hour and 0.03 during the p.m. peak hour on southbound U.S. 101 between Todd Road and Golf Course Drive. According to the California Department of Transportation's (Caltrans') thresholds of significance for U.S. 101 freeway segments, the proposed plan's contribution to unacceptable LOS conditions at these locations is considered a *significant and unavoidable* impact. A summary of freeway segment LOS is shown in Table 17 and Table 18 of Appendix E.

Other impacts associated with implementation of the proposed plan could be reduced to a less-than-significant level through compliance with existing regulations and through mitigation imposed upon the plan, as described throughout Chapter 3 of this EIR.

6.2 IDENTIFICATION OF ALTERNATIVES TO THE PROPOSED PLAN

In identifying alternatives to the proposed plan, primary consideration was given to alternatives that could reduce the significant and unavoidable traffic impacts resulting from the proposed plan. Traffic impacts at three freeway segments, already projected to operate at LOS F at peak hours under future conditions, could worsen with the addition of the proposed plan, as described in the previous section and in Section 3.9, "Transportation and Traffic," of this EIR. Future reductions in vehicle miles traveled (VMT) resulting from operation of the SMART rail line, mixed-use development, and increases in pedestrian activity are not fully taken into account by this analysis because they are unknown at this time.

To reduce traffic impacts on these freeway segments in the northern portion of the plan area while achieving the project objectives, the alternatives considered land use changes that would reduce traffic impacts on the freeway by supporting transit-oriented development closer to the SMART rail station and supporting the use of transit and other alternative transportation modes besides the automobile.

6.2.1 Alternatives Considered and Dismissed from Further Consideration

Other potential alternatives were explored as part of the alternatives analysis for the proposed plan. These alternatives proposed a different proportion and mix of retail, office, and residential uses in the plan area, focused primarily on the Station Center subarea opportunity site. These concepts included:

- a residentially focused plan supporting a mix of medium- and high-density residential development in the Station Center subarea with an average target density of approximately 25 dwelling units per acre; and
- a commercially focused plan, with retail blocks oriented to RPX and State Farm Drive along the major roadways that bound the Station Center subarea; mixed-use development in the blocks central to the Station Center subarea, with a nonresidential floor area ratio range of 0.5 to 1.5; and medium- and high-density residential uses in the blocks adjacent to the SMART rail corridor, with a target density of 55 units per acre.

These two alternatives did not meet the community's criteria for a Downtown adjacent to the future SMART rail station or were greater in density/intensity than the alternatives analyzed. Therefore, these alternatives were rejected from further consideration.

The residentially focused plan would generate fewer trips from the Station Center subarea and result in less a.m. and p.m. peak-hour traffic; however, like Alternative 3 considered in this EIR, the residentially focused plan would only marginally reduce traffic impacts. This site option is inconsistent with the primary objective of the PDA Plan to create a pedestrian-friendly, mixed-use downtown destination, as it does not provide enough retail to support a downtown environment. This alternative proposed an average residential density of 25 units per acre, consistent with the allowed current density in the PDA. The Central Rohnert Park PDA, however, is most closely associated with the "Transit Town Center" place type, as defined in the Metropolitan Transportation Commission's *Station Area Planning Manual* (MTC, 2007). Housing development guidelines for the Transit Town Center encourage existing housing at the current density of 25 units per acre and future density projected at 40 units per acre.

The commercially focused plan concept proposed more commercial retail development at greater densities and intensities than the proposed plan. The larger amount of retail uses would generate more single-occupancy vehicle trips, and retail uses are generally less supportive of transit use than office or residential uses. Thus, the commercially focused plan would generate more single-occupancy vehicle trips than the proposed plan and worsen traffic and related air quality and greenhouse gas (GHG) emissions.

None of these alternatives would have lessened the proposed plan's significant and unavoidable traffic impact. Thus, these alternatives have been eliminated from further consideration.

6.3 ALTERNATIVES CONSIDERED IN THIS EIR

This section describes the range of alternatives to the proposed plan that are analyzed in this EIR and presents how specific impacts differ in severity from those associated with the proposed plan.

As with the proposed plan, the significant impacts of the alternatives (except for transportation and traffic impacts) can be mitigated to a less-than-significant level through adoption of mitigation measures identified in Chapter 3 of this EIR, which contains the environmental analysis for the proposed plan. All of the mitigation measures identified for this project are included in Chapter 3. It also should be noted that each of those mitigation measures can be applied to each of the alternatives outlined in this section to further reduce potential environmental effects. Each of the mitigation measures identified in the EIR as necessary to reduce a potentially significant impact to a less-than-significant level also would be required to reduce the potentially significant effects of Alternatives 2 and 3 to a less-than-significant level, with the exception of impacts related to transportation and traffic.

To varying degrees, the following alternatives also would avoid and/or lessen project impacts, including the significant and unavoidable impact related to transportation and traffic, but would not reduce this impact to a less-than-significant level. The alternatives to the proposed plan analyzed in this EIR are:

Alternative 1: No Project/No Development

Alternative 2: No Regional Commercial Overlay Zone

Alternative 3: Station Center Office and Residential Focus

Table 6-1 presents a comparison of various characteristics of the three alternatives and the proposed plan.

Table 6-1: Comparison of Alternatives

	Alternative 1	Alternative 2	Alternative 3	Proposed Plan
Proposed Plan Additional Development Potential				
1. Residential Units	0	835	822	835
2. Nonresidential Building Footprint	0	1,043,125	828,423	822,324
Retail or Service Commercial Area (square feet)	*0*	*416,899*	*368,577*	*440,886*
Office Area (square feet)	*0*	*189,315*	*267,723*	*189,315*
Public-Institutional Area (square feet)	*0*	*62,807*	*62,807*	*62,807*
Industrial Area (square feet)	*0*	*153,430*	*129,315*	*129,315*
Hotel Rooms	0	250	500	500
3. Park/Open Space (acre)	0	8.5	8.3	8.5
Total Development Potential				
1. Residential Units	1,390	2,225	2,212	2,225
2. Nonresidential Building Footprint	2,717,414	3,201,365	3,255,438	3,249,337
Total Retail or Service Commercial Area (square feet)	*700,728*	*1,117,627*	*1,069,305*	*1,141,614*
Total Office Area (square feet)	*1,081,780*	*987,865*	*1,066,273*	*987,865*
Total Public-Institutional Area (square feet)	*166,477*	*222,116*	*222,116*	*222,116*
Total Industrial Area (square feet)	*768,429*	*921,860*	*897,744*	*897,744*
Total New Hotel Rooms	0	250	500	500
3. Park/Open Space (acre)	16.7	25.2	25.0	25.2

Source: Data compiled by AECOM in 2015

6.3.1 Alternative 1: No Project/No Development Alternative

Under CEQA, the No Project Alternative must consider the effects of not developing the project, or in this case, the proposed plan. The No Project/No Development Alternative describes the environmental conditions that exist at the time that the environmental analysis commences (State CEQA Guidelines, Section 15126.6[e][2]). In the case of the proposed plan, the plan area is already developed, so continuation of existing conditions would involve continuing existing uses as currently zoned. Existing conditions are described in the Environmental Setting of each section in Chapter 3 of this EIR.

Under Alternative 1, the City Council would not approve any project, and none of the mitigation measures identified in this EIR would be implemented. No demolition would occur under Alternative 1, because existing structures, landscape features, and site layout would remain. The State Farm campus would remain as an office use.

Without the proposed plan, several intersections and freeway segments of U.S. 101 would be expected to operate at unacceptable conditions during the a.m. and p.m. peak hours, because of future development projected in the city. The No Project/No Development Alternative would not further worsen these conditions with added traffic under the proposed plan; however, this alternative also would not support traffic intersection improvements and nonvehicular circulation improvements under the proposed plan, as identified in Table 10 of Appendix E, to help improve intersection traffic operations to acceptable conditions and maintain existing LOS standards at these intersections.

The currently allowed density and intensity in the plan area under the City's Zoning Code is higher than the actual existing density and intensity in the plan area (Table 6-2).

Table 6-2: No Project/No Development Alternative—Existing and Allowed Density/Intensity

	Existing Plan Density/Intensity	Maximum Allowable Plan Density/Intensity
Residential Use Designations	21.3 units per gross acre	24 units per gross acre
Retail Designations	0.24 FAR	0.4 FAR
Office Designations	0.22 FAR	1.0 FAR
Mixed-Use Designations	0.325 FAR	1.5 FAR for nonresidential projects; 2.0 FAR for residential mixed-use projects
Public-Institutional Use Designation	0.21 FAR	0.5 FAR
Industrial Use Designations	0.25 FAR (I-L zone); 0.30 FAR (I-L/O zone)	0.5 FAR; 1.0 FAR is allowed for projects approved by the Planning Commission that meet criteria in the City's approved design guidelines

Notes: City = City of Rohnert Park; FAR = floor area ratio; I-L = Industrial; I-L/O = Industrial with Office Overlay

Source: Data compiled by AECOM in 2015

Alternative 1 would forgo the opportunity to increase residential density or commercial retail and office intensity adjacent to the future SMART rail station for Rohnert Park. As such, this option is not consistent with the objectives of the PDA Plan or the transit-oriented development objectives of the PDA program. PDA program objectives support additional high-density residential and supporting retail and service uses near the SMART rail station.

6.3.2 Alternative 2: No Regional Commercial Overlay Zone

Alternative 2, the No Regional Commercial Overlay Zone Alternative, proposes removing the Regional Commercial Overlay zone from portions of the Industrial zone that abut U.S. 101 in the Triangle Business subarea. This alternative supports some modest infill growth of existing vacant properties and the reuse of existing structures in the Triangle Business subarea. Based on project assumptions and the area's large size, the increase in industrial development under this alternative would further intensify development and associated traffic impacts adjacent to the U.S. 101 freeway segment north of Golf Course Drive (an impact that is already considered significant) under future conditions with the future build-out of other areas of the city.

Figure 6-1 illustrates the overall zoning concept for Alternative 2. This alternative would not change the land use concept for the Station Center planned development as described in the proposed plan. A total of 28.4 acres in the Regional Commercial Overlay zone is proposed to remain in the current Industrial zoning district.

The total nonresidential building footprint of Alternative 2, 921,860 square feet, would be greater than the nonresidential building footprint for the proposed plan (822,324 square feet). This alternative would include more development and building area than the proposed plan: 153,430 square feet of industrial uses and 416,899 square feet of retail and support service uses, compared to the 440,886 square feet of new retail and service uses and 129,315 square feet of industrial uses in the proposed plan (Table 6-1). Alternative 2 does not propose any changes to the amount of office or public-institutional uses, number of residential units, or amount of park and open space area compared to the proposed plan.

Alternative 2 proposes greater density/intensity of industrial uses and overall building footprint and slightly less retail area than the proposed plan, based on plan assumptions. The difference in the amount of industrial and residential building areas between Alternative 2 and the proposed plan is small, and industrial uses generally result in fewer customer and employee trips. Thus, overall, Alternative 2 would result in lesser impacts related to traffic and air pollutant emissions than would result from the proposed plan. Like Alternative 1, this alternative would have a slightly lesser impact on U.S. 101 than the proposed plan, but it would not reduce the significant and unavoidable impact for the segment of U.S. 101 north of Golf Course Drive to a less-than-significant level.

6.3.3 Alternative 3: Station Center Office and Residential Focus Alternative

Alternative 3, the Station Center Office and Residential Focus Alternative does not propose changes to the zoning in the proposed plan (Figure 6-2). However, it does propose modifying the land use concept within the Station Center planned development/subarea. This subarea, located adjacent to the SMART rail station, is envisioned to have the potential for the greatest change in the plan area. Alternative 3 proposes less retail development than the proposed plan and more office and high-density residential uses placed near the future SMART rail station (Figure 6-3).

As discussed in Section 3.9, "Transportation and Traffic," extensive research has shown that population and employment densities can influence transportation mode choice, supporting increased walking and transit trips and reducing single-occupancy vehicle use for both work and shopping trips. Trip generation factors used in Table 11, "Trip Generation Summary," of the project's traffic impact study indicate that a plan with less retail development and more residential and office development would reduce the number of daily trips and potentially a.m. and p.m. peak-hour trips.

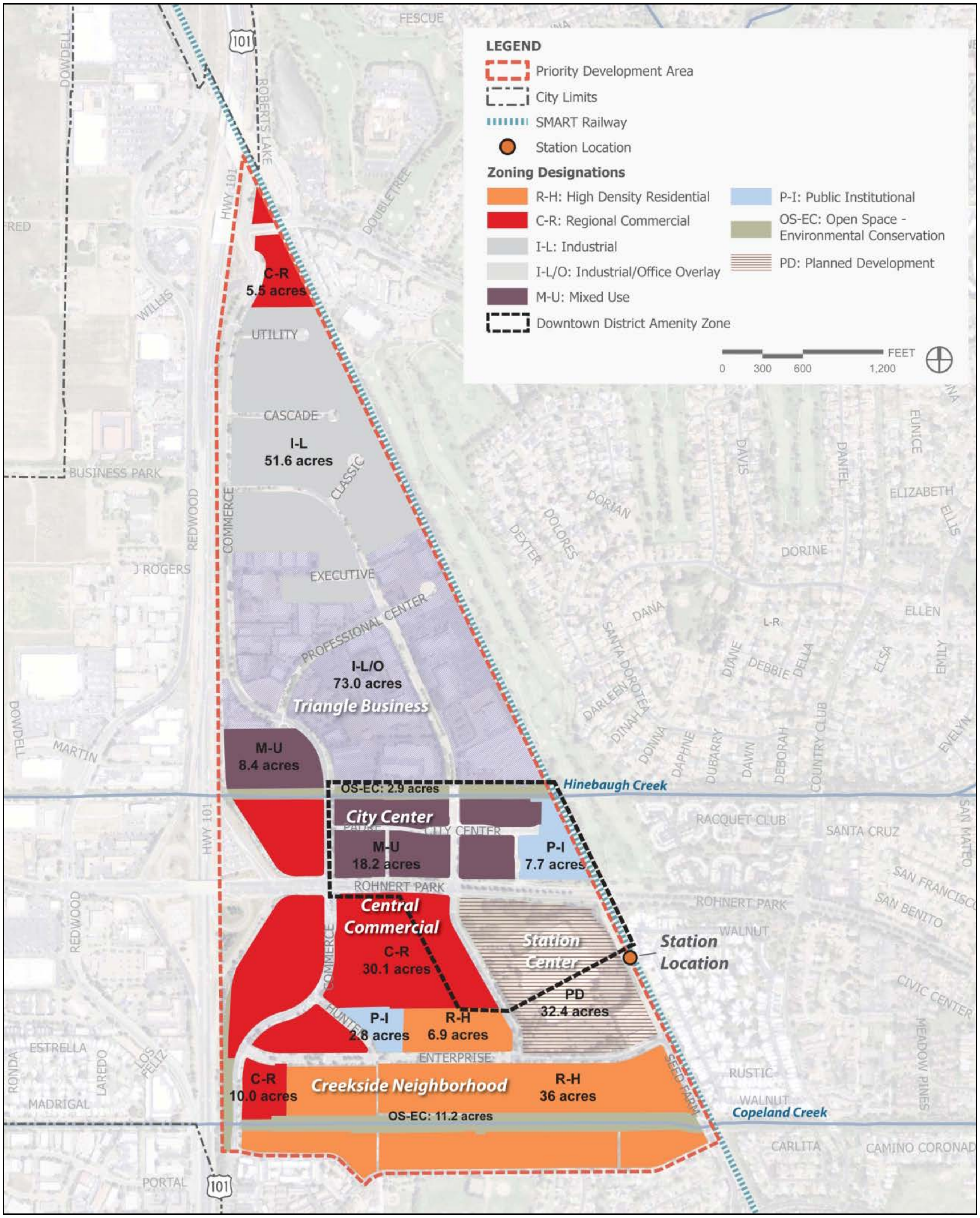

Figure 6-1: **CEQA Alternative 2 Proposed Zoning Concept**

Alternative 3 employs this strategy, proposing a balance of residential, office, and retail uses intended to reduce traffic impacts and support increased walking and transit trips. This strategy is intended to support station area employment targets and intensities for the Transit Town Center place type, based on guidance provided in the Metropolitan Transportation Commission *Station Area Planning Manual* (MTC, 2007). The strategy is consistent with the goals of the PDA program to (1) support additional housing and jobs in PDAs; and (2) efficiently manage regional growth to support nonvehicular travel modes that help minimize vehicular impacts. This approach is also consistent with goals and policies of the *City of Rohnert Park General Plan* and *Sonoma County General Plan 2020* to support shifting a portion of automobile trips to other modes of transit, including biking, walking, and public transit.

Alternative 3 proposes slightly fewer residential units than the proposed plan: 402 units compared to 415 units. This alternative proposes a total nonresidential building footprint of 828,423 square feet, which is slightly greater than the proposed plan, which proposes 822,324 square feet. This alternative would include 267,723 square feet of office uses and 368,577 square feet of retail and support service uses with no changes to industrial or public-institutional uses, compared to the 189,315 square feet of office uses and 440,886 square feet of new retail and service uses in the proposed plan.

Because of the mix of office and residential development and lesser amount of retail uses, Alternative 3 is anticipated to better support transit use, and thus, to reduce daily trips and p.m. trips, slightly reducing traffic impacts and air pollutant emissions relative to the proposed plan. This alternative would slightly reduce impacts on U.S. 101 compared to the proposed plan, but would not lessen the significant and unavoidable impact on the segment of U.S. 101 north of Golf Course Drive to a less-than-significant level. Alternative 3 also would be less effective in supporting the community’s desire or the plan’s objective for a Downtown retail environment, with substantial retail uses adjacent to the SMART rail station.

6.3.4 Relative Impacts of the Alternatives

In an EIR, the relative environmental effects of alternatives can be described using different organizational approaches. When alternatives are designed to address different potentially significant effects or are substantially different from one another, it may be advantageous to organize the impact evaluation by alternative. For this project, the alternatives are focused on reducing traffic impacts. For other environmental topics, the impacts of the different alternatives are relatively similar to one another. This section is organized by EIR impact topic to provide a more reader-friendly explanation of the alternatives.

For each resource area, summary statements have been provided at the conclusion of the discussion of each alternative to indicate whether the impacts of the alternative on the resource area would be greater than, similar to, or less than those of the proposed plan.

Air Quality

Alternative 1: No Project/No Development Alternative

The No Project/No Development Alternative (Alternative 1) would include land use changes from other approved plans, but no direct changes associated with the proposed plan. Therefore, Alternative 1 would not result in a net increase in any air pollutant emissions that would impact regional ambient air quality goals or sensitive receptors.

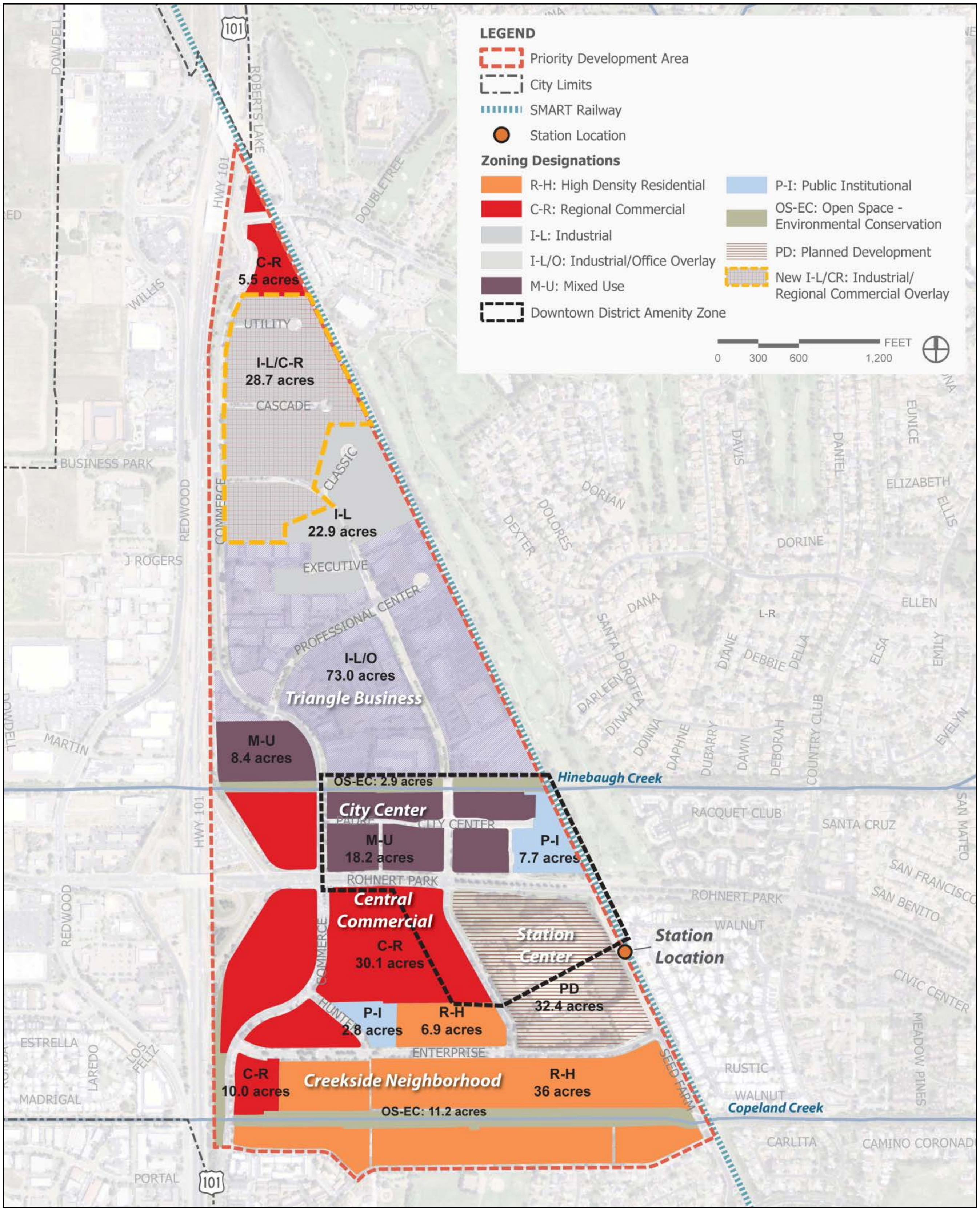

Figure 6-2: CEQA Alternative 3 Proposed Zoning Concept

Figure 6-3: CEQA Alternative 3 Station Center Subarea Land Use Concept

Alternative 1 would have no impact. Overall, the air quality impacts of Alternative 1 would be *less than* those of the proposed plan.

Alternative 2: No Regional Commercial Overlay Zone Alternative

The No Regional Commercial Overlay Zone Alternative (Alternative 2) would remove the Industrial Overlay Zone from the Triangle Business subarea. Alternative 2 would result in slightly more industrial and slightly fewer retail/service land uses than the proposed plan (see Table 6-1 for detailed land use differences between alternatives). The additional industrial and slightly fewer retail/service land uses associated with Alternative 2 is anticipated to result in slightly greater overall construction activities, because construction is expected to still occur but in the form of more nonresidential building square footage. Long-term operational area- and stationary-source emissions would likely increase above the emissions associated with the proposed plan, because more industrial uses would be built and such uses typically are more energy intensive. However, Alternative 2 would result in slightly fewer vehicle trips than the proposed plan, and, therefore, mobile sources would be slightly less.

Although Alternative 2 would result in slightly higher overall construction emissions than the proposed plan, construction activities would likely occur at the same intensity. In other words, the same amount of daily construction would occur but for more overall days than under the proposed plan. Therefore, Alternative 2 would also generate daily construction emissions that would exceed Bay Area Air Quality Management District (BAAQMD) construction thresholds of significance. Similar to the proposed plan, Alternative 2's construction emissions would be considered potentially significant. However, implementation of Mitigation Measures 3.1a-1 to 3.1a-4 would reduce Alternative 2 impacts to a less-than-significant level.

At full build-out, daily operational activities under Alternative 2 would result in slightly fewer vehicle trips and VMT than those for the proposed plan. In addition, because of the increased industrial land uses, Alternative 2 would result in higher overall operational emissions of air pollutants (area- and energy-related emissions) than the proposed plan. However, similar to the proposed plan, Alternative 2's daily operational emissions would likely continue to exceed BAAQMD thresholds of significance. However, implementation of Mitigation Measures 3.1a-4 and 3.1a-5 would reduce operational impacts of Alternative 2 would be reduced to a less-than-significant level.

With respect to exposing sensitive receptors to substantial pollutant concentrations, Alternative 2 would slightly increase the total construction emissions (i.e., construction health risk impacts) and operational emissions from area- and energy-related sources (i.e., operational health risk impacts), compared to the proposed plan. These potential impacts would be slightly higher under Alternative 2 than under the proposed plan, and it is anticipated that similar to the proposed plan, these impacts could be potentially significant. However, implementation of Mitigation Measures 3.1d-1, 3.1d-2, and 3.1d-3 would reduce Alternative 2 health-risk impacts from construction and operational activities to a less-than-significant level.

The increased nonresidential land uses associated with Alternative 2 would result in slightly greater construction-related and operational odor sources (e.g., diesel exhaust emissions and potential retail land uses, respectively) than would be associated with the proposed plan. Like the proposed plan, Alternative 2 would result in retail/services near residential receptors and would have the potential to expose receptors to objectionable odor sources. With implementation of Mitigation Measure 3.1e-1, similar to the proposed plan, odor emissions under Alternative 2 would be reduced to a less-than-significant level.

Overall, the air quality impacts of Alternative 2 would be *less than* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

The Station Center Office and Residential Focus Alternative (Alternative 3) would reduce the amount of retail land uses and dwelling units while increasing office land uses. Compared to the proposed plan, this alternative would result in approximately 6,099 additional square feet of net total nonresidential land uses and 13 fewer dwelling units (see Table 6-1 for detailed land use differences between alternatives). It is anticipated that the net increase in nonresidential land uses and decrease in residential land uses associated with Alternative 3 would result in comparable overall construction activities (i.e., less square footage to construct) and fewer operational emissions as a result of fewer vehicle trips.

Alternative 3 would result in overall construction emissions comparable to those of the proposed plan. Although commercial land uses would increase and residential land uses would decrease, it is anticipated that construction activities would occur at similar intensities to the proposed plan. Therefore, Alternative 3 would likely also generate daily construction emissions that would exceed BAAQMD thresholds of significance. Similar to the proposed plan, Alternative 3's construction emissions would be considered potentially significant. However, implementation of Mitigation Measures 3.1a-1 to 3.1a-4 would reduce Alternative 3 impacts to a less-than-significant level.

At full buildout, daily operational activities under Alternative 3 would result in slightly fewer vehicle trips and VMT than those for the proposed plan. Alternative 3 is anticipated to generate comparable area- and energy-related operational emissions to those of the proposed plan. Therefore, similar to the proposed plan, Alternative 3's daily operational emissions would likely exceed BAAQMD thresholds of significance. However, implementation of Mitigation Measures 3.1a-4 and 3.1a-5 would reduce operational impacts of Alternative 3 to a less-than-significant level.

With respect to exposing sensitive receptors to substantial pollutant concentrations, Alternative 3 would result in a similar amount of total construction emissions (i.e., construction health risk impacts) and operational emissions from area- and energy-related sources, compared to the proposed plan. The additional office land uses associated with Alternative 3 would not be major sources of toxic air contaminants (TACs); thus, operational TAC impacts would be similar to those of the proposed plan. Alternative 3 would generate fewer operational vehicle trips than the proposed plan, and as a result, its impact on potential carbon monoxide hotspots would be less than the impact of the proposed plan. Because Alternative 3 would result in TAC impacts similar to or slightly less than those of the proposed plan, it is anticipated that similar to the proposed plan, these impacts could be potentially significant. However, implementation of Mitigation Measures 3.1d-1, 3.1d-2, and 3.1d-3 would reduce Alternative 3 health-risk impacts to a less-than-significant level.

The reduced retail, increased office, and decreased residential land uses associated with Alternative 3 would result in construction-related odor sources comparable to those of the proposed plan. However, because Alternative 3 would reduce retail land uses (which are a potential odor source) and increase office land uses (which are not typically large odor sources), it is anticipated that Alternative 3's odor impacts would be less than those of the proposed plan. Like the proposed plan, Alternative 3 would result in retail/services near residential receptors and would have the potential to expose receptors to objectionable odor sources. With implementation of Mitigation

Measure 3.1e-1, similar to the proposed plan, odor emissions under Alternative 3 would be reduced to a less-than-significant level.

Overall, the air quality impacts of Alternative 3 would be *less than* those of the proposed plan.

Biological Resources

Alternative 1: No Project/No Development Alternative

No new development would occur under the No Project/No Development Alternative (Alternative 1). Thus, there would be no substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service. This includes special-status plants, fish, amphibians, mammals, invertebrates, reptiles, and birds, as well as migratory birds. Alternative 1 would not result in any new construction, and thus, would not have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service.

This alternative includes no ground-disturbing activities and would not have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means. Alternative 1 also would not involve the construction of any new structures; therefore, this alternative would not interfere with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites. Alternative 1 would not involve any construction, and thus, would not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance, nor would it conflict with the provisions of an adopted habitat conservation plan; natural community conservation plan; or other approved local, regional, or state habitat conservation plan.

Overall, the impacts of Alternative 1 on biological resources would be *less than* those of the proposed plan.

Alternative 2: No Regional Commercial Overlay Zone Alternative

The overall square footage of development under the No Regional Commercial Overlay Zone Alternative (Alternative 2) would be slightly greater than that under the proposed plan. Thus, the construction activities under this alternative also would be slightly increased. However, construction for Alternative 2 would involve similar equipment as construction for the proposed plan. Therefore, similar to the proposed plan, construction-related activities for Alternative 2 could result in impacts on special-status species and the degradation of aquatic habitat for special-status species (particularly aquatic habitat for amphibian, reptile, and fish species). With the implementation of Mitigation Measures 3.2-1, 3.2-2, and 3.2-4, preconstruction surveys for special-status plants and wildlife species would reduce the potential for impacts on special-status wildlife. In addition, Mitigation Measures 3.2-3, 3.9-1, and 3.9-2 would require that proper erosion control devices be used to reduce the potential for erosion and sedimentation of nearby watercourses and wetlands (special-status species aquatic habitat), and would ensure that no materials that could harm special-status wildlife would be used. Mitigation Measures 3.2-1 through 3.2-4, 3.9-1, and 3.9-2 would reduce the impact on special-status plants and wildlife species to a less-than-significant level.

Like the proposed plan, Alternative 2 would not result in construction in riparian areas or wetlands. Project-related runoff or accidental spills could enter riparian habitats or wetlands, thus resulting in increased turbidity or pollutants and degradation of aquatic habitat, and making the habitats or wetlands less useful for wildlife. Implementation of Mitigation Measures 3.2-3, 3.9-1, and 3.9-2 would reduce the impact of Alternative 2 on water features and riparian sensitive natural communities and U.S. Army Corps of Engineers Section 404 jurisdictional water features to a less-than-significant level.

The two perennial streams that traverse the plan area are the only wildlife corridors in the area. These two features accommodate the movement of wildlife within the area, from east to west. Similar to the proposed plan, Alternative 2 would not result in development activities within these two features. In addition, with the exception of the two perennial stream features, the remainder of the plan area does not function as an important corridor between larger open space wildlife areas, because it is composed of dense urban development and is bordered on all sides by dense urban development. Therefore, the impact of Alternative 2 on wildlife corridors would be less than significant.

Similar to the proposed plan, Alternative 2 would likely require removing trees that meet the definition of “protected tree” under the City’s Zoning Ordinance and Municipal Code, to “address tree preservation and protection.” The impact from the loss of these trees during construction would be potentially significant. Implementation of Mitigation Measure 3.2-5 would address compliance with the ordinance and code.

No drafted or adopted conservation plans are in place that would apply to Alternative 2 or affect the plan area. Therefore, no impact would occur.

Overall, the impacts of Alternative 2 on biological resources would be *similar to* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

The Station Center Office and Residential Focus Alternative (Alternative 3) is an action alternative and is generally similar to the proposed plan, but this alternative has a slightly different set of proposed land use changes and a slightly smaller footprint. As described for Alternative 2, mitigation measures and adherence to state and local regulatory requirements would reduce the impacts of Alternative 3 on biological resources to a less-than-significant level. Overall, the impacts of Alternative 3 on biological resources would be *similar to* those of the proposed plan.

Cultural Resources

No cultural resources, either archaeological or built-environment resources, have been identified in the plan area. The plan area is located within a geologic formation area that is not considered paleontologically sensitive, and the potential for the presence of unique paleontological resources is minimal. In addition, no sacred or traditional Native American tribal cultural resources associated with the plan area have been identified, and the area is not considered sensitive for tribal cultural resources. However, the potential exists for subsurface archaeological resources and human remains to be present in the plan area.

Alternative 1: No Project/No Development Alternative

No activities are proposed under the No Project/No Development Alternative (Alternative 1) that would cause a substantial adverse change to any historical resources as defined in State CEQA Guidelines Section 15064.5, or that would disturb potential subsurface archaeological or paleontological resources or human remains. Alternative 1 would have no impact on historical resources. Overall, the cultural resources impacts of Alternative 1 would be *less than* those of the proposed plan.

Alternative 2: No Regional Commercial Overlay Zone Alternative

Similar to the proposed plan, no activities are proposed under the No Regional Commercial Overlay Zone Alternative (Alternative 2) that would cause a substantial adverse change to any historical resources as defined in State CEQA Guidelines Section 15064.5. Proposed activities involving excavation and ground disturbance have the potential to inadvertently affect subsurface archaeological resources or human remains. With implementation of Mitigation Measures 3.3-1 and 3.3-2, Alternative 2 would result in a less-than-significant impact with mitigation incorporated for archaeological resources or human remains. Overall, the cultural resources impacts of Alternative 2 would be *similar to* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

Similar to the proposed plan and Alternative 2, no activities are proposed under the Station Center Office and Residential Focus Alternative (Alternative 3) that would cause a substantial adverse change to any historical resources as defined in State CEQA Guidelines Section 15064.5. Proposed activities involving excavation and ground disturbance have the potential to inadvertently affect subsurface archaeological resources or human remains. With implementation of Mitigation Measures 3.3-1 and 3.3-2, the plan would result in a less-than-significant impact with mitigation incorporated for archaeological resources or human remains. Overall, the cultural resources impacts of Alternative 3 would be *similar to* those of the proposed plan.

Geology and Soils

Alternative 1: No Project/No Development Alternative

No activities or operations are proposed under the No Project/No Development Alternative **(**Alternative 1) that would cause a substantial adverse change related to geology and soils. Alternative 1 would have no impact on geology and soils. Overall, the geology and soils impacts of Alternative 1 would be *less than* those of the proposed plan.

Alternative 2: No Regional Commercial Overlay Zone Alternative

Similar to the proposed plan, no activities are proposed under the No Regional Commercial Overlay Zone Alternative (Alternative 2) that would cause a substantial adverse change related to geology and soils. Proposed construction activities would involve excavation and ground disturbance. Under the Rohnert Park Municipal Code, all projects involving engineered grading require a site-specific geotechnical report, a soils report, and a liquefaction analysis, and inspection by the geotechnical engineer is required during the construction process for each project. Furthermore, no Alquist-Priolo Earthquake Fault Zone is located in the plan area. With implementation of Mitigation Measure 3.4-1, Alternative 2 would result in a less-than-significant impact with mitigation incorporated with respect to geology and soils. Overall, the geology and soils impacts of Alternative 2 would be *similar to* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

Similar to the proposed plan and Alternative 2, no activities are proposed under the Station Center Office and Residential Focus Alternative (Alternative 3) that would cause a substantial adverse change related to geology and soils. Proposed construction activities would involve excavation and ground disturbance; however, a similar extent of construction activities would occur under Alternative 3 compared to the proposed plan. Under the Rohnert Park Municipal Code, all projects involving engineered grading require a site-specific geotechnical report, a soils report, and a liquefaction analysis, and inspection by the geotechnical engineer is required during the construction process for each project. Furthermore, no Alquist-Priolo Earthquake Fault Zone is located in the plan area. With implementation of Mitigation Measure 3.4-1, Alternative 3 would result in a less-than-significant impact with mitigation incorporated with respect to geology and soils. Overall, the geology and soils impacts of Alternative 2 would be *similar to* those of the proposed plan.

Greenhouse Gas Emissions

Alternative 1: No Project/No Development Alternative

The No Project/No Development Alternative (Alternative 1) would include land use changes from other approved plans but no direct changes associated with the proposed plan, and thus would not include any construction-related GHG emissions. However, all land uses under the proposed plan would be built to meet the most current energy efficiency standards. As a result, Alternative 1 would likely result in greater long-term operational GHG emissions than the proposed plan because older and existing buildings would still be used under this alternative. In addition, the GHG efficiency of Alternative 1 would be less than that of the proposed plan, because of the lack of the mixed-use, transit-oriented, and infill features that would allow jobs and populations to operate in a manner resulting in lower GHG emissions. Alternative 1 would not result in a net increase in GHG emissions from construction activities, but would operate at a higher level of GHG emissions than the proposed plan. Overall, the GHG emissions impacts of Alternative 1 would be *greater than* those of the proposed plan.

Alternative 2: No Regional Commercial Overlay Zone Alternative

The No Regional Commercial Overlay Zone Alternative (Alternative 2) would remove the Commercial Overlay Zone from the Triangle Business subarea, which would reduce the total amount of retail land uses and increase the total industrial land uses compared to the proposed plan. Under Alternative 2, total nonresidential land uses would increase compared to the proposed plan and result in slightly higher overall construction-related GHG emissions. Furthermore, even with the slight reduction in operational mobile-source activities associated with Alternative 2, long-term annual operational emissions under Alternative 2 (with amortized construction emissions) would continue to exceed BAAQMD thresholds of significance (i.e., annual emissions and GHG efficiency thresholds). Similar to the proposed plan, Mitigation Measures 3.5a-1, 3.5a-2, and 3.5a-3 would reduce Alternative 2's construction and operational emissions to a less-than-significant level.

Although Alternative 2 would result in reduced retail and increased industrial land uses compared to the proposed plan, this alternative would continue to be an infill, mixed-use, and transit-oriented development. In addition, Policy L-8.3 and Mitigation Measure 3.5a-1 would ensure that development in the plan area under Alternative 2 would comply with the applicable GHG reduction strategies of the Rohnert Park GHG Reduction Plan and Sonoma County Community Climate Action Plan (CAP). In addition, the slightly reduced VMT associated with Alternative 2 compared to the proposed plan would contribute to an overall reduction in regional mobile-source GHG emissions, consistent with the goals of Assembly Bill (AB) 32. Therefore, Alternative 2 would continue to incorporate the types of design measures (i.e., infill, mixed-use, transit-oriented) necessary to support and serve population growth in the state while also helping achieve the GHG emission reduction goals of AB 32. Therefore, like the proposed plan, Alternative 2 would not conflict with any plan, policy, or regulation adopted for the purpose of reducing GHG emissions. This impact would be less than significant.

Overall, the GHG emissions impacts of Alternative 2 would be *similar to* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

The Station Center Office and Residential Focus Alternative (Alternative 3) would reduce the overall dwelling units and retail land uses while increasing office land uses compared to the proposed plan. Alternative 3 would result in overall construction-related GHG emissions comparable to those of the proposed plan. With respect to long-term operational emissions, Alternative 3 would generate slightly less mobile-source GHG emissions due to reduced daily trips. Other operational emissions are anticipated to be comparable to the proposed land and therefore even with the reduction in vehicle trips and VMT, Alternative 3’s long-term annual operational emissions (with amortized construction emissions) would continue to exceed BAAQMD thresholds of significance (i.e., annual emissions and GHG efficiency thresholds). Similar to the proposed plan, Mitigation Measures 3.5a-1, 3.5a-2, and 3.5a-3 would reduce Alternative 3’s construction and operational emissions to a less-than-significant level.

Although Alternative 3 would result in a slight decrease in residential and retail land uses and an increase in commercial land uses compared to the proposed plan, this alternative would continue to be an infill, mixed-use, and transit-oriented development. In addition, Policy L-8.3 and Mitigation Measure 3.5a-1 would ensure that development in the plan area under Alternative 3 would comply with the applicable GHG reduction strategies of the Rohnert Park GHG Reduction Plan and Sonoma County Community CAP. In addition, the reduced VMT associated with Alternative 3 compared to the proposed plan would contribute an overall reduction in regional mobile-source GHG emissions compared to the proposed plan, consistent with the goals of AB 32. Therefore, Alternative 3 would continue to incorporate the types of design measures (i.e., infill, mixed-use, transit-oriented) necessary to support and serve population growth in the state while also helping achieve the GHG emission reduction goals of AB 32. Therefore, like the proposed plan, Alternative 3 would not conflict with any plan, policy, or regulation adopted for the purpose of reducing GHG emissions. This impact would be less than significant.

Overall, the GHG emissions impacts of Alternative 3 would be *less than* those of the proposed plan.

Hazards and Hazardous Materials

Alternative 1: No Project/No Development Alternative

No activities or operations are proposed under the No Project/No Development Alternative **(**Alternative 1) that would cause a substantial adverse change related to hazards and hazardous materials. Alternative 1 would have no impact on hazards and hazardous materials. Overall, the hazards and hazardous materials impacts of Alternative 1 would be *less than* those of the proposed plan.

Alternative 2: No Regional Commercial Overlay Zone Alternative

Similar to the proposed plan, activities proposed under the No Regional Commercial Overlay Zone Alternative (Alternative 2) that would not cause a substantial adverse change related to hazards and hazardous materials. There are three known sites in the plan area where hazardous materials contamination has occurred as well as structures that may contain asbestos and lead-based paint that could be disturbed by construction activities; however, similar construction activities would occur under Alternative 2 or the proposed plan. The Rohnert Park Municipal Code requires all projects to minimize risk to life and property from the generation, storage, and transportation of hazardous materials and waste. Projects must comply with all applicable regulations and provisions for the storage, use, and handling of hazardous substances as established by federal (U.S. Environmental Protection Agency [EPA]), state (California Department of Toxic Substances Control [DTSC], Regional Water Quality Control Board [RWQCB], California Occupational Safety and Health Administration [Cal-OSHA], California Environmental Protection Agency [Cal EPA]), and local (Sonoma County, City of Rohnert Park) regulations, and assure the proper disposal of all hazardous waste that may be generated. With implementation of Mitigation Measures 3.6-1a, 3.6-1b, and 3.6-2, Alternative 2 would result in a less-than-significant impact with mitigation incorporated with respect to hazards and hazardous materials. Overall, the hazards and hazardous materials impacts of Alternative 2 would be *similar to* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

Similar to the proposed plan and Alternative 2, no activities are proposed under the Station Center Office and Residential Focus Alternative (Alternative 3) that would cause a substantial adverse change related to hazards and hazardous materials. Proposed construction activities would involve excavation and ground disturbance; however, a similar extent of construction activities would occur under Alternative 3 compared to the proposed plan. The Rohnert Park Municipal Code requires all projects to minimize risk to life and property from the generation, storage, and transportation of hazardous materials and waste. Projects must comply with all applicable regulations and provisions for the storage, use, and handling of hazardous substances as established by federal (EPA), state (DTSC, RWQCB, Cal-OSHA, Cal EPA), and local (Sonoma County, City of Rohnert Park) regulations, and assure the proper disposal of all hazardous waste that may be generated. With implementation of Mitigation Measures 3.6-1a, 3.6-1b, and 3.6-2, Alternative 3 would result in a less-than-significant impact with mitigation incorporated with respect to hazards and hazardous materials. Overall, the hazards and hazardous materials impacts of Alternative 2 would be *similar to* those of the proposed plan.

Hydrology and Water Quality

Alternative 1: No Project/No Development Alternative

No new development would occur under the No Project/No Development Alternative (Alternative 1). There would not be any construction activities under this alternative that could result in water quality impacts in the vicinity of the plan area. Therefore, temporary water quality impacts would not occur. Alternative 1 would not result in new construction; thus, associated changes in drainage patterns from conversion of existing undeveloped areas into developed, impervious areas would not occur. In addition, without the construction of new urban surfaces, stormwater would not carry different, possibly higher, concentrations of pollutants into receiving waters. Temporary construction dewatering would not be required and groundwater recharge would not be reduced. Without dewatering, there also would be no potential for adverse water quality impacts under this alternative.

Because most of the plan area is developed, redevelopment of existing sites and buildings could improve water quality as new low-impact development (LID) techniques are implemented, as required by the City's MS4 permit and associated City of Santa Rosa and County of Sonoma 2011 *Storm Water Low Impact Development Technical Design Manual* (LID Manual). Without new development or redevelopment, LID techniques would not be implemented. However, it is expected that even with the implementation of required LID, overall impervious surfaces in the plan area would likely increase. Overall, the hydrology and water quality impacts of Alternative 1 would be *less than* those of the proposed plan.

Alternative 2: No Regional Commercial Overlay Zone Alternative

The overall square footage of development under the No Regional Commercial Overlay Zone Alternative (Alternative 2) would be slightly more than that under the proposed plan, which may result in a slightly greater impact footprint. Thus, the construction activities under Alternative 2 also would be similar to, or slightly greater than, construction activities under the proposed plan. However, construction for Alternative 2 and for the proposed plan would involve similar equipment. Therefore, as under the proposed plan, construction-related activities under Alternative 2 would have the potential to degrade water quality if not managed properly. Implementation of Policy L-7.1 in the proposed plan and Mitigation Measures 3.9-1 and 3.9-2, adherence to applicable local regulations, and compliance with grading plan requirements would adequately avoid violations of water quality standards under Alternative 2 and would reduce construction-related impacts of this alternative on water quality to a less-than-significant level.

Like the proposed plan, Alternative 2 would not result in a net increase of impervious surfaces. Through compliance with the Municipal Separate Storm Sewer System Permit requirements, including adherence to the City's Storm Water Management Plan (SWMP), Alternative 2 would not increase runoff volumes compared to existing conditions, because 100 percent of any increase in stormwater volume would be infiltrated and/or reused on-site. In addition, Sonoma County Water Agency (SCWA) reviews project drainage system plans for compliance with its *Flood Control Design Criteria*. Compliance with these regulations would ensure that storm drainage systems are adequately sized to convey post development runoff.

Although the square footage of development and development footprint under Alternative 2 would be slightly greater than that under the proposed plan, this alternative could still affect drainage patterns and water quality by converting existing undeveloped areas into developed, impervious areas. Design and construction of drainage systems per SCWA's *Flood Control Design Criteria* would ensure that storm drainage systems are adequately sized. Alternative 2 would require implementation of Policy U-1.7 and Policy U-1.6 and adherence to the City's Revised Phase II National Pollutant Discharge Elimination System (NPDES) SWMP. Policy U.1-7 requires new development to upgrade or install storm drainage facilities, including on-site facilities, as needed to serve the plan area; Policy U-1.6 requires new development and capital improvement projects to reduce pollution and runoff affecting plan area creeks by following the adopted *City of Santa Rosa and Sonoma County Storm Water Low Impact Development Technical Design Manual.* Implementation of Mitigation Measures 3.9-1 and 3.9-2, which include postconstruction best management practices, and adherence to the City's SWMP and state and local regulatory requirements would reduce potential water quality and runoff impacts of Alternative 2 from changes to the plan area's land use and runoff to a less-than-significant level.

Although the square footage of development and development footprint under Alternative 2 would be slightly greater than that under the proposed plan, temporary construction dewatering could reduce groundwater infiltration and recharge, thereby resulting in a decrease in groundwater levels. Adverse water quality impacts or illicit discharges to the stormwater drainage system could occur during construction dewatering activities if water is not properly stored and disposed of. Mitigation Measure 3.9-4 would be implemented to reduce these impacts of Alternative 2. As under the proposed plan, implementation of this mitigation measure and adherence to state and local regulatory requirements as part of NPDES Construction General Permit requirements would reduce the potential water quality impact from dewatering under Alternative 2 to a less-than-significant level.

Neither Alternative 2 nor the proposed plan would include the placement of housing with a 100-year flood hazard area or the placement of structures within a 100-year flood hazard area; would expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam. Therefore, no impacts would occur and the impacts of Alternative 2 with regard to these issues would be similar to those of the proposed plan. As under the proposed plan, development under Alternative 2 would occur on flat terrain where soils are primarily Clear Lake clays, which typically have low erosion potential. Therefore, similar to the proposed plan, potential impacts of Alternative 2 related to mudflows would be less than significant.

Overall, the hydrology and water quality impacts of Alternative 2 would be *similar to* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

The Station Center Office and Residential Focus Alternative (Alternative 3) is an action alternative and is generally similar to the proposed plan, but this alternative has a slightly different set of proposed land use changes. As with Alternative 2, the impacts of Alternative 3 on hydrology and water quality would be similar to those of the proposed plan. These impacts would be reduced to less-than-significant levels with the implementation of mitigation measures, adherence to state and local regulatory requirements, and implementation of Policies L-7.1, U-1.7, and U-1.6. Overall, the hydrology and water quality impacts of Alternative 3 would be *similar to* the impacts of the proposed plan.

Noise

Alternative 1: No Project/No Development Alternative

No new development would occur under the No Project/No Development Alternative (Alternative 1). Thus, there would not be any construction activities under this alternative that would generate additional noise or vibration in the vicinity of the plan area. The temporary increase in existing ambient noise at the existing residential uses located near the construction areas would not occur under Alternative 1.

Alternative 1 would not introduce new on-site noise sources (e.g., mechanical equipment). As such, the noise levels generated from on-site stationary sources in the plan area would remain at existing levels. However, the noise levels from off-site mobile noise sources (i.e., traffic volumes) would increase along the nearby roadways because of the increase in the traffic volumes from other projects in the area. The future traffic volumes for this alternative would be equivalent to the Future without Project conditions in 2040. Relative to existing conditions, future (cumulative) off-site traffic noise levels under Alternative 1 (i.e., Future without Project conditions) would increase by a maximum of 4.1 A-weighted decibels (dBA) day-night level (L_{dn}), compared to a maximum 4.2-dBA L_{dn} increase under the proposed plan (Future with Project conditions).

Overall, the noise impacts of Alternative 1 would be *less than* those of the proposed plan.

Alternative 2: No Regional Commercial Overlay Zone Alternative

The overall square footage of development under the No Regional Commercial Overlay Zone Alternative (Alternative 2) would be slightly greater than that under the proposed plan. Thus, the construction activities under Alternative 2 also would be expected to increase. However, construction for Alternative 2 would involve similar equipment as construction for the proposed plan. Therefore, similar to the proposed plan, construction-related activities under Alternative 2 would generate noise levels up to 86.3 dBA at 50 feet from the construction area (during the building construction phase). As such, the construction activities under this alternative would temporarily increase the existing ambient noise level at the existing residential uses near the construction area. As under the proposed plan, construction activities under Alternative 2 would be required to comply with the City's allowable hours (daytime hours between 8:00 a.m. and 6:00 p.m.). As under the proposed plan, Mitigation Measure 3.12d-1 would be implemented under Alternative 2, which would ensure that construction noise impacts would be less than significant. Therefore, construction-related noise under Alternative 2 would be similar to the proposed plan and, like the proposed plan, would result in a less-than-significant noise impact.

Similar to the proposed plan, construction activities under Alternative 2 would generate groundborne vibration levels up to 78 vibration decibels (VdB) at 50 feet from the operation of heavy construction equipment (i.e., large bulldozer and caisson drilling). Therefore, groundborne vibration levels from construction activities at off-site residential uses, which are a minimum of 100 feet from the project construction areas, would be further attenuated to well below the threshold of 80 VdB. As under the proposed plan, the existing on-site residential uses could be exposed to groundborne vibration up to 87 VdB when construction equipment is operating within 25 feet of the residential uses. However, construction activities would comply with the City's allowable construction hours and would be limited to the daytime hours, thereby avoiding the normal sleeping hours (i.e., nighttime hours). Thus, vibration impacts from the Alternative 2 construction activities would be similar to the impacts from the proposed plan and would be less than significant.

Alternative 2 would result in a small reduction of project-generated vehicle traffic relative to the proposed plan, from 27,777 daily trips to 27,022 daily trips (approximately 3 percent reduction). The 3 percent reduction in project-related traffic generation represents a 0.1-dBA reduction in the project-related noise contribution, compared to the proposed plan. This change is considered negligible. Therefore, noise associated with off-site traffic under Alternative 2 would be slightly less than under the proposed plan and noise impacts would be similar to the impacts of the proposed plan, less than significant.

There would be no changes to the locations or number of residential units under Alternative 2 as compared to the proposed plan. As under the proposed plan, Mitigation Measure 3.12a-1 would be implemented to ensure that the interior noise levels at the future residential use under Alternative 2 would meet the City's interior noise requirement of 45 dBA L_{dn}, and Mitigation Measure 3.12a-2 would be implemented to ensure that the exterior noise levels at the residential outdoor uses do not exceed 60 dBA L_{dn}. Therefore, operational noise impacts under Alternative 2 would be reduced to a less-than-significant level.

Overall, the noise impacts of Alternative 2 would be *similar to* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

The Station Center Office and Residential Focus Alternative (Alternative 3) would reduce the overall dwelling units and retail land uses while increasing office land uses compared to the proposed plan. However, Alternative 3 would involve construction activities and equipment similar to the activities and equipment for the proposed plan. Similar to the proposed plan, construction-related activities under this alternative would generate noise levels up to 86.3 dBA at 50 feet from the construction area (during the building construction phase). Therefore, the construction activities for Alternative 3, like the construction activities for the proposed plan, would temporarily increase the existing ambient noise level at the existing residential uses near the construction area. Like the proposed plan, construction activities under this alternative would be required to comply with the City's allowable hours (daytime hours between 8:00 a.m. and 6:00 p.m.). As under the proposed plan, Mitigation Measure 3.12d-1 would be implemented under Alternative 3 to ensure that construction noise impacts would be less than significant. Therefore, construction-related noise levels under Alternative 3 would be similar to construction noise under the proposed plan and the impact would be less than significant.

As under the proposed plan, construction activities under Alternative 3 would generate groundborne vibration levels up to 78 VdB at 50 feet from the heavy construction equipment (i.e., large bulldozer and caisson drilling). Therefore, the groundborne vibration levels from construction activities at off-site residential uses, which are a minimum of 100 feet from the project construction areas, would be well below the threshold of 80 VdB. As under the proposed plan, under Alternative 3 the existing on-site residential uses could be exposed to groundborne vibration up to 87 VdB when construction equipment is operating within 25 feet of the residential uses. However, construction activities would comply with the City's allowable construction hours and would be limited to the daytime hours, thereby avoiding the normal sleeping hours (i.e., nighttime hours). As such, vibration impacts from Alternative 3 construction activities would be similar to impacts of the proposed plan and would be less than significant.

Alternative 3 would result in a slight reduction in project-generated vehicle traffic relative to the proposed plan, from 27,777 daily trips to 25,830 daily trips (7 percent reduction). The 7 percent reduction in project-related traffic generation represents a 0.3-dBA reduction in project noise contribution compared to the proposed plan. This change is considered negligible. Therefore, noise associated with off-site traffic under Alternative 3 would be less than under the proposed plan and noise impacts would be similar, less than significant. Alternative 3 proposes fewer residential units than the proposed plan, 402 units compared to 415 units. The residential uses under Alternative 3 would be placed near the future SMART rail station, as in the proposed plan. As under the proposed plan, Mitigation Measure 3.12a-1 would be implemented under Alternative 3 to ensure that the interior noise levels at the future residential use would meet the City's interior noise requirement of 45 dBA L_{dn}, and

Mitigation Measure 3.12a-2 would be implemented to ensure that the exterior noise levels at the residential outdoor uses would not exceed 60 dBA L_{dn}. Therefore, operational noise impacts under Alternative 3 would be reduced to a less-than-significant level.

Overall, the noise impacts of Alternative 3 would be *less than* those of the proposed plan.

Transportation/Traffic

Alternative 1: No Project/No New Development Alternative

The No Project/No New Development Alternative (Alternative 1) includes foreseeable changes to land use and the transportation network that have already been approved, but none of the changes included in the proposed plan.

Under Alternative 1, the proposed plan would not be implemented, and none of the proposed changes to land use or improvements to transportation facilities proposed under the plan would take effect under this alternative. As a result, no impact would occur related to a conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system. The impact of Alternative 1 with regard to this issue would be less than the impact of the proposed plan, which would result in a significant and unavoidable impact under future cumulative conditions..

Because of future development in the city, however, operations at several study intersections and freeway segments would be expected to degrade to unacceptable conditions under Alternative 1. The following intersections would operate at unacceptable conditions in the future under this alternative:

- Commerce Boulevard/State Farm Drive (p.m. peak hour),
- RPX/Commerce Boulevard (p.m. peak hour),
- RPX/State Farm Drive (a.m. and p.m. peak hours), and
- Enterprise Drive/State Farm Drive (p.m. peak hour).

The proposed plan would add traffic to these intersections, but would include traffic signal or lane geometry improvements to improve intersection operations to acceptable conditions or mitigate the effects of the additional traffic. As a result, the proposed plan would result in less-than-significant impacts on intersection operations. The proposed plan also would create more opportunity to complete the intersection improvements as nearby properties are developed and redeveloped. These improvements may not be made under the No-Project Alternative.

The following freeway segments also would be expected to operate at unacceptable conditions in the future under Alternative 1:

- northbound U.S. 101 between Golf Course Drive and Santa Rosa Avenue (p.m. peak hour),
- northbound U.S. 101 between Santa Rosa Avenue and Todd Road (p.m. peak hour), and
- southbound U.S. 101 between Todd Road and Golf Course Drive (a.m. and p.m. peak hours).

The proposed plan would add traffic to these freeway segments, which would continue to operate at LOS F but with an increase in the v/c ratio in excess of Caltrans' thresholds of significance. As a result, the proposed plan would result in a significant and unavoidable impact at these locations under future cumulative conditions.

Under Alternative 1, the proposed plan would not be implemented and none of the land use changes or transportation facility improvements included in the proposed plan would take effect. As a result, no impact would occur related to a conflict with an applicable congestion management system. With regard to this issue, Alternative 1 would generate an impact less than that of the proposed plan, which would result in a less-than-significant impact.

Neither Alternative 1 nor the proposed plan would result in a change in air traffic patterns—either an increase in air traffic levels or a change in location that would result in substantial safety risks during construction or operation. The closest airports to the plan area, the Sonoma County Airport and Petaluma Municipal Airport, are both located more than 10 miles away. There would be no safety risks associated with proximity to airports; therefore, no impact would occur regarding a potential change in air traffic patterns, and Alternative 1 would generate an impact similar to that of the proposed plan.

Neither Alternative 1 nor the proposed plan would include any hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses, and neither would alter design features developed to mitigate such hazards during construction or operations. Therefore, no impact would occur related to a substantial increase in hazards due to a design feature, and Alternative 1 would generate an impact similar to that of the proposed plan.

Because none of the land use changes or transportation facility improvements included in the proposed plan would take effect under Alternative 1, no impact related to the adequacy of emergency access would occur under this alternative. Alternative 1 would generate an impact less than that of the proposed plan, which would result in a less-than-significant impact.

In addition, because Alternative 1 would not include the proposed plan's land use changes and transportation facility improvements, this alternative would fail to meet Goal CT-1 (and Objectives CT-1.4, CT-1.5, and CT-1.8 and Policy CT-1k), Goal CT-2, and Goal CT-3 (and Objectives CT-3.3 and CT-3.8) of the *Sonoma County General Plan 2020* and Goal TR-L of the *City of Rohnert Park General Plan*. The proposed plan was expressly developed to help address and achieve these goals, objectives, and policies. Therefore, Alternative 1 would result in a significant impact related to a conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities or other decrease in the performance or safety of such facilities. With regard to this issue, the impact of this alternative would be greater than that of the proposed plan, which would result in a less-than-significant impact.

Overall, the transportation and traffic impacts of Alternative 1 would be *less than* those of the proposed plan, but also Alternative 1 does not support the improvements of the proposed plan, consistent with adopted General Plan goals and policies.

Alternative 2: No Regional Commercial Overlay Zone Alternative

The No Regional Commercial Overlay Zone Alternative (Alternative 2) is an action alternative and is generally similar to the proposed plan, but this alternative has a slightly different set of proposed land use changes. Alternative 2 would reduce the amount of regional commercial uses permitted in the Triangle Business subarea; otherwise, this alternative proposes the same land use changes as the proposed plan.

Under the proposed plan, future development permitted in the plan area would generate approximately 27,777 additional vehicle-trips per day, including 1,352 vehicle-trips during the a.m. peak hour and 1,973 vehicle-trips during the p.m. peak hour. In contrast, future development under Alternative 2 would generate approximately 27,022 additional vehicle-trips per day, including 1,356 vehicle-trips during the a.m. peak hour and 1,955 vehicle-trips during the p.m. peak hour. As a result, Alternative 2 would generate similar vehicle-trips to the proposed plan: four more trips during the a.m. peak hour, but 18 fewer trips during the p.m. peak hour. This represents a vehicle-trip increase of less than 1 percent during the a.m. peak hour and a vehicle-trip decrease of 1 percent during the p.m. peak hour under Alternative 2, compared to the proposed plan.

The projected increase in vehicle-trips of less than 1 percent during the a.m. peak hour and decrease in vehicle-trips of 1 percent during the p.m. peak hour under Alternative 2 would be spread across two directions (inbound and outbound) and across various roadways serving the plan area. The effect of this difference on any specific transportation facility likely would be relatively small. Thus, Alternative 2 would generate an impact similar to that of the proposed plan related to a conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system. This alternative would result in a significant impact under future cumulative conditions. For the same reason, Alternative 2 would generate an impact similar to that of the proposed plan related to a conflict with an applicable congestion management system. This alternative would result in a less-than-significant impact.

Neither Alternative 2 nor the proposed plan would result in a change in air traffic patterns—either an increase in air traffic levels or a change in location that would result in substantial safety risks during construction or operation. The closest airports to the plan area, the Sonoma County Airport and Petaluma Municipal Airport, are both located more than 10 miles away. There would be no safety risks associated with proximity to airports; therefore, no impact would occur regarding a potential change in air traffic patterns, and Alternative 2 would generate an impact similar to that of the proposed plan.

Neither Alternative 2 nor the proposed plan would include any hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses, and neither would alter design features developed to mitigate such hazards during construction or operations. Therefore, no impact would occur related to a substantial increase in hazards due to a design feature, and Alternative 2 would generate an impact similar to that of the proposed plan.

Neither Alternative 2 nor the proposed plan would interfere with emergency access or result in inadequate emergency access, and both would be designed consistent with City and Caltrans standards as required to provide adequate emergency access. Therefore, no impact would occur related to the adequacy of emergency access, and Alternative 2 would generate an impact similar to that of the proposed plan.

Alternative 2 would feature a slightly different set of land use changes than the proposed plan, but would be fundamentally identical to the proposed plan with regard to improvements to transportation facilities. This alternative would be expected to generate slightly more vehicle-trips during the a.m. peak hour and slightly fewer vehicle-trips during the p.m. peak hour than the proposed plan; however, the magnitude of this difference is on the order of zero to 1 percent, spread across two directions (inbound and outbound) and across various roadways serving the plan area. As a result, any change in the magnitude of potential effects on public transit, bicycle, or pedestrian facilities because of additional vehicle-trips would be relatively small. Any such effects under Alternative 2 would likely be similar to those identified for the proposed plan. As a result, Alternative 2 would generate an impact similar to that of the proposed plan related to a conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities or other decrease in the performance or safety of such facilities. With regard to this issue, this alternative would result in a less-than-significant impact.

Overall, the transportation and traffic impacts of Alternative 2 would be *similar to* those of the proposed plan.

Alternative 3: Station Center Office and Residential Focus Alternative

The Station Center Office and Residential Focus Alternative (Alternative 3) is an action alternative and is generally similar to the proposed plan, but this alternative has a slightly different set of proposed land use changes. In particular, Alternative 3 would slightly adjust the nonresidential land use mix in the Station Center subarea by reducing the amount of retail/service uses and increasing the amount of office uses.

Under the proposed plan, future development permitted in the plan area would generate approximately 27,777 additional vehicle-trips per day, including 1,352 vehicle-trips during the a.m. peak hour and 1,973 vehicle-trips during the p.m. peak hour. In contrast, future development permitted in the plan area under Alternative 3 would generate approximately 25,830 additional vehicle-trips per day, including 1,401 vehicle-trips during the a.m. peak hour and 1,930 vehicle-trips during the p.m. peak hour. As a result, relative to the proposed plan, Alternative 3 would generate slightly more vehicle-trips (49) during the a.m. peak hour but slightly fewer vehicle-trips (43) during the p.m. peak hour. This represents a vehicle-trip increase of approximately 4 percent during the a.m. peak hour and decrease of approximately 2 percent during the p.m. peak hour, compared to the proposed plan.

The projected 4 percent increase and 2 percent decrease in vehicle-trips during the a.m. and p.m. peak hours, respectively, under Alternative 3 would be spread across two directions (inbound and outbound) and across various roadways serving the plan area. The effect of these differences on any specific transportation facility would likely be relatively small. Thus, Alternative 3 would generate an impact similar to that of the proposed plan related to a conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system. With regard to this issue, Alternative 3 would result in a significant impact under future cumulative conditions. For the same reason, Alternative 3 would generate an impact similar to that of the proposed plan with regard to a conflict with an applicable congestion management program. This alternative would result in a less-than-significant impact.

Neither Alternative 3 nor the proposed plan would result in a change in air traffic patterns—either an increase in air traffic levels or a change in location that would result in substantial safety risks during construction or operation. The closest airports to the plan area, the Sonoma County Airport and Petaluma Municipal Airport, are both located more than 10 miles away. There would be no safety risks associated with proximity to airports;

therefore, no impact would occur regarding a potential change in air traffic concerns. With regard to this issue, Alternative 3 would generate an impact similar to that of the proposed plan.

Neither Alternative 3 nor the proposed plan would include any hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses, and neither would alter design features developed to mitigate such hazards during construction or operations. Therefore, no impact would occur related to a substantial increase in hazards due to a design feature. With regard to this issue, Alternative 3 would generate an impact similar to that of the proposed plan.

Neither Alternative 3 nor the proposed plan would interfere with emergency access or result in inadequate emergency access, and both would be designed consistent with City and Caltrans standards as required to provide adequate emergency access. Therefore, no impact would occur related to the adequacy of emergency access, and Alternative 3 would generate an impact similar to that of the proposed plan.

Alternative 3 would feature a slightly different set of land use changes than the proposed plan, but would be fundamentally identical to the proposed plan with regard to improvements to transportation facilities. This alternative would be expected to generate slightly more vehicle-trips during the a.m. peak hour and slightly fewer vehicle-trips during the p.m. peak hour than the proposed plan; however, the magnitude of this difference is on the order of 2 to 4 percent, spread across two directions (inbound and outbound) and across various roadways serving the plan area. As a result, any change in the magnitude of potential effects on public transit, bicycle, or pedestrian facilities because of additional vehicle-trips would be relatively small. Any such effects under Alternative 3 would likely be similar to those identified for the proposed plan. Thus, Alternative 3 would generate an impact similar to that of the proposed plan related to a conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities or other decrease in the performance or safety of such facilities. With regard to this issue, this alternative would result in a less-than-significant impact.

Overall, the transportation and traffic impacts of Alternative 3 would be *less than* those of the proposed plan.

6.3.5 Environmentally Superior Alternative

The State CEQA Guidelines (Section 15126.6[e][2]) require that an EIR identify the environmentally superior alternative. If the environmentally superior alternative is the “No Project” Alternative, the EIR must identify an environmentally superior alternative from among the other alternatives. Alternative 1, the No Project/No Development Alternative, would minimize the significant impacts of the proposed plan related to transportation and traffic would have less severe impacts in all other issue areas. Because the No Project/No Development Alternative is the environmentally superior alternative, an environmentally superior alternative must be identified from among the other development alternatives.

Table 6-3 presents a comparison of the alternative impacts. Alternatives 2 and 3 would achieve the greater reduction in terms of contribution to the significant and unavoidable traffic impact by reducing the amount of regional commercial uses permitted in the plan area. However, similar to the proposed plan, in both instances this impact would still be significant and unavoidable.

Alternative 3, the Station Center Office and Residential Focus Alternative, would have less severe traffic impacts than the proposed plan by slightly adjusting the nonresidential land use mix in the Station Center subarea through a reduction in the amount of retail/service uses and an increase in the amount of office uses. However, similar to the proposed plan, this transportation impact would still be significant and unavoidable under this alternative.

Table 6-3: Comparison of the Impacts of the Alternatives with Those of the Proposed Plan

	Alternative 1	Alternative 2	Alternative 3
Air Quality	Less	Less	Less
Biological Resources	Less	Similar	Similar
Cultural Resources	Less	Similar	Similar
Geology and Soils	Less	Similar	Similar
GHG Emissions	Greater	Similar	Less
Hazards and Hazardous Materials	Less	Similar	Similar
Hydrology and Water Quality	Less	Similar	Similar
Noise and Vibration	Less	Similar	Less
Transportation and Traffic	Less	Similar	Less

Source: Data compiled by AECOM in 2015

Alternative 3 would be the environmentally superior alternative, given it would result in less traffic, noise, and greenhouse gas emissions impacts compared to the proposed plan and Alternative 2. Alternative 3 would meet the majority of the plan's objectives (presented in detail in Section 6.1.5), but to a lesser extent than the proposed plan and Alternative 2. Alternative 3 would meet the majority of the plan objectives but would be less effective in supporting the community's desire or the plan's objective for a Downtown retail environment, with substantial retail uses adjacent to the SMART rail station.

Furthermore, all of the alternatives would deliver fewer of the Downtown retail and entertainment benefits desired by the community than the proposed plan. The plan area has the potential for retail and employment infill opportunities near transit. Reduction of some of the retail and residential development in the alternatives would not support the plan's objectives or leverage the advantages of the coming SMART rail station to the support the creation of a downtown for the city.

6.4 REFERENCES

Metropolitan Transportation Commission. 2007 (October 18). *Station Area Planning Manual*. Prepared by Reconnecting America, Center for Transit-Oriented Development.

MTC. *See* Metropolitan Transportation Commission.

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7.0 LIST OF PREPARERS

7.1 LEAD AGENCY: CITY OF ROHNERT PARK

Mary Grace Pawson, Director of Development Services/City Engineer
Marilyn Ponton, Former Director of Development Services
Jeffrey Beiswenger, Planning Manager
Cathy Spence Wells, Dudek, EIR Peer Review
Heather Ivey, Dudek, EIR Peer Review

7.2 ENVIRONMENTAL CONSULTANT: AECOM

Kelsey Bennett, LEED-AP: Environmental Planning Project Manager
Anh Thai, LEED-AP: Urban Planning Project Manager
Jeff Goldman, AICP: Project Director

California Environmental Quality Act (CEQA) Topic Authors

Aesthetics: Juliana Lehnen and Nick Mitrovich
Agriculture and Forestry Resources: Whitney Broeking
Air Quality: George Lu, and Kelsey Bennett
Biological Resources: Peter Boice and Susan Sanders
Cultural Resources: Madeline Bowen, Jenifer Rogers, and Trina Meiser
Geology/Soils: Wendy Copeland
Greenhouse Gas Emissions: George Lu and Kelsey Bennett
Hazards and Hazardous Materials: Wendy Copeland
Hydrology and Water Quality: Kristin Tremain and Kara Baker
Land Use/Planning: Susan Yogi, Kelsey Bennett, and Anh Thai
Mineral Resources: Whitney Broeking
Noise: Sean Bui
Population/Housing: Elliott Schwimmer and Nick Mitrovich
Public Services: Conor Pigaga and Nick Mitrovich
Recreation: Diana Edwards, Anh Thai, and Nick Mitrovich
Transportation/Traffic: Amanda Leahy and Anthony Mangonon
Utilities/Service Systems: Conor Pigaga and Nick Mitrovich

Document Production

Editing: Beth Duffey, Pamela Cory, Derek McCulloch, and Julie Nichols
Word Processing: Marisa Fabrigas, Charisse Case, and Kristine Olsen
Graphics: Brian Perry

7.3 TRAFFIC IMPACT STUDY SUBCONSULTANT: W-TRANS

Zack Matley, AICP: Principal in Charge
Darlene Whitlock, PE, PTOE: Senior Reviewer
Sam Lam, PE: Transportation Engineer
Lauren Davini, EIT: Assistant Transportation Engineer
Angela McCoy: Editor/Word Processing
Deborah Mizell: Graphics

APPENDIX A

Air Quality / Greenhouse Gas Emissions Data

- Emissions Model Data
- Bay Area 2010 Clean Air Plan

Rohert Park PDAP

Sonoma-San Francisco County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Condo/Townhouse High Rise	341.00	Dwelling Unit	3.86	336,108.00	975
Apartments Mid Rise	417.00	Dwelling Unit	10.01	419,442.00	1193
Single Family Housing	78.00	Dwelling Unit	3.70	85,250.00	223
Strip Mall	440.89	1000sqft	7.50	440,886.00	0
General Office Building	189.32	1000sqft	3.40	189,315.00	0
Government Office Building	62.81	1000sqft	2.90	62,807.00	0
General Light Industry	129.32	1000sqft	5.94	129,315.00	0
Enclosed Parking with Elevator	2,217.00	Space	19.95	886,800.00	0
Parking Lot	2,324.00	Space	20.92	929,600.00	0
Other Asphalt Surfaces	44.95	1000sqft	1.03	44,946.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.2 **Precipitation Freq (Days)** 75

Climate Zone 4 **Operational Year** 2035

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 641.35 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - site specific data from project description

Construction Phase -

Vehicle Trips - Trip rates from Traffic Impact Study

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	EF_Nonresidential_Exterior	150.00	250.00
tblArchitecturalCoating	EF_Nonresidential_Interior	100.00	250.00
tblArchitecturalCoating	EF_Residential_Exterior	150.00	250.00
tblLandUse	LandUseSquareFeet	341,000.00	336,108.00
tblLandUse	LandUseSquareFeet	417,000.00	419,442.00
tblLandUse	LandUseSquareFeet	140,400.00	85,250.00
tblLandUse	LotAcreage	5.33	3.86
tblLandUse	LotAcreage	10.97	10.01
tblLandUse	LotAcreage	25.32	3.70
tblLandUse	LotAcreage	10.12	7.50
tblLandUse	LotAcreage	4.35	3.40
tblLandUse	LotAcreage	1.44	2.90
tblLandUse	LotAcreage	2.97	5.94
tblProjectCharacteristics	OperationalYear	2014	2035
tblVehicleTrips	ST_TR	7.16	6.65
tblVehicleTrips	ST_TR	7.16	6.65
tblVehicleTrips	ST_TR	1.32	5.94
tblVehicleTrips	ST_TR	2.37	11.03
tblVehicleTrips	ST_TR	10.08	6.65
tblVehicleTrips	ST_TR	42.04	44.32
tblVehicleTrips	SU_TR	6.07	6.65
tblVehicleTrips	SU_TR	6.07	6.65

tblVehicleTrips	SU_TR	0.68	5.94
tblVehicleTrips	SU_TR	0.98	11.03
tblVehicleTrips	SU_TR	8.77	6.65
tblVehicleTrips	SU_TR	20.43	44.32
tblVehicleTrips	WD_TR	6.59	6.65
tblVehicleTrips	WD_TR	6.59	6.65
tblVehicleTrips	WD_TR	6.97	5.94
tblVehicleTrips	WD_TR	11.01	11.03
tblVehicleTrips	WD_TR	68.93	33.82
tblVehicleTrips	WD_TR	9.57	6.65

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2016	0.7037	7.7134	5.5983	6.5300e-003	1.2349	0.3840	1.6189	0.5822	0.3546	0.9368	0.0000	608.8251	608.8251	0.1735	0.0000	612.4695
2017	1.7334	10.2910	19.9184	0.0354	2.5393	0.3554	2.8947	0.7829	0.3304	1.1133	0.0000	2,870.5679	2,870.5679	0.1887	0.0000	2,874.5314
2018	1.7230	9.5525	21.5301	0.0426	2.3593	0.2918	2.6511	0.6371	0.2724	0.9095	0.0000	3,344.2421	3,344.2421	0.1693	0.0000	3,347.7984
2019	1.5794	8.6862	20.1912	0.0426	2.3594	0.2583	2.6177	0.6371	0.2411	0.8782	0.0000	3,260.1405	3,260.1405	0.1616	0.0000	3,263.5331
2020	1.4408	7.6546	18.9741	0.0427	2.3684	0.2283	2.5967	0.6395	0.2131	0.8526	0.0000	3,173.8596	3,173.8596	0.1560	0.0000	3,177.1354
2021	1.3454	6.5799	18.0162	0.0425	2.3595	0.2000	2.5595	0.6371	0.1866	0.8238	0.0000	3,135.4590	3,135.4590	0.1508	0.0000	3,138.6254
2022	1.2453	5.8600	16.8437	0.0424	2.3507	0.1788	2.5295	0.6348	0.1668	0.8016	0.0000	3,099.5197	3,099.5197	0.1467	0.0000	3,102.5995
2023	28.1962	1.4563	3.8646	9.7600e-003	0.5216	0.0572	0.5788	0.1402	0.0533	0.1935	0.0000	708.5996	708.5996	0.0625	0.0000	709.9125
Total	**37.9671**	**57.7939**	**124.9366**	**0.2645**	**16.0930**	**1.9538**	**18.0469**	**4.6908**	**1.8184**	**6.5092**	**0.0000**	**20,201.2135**	**20,201.2135**	**1.2091**	**0.0000**	**20,226.6050**

2.1 Overall Construction

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2016	0.7037	7.7133	5.5983	6.5300e-003	1.2349	0.3840	1.6189	0.5822	0.3546	0.9368	0.0000	608.8244	608.8244	0.1735	0.0000	612.4688
2017	1.7334	10.2910	19.9184	0.0354	2.5393	0.3554	2.8947	0.7829	0.3304	1.1133	0.0000	2,870.5675	2,870.5675	0.1887	0.0000	2,874.5309
2018	1.7230	9.5525	21.5301	0.0426	2.3593	0.2918	2.6511	0.6371	0.2724	0.9095	0.0000	3,344.2418	3,344.2418	0.1693	0.0000	3,347.7980
2019	1.5794	8.6862	20.1912	0.0426	2.3594	0.2583	2.6177	0.6371	0.2411	0.8782	0.0000	3,260.1402	3,260.1402	0.1616	0.0000	3,263.5327
2020	1.4408	7.6546	18.9741	0.0427	2.3684	0.2283	2.5967	0.6395	0.2131	0.8526	0.0000	3,173.8592	3,173.8592	0.1560	0.0000	3,177.1351
2021	1.3454	6.5798	18.0162	0.0425	2.3595	0.2000	2.5595	0.6371	0.1866	0.8238	0.0000	3,135.4586	3,135.4586	0.1508	0.0000	3,138.6250
2022	1.2453	5.8600	16.8437	0.0424	2.3507	0.1788	2.5295	0.6348	0.1668	0.8016	0.0000	3,099.5194	3,099.5194	0.1467	0.0000	3,102.5992
2023	28.1962	1.4563	3.8646	9.7600e-003	0.5216	0.0572	0.5788	0.1402	0.0533	0.1935	0.0000	708.5994	708.5994	0.0625	0.0000	709.9123
Total	**37.9671**	**57.7938**	**124.9366**	**0.2645**	**16.0930**	**1.9538**	**18.0469**	**4.6908**	**1.8184**	**6.5092**	**0.0000**	**20,201.2103**	**20,201.2103**	**1.2091**	**0.0000**	**20,226.6018**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	16.5217	0.0904	7.7808	1.8000e-003		0.2597	0.2597		0.2597	0.2597	23.1958	33.3029	56.4988	0.0562	1.6000e-003	58.1755
Energy	0.1174	1.0294	0.6206	6.4000e-003		0.0811	0.0811		0.0811	0.0811	0.0000	7,438.9383	7,438.9383	0.3061	0.0800	7,470.1732
Mobile	9.5066	14.4205	77.5826	0.2841	19.3283	0.3286	19.6569	5.1903	0.3035	5.4938	0.0000	18,270.9207	18,270.9207	0.4889	0.0000	18,281.1871
Waste						0.0000	0.0000		0.0000	0.0000	263.9045	0.0000	263.9045	15.5963	0.0000	591.4270
Water						0.0000	0.0000		0.0000	0.0000	51.7613	340.9525	392.7137	5.3318	0.1287	544.5850
Total	**26.1457**	**15.5403**	**85.9840**	**0.2923**	**19.3283**	**0.6693**	**19.9977**	**5.1903**	**0.6442**	**5.8345**	**338.8616**	**26,084.1144**	**26,422.9760**	**21.7792**	**0.2103**	**26,945.5477**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	16.5217	0.0904	7.7808	1.8000e-003		0.2597	0.2597		0.2597	0.2597	23.1958	33.3029	56.4988	0.0562	1.6000e-003	58.1755
Energy	0.1174	1.0294	0.6206	6.4000e-003		0.0811	0.0811		0.0811	0.0811	0.0000	7,438.9383	7,438.9383	0.3061	0.0800	7,470.1732
Mobile	9.5066	14.4205	77.5826	0.2841	19.3283	0.3286	19.6569	5.1903	0.3035	5.4938	0.0000	18,270.9207	18,270.9207	0.4889	0.0000	18,281.1871
Waste						0.0000	0.0000		0.0000	0.0000	263.9045	0.0000	263.9045	15.5963	0.0000	591.4270
Water						0.0000	0.0000		0.0000	0.0000	51.7613	340.9525	392.7137	5.3308	0.1285	544.5024
Total	**26.1457**	**15.5403**	**85.9840**	**0.2923**	**19.3283**	**0.6693**	**19.9977**	**5.1903**	**0.6442**	**5.8345**	**338.8616**	**26,084.1144**	**26,422.9760**	**21.7783**	**0.2101**	**26,945.4651**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2016	5/19/2016	5	100	
2	Site Preparation	Site Preparation	5/20/2016	8/11/2016	5	60	
3	Grading	Grading	8/12/2016	3/16/2017	5	155	
4	Building Construction	Building Construction	3/17/2017	2/23/2023	5	1550	
5	Paving	Paving	2/24/2023	7/27/2023	5	110	
6	Architectural Coating	Architectural Coating	7/28/2023	12/28/2023	5	110	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 387.5

Acres of Paving: 0

Residential Indoor: 1,702,620; Residential Outdoor: 567,540; Non-Residential Indoor: 2,672,936; Non-Residential Outdoor: 890,979 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Demolition	Excavators	3	8.00	162	0.38
Grading	Excavators	2	8.00	162	0.38
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Building Construction	Generator Sets	1	8.00	84	0.74
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Grading	Graders	1	8.00	174	0.41
Paving	Pavers	2	8.00	125	0.42
Paving	Rollers	2	8.00	80	0.38
Paving	Paving Equipment	2	8.00	130	0.36
Architectural Coating	Air Compressors	1	6.00	78	0.48
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Grading	Scrapers	2	8.00	361	0.48
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	1,632.00	529.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	326.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2144	2.2828	1.7515	1.9900e-003		0.1146	0.1146		0.1068	0.1068	0.0000	185.4868	185.4868	0.0504	0.0000	186.5461
Total	**0.2144**	**2.2828**	**1.7515**	**1.9900e-003**		**0.1146**	**0.1146**		**0.1068**	**0.1068**	**0.0000**	**185.4868**	**185.4868**	**0.0504**	**0.0000**	**186.5461**

3.2 Demolition - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.2000e-003	4.4000e-003	0.0431	8.0000e-005	6.7600e-003	6.0000e-005	6.8200e-003	1.8000e-003	6.0000e-005	1.8600e-003	0.0000	6.1365	6.1365	3.5000e-004	0.0000	6.1439
Total	**3.2000e-003**	**4.4000e-003**	**0.0431**	**8.0000e-005**	**6.7600e-003**	**6.0000e-005**	**6.8200e-003**	**1.8000e-003**	**6.0000e-005**	**1.8600e-003**	**0.0000**	**6.1365**	**6.1365**	**3.5000e-004**	**0.0000**	**6.1439**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2144	2.2828	1.7515	1.9900e-003		0.1146	0.1146		0.1068	0.1068	0.0000	185.4866	185.4866	0.0504	0.0000	186.5459
Total	**0.2144**	**2.2828**	**1.7515**	**1.9900e-003**		**0.1146**	**0.1146**		**0.1068**	**0.1068**	**0.0000**	**185.4866**	**185.4866**	**0.0504**	**0.0000**	**186.5459**

3.2 Demolition - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.2000e-003	4.4000e-003	0.0431	8.0000e-005	6.7600e-003	6.0000e-005	6.8200e-003	1.8000e-003	6.0000e-005	1.8600e-003	0.0000	6.1365	6.1365	3.5000e-004	0.0000	6.1439
Total	**3.2000e-003**	**4.4000e-003**	**0.0431**	**8.0000e-005**	**6.7600e-003**	**6.0000e-005**	**6.8200e-003**	**1.8000e-003**	**6.0000e-005**	**1.8600e-003**	**0.0000**	**6.1365**	**6.1365**	**3.5000e-004**	**0.0000**	**6.1439**

3.3 Site Preparation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.5420	0.0000	0.5420	0.2979	0.0000	0.2979	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1523	1.6390	1.2332	1.1700e-003		0.0882	0.0882		0.0811	0.0811	0.0000	110.6313	110.6313	0.0334	0.0000	111.3321
Total	**0.1523**	**1.6390**	**1.2332**	**1.1700e-003**	**0.5420**	**0.0882**	**0.6302**	**0.2979**	**0.0811**	**0.3790**	**0.0000**	**110.6313**	**110.6313**	**0.0334**	**0.0000**	**111.3321**

3.3 Site Preparation - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3000e-003	3.1700e-003	0.0310	6.0000e-005	4.8600e-003	4.0000e-005	4.9100e-003	1.2900e-003	4.0000e-005	1.3400e-003	0.0000	4.4183	4.4183	2.5000e-004	0.0000	4.4236
Total	**2.3000e-003**	**3.1700e-003**	**0.0310**	**6.0000e-005**	**4.8600e-003**	**4.0000e-005**	**4.9100e-003**	**1.2900e-003**	**4.0000e-005**	**1.3400e-003**	**0.0000**	**4.4183**	**4.4183**	**2.5000e-004**	**0.0000**	**4.4236**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.5420	0.0000	0.5420	0.2979	0.0000	0.2979	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1523	1.6390	1.2332	1.1700e-003		0.0882	0.0882		0.0811	0.0811	0.0000	110.6312	110.6312	0.0334	0.0000	111.3320
Total	**0.1523**	**1.6390**	**1.2332**	**1.1700e-003**	**0.5420**	**0.0882**	**0.6302**	**0.2979**	**0.0811**	**0.3790**	**0.0000**	**110.6312**	**110.6312**	**0.0334**	**0.0000**	**111.3320**

3.3 Site Preparation - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3000e-003	3.1700e-003	0.0310	6.0000e-005	4.8600e-003	4.0000e-005	4.9100e-003	1.2900e-003	4.0000e-005	1.3400e-003	0.0000	4.4183	4.4183	2.5000e-004	0.0000	4.4236
Total	**2.3000e-003**	**3.1700e-003**	**0.0310**	**6.0000e-005**	**4.8600e-003**	**4.0000e-005**	**4.9100e-003**	**1.2900e-003**	**4.0000e-005**	**1.3400e-003**	**0.0000**	**4.4183**	**4.4183**	**2.5000e-004**	**0.0000**	**4.4236**

3.4 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.6722	0.0000	0.6722	0.2787	0.0000	0.2787	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.3272	3.7781	2.4814	3.1200e-003		0.1810	0.1810		0.1665	0.1665	0.0000	293.8884	293.8884	0.0887	0.0000	295.7500
Total	**0.3272**	**3.7781**	**2.4814**	**3.1200e-003**	**0.6722**	**0.1810**	**0.8532**	**0.2787**	**0.1665**	**0.4453**	**0.0000**	**293.8884**	**293.8884**	**0.0887**	**0.0000**	**295.7500**

3.4 Grading - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.3000e-003	5.9300e-003	0.0581	1.1000e-004	9.1000e-003	8.0000e-005	9.1800e-003	2.4200e-003	8.0000e-005	2.5000e-003	0.0000	8.2638	8.2638	4.8000e-004	0.0000	8.2738
Total	**4.3000e-003**	**5.9300e-003**	**0.0581**	**1.1000e-004**	**9.1000e-003**	**8.0000e-005**	**9.1800e-003**	**2.4200e-003**	**8.0000e-005**	**2.5000e-003**	**0.0000**	**8.2638**	**8.2638**	**4.8000e-004**	**0.0000**	**8.2738**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.6722	0.0000	0.6722	0.2787	0.0000	0.2787	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.3272	3.7781	2.4814	3.1200e-003		0.1810	0.1810		0.1665	0.1665	0.0000	293.8881	293.8881	0.0887	0.0000	295.7497
Total	**0.3272**	**3.7781**	**2.4814**	**3.1200e-003**	**0.6722**	**0.1810**	**0.8532**	**0.2787**	**0.1665**	**0.4453**	**0.0000**	**293.8881**	**293.8881**	**0.0887**	**0.0000**	**295.7497**

3.4 Grading - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.3000e-003	5.9300e-003	0.0581	1.1000e-004	9.1000e-003	8.0000e-005	9.1800e-003	2.4200e-003	8.0000e-005	2.5000e-003	0.0000	8.2638	8.2638	4.8000e-004	0.0000	8.2738
Total	**4.3000e-003**	**5.9300e-003**	**0.0581**	**1.1000e-004**	**9.1000e-003**	**8.0000e-005**	**9.1800e-003**	**2.4200e-003**	**8.0000e-005**	**2.5000e-003**	**0.0000**	**8.2638**	**8.2638**	**4.8000e-004**	**0.0000**	**8.2738**

3.4 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.6722	0.0000	0.6722	0.2787	0.0000	0.2787	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1647	1.8790	1.2637	1.6700e-003		0.0896	0.0896		0.0824	0.0824	0.0000	154.6396	154.6396	0.0474	0.0000	155.6346
Total	**0.1647**	**1.8790**	**1.2637**	**1.6700e-003**	**0.6722**	**0.0896**	**0.7617**	**0.2787**	**0.0824**	**0.3611**	**0.0000**	**154.6396**	**154.6396**	**0.0474**	**0.0000**	**155.6346**

3.4 Grading - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-003	2.8100e-003	0.0272	6.0000e-005	4.8600e-003	4.0000e-005	4.9100e-003	1.2900e-003	4.0000e-005	1.3300e-003	0.0000	4.2489	4.2489	2.3000e-004	0.0000	4.2537
Total	**2.0000e-003**	**2.8100e-003**	**0.0272**	**6.0000e-005**	**4.8600e-003**	**4.0000e-005**	**4.9100e-003**	**1.2900e-003**	**4.0000e-005**	**1.3300e-003**	**0.0000**	**4.2489**	**4.2489**	**2.3000e-004**	**0.0000**	**4.2537**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.6722	0.0000	0.6722	0.2787	0.0000	0.2787	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1647	1.8790	1.2637	1.6700e-003		0.0896	0.0896		0.0824	0.0824	0.0000	154.6394	154.6394	0.0474	0.0000	155.6344
Total	**0.1647**	**1.8790**	**1.2637**	**1.6700e-003**	**0.6722**	**0.0896**	**0.7617**	**0.2787**	**0.0824**	**0.3611**	**0.0000**	**154.6394**	**154.6394**	**0.0474**	**0.0000**	**155.6344**

3.4 Grading - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-003	2.8100e-003	0.0272	6.0000e-005	4.8600e-003	4.0000e-005	4.9100e-003	1.2900e-003	4.0000e-005	1.3300e-003	0.0000	4.2489	4.2489	2.3000e-004	0.0000	4.2537
Total	**2.0000e-003**	**2.8100e-003**	**0.0272**	**6.0000e-005**	**4.8600e-003**	**4.0000e-005**	**4.9100e-003**	**1.2900e-003**	**4.0000e-005**	**1.3300e-003**	**0.0000**	**4.2489**	**4.2489**	**2.3000e-004**	**0.0000**	**4.2537**

3.5 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3195	2.7198	1.8673	2.7600e-003		0.1835	0.1835		0.1723	0.1723	0.0000	246.6635	246.6635	0.0607	0.0000	247.9384
Total	**0.3195**	**2.7198**	**1.8673**	**2.7600e-003**		**0.1835**	**0.1835**		**0.1723**	**0.1723**	**0.0000**	**246.6635**	**246.6635**	**0.0607**	**0.0000**	**247.9384**

3.5 Building Construction - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.6230	4.8162	8.2986	0.0128	0.3479	0.0692	0.4171	0.0998	0.0636	0.1634	0.0000	1,142.3884	1,142.3884	8.8100e-003	0.0000	1,142.5735
Worker	0.6241	0.8732	8.4616	0.0181	1.5144	0.0131	1.5275	0.4031	0.0120	0.4151	0.0000	1,322.6276	1,322.6276	0.0716	0.0000	1,324.1312
Total	**1.2471**	**5.6894**	**16.7602**	**0.0309**	**1.8623**	**0.0823**	**1.9446**	**0.5029**	**0.0756**	**0.5785**	**0.0000**	**2,465.0160**	**2,465.0160**	**0.0804**	**0.0000**	**2,466.7047**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3195	2.7198	1.8673	2.7600e-003		0.1835	0.1835		0.1723	0.1723	0.0000	246.6632	246.6632	0.0607	0.0000	247.9381
Total	**0.3195**	**2.7198**	**1.8673**	**2.7600e-003**		**0.1835**	**0.1835**		**0.1723**	**0.1723**	**0.0000**	**246.6632**	**246.6632**	**0.0607**	**0.0000**	**247.9381**

3.5 Building Construction - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.6230	4.8162	8.2986	0.0128	0.3479	0.0692	0.4171	0.0998	0.0636	0.1634	0.0000	1,142.388 4	1,142.388 4	8.8100e-003	0.0000	1,142.573 5
Worker	0.6241	0.8732	8.4616	0.0181	1.5144	0.0131	1.5275	0.4031	0.0120	0.4151	0.0000	1,322.627 6	1,322.627 6	0.0716	0.0000	1,324.131 2
Total	**1.2471**	**5.6894**	**16.7602**	**0.0309**	**1.8623**	**0.0823**	**1.9446**	**0.5029**	**0.0756**	**0.5785**	**0.0000**	**2,465.016 0**	**2,465.016 0**	**0.0804**	**0.0000**	**2,466.704 7**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3483	3.0355	2.2880	3.5000e-003		0.1950	0.1950		0.1833	0.1833	0.0000	308.9844	308.9844	0.0756	0.0000	310.5723
Total	**0.3483**	**3.0355**	**2.2880**	**3.5000e-003**		**0.1950**	**0.1950**		**0.1833**	**0.1833**	**0.0000**	**308.9844**	**308.9844**	**0.0756**	**0.0000**	**310.5723**

3.5 Building Construction - 2018

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.6787	5.5292	9.7645	0.0162	0.4406	0.0810	0.5216	0.1264	0.0745	0.2009	0.0000	1,421.5801	1,421.5801	0.0110	0.0000	1,421.8103
Worker	0.6960	0.9878	9.4776	0.0229	1.9188	0.0158	1.9346	0.5107	0.0146	0.5253	0.0000	1,613.6776	1,613.6776	0.0828	0.0000	1,615.4157
Total	**1.3747**	**6.5170**	**19.2421**	**0.0391**	**2.3593**	**0.0968**	**2.4561**	**0.6371**	**0.0891**	**0.7261**	**0.0000**	**3,035.2577**	**3,035.2577**	**0.0937**	**0.0000**	**3,037.2260**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3483	3.0355	2.2880	3.5000e-003		0.1950	0.1950		0.1833	0.1833	0.0000	308.9841	308.9841	0.0756	0.0000	310.5720
Total	**0.3483**	**3.0355**	**2.2880**	**3.5000e-003**		**0.1950**	**0.1950**		**0.1833**	**0.1833**	**0.0000**	**308.9841**	**308.9841**	**0.0756**	**0.0000**	**310.5720**

3.5 Building Construction - 2018

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.6787	5.5292	9.7645	0.0162	0.4406	0.0810	0.5216	0.1264	0.0745	0.2009	0.0000	1,421.5801	1,421.5801	0.0110	0.0000	1,421.8103
Worker	0.6960	0.9878	9.4776	0.0229	1.9188	0.0158	1.9346	0.5107	0.0146	0.5253	0.0000	1,613.6776	1,613.6776	0.0828	0.0000	1,615.4157
Total	**1.3747**	**6.5170**	**19.2421**	**0.0391**	**2.3593**	**0.0968**	**2.4561**	**0.6371**	**0.0891**	**0.7261**	**0.0000**	**3,035.2577**	**3,035.2577**	**0.0937**	**0.0000**	**3,037.2260**

3.5 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.7359	2.2342	3.5000e-003		0.1677	0.1677		0.1577	0.1577	0.0000	305.5302	305.5302	0.0743	0.0000	307.0913
Total	**0.3069**	**2.7359**	**2.2342**	**3.5000e-003**		**0.1677**	**0.1677**		**0.1577**	**0.1577**	**0.0000**	**305.5302**	**305.5302**	**0.0743**	**0.0000**	**307.0913**

3.5 Building Construction - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.6454	5.0568	9.4365	0.0162	0.4406	0.0753	0.5159	0.1264	0.0693	0.1957	0.0000	1,398.6834	1,398.6834	0.0107	0.0000	1,398.9085
Worker	0.6272	0.8936	8.5205	0.0229	1.9188	0.0153	1.9341	0.5107	0.0142	0.5249	0.0000	1,555.9269	1,555.9269	0.0765	0.0000	1,557.5333
Total	**1.2725**	**5.9503**	**17.9570**	**0.0391**	**2.3594**	**0.0906**	**2.4500**	**0.6371**	**0.0835**	**0.7205**	**0.0000**	**2,954.6103**	**2,954.6103**	**0.0872**	**0.0000**	**2,956.4418**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.7359	2.2342	3.5000e-003		0.1677	0.1677		0.1577	0.1577	0.0000	305.5299	305.5299	0.0743	0.0000	307.0909
Total	**0.3069**	**2.7359**	**2.2342**	**3.5000e-003**		**0.1677**	**0.1677**		**0.1577**	**0.1577**	**0.0000**	**305.5299**	**305.5299**	**0.0743**	**0.0000**	**307.0909**

3.5 Building Construction - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.6454	5.0568	9.4365	0.0162	0.4406	0.0753	0.5159	0.1264	0.0693	0.1957	0.0000	1,398.6834	1,398.6834	0.0107	0.0000	1,398.9085
Worker	0.6272	0.8936	8.5205	0.0229	1.9188	0.0153	1.9341	0.5107	0.0142	0.5249	0.0000	1,555.9269	1,555.9269	0.0765	0.0000	1,557.5333
Total	**1.2725**	**5.9503**	**17.9570**	**0.0391**	**2.3594**	**0.0906**	**2.4500**	**0.6371**	**0.0835**	**0.7205**	**0.0000**	**2,954.6103**	**2,954.6103**	**0.0872**	**0.0000**	**2,956.4418**

3.5 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2766	2.5000	2.2019	3.5100e-003		0.1458	0.1458		0.1371	0.1371	0.0000	302.1514	302.1514	0.0736	0.0000	303.6973
Total	**0.2766**	**2.5000**	**2.2019**	**3.5100e-003**		**0.1458**	**0.1458**		**0.1371**	**0.1371**	**0.0000**	**302.1514**	**302.1514**	**0.0736**	**0.0000**	**303.6973**

3.5 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5829	4.3324	8.9431	0.0162	0.4423	0.0675	0.5097	0.1269	0.0621	0.1889	0.0000	1,372.0671	1,372.0671	0.0104	0.0000	1,372.2862
Worker	0.5813	0.8223	7.8291	0.0230	1.9261	0.0151	1.9412	0.5126	0.0140	0.5266	0.0000	1,499.6412	1,499.6412	0.0719	0.0000	1,501.1519
Total	**1.1642**	**5.1546**	**16.7722**	**0.0392**	**2.3684**	**0.0826**	**2.4509**	**0.6395**	**0.0761**	**0.7156**	**0.0000**	**2,871.7082**	**2,871.7082**	**0.0824**	**0.0000**	**2,873.4382**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2766	2.5000	2.2019	3.5100e-003		0.1458	0.1458		0.1371	0.1371	0.0000	302.1510	302.1510	0.0736	0.0000	303.6969
Total	**0.2766**	**2.5000**	**2.2019**	**3.5100e-003**		**0.1458**	**0.1458**		**0.1371**	**0.1371**	**0.0000**	**302.1510**	**302.1510**	**0.0736**	**0.0000**	**303.6969**

3.5 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5829	4.3324	8.9431	0.0162	0.4423	0.0675	0.5097	0.1269	0.0621	0.1889	0.0000	1,372.0671	1,372.0671	0.0104	0.0000	1,372.2862
Worker	0.5813	0.8223	7.8291	0.0230	1.9261	0.0151	1.9412	0.5126	0.0140	0.5266	0.0000	1,499.6412	1,499.6412	0.0719	0.0000	1,501.1519
Total	**1.1642**	**5.1546**	**16.7722**	**0.0392**	**2.3684**	**0.0826**	**2.4509**	**0.6395**	**0.0761**	**0.7156**	**0.0000**	**2,871.7082**	**2,871.7082**	**0.0824**	**0.0000**	**2,873.4382**

3.5 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2471	2.2629	2.1582	3.5000e-003		0.1246	0.1246		0.1172	0.1172	0.0000	301.0339	301.0339	0.0725	0.0000	302.5568
Total	**0.2471**	**2.2629**	**2.1582**	**3.5000e-003**		**0.1246**	**0.1246**		**0.1172**	**0.1172**	**0.0000**	**301.0339**	**301.0339**	**0.0725**	**0.0000**	**302.5568**

3.5 Building Construction - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5535	3.5561	8.5932	0.0161	0.4408	0.0605	0.5013	0.1265	0.0557	0.1821	0.0000	1,366.4089	1,366.4089	0.0104	0.0000	1,366.6272
Worker	0.5449	0.7608	7.2648	0.0229	1.9188	0.0149	1.9336	0.5107	0.0138	0.5245	0.0000	1,468.0162	1,468.0162	0.0679	0.0000	1,469.4413
Total	**1.0984**	**4.3170**	**15.8580**	**0.0390**	**2.3595**	**0.0754**	**2.4349**	**0.6372**	**0.0695**	**0.7066**	**0.0000**	**2,834.4251**	**2,834.4251**	**0.0783**	**0.0000**	**2,836.0685**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2471	2.2629	2.1582	3.5000e-003		0.1246	0.1246		0.1172	0.1172	0.0000	301.0335	301.0335	0.0725	0.0000	302.5565
Total	**0.2471**	**2.2629**	**2.1582**	**3.5000e-003**		**0.1246**	**0.1246**		**0.1172**	**0.1172**	**0.0000**	**301.0335**	**301.0335**	**0.0725**	**0.0000**	**302.5565**

3.5 Building Construction - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5535	3.5561	8.5932	0.0161	0.4408	0.0605	0.5013	0.1265	0.0557	0.1821	0.0000	1,366.4089	1,366.4089	0.0104	0.0000	1,366.6272
Worker	0.5449	0.7608	7.2648	0.0229	1.9188	0.0149	1.9336	0.5107	0.0138	0.5245	0.0000	1,468.0162	1,468.0162	0.0679	0.0000	1,469.4413
Total	**1.0984**	**4.3170**	**15.8580**	**0.0390**	**2.3595**	**0.0754**	**2.4349**	**0.6372**	**0.0695**	**0.7066**	**0.0000**	**2,834.4251**	**2,834.4251**	**0.0783**	**0.0000**	**2,836.0685**

3.5 Building Construction - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2209	2.0197	2.1226	3.4900e-003		0.1047	0.1047		0.0986	0.0986	0.0000	299.9946	299.9946	0.0718	0.0000	301.5017
Total	**0.2209**	**2.0197**	**2.1226**	**3.4900e-003**		**0.1047**	**0.1047**		**0.0986**	**0.0986**	**0.0000**	**299.9946**	**299.9946**	**0.0718**	**0.0000**	**301.5017**

3.5 Building Construction - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5121	3.1329	7.9628	0.0160	0.4393	0.0594	0.4986	0.1261	0.0546	0.1807	0.0000	1,360.613 9	1,360.613 9	0.0106	0.0000	1,360.836 2
Worker	0.5122	0.7073	6.7583	0.0228	1.9114	0.0147	1.9261	0.5087	0.0136	0.5224	0.0000	1,438.911 2	1,438.911 2	0.0643	0.0000	1,440.261 7
Total	**1.0244**	**3.8403**	**14.7211**	**0.0389**	**2.3507**	**0.0741**	**2.4247**	**0.6348**	**0.0683**	**0.7030**	**0.0000**	**2,799.525 1**	**2,799.525 1**	**0.0749**	**0.0000**	**2,801.097 9**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2209	2.0197	2.1226	3.4900e-003		0.1047	0.1047		0.0986	0.0986	0.0000	299.9943	299.9943	0.0718	0.0000	301.5013
Total	**0.2209**	**2.0197**	**2.1226**	**3.4900e-003**		**0.1047**	**0.1047**		**0.0986**	**0.0986**	**0.0000**	**299.9943**	**299.9943**	**0.0718**	**0.0000**	**301.5013**

3.5 Building Construction - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5121	3.1329	7.9628	0.0160	0.4393	0.0594	0.4986	0.1261	0.0546	0.1807	0.0000	1,360.6139	1,360.6139	0.0106	0.0000	1,360.8362
Worker	0.5122	0.7073	6.7583	0.0228	1.9114	0.0147	1.9261	0.5087	0.0136	0.5224	0.0000	1,438.9112	1,438.9112	0.0643	0.0000	1,440.2617
Total	**1.0244**	**3.8403**	**14.7211**	**0.0389**	**2.3507**	**0.0741**	**2.4247**	**0.6348**	**0.0683**	**0.7030**	**0.0000**	**2,799.5251**	**2,799.5251**	**0.0749**	**0.0000**	**2,801.0979**

3.5 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0305	0.2791	0.3161	5.2000e-004		0.0136	0.0136		0.0128	0.0128	0.0000	45.0147	45.0147	0.0107	0.0000	45.2392
Total	**0.0305**	**0.2791**	**0.3161**	**5.2000e-004**		**0.0136**	**0.0136**		**0.0128**	**0.0128**	**0.0000**	**45.0147**	**45.0147**	**0.0107**	**0.0000**	**45.2392**

3.5 Building Construction - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0728	0.3976	1.1547	2.4000e-003	0.0659	8.7000e-003	0.0746	0.0189	8.0000e-003	0.0269	0.0000	203.7665	203.7665	1.4700e-003	0.0000	203.7974
Worker	0.0726	0.0995	0.9492	3.4200e-003	0.2867	2.1900e-003	0.2889	0.0763	2.0300e-003	0.0783	0.0000	212.6495	212.6495	9.2200e-003	0.0000	212.8431
Total	**0.1454**	**0.4971**	**2.1039**	**5.8200e-003**	**0.3526**	**0.0109**	**0.3635**	**0.0952**	**0.0100**	**0.1053**	**0.0000**	**416.4160**	**416.4160**	**0.0107**	**0.0000**	**416.6404**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0305	0.2791	0.3161	5.2000e-004		0.0136	0.0136		0.0128	0.0128	0.0000	45.0147	45.0147	0.0107	0.0000	45.2392
Total	**0.0305**	**0.2791**	**0.3161**	**5.2000e-004**		**0.0136**	**0.0136**		**0.0128**	**0.0128**	**0.0000**	**45.0147**	**45.0147**	**0.0107**	**0.0000**	**45.2392**

3.5 Building Construction - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0728	0.3976	1.1547	2.4000e-003	0.0659	8.7000e-003	0.0746	0.0189	8.0000e-003	0.0269	0.0000	203.7665	203.7665	1.4700e-003	0.0000	203.7974
Worker	0.0726	0.0995	0.9492	3.4200e-003	0.2867	2.1900e-003	0.2889	0.0763	2.0300e-003	0.0783	0.0000	212.6495	212.6495	9.2200e-003	0.0000	212.8431
Total	**0.1454**	**0.4971**	**2.1039**	**5.8200e-003**	**0.3526**	**0.0109**	**0.3635**	**0.0952**	**0.0100**	**0.1053**	**0.0000**	**416.4160**	**416.4160**	**0.0107**	**0.0000**	**416.6404**

3.6 Paving - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0557	0.5499	0.7857	1.2300e-003		0.0276	0.0276		0.0254	0.0254	0.0000	107.8042	107.8042	0.0349	0.0000	108.5364
Paving	0.0288					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0845**	**0.5499**	**0.7857**	**1.2300e-003**		**0.0276**	**0.0276**		**0.0254**	**0.0254**	**0.0000**	**107.8042**	**107.8042**	**0.0349**	**0.0000**	**108.5364**

3.6 Paving - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.8800e-003	2.5800e-003	0.0246	9.0000e-005	7.4300e-003	6.0000e-005	7.4900e-003	1.9800e-003	5.0000e-005	2.0300e-003	0.0000	5.5127	5.5127	2.4000e-004	0.0000	5.5177
Total	**1.8800e-003**	**2.5800e-003**	**0.0246**	**9.0000e-005**	**7.4300e-003**	**6.0000e-005**	**7.4900e-003**	**1.9800e-003**	**5.0000e-005**	**2.0300e-003**	**0.0000**	**5.5127**	**5.5127**	**2.4000e-004**	**0.0000**	**5.5177**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0557	0.5499	0.7857	1.2300e-003		0.0276	0.0276		0.0254	0.0254	0.0000	107.8041	107.8041	0.0349	0.0000	108.5362
Paving	0.0288					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0845**	**0.5499**	**0.7857**	**1.2300e-003**		**0.0276**	**0.0276**		**0.0254**	**0.0254**	**0.0000**	**107.8041**	**107.8041**	**0.0349**	**0.0000**	**108.5362**

3.6 Paving - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.8800e-003	2.5800e-003	0.0246	9.0000e-005	7.4300e-003	6.0000e-005	7.4900e-003	1.9800e-003	5.0000e-005	2.0300e-003	0.0000	5.5127	5.5127	2.4000e-004	0.0000	5.5177
Total	**1.8800e-003**	**2.5800e-003**	**0.0246**	**9.0000e-005**	**7.4300e-003**	**6.0000e-005**	**7.4900e-003**	**1.9800e-003**	**5.0000e-005**	**2.0300e-003**	**0.0000**	**5.5127**	**5.5127**	**2.4000e-004**	**0.0000**	**5.5177**

3.7 Architectural Coating - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	27.8824					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0105	0.0717	0.0996	1.6000e-004		3.9000e-003	3.9000e-003		3.9000e-003	3.9000e-003	0.0000	14.0429	14.0429	8.4000e-004	0.0000	14.0605
Total	**27.8930**	**0.0717**	**0.0996**	**1.6000e-004**		**3.9000e-003**	**3.9000e-003**		**3.9000e-003**	**3.9000e-003**	**0.0000**	**14.0429**	**14.0429**	**8.4000e-004**	**0.0000**	**14.0605**

3.7 Architectural Coating - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0409	0.0560	0.5348	1.9300e-003	0.1615	1.2300e-003	0.1628	0.0430	1.1500e-003	0.0441	0.0000	119.8091	119.8091	5.1900e-003	0.0000	119.9182
Total	**0.0409**	**0.0560**	**0.5348**	**1.9300e-003**	**0.1615**	**1.2300e-003**	**0.1628**	**0.0430**	**1.1500e-003**	**0.0441**	**0.0000**	**119.8091**	**119.8091**	**5.1900e-003**	**0.0000**	**119.9182**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	27.8824					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0105	0.0717	0.0996	1.6000e-004		3.9000e-003	3.9000e-003		3.9000e-003	3.9000e-003	0.0000	14.0429	14.0429	8.4000e-004	0.0000	14.0605
Total	**27.8930**	**0.0717**	**0.0996**	**1.6000e-004**		**3.9000e-003**	**3.9000e-003**		**3.9000e-003**	**3.9000e-003**	**0.0000**	**14.0429**	**14.0429**	**8.4000e-004**	**0.0000**	**14.0605**

3.7 Architectural Coating - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0409	0.0560	0.5348	1.9300e-003	0.1615	1.2300e-003	0.1628	0.0430	1.1500e-003	0.0441	0.0000	119.8091	119.8091	5.1900e-003	0.0000	119.9182
Total	**0.0409**	**0.0560**	**0.5348**	**1.9300e-003**	**0.1615**	**1.2300e-003**	**0.1628**	**0.0430**	**1.1500e-003**	**0.0441**	**0.0000**	**119.8091**	**119.8091**	**5.1900e-003**	**0.0000**	**119.9182**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	9.5066	14.4205	77.5826	0.2841	19.3283	0.3286	19.6569	5.1903	0.3035	5.4938	0.0000	18,270.9207	18,270.9207	0.4889	0.0000	18,281.1871
Unmitigated	9.5066	14.4205	77.5826	0.2841	19.3283	0.3286	19.6569	5.1903	0.3035	5.4938	0.0000	18,270.9207	18,270.9207	0.4889	0.0000	18,281.1871

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Mid Rise	2,773.05	2,773.05	2773.05	6,190,463	6,190,463
Condo/Townhouse High Rise	2,267.65	2,267.65	2267.65	5,062,225	5,062,225
Enclosed Parking with Elevator	0.00	0.00	0.00		
General Light Industry	768.13	768.13	768.13	2,242,567	2,242,567
General Office Building	2,088.14	2,088.14	2088.14	4,990,149	4,990,149
Government Office Building	2,124.13	0.00	0.00	2,601,881	2,601,881
Other Asphalt Surfaces	0.00	0.00	0.00		
Parking Lot	0.00	0.00	0.00		
Single Family Housing	518.70	518.70	518.70	1,157,928	1,157,928
Strip Mall	19,540.07	19,540.07	19540.07	30,092,350	30,092,350
Total	30,079.88	27,955.74	27,955.74	52,337,563	52,337,563

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Mid Rise	12.40	4.30	5.40	26.10	29.10	44.80	86	11	3
Condo/Townhouse High Rise	12.40	4.30	5.40	26.10	29.10	44.80	86	11	3
Enclosed Parking with Elevator	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
General Light Industry	9.50	7.30	7.30	59.00	28.00	13.00	92	5	3
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4
Government Office Building	9.50	7.30	7.30	33.00	62.00	5.00	50	34	16
Other Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Single Family Housing	12.40	4.30	5.40	26.10	29.10	44.80	86	11	3
Strip Mall	9.50	7.30	7.30	16.60	64.40	19.00	45	40	15

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.471369	0.078902	0.178820	0.147049	0.061984	0.009364	0.021694	0.013140	0.002967	0.002368	0.009182	0.000413	0.002748

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,277.4216	6,277.4216	0.2839	0.0587	6,301.5877
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,277.4216	6,277.4216	0.2839	0.0587	6,301.5877
NaturalGas Mitigated	0.1174	1.0294	0.6206	6.4000e-003		0.0811	0.0811		0.0811	0.0811	0.0000	1,161.5167	1,161.5167	0.0223	0.0213	1,168.5855
NaturalGas Unmitigated	0.1174	1.0294	0.6206	6.4000e-003		0.0811	0.0811		0.0811	0.0811	0.0000	1,161.5167	1,161.5167	0.0223	0.0213	1,168.5855

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse High Rise	6.64084e+006	0.0358	0.3060	0.1302	1.9500e-003		0.0247	0.0247		0.0247	0.0247	0.0000	354.3806	354.3806	6.7900e-003	6.5000e-003	356.5373
Enclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
General Light Industry	3.54452e+006	0.0191	0.1738	0.1460	1.0400e-003		0.0132	0.0132		0.0132	0.0132	0.0000	189.1493	189.1493	3.6300e-003	3.4700e-003	190.3004
General Office Building	3.26e+006	0.0176	0.1598	0.1342	9.6000e-004		0.0122	0.0122		0.0122	0.0122	0.0000	173.9662	173.9662	3.3300e-003	3.1900e-003	175.0250
Government Office Building	1.08154e+006	5.8300e-003	0.0530	0.0445	3.2000e-004		4.0300e-003	4.0300e-003		4.0300e-003	4.0300e-003	0.0000	57.7149	57.7149	1.1100e-003	1.0600e-003	58.0662
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Single Family Housing	2.75207e+006	0.0148	0.1268	0.0540	8.1000e-004		0.0103	0.0103		0.0103	0.0103	0.0000	146.8610	146.8610	2.8100e-003	2.6900e-003	147.7548
Strip Mall	1.09781e+006	5.9200e-003	0.0538	0.0452	3.2000e-004		4.0900e-003	4.0900e-003		4.0900e-003	4.0900e-003	0.0000	58.5831	58.5831	1.1200e-003	1.0700e-003	58.9396
Apartments Mid Rise	3.38922e+006	0.0183	0.1562	0.0665	1.0000e-003		0.0126	0.0126		0.0126	0.0126	0.0000	180.8616	180.8616	3.4700e-003	3.3200e-003	181.9623
Total		**0.1174**	**1.0294**	**0.6206**	**6.4000e-003**		**0.0811**	**0.0811**		**0.0811**	**0.0811**	**0.0000**	**1,161.5167**	**1,161.5167**	**0.0223**	**0.0213**	**1,168.5855**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse High Rise	6.64084e+006	0.0358	0.3060	0.1302	1.9500e-003		0.0247	0.0247		0.0247	0.0247	0.0000	354.3806	354.3806	6.7900e-003	6.5000e-003	356.5373
Enclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
General Light Industry	3.54452e+006	0.0191	0.1738	0.1460	1.0400e-003		0.0132	0.0132		0.0132	0.0132	0.0000	189.1493	189.1493	3.6300e-003	3.4700e-003	190.3004
General Office Building	3.26e+006	0.0176	0.1598	0.1342	9.6000e-004		0.0122	0.0122		0.0122	0.0122	0.0000	173.9662	173.9662	3.3300e-003	3.1900e-003	175.0250
Government Office Building	1.08154e+006	5.8300e-003	0.0530	0.0445	3.2000e-004		4.0300e-003	4.0300e-003		4.0300e-003	4.0300e-003	0.0000	57.7149	57.7149	1.1100e-003	1.0600e-003	58.0662
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Single Family Housing	2.75207e+006	0.0148	0.1268	0.0540	8.1000e-004		0.0103	0.0103		0.0103	0.0103	0.0000	146.8610	146.8610	2.8100e-003	2.6900e-003	147.7548
Strip Mall	1.09781e+006	5.9200e-003	0.0538	0.0452	3.2000e-004		4.0900e-003	4.0900e-003		4.0900e-003	4.0900e-003	0.0000	58.5831	58.5831	1.1200e-003	1.0700e-003	58.9396
Apartments Mid Rise	3.38922e+006	0.0183	0.1562	0.0665	1.0000e-003		0.0126	0.0126		0.0126	0.0126	0.0000	180.8616	180.8616	3.4700e-003	3.3200e-003	181.9623
Total		**0.1174**	**1.0294**	**0.6206**	**6.4000e-003**		**0.0811**	**0.0811**		**0.0811**	**0.0811**	**0.0000**	**1,161.5167**	**1,161.5167**	**0.0223**	**0.0213**	**1,168.5855**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Mid Rise	1.47058e +006	427.8073	0.0193	4.0000e-003	429.4542
Condo/Townhouse High Rise	1.47012e +006	427.6745	0.0193	4.0000e-003	429.3210
Enclosed Parking with Elevator	5.97703e +006	1,738.7871	0.0786	0.0163	1,745.4809
General Light Industry	1.16771e +006	339.7015	0.0154	3.1800e-003	341.0093
General Office Building	3.7314e +006	1,085.5067	0.0491	0.0102	1,089.6855
Government Office Building	1.23793e +006	360.1269	0.0163	3.3700e-003	361.5132
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	818048	237.9795	0.0108	2.2300e-003	238.8957
Single Family Housing	551689	160.4928	7.2600e-003	1.5000e-003	161.1106
Strip Mall	5.15396e +006	1,499.3453	0.0678	0.0140	1,505.1173
Total		**6,277.4216**	**0.2838**	**0.0587**	**6,301.5877**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Mid Rise	1.47058e+006	427.8073	0.0193	4.0000e-003	429.4542
Condo/Townhouse High Rise	1.47012e+006	427.6745	0.0193	4.0000e-003	429.3210
Enclosed Parking with Elevator	5.97703e+006	1,738.7871	0.0786	0.0163	1,745.4809
General Light Industry	1.16771e+006	339.7015	0.0154	3.1800e-003	341.0093
General Office Building	3.7314e+006	1,085.5067	0.0491	0.0102	1,089.6855
Government Office Building	1.23793e+006	360.1269	0.0163	3.3700e-003	361.5132
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	818048	237.9795	0.0108	2.2300e-003	238.8957
Single Family Housing	551689	160.4928	7.2600e-003	1.5000e-003	161.1106
Strip Mall	5.15396e+006	1,499.3453	0.0678	0.0140	1,505.1173
Total		**6,277.4216**	**0.2838**	**0.0587**	**6,301.5877**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	16.5217	0.0904	7.7808	1.8000e-003		0.2597	0.2597		0.2597	0.2597	23.1958	33.3029	56.4988	0.0562	1.6000e-003	58.1755
Unmitigated	16.5217	0.0904	7.7808	1.8000e-003		0.2597	0.2597		0.2597	0.2597	23.1958	33.3029	56.4988	0.0562	1.6000e-003	58.1755

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	1.5211					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	13.7648					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	1.0463	0.0186	1.5459	1.4600e-003		0.2251	0.2251		0.2251	0.2251	23.1958	23.0666	46.2624	0.0463	1.6000e-003	47.7313
Landscaping	0.1895	0.0718	6.2350	3.3000e-004		0.0346	0.0346		0.0346	0.0346	0.0000	10.2363	10.2363	9.9000e-003	0.0000	10.4442
Total	**16.5217**	**0.0904**	**7.7808**	**1.7900e-003**		**0.2597**	**0.2597**		**0.2597**	**0.2597**	**23.1958**	**33.3029**	**56.4988**	**0.0562**	**1.6000e-003**	**58.1755**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	1.5211					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	13.7648					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	1.0463	0.0186	1.5459	1.4600e-003		0.2251	0.2251		0.2251	0.2251	23.1958	23.0666	46.2624	0.0463	1.6000e-003	47.7313
Landscaping	0.1895	0.0718	6.2350	3.3000e-004		0.0346	0.0346		0.0346	0.0346	0.0000	10.2363	10.2363	9.9000e-003	0.0000	10.4442
Total	**16.5217**	**0.0904**	**7.7808**	**1.7900e-003**		**0.2597**	**0.2597**		**0.2597**	**0.2597**	**23.1958**	**33.3029**	**56.4988**	**0.0562**	**1.6000e-003**	**58.1755**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	392.7137	5.3308	0.1285	544.5024
Unmitigated	392.7137	5.3318	0.1287	544.5850

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Mid Rise	27.1692 / 17.1284	68.8272	0.8880	0.0215	94.1308
Condo/Townhouse High Rise	22.2175 / 14.0067	56.2832	0.7262	0.0176	76.9750
Enclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
General Light Industry	29.9029 / 0	56.5577	0.9765	0.0235	84.3333
General Office Building	33.6468 / 20.6222	84.6360	1.0997	0.0266	115.9700
Government Office Building	12.4778 / 7.64769	31.3870	0.4078	9.8600e-003	43.0072
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Single Family Housing	5.08201 / 3.20388	12.8742	0.1661	4.0200e-003	17.6072
Strip Mall	32.6578 / 20.0161	82.1484	1.0674	0.0258	112.5614
Total		**392.7137**	**5.3318**	**0.1287**	**544.5850**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Mid Rise	27.1692 / 17.1284	68.8272	0.8879	0.0214	94.1170
Condo/Townhouse High Rise	22.2175 / 14.0067	56.2832	0.7261	0.0175	76.9638
Enclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
General Light Industry	29.9029 / 0	56.5577	0.9763	0.0234	84.3182
General Office Building	33.6468 / 20.6222	84.6360	1.0995	0.0265	115.9530
Government Office Building	12.4778 / 7.64769	31.3870	0.4078	9.8400e-003	43.0009
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Single Family Housing	5.08201 / 3.20388	12.8742	0.1661	4.0100e-003	17.6046
Strip Mall	32.6578 / 20.0161	82.1484	1.0672	0.0258	112.5449
Total		**392.7137**	**5.3308**	**0.1285**	**544.5024**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	263.9045	15.5963	0.0000	591.4270
Unmitigated	263.9045	15.5963	0.0000	591.4270

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Mid Rise	191.82	38.9377	2.3012	0.0000	87.2620
Condo/Townhouse High Rise	156.86	31.8412	1.8818	0.0000	71.3581
Enclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
General Light Industry	160.34	32.5476	1.9235	0.0000	72.9412
General Office Building	176.06	35.7386	2.1121	0.0000	80.0925
Government Office Building	58.41	11.8567	0.7007	0.0000	26.5716
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Single Family Housing	93.66	19.0121	1.1236	0.0000	42.6074
Strip Mall	462.93	93.9706	5.5535	0.0000	210.5942
Total		**263.9045**	**15.5963**	**0.0000**	**591.4270**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Mid Rise	191.82	38.9377	2.3012	0.0000	87.2620
Condo/Townhouse High Rise	156.86	31.8412	1.8818	0.0000	71.3581
Enclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
General Light Industry	160.34	32.5476	1.9235	0.0000	72.9412
General Office Building	176.06	35.7386	2.1121	0.0000	80.0925
Government Office Building	58.41	11.8567	0.7007	0.0000	26.5716
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Single Family Housing	93.66	19.0121	1.1236	0.0000	42.6074
Strip Mall	462.93	93.9706	5.5535	0.0000	210.5942
Total		**263.9045**	**15.5963**	**0.0000**	**591.4270**

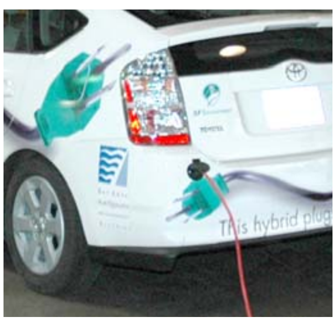
9.0 Operational Offroad

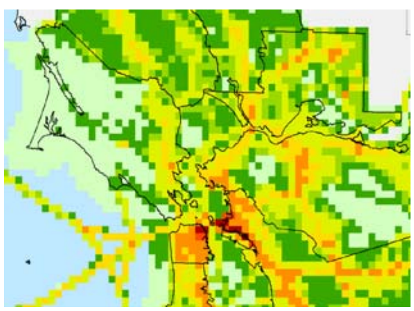
Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Bay Area Air Quality Management District

Bay Area 2010 Clean Air Plan





Final Clean Air Plan - Volume II

Adopted September 15, 2010

Association of Bay Area Governments

bcdc

Metropolitan Transportation Commission

Final
BAY AREA
2010 CLEAN AIR PLAN

VOLUME II

Adopted September 15, 2010

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

939 Ellis Street
San Francisco, CA 94109
(415) 771.6000
www.baaqmd.gov

justified. Where a range of emission reduction potential is given for a measure, the lead agency should provide justification for the mitigation reduction efficiency assumed for the project. If mitigation does not bring a project back within the threshold requirements, the project could be cumulatively significant and could be approved only with a Statement of Overriding Considerations and a showing that all feasible mitigation measures have been implemented.

Reductions from mitigation measures should be scaled proportionally to their sector of project-generated emissions. For example, if a measure would result in a 50 percent reduction in residential natural gas consumption, but only 20 percent of a project's emissions are associated with natural gas consumption, and only 10 percent of a project's emissions are from residential land uses, then the scaled reduction would equal one percent (50% * 20% * 10% = 1%).

Once all emission reductions are scaled by their applicable sector and land use, they should be added together for the total sum of emission reductions. Once all emission reductions are scaled by their applicable sector and land use, they should be added together for the total sum of emission reductions.

The Air District prefers for project emissions to be reduced to their extent possible onsite. For projects that are not able to mitigate onsite to a level below significance, offsite mitigation measures serve as a feasible alternative. Recent State's CEQA Guidelines amendments allow for offsite measures to mitigate a project's emissions, (Section 15126.4(c)(4)).

In implementing offsite mitigation measures, the lead agency must ensure that emission reductions from identified projects are real, permanent through the duration of the project, enforceable, and are equal to the pollutant type and amount of the project impact being offset. BAAQMD recommends that offsite mitigation projects occur within the nine-county Bay Area in order to reduce localized impacts and capture potential co-benefits. Offsite mitigation for PM and toxics emission reductions should occur within a five mile radius to the project site.

Another feasible mitigation measure the Air District is exploring establishing is an offsite mitigation program to assist lead agencies and project applicants in achieving emission reductions. A project applicant would enter into an agreement with the Air District and pay into an Air District fund. The Air District would commit to reducing the type and amount of emission indentified in the agreement. The Air District would identify, implement, and manage offsite mitigation projects.

The following tables list feasible mitigation measures for consideration in projects. The estimated emission reductions are a work in progress and the Air District will continue to improve guidance on quantifying the mitigation measures.

URBEMIS Mitigation Measures for Operational Mobile Source Emissions

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
Mix of Uses	-3% to 9%	CAPs, GHGs	Mobile sources	-3 when no housing or employment centers within 1/2 mile	Residential: % reduction is taken from base trips (9.57) and subtracted from ITE trip generation; Nonresidential:
Local serving retail within 1/2 mile of project	2%	CAPs, GHGs	Mobile sources	Uses lower end of reported research to avoid double counting with mix of uses measure	
Transit Service	0% to 15%	CAPs, GHGs	Mobile sources		

URBEMIS Mitigation Measures for Operational Mobile Source Emissions

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
Bike & Pedestrian	0%–9%	CAPs, GHGs	Mobile sources	Credit is given based on intersection density, sidewalk completeness, and bike network completeness; No reduction if entire area within 1/2 mile is single use	% reduction from ITE trip generation
Affordable Housing	0%–4%	CAPs, GHGs	Mobile sources		
Transportation Demand Management Parking, Transit Passes					
Daily Parking Charge	0%–25%	CAPs, GHGs	Only resident/ employee trips, no visitor/ shopper trips		
Parking Cash-Out	0%–12.5%	CAPs, GHGs		Shoup, Donald. 2005. Parking Cash Out. American Planning Association. Chicago, IL.	
Free Transit Passes	25% of Transit Service Reduction	CAPs, GHGs			
Telecommuting					
Employee Telecommuting Program	1%–100%	CAPs, GHGs	Mobile sources, Worker Trips only		
Compressed Work Schedule 3/36	1%–40%	CAPs, GHGs			
Compressed Work Schedule 4/40	1%–20%	CAPs, GHGs			
Compressed Work Schedule 9/80	1%–10%	CAPs, GHGs			
Other Transportation Demand Measures					
Secure Bike Parking (at least 1 space per 20 vehicle spaces)	At least 3 elements: 1% reduction, plus 5% of the reduction for transit and pedestrian/bike friendliness; At least 5 elements: 2% reduction, plus 10% of the reduction for transit and pedestrian/bike friendliness	CAPs, GHGs	Mobile sources, Worker Trips only		
Showers/Changing Facilities Provided					
Guaranteed Ride Home Program Provided					
Car-Sharing Services Provided					
Information Provided on Transportation Alternatives (Bike Schedules, Maps)					
Dedicated Employee Transportation Coordinator					

URBEMIS Mitigation Measures for Operational Mobile Source Emissions

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
Carpool Matching Program					
Preferential Carpool/Vanpool Parking					
Parking Supply	0%–50%	CAPs, GHGs	Mobile sources		
On Road Trucks	As input by user in URBEMIS	CAPs, GHGs	Mobile sources		

URBEMIS Mitigation Measures for Operational Area-Source Emissions

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes
Increase Energy Efficiency Beyond Title 24	Same as % improvement over Title 24	CAPs, GHGs	Natural gas sector in URBEMIS for applicable land use only	User should specify baseline year for the Title 24 standards
Electrically powered landscape equipment and outdoor electrical outlets	Same as % of landscape equipment emissions	CAPs, GHGs	Landscape emissions: residential only	
Low VOC architectural coatings	Same as % VOC reduction in applicable coatings (Interior/Exterior)	ROG only	Architectural coating	

NON-URBEMIS Energy Efficiency Mitigation Measures

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
Plant shade trees within 40 feet of the south side or within 60 feet of the west sides of properties.	30%	GHGs	R,C A/C Electricity	USDA Forest Service, Pacific Northwest Research Station. "California Study Shows Shade Trees Reduce Summertime Electricity Use." Science Daily 7 January 2009. 20 February 2009 <http://www.sciencedaily.com/releases/2009/01/090105150831.htm>.	Electricity-related measures reduce CAPs off-site, but they are not typically quantified as part of a CEQA analysis.
Require cool roof materials (albedo	34%	GHGs	C A/C Electricity	U.S. EPA Cool Roof Product Information,	

NON-URBEMIS Energy Efficiency Mitigation Measures

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
>= 30)	69%	GHGs	R A/C Electricity	Available: <http://www.epa.gov/heatisland/resources/pdf/CoolRoofsCompendium.pdf>	
Install green roofs	1%	GHGs	R,C A/C Electricity	Reductions are based on the Energy & Atmosphere credits (EA Credit 2) documented in the Leadership in Energy & Environmental Design (LEED), Green Building Rating System for New Constructions and Major Renovations, Version 2.2, October 2005. The reduction assumes that a vegetated roof is installed on a least 50% of the roof area or that a combination high albedo and vegetated roof surface is installed that meets the following standard: (Area of SRI Roof/0.75)+(Area of vegetated roof/0.5) >= Total Roof Area.	
Require smart meters and programmable thermostats	10%	CAPs, GHGs	R, C electricity and natural gas space heating	U. S. Environmental Protection Agency. 2009. Programmable Thermostat. http://www.energystar.gov/ia/new_homes/features/ProgThermostats1-17-01.pdf	
Meet GBC standards in all New construction	17%	GHGs	R electricity	California Energy Commission [CEC] 2007. Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings	
	7%	GHGs	C electricity		
	9%	CAPs, GHGs	R natural gas		
	3%	CAPs, GHGs	C natural gas		
Retrofit existing buildings to meet CA GBC standards	38%	GHGs	R electricity	California Energy Commission [CEC] 2003. Impact Analysis 2005 Update to the California	
	12%	GHGs	C electricity		
	18%	CAPs, GHGs	R natural gas		

NON-URBEMIS Energy Efficiency Mitigation Measures

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
	12%	CAPs, GHGs	C natural gas	Energy Efficiency Standards for Residential and Nonresidential Buildings; California Energy Commission [CEC] 2007. Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings	
Install solar water heaters	70%	CAPs, GHGs	R natural gas water heating	Energy Star. 2009. Solar Water Heater. http://www.energystar.gov/ia/new_homes/features/WaterHtrs_062906.pdf; Department of Energy. California Energy Commission [CEC] 2007. Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings	Cannot take credit for both solar and tank-less water heater measures
	70%	CAPs, GHGs	C natural gas water heating		
Install tank-less water heaters	35%	CAPs, GHGs	R natural gas water heating	Tankless Water Heater. 2008. Available: <http://www.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12820>	
	35%	CAPs, GHGs	C natural gas water heating		
Install solar panels on residential and commercial buildings	100%	GHGs	R, C electricity		

NON-URBEMIS Energy Efficiency Mitigation Measures

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
100% increase in diversity of land use mix	5%	CAPs, GHGs	Mobile sources	Ewing, Reid, et al. 2001. *Travel and the Built Environment: A Synthesis.* Transportation Research Record 1780. Paper No. 01-3515 as cited in Urban Land Institute. 2008. *Growing Cooler.* ISBN: 978-0-87420-082-2. Washington, DC	
Jobs housing balance	Trip reduction = (1 – (ABS (1.5 * HH – E)/(1.5 * HH + E)) – 0.25) / 0.25 * 0.03; where ABS = absolute value; HH = study area households ; E = study area employment	CAPs, GHGs	Mobile sources	*Nelson/Nygaard Consultants. 2005. Crediting Low-Traffic Developments: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS. Pg 12, (adapted from Criterion and Fehr & Peers, 2001)*	
100% increase in design (i.e., presence of design guidelines for transit oriented development, complete streets standards)	3%	CAPs, GHGs	Mobile sources	Ewing, Reid, et al. 2001. *Travel and the Built Environment: A Synthesis.* Transportation Research Record 1780. Paper No. 01-3515 as cited in Urban Land Institute. 2008. *Growing Cooler.* ISBN: 978-0-87420-082-2. Washington, DC	

NON-URBEMIS Energy Efficiency Mitigation Measures

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
100% increase in density	5%	CAPs, GHGs	Mobile sources	Ewing, Reid, et al. 2001. *Travel and the Built Environment: A Synthesis.* Transportation Research Record 1780. Paper No. 01-3515 as cited in Urban Land Institute. 2008. *Growing Cooler.* ISBN: 978-0-87420-082-2. Washington, DC	
HVAC duct sealing	30%	GHGs	R,C A/C electricity	Sacramento Metropolitan Utilities District. 2008. Duct Sealing. Available: <http://www.pge.com/myhome/saveenergymoney/rebates/coolheat/duct/index.shtml>.	
Provide necessary infrastructure and treatment to allow use of 50% greywater/ recycled water in residential and commercial uses for outdoor irrigation	SFR: 74%*50% = 37.5% MFR: 58% * 50% = 29% Commercial: 12% * 50% = 6%	GHGs	R electricity (water consumption) C electricity (water consumption)	Department of Water Resources. 2001. Statewide Indoor/Outdoor Split. Accessed December 2, 2008. Available at: <http://www.landwateruse.water.ca.gov/annualdata/urbanwateruse/2001/landuselevels.cfm?use=8>.	
Complete streets (i.e., bike lanes and pedestrian sidewalks on both sides of streets, traffic calming features such as pedestrian bulb-outs, cross-walks, traffic circles, and elimination of physical and psychological barriers (e.g., sound walls and large arterial roadways, respectively).)	1-5%	CAPs, GHGs	Mobile sources	Dierkers, G., E. Silsbe, S. Stott, S. Winkelman, an M. Wubben. 2007. *CCAP Transportation Emissions Guidebook*. Center for Clean Air Policy. Washington, D.C. Available: <http://www.ccap.org/safe/guidebook.php>. as cited in California Air Pollution Control Officers Association (CAPCOA) 2008. *CEQA and Climate Change.*	

Measure	Sector Reductions	Applicable Pollutants	Sector	Notes	Additional comments
NON-URBEMIS Energy Efficiency Mitigation Measures					
Maximize interior day light		GHGs	R, C, M		
Increase roof/ceiling insulation		CAPs, GHGs	R, C, M		
Create program to encourage efficiency improvements in rental units		CAPs, GHGs	R		
Install rainwater collection systems in residential and Commercial Buildings		GHGs	R,C,M		
Install low-water use appliances and fixtures		GHGs	R,C,M	California Air Pollution Control Officers Association (CAPCOA) 2008. CEQA and Climate Change.	
Restrict the use of water for cleaning outdoor surfaces/Prohibit systems that apply water to non-vegetated surfaces		GHGs	R,C,M	California Attorney General's Office GHG Reduction Measures	
Implement water-sensitive urban design practices in new construction		GHGs	R,C,M		
NON-URBEMIS Waste Reduction Mitigation Measures					
Provide composting facilities at residential uses		GHGs	R		
Create food waste and green waste curb-side pickup service		GHGs	R,C,M		
Require the provision of storage areas for recyclables and green waste in new construction		GHGs	R,C,M		

Notes: CAPs = Criteria Air Pollutants; GHGs = Greenhouse Gases; ROG = Reactive Organic Gases; R = Residential Development; C = Commercial Development; M = Mixed Use Development; A/C = Air Conditioning; and VOC = Volatile Organic Compounds.
Source: Information compiled by EDAW 2009.

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BAY AREA
2010 CLEAN AIR PLAN

VOLUME II

Section A

Stationary Source Measures

September 2010

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

939 Ellis Street
San Francisco, CA 94109
(415) 771.6000
www.baaqmd.gov

SSM 1 - Metal Melting Facilities

Brief Summary:
Limit emissions of organic compounds, fine particulates, toxic compounds and odors from foundry operations and metal melting facilities in the District.

Purpose:
Reduce organic compounds, fine particulates, toxic compounds and odor emissions.

Source Category:
Stationary

Regulatory Context and Background:
Foundries specialize in melting and casting metal into desired shapes. Foundry products are most often used in automobiles, truck parts, pipe and plumbing fixtures, train locomotives, airplanes and as metal pieces in other kinds of equipment. Die casting facilities melt metal and inject it into molds under pressure. In addition, some facilities melt metals from scrap to create specific alloys to be re-melted and cast at different locations, either in or out of the District.

Emissions produced by metal melting directly relate to the metal type, the furnace type and the molding technology used. Nonferrous foundries and steel foundries may produce hazardous emissions because of the lead, mercury, zinc, manganese, nickel, cadmium and other metals present.

Emissions of coarse and fine particulate come from mold making, pouring metal into molds, mold removal and any sand reclamation for re-use. Toxic compounds can also be emitted from fine sand particles from the shakeout (mold removal) step. Also, particulate matter is generated from receiving scrap metal for melting. Die casting uses molds, called tools, of machined steel for producing multiple casts, so little particulate matter is generated from the tool once manufactured. Metal melting and pouring can be the source of vaporized toxic compounds and odors can be generated from the organic binder systems used in mold making and from metal pouring and cooling.

Facilities in the District are currently regulated under Title V, the California ATCM for Non-Ferrous Foundries, and NESHAPS rules for Iron and Steel Foundries (40 CFR 63, subpart ZZZZZ), Aluminum, Copper and other Nonferrous Foundries (subpart EEEEE and ZZZZZZ), Secondary Aluminum Production (subpart RRR) and Electric Arc Furnace Steelmaking Facilities (subpart YYYYY). In addition, District standards governing particulate matter (Regulation 6, Rule 1) apply to these facilities and some are subject to the District's odor regulation (Regulation 7).

Implementation Actions:
The control measure would be implemented through the adoption of a new regulation targeted specifically at metal melting industries. The regulation would contemplate particulate matter control for the molding process, also consider controls on the metal melting, pouring and cooling, scrap receiving and processing and odor controls as appropriate. These would likely consist of baghouses. In addition, organic compounds (including odorous compounds) from these steps could be abated by carbon. Sand reclamation, which reduces waste from the facility, is typically done by burning, which generates fine particulate and odors. This could be abated by afterburner. Further requirements of the regulation could enhance capture of emissions through improved operating methods.

Emission Reductions:
Unknown at this time.

Emission Reduction Methodology:
TBD. Methodologies could include setting emission standards, work practice standards and management plans to reduce fugitive emissions.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
If afterburners were used to control PM and other compounds from sand reclamation, NOx and CO2 emissions would result.

Cost:
Unknown at this time.

Co-benefits:
None. The measure would directly target PM and VOC emissions.

Monitoring Mechanisms:
Source testing, parametric / CEM.

Issues/Impediments: The technology to implement the control measure is in place at some operations, however, cost may be an impediment for smaller businesses.

Sources:
1. National Emissions Standards for Iron and Steel Foundries (40 CFR, Part 63, Subpart EEEEE)
2. National Emissions Standards for Iron and Steel Foundries, Area Sources (40 CFR, Part 63, Subpart EEEEE)
3. Iron and Steel Foundries
4. Aluminum, Copper and other Nonferrous Foundries (40 CFR, Part 63, Subpart ZZZZZZ)

SSM 2 - Digital Printing

Brief Summary:
This control measure would reduce ROG emissions from digital printing operations by one of two approaches:
- Adopting VOC limits on inks and solvents used, or
- Adopting control technology requirements.

Purpose:
Reduce emissions of VOC from digital printing operations.

Source Category:
Area Source

Regulatory Context and Background:
District Regulation 8, Rule 20: Graphics Arts Printing and Coating Operations limits organic emissions from traditional graphic arts operations during printing, coating, adhesive, and cleaning activities. Traditional printing technologies include lithographic, letterpress, gravure, flexographic, and screen printing. VOC limits are further differentiated by the types of inks and substrates used during the printing process.

The digital printing (DP) is a fairly new, non-traditional printing process that is emerging virtually every segment of the graphic arts industry. In this process a digital image stored on a computer is converted into an image that can be printed on a wide variety of substrates besides paper, such as textiles; three dimensional objects, like ball bearings; and synthetic skin. This differs from traditional graphic arts printing, which uses fixed-image masters or "plates." One primary reason DP is gaining greater acceptance is that DP has a faster turnaround time because it requires considerably less setup time for each job compared to other printing processes. Furthermore, last minute revisions are easily carried out without having to make significant changes, and may have environmental advantages, such as reduced waste. The five basic types of digital printing technology are liquid inkjet printing; thermal wax printing; laser printing, including liquid electrophotographic printing; solid ink printing; and dye sublimation printing. Of all the digital printing operations, inkjet printing appears to be gaining the largest market share in the graphic arts industry on a world-wide basis. Although DP accounted for only about three percent of the total U.S. printing industry output in 1991, it is forecast to have at least a 21 percent market share by 2025.

Emissions from the DP industry are not regulated by the District's rule to control emissions from printing presses, Regulation 8, Rule 20, however the 2008 amendments to Regulation 8, Rule 20 require certain large commercial digital printing operations to keep records of the usage of ink and other VOC-containing materials. Staff has identified two DP technologies that are believed to have significant emissions, District-wide: liquid electrophotographic printing and solvent-based inkjet printing. Staff reviewed records on one large liquid electrophotographic press and estimated that the VOC emissions were approximately 1 ton/year. Solvent-based inkjet printers can produce images on the widest formats in the printing industry and use inks that contain high VOC contents. Inkjet printing appears to be the most likely to emit significant ROG emissions.

Implementation Actions:
One option is to establish a limit for VOC emissions from DP facilities, such as Maryland's 100 pounds per day limit. Lower VOC inks may be able to be developed, although the necessary properties of inks for some types of DP may preclude low-VOC formulations. Add-on controls or equipment requirements could be developed to prevent emissions, or add-on controls could be required. Finally, emission limits could be established for each printing technology, allowing a combination of low-VOC materials, on-board controls and add-on controls, as necessary.

Emission Reductions:
TBD. It is estimated that 40 – 50 large, liquid electrophotographic presses may exist in the Bay Area. The number of large, commercial inkjet printers is not known.

Emission Reduction Methodology:
TBD

Exposure Reduction:
TBD

Emission Reductions Trade-offs:
Add on control equipment may require the use of electricity or natural gas, increasing GHGs.

Cost:
Unknown at this time. Some DP may reduce emissions through internal controls of ink usage, making ink available for re-use.

Co-benefits:
- Reduction in ROG emissions may reduce emissions of toxic organic compounds.

Monitoring Mechanisms:
Source testing, recordkeeping, parametric monitoring.

Issues/Impediments:
Unlike traditional printing, technical barriers to the development of low-VOC inks may exist due to the nature of how the DP creates images. Inkjet printing relies on ink with a very low viscosity to be sprayed through tiny nozzles. Electrophotographic printing relies on the polarity of ink molecules to be attracted to charged plates.

Sources:

1. EPA Office of Compliance sector Notebook Project: Profile of the Printing & Publishing Industry, 1995 http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/printpt1.pdf
2. EPA Design for the Environment Printing Industry Profile, http://www.p2pays.org/ref/01/00936/execsum.htm
3. Digital Printing: The Reference Handbook, 2004, Uri Levy & Gilles Biscos
4. Today's Digital Imaging: Version 5.0, 2005, Smart Papers
5. Conference call with Sandra Lowe-Leseth, Rule Developer, San Joaquin Valley Air Pollution Control District, 5/2/07
6. Code of Maryland Regulations: 26.11.19.18. 18 Control of Volatile Organic Compound Emissions from Screen Printing and Digital Imaging http://www.dsd.state.md.us/comar/26/26.11.19.18.htm

SSM 3 - Livestock Waste

Brief Summary:
This control measure would reduce organic emissions from livestock waste by requiring best management practices already being implemented in San Joaquin Valley Unified Air Pollution Control District, Sacramento Metropolitan and South Coast Air Quality Management Districts to be applied at Bay Area dairies.

Purpose:
Reduce emissions of organic compounds from livestock waste.

Source Category:
Area source.

Regulatory Context and Background:
California law and District regulations have historically exempted agricultural sources of air pollution from obtaining air quality permits, or complying with most air quality regulation. This exemption was revoked in 2003 with the passing of Senate Bill 700 that requires air districts to adopt regulations for large confined animal facilities and amends air pollution control requirements of the California Health and Safety Code (CH&SC) related to agricultural sources of air pollution, effective January 1, 2004.

Pursuant to Senate Bill 700, the District adopted Regulation 2, Rule 10: Large Confined Animal Facilities in 2006. The regulation requires that large confined animal facilities (at least 1000 milk-producing cows for dairies) obtain a permit to operate and implement control measures to reduce emissions of POC (Precursor Organic Compound), NOx, and PM_{10} from the facility. The rule allows the APCO to establish a reasonable compliance schedule for facilities to implement these control measures within one year of the date on which the permit is issued.

Currently, the District does not provide a list of control measures that are applicable under this regulation. Based on the District's review of USDA census data, no facility in the Bay Area currently meets the applicability requirements of Regulation 2, Rule 10. According to the California Food and Agriculture Report for 2005, there are approximately 100 dairies in the Bay Area with an average herd size of 350 milking cows. Milking cows must give birth to calves in order to produce milk. On average, a milking cow produces 17,000 pounds of milk a year. Due to the high number of calve births required for cows to continue to lactate, dairy operations must also handle calves, heifers, and other support stock. Support stock typically composes about 50 percent of the total cattle on a dairy, although many larger dairies are sending calves and heifers to special farms in order to focus solely on milk producing cows.

In addition to dairies, the Bay Area also supports a small stock of chicken, turkey, goat, and swine farms. Research is ongoing to determine the number of facilities in operation and the average amount of animals being supported at these facilities. Most of these facilities as well as the dairies are located in Sonoma or Marin Counties.

Implementation Actions:
Emission mitigation measures are based on San Joaquin Valley Unified Air Pollution Control District Rule 4570 and South Coast Air Quality Management District Rule 223. Because most Bay Area dairies are smaller operations than those in San Joaquin and South Coast, the District is focusing on implementation of best management practices rather than requiring controls at this time. Preliminary research by Schmidt (2005) has shown that organic compounds emitted from the feed may constitute over 50% of the total organic emissions from animal facilities. Simple techniques such as keeping silage covered and reducing wet feed can potentially reduce organic emissions. Additionally, feeding the animals food that will result in more complete digestion can reduce organic emissions directly from the animal and the waste. The District will review the best management practices implemented in San Joaquin and South Coast and determine if any may be applied to Bay Area dairies. The practices include:

- Prepare feed according to National Research Council guidelines specified in the most recent version of the “Nutrient Requirements of Dairy Cattle”
- Store grain in a weatherproof storage structure from October through May
- Remove feed from the area where animals eat at least once every 14 days
- Cover the horizontal surface of silage piles, except for the area where feed is being removed from the silage pile.
- Flush or hose milking parlor immediately prior to, immediately after, or during each milking
- Flush freestalls more frequently than the milking schedule
- Use non-manure-based bedding for at least 90% of the bedding material, by weight, for freestalls (e.g., rubber mats, almond hulls, sand, or waterbeds)
- Inspect water pipes and troughs and repair leaks at least once every 14 days
- Clean concrete areas such that the depth of animal waste does not exceed twelve inches at any point or time, except in-corral mounding
- Manage corrals such that the animal waste depth in the corral does not exceed twelve inches at any point or time, except for in-corral mounding
- Knock down fence line animal waste build-up prior to it exceeding a height of twelve inches at any time.
- Scrape or flush feed aprons in corrals at least once every seven days
- Maintain corrals to ensure drainage and to prevent water from standing more than 48 hours
- Cover dry animal waste piles outside of the corrals with a waterproof covering from October through May, except for times, not to exceed 24 hours, when wind removes the covering
- Cover dry separated solids outside the corrals with a waterproof covering from

October through May, except for times, not to exceed 24 hours, when wind removes the covering.
- Remove solids from the waste system with a solid separator system, prior to the waste entering the lagoon
- Manage the liquid animal waste so it stands in the fields no more than 24 hours, if it is applied on land as fertilizer
- Do not apply any solid animal waste that has a moisture content of more than 50% as fertilizer on fields.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.30	0.30
$C0_2$-e	65.00	65.00

The emission reductions potential for this measure equals 3.4 tons per day TOG, or 0.3 tons per day ROG and 3.1 tpd of methane. Based on its global warming potential (GWP) factor of 21, the 3.1 tpd of methane emissions are equivalent to 65 tpd of CO2-e.

Emission Reduction Methodology:
The emission reduction estimates considers that a dairy would adopt all of the best management practices listed above. Additional reductions are possible from large facilities that may opt to install advanced control technologies including anaerobic digesters, aerobic lagoons, aerated static piles, and/or biofilters. Because most of these technologies are new and just beginning to reach commercial use, the emission reduction potentials are unknown. Because of the capital costs associated with construction of these technologies, they may be better suited for larger confined animal facilities similar to those typically found in San Joaquin or South Coast.

The 2005 emission inventory estimates emissions from dairy cattle are 13.75 tons per day of TOG and 1.1 tons per day of ROG. Adoption of best management practices is estimated to reduce TOG emissions by 25% or 3.4 tons per day. The majority of dairies in the Bay Area are considered small operations that house an average of 350 milking cows. It is possible that some of the Bay Area dairies are already implementing some of these practices, in which case, the emissions, and potential emission reductions, may not be as significant.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
None.

Cost:
The control costs are based on San Joaquin staff report and knowledge of current operations performed at the affected sources. San Joaquin's Rule 4570 applies only to

Large Confined Animal Facilities and due to their small size, no Bay Area dairy meets this definition. As such, the District only estimated costs for facilities to adopt the best management practices. The annual cost is estimated at approximately $15 per cow. The District has approximately 80,000 dairy cows, so total costs are estimated to be $1.2 million per year. For an average dairy in the Bay Area that houses 350 dairy cows, the cost is estimated at $5,250 per year.

Co-benefits:
The adoption of best management practices may also reduce emissions of ammonia, a secondary precursor to the formation of particulate matter and methane, a greenhouse gas.

Monitoring Mechanisms:
District Compliance and Enforcement Staff will monitor adoption of the best management practices through facility inspections. The success of this control measure in terms of emissions reductions would be difficult to monitor, as the majority of facilities would remain exempt from permitting due to their small size. Furthermore, the ongoing variability in the determination of emission factors for livestock may complicate efforts to quantify the reduction of emissions from adoption of these management practices.

Issues/Impediments:
There may be some opposition from this industry to being regulated when only recently they were exempt from complying with air quality regulations. The best management practices, however, are supported by industry representatives and were developed through a collaborative effort with effected parties in the San Joaquin and South Coast districts.

Sources:
1. Bay Area Proposed Regulation 2, Rule 10: Large Confined Animal Facilities, Staff Report, dated 7/5/2006
2. Mitoehner, F. et al, Volatile Fatty Acids, Amine, Phenol, and Alcohol Emissions from Dairy Cows and Fresh Waste. Final Report, dated 5/31/2006.
3. Sacramento Metropolitan Air Quality Management District, Rule 496 Large Confined Animal Facilities, Staff Report, dated 6/19/2006.
4. San Joaquin Rule 4570: Confined Animal Facilities, Final Draft Staff Report, dated 6/15/2006
5. Schmidt, C.E., and Card, T.R., Dairy Air Emissions, Summary of Dairy Emission Estimation Procedures, dated May 2006.
6. South Coast Rule 1127: Emission Reductions from Livestock Waste, Final Staff Report, dated 8/6/2004

SSM 4 - Natural Gas Production and Processing

Brief Summary:
Equipment at natural gas wells in the District is prone to leaks and excess emissions. Emissions are mostly methane, which is a potent greenhouse gas (GHG), with smaller amounts of volatile organic compounds (VOCs) and some toxic compounds. Exemptions for these gas wells in Rule 8-37 would be reconsidered and excess emissions controlled.

Purpose:
Control fugitive emissions, including methane, from natural gas production wells and associated equipment.

Source Category:
Stationary source.

Regulatory Context and Background:
The District has many natural gas wells in eastern Contra Costa County and southern Solano County. These wells extract natural gas from pockets that are found at greater than 1000 ft below grade. This gas is stripped of moisture and then pressurized to main-line pressure for use by utilities. This gas has been found to contain greater than 90 percent methane. Liquids stripped from the gas often contain toxic airborne contaminants (TAC). These gas wells typically have the following equipment on site:

- Gas well
- Liquid knockout
- Compressor (natural gas fired)
- Dehydrator with associated tanks
- Pneumatic liquid transfer pump
- Oil/water separator
- Fixed roof tank(s) for water and condensate

Gas well: A gas well may have a natural pressure of up to 7200 pounds per square inch (psi) though most wellheads are typically 40 to 150 psi. The gas wells in the District have methane content at about 92 percent with a large nitrogen component in the remaining eight percent of the gas. This gas is “wet” (meaning it contains water vapor), and contains other hydrocarbons, including toxic compounds.

Liquid knockout: The liquid knockout or separator is simple tank that utilizes a series of baffles. The collected liquids are routed to the “produced water” tank via an automatic liquid level controller. These controllers are powered by pressurized natural gas and are of two types. Type one is the normally open variety that continually vents natural gas to atmosphere. Type two is a unit that is normally closed to atmosphere except when liquids are being routed to the produced water tank.

Compressor (natural gas-fired): The engine for the compressor is usually a four-cylinder, natural gas-fired compressor that is exempt from District permits and emission requirements due to being less than 50 brake horse power (Rule 2-1-114.2.1 and Rule 9-8-110.2). However these units are often 1960s units that are in very poor condition. These units should be source tested initially as they may not meet the requirements of Rule 8-2-301 for 300 ppm and 15 lbs/day.[1] The compressor is usually coupled to a two stage horizontally opposed positive displacement compressor with liquid knockout with automatic liquid level controllers that dump to the produced water tankage. Utility line pressure is generally about 500 to 600 psi. These compressors continuously emit natural gas from leaks.

Dehydration units with associated tanks: The dehydration unit is used to remove residual moisture from the gas stream prior to release of the gas to the utility. The gas stream is routed through a contact tower containing a glycol solution. The glycol solution absorbs both water and non-methane hydrocarbons, leaving the natural gas. This “dried” gas is then sent on to the utility. The glycol is regenerated via heating, which drives off the hydrocarbon and water from the glycol and this resulting vapor is then condensed via overhead piping and collected in the “cooling tank”.

In the past these dehydration units just vented the vapors to atmosphere; but since 1998, more of these units have captured the vapors, referred to as closed loop systems. This additional condensing and liquid collection equipment has been added to the existing equipment in the field on an ‘as needed’ basis. There can be many problems with the closed loop systems, primary of which is that the cooling of the vapors is insufficient to collect them effectively. Most systems use a long, gently sloped overhead metal line (two-inch galvanized pipe approximately 50 feet long); often, these systems are not adequate to sufficiently cool the vapors. Dehydration units also generally have flash drums between the absorber tower and the regeneration units that flash methane and other light components from the glycol before generation.

Pneumatic liquid transfer pumps: These pumps are powered with natural gas that vent to the atmosphere with every stroke of the pump.

Pneumatic controls: These controls are powered with natural gas that vents to the atmosphere for safety reasons and because there is generally no electricity at remote locations.

Oil/water separator: Only a few of the facilities separate the hydrocarbons from water via equipment called a “Gun Barrel.” This equipment is basically a vertical tower that allows for phase separation. Without the Gun Barrel, sites will co-mingle water and hydrocarbons in

[1] Rule 8-2 applies to miscellaneous sources of VOC emissions that are not addressed by any other rule. It limits VOC emissions from such sources to both 300 ppm and 15 lbs/day.

the single tank that is called the "produced water tank." Phase separation also occurs in the tank.

Fixed roof tank(s) for water and for condensate "produced water": As discussed above the produced water tankage allows for phase separation of hydrocarbons and water. Sampling has shown total vapor pressure of 3.2 to 3.5 psi in these tanks with 1.0 percent benzene, 5.9 percent toluene, and 6.5 percent xylene in the hydrocarbon phase. Vapor headspace sampling of these same tanks found total hydrocarbon concentrations of up to 55,000 ppm; control of these vapors would reduce emissions when tanks are serviced.

These tanks are emptied via vacuum truck from a fitting on the bottom of the tank. Vacuum truck operators commonly remove the lid from these tanks while emptying the tank due to concerns of collapsing the tank. A common problem is that these lids remain open after the unloading of the liquids.

Implementation Actions:
Staff would consider a range of possible controls including the following:

- Pumps / Compressors:
  - Identify "high bleed" pneumatic pumps (bleed natural gas at a rate of 6 scf/h) and replace with "low" (less than 1 scf/h) or no bleed pumps.
  - Address combustion emissions from compressors with requirements similar to those in Rule 9-8: IC Engines.
- Tanks:
  - Amend Rule 8-37 to address the tanks that are associated with the dehydration unit (condensation tank) that is very specialized and should be considered part of the dehydration process unit.
  - Amend Rule 8-5 to address the set pressure PV valves on fixed roof tanks that are the standard in the industry. Many of these facilities use polyethylene tanks where the set pressure of the tank's PV valve is zero, allowing venting of emissions.
  - Require that lids and hatches on tanks remain sealed at all times (including during liquid transfers), except when performing maintenance (reflect language in Rule 8-8: Wastewater Collection and Separation Systems).
- Valves:
  - Include monitoring requirement for leak checking of the pressure vacuum valves installed on the tanks and also on the piping and equipment associated with the dehydration unit.
  - Address adequate flow requirements for pressure vacuum valves when connected to vacuum trucks.
- Pipes / Connectors
  - Address fugitive emissions from vapor return lines when the reboiler burner is off.
  - Address liquids issues on the vapor return line from the cooling tank. During the summer, it is common to see uncondensed vapor at the end of the cooling segments of the vapor return line from the condensation tank. These may be controlled by requiring the condensate to be refrigerated.

- Reconsider the exemption in Rule 8-37 that allows gas wells to petition for an exemption from the standards of Rule 8-37 if the gas is more than 90 percent methane. Gas typically is predominately methane, a potent GHG.
- Require that dehydration units operate as a closed loop systems, as required in Yolo-Solano Air Quality Management District, to prevent the stripped hydrocarbons from being emitted to the atmosphere.
- Identify "high bleed" pneumatic controls and replace with "low bleed" (less than 1 scf/h) controls.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0	0.30
$C0_2$-e	0	120.00

Emission Reduction Methodology:
Emission reductions are based on an overall leakage rate of 1.4 percent and the relative amounts of the components of natural gas, methane, ethane, propane and butane. Total emissions are estimated to be 11.1 tpd of total organic gases (TOG), including 0.44 tpd of ROG. Emissions reductions are estimated to be between 6 - 9 tpd TOG. This includes 0.3 tpd of ROG and 5.7 tpd of methane. Based on its global warming potential (GWP) factor of 21, the 5.7 tpd of methane emissions are equivalent to 120 tpd of CO2-e.

Exposure Reduction:
TBD

Emission Reductions Trade-offs:
Potential increases in CO2 due to combustion control equipment (which would be greatly offset with the reductions in methane emissions).

Costs:
TBD

Co-benefits:
Reductions in GHG, ROG and toxics.

Monitoring Mechanisms:
Source testing, LDAR, and parametric monitors.

Issues/Impediments:
The majority of emissions reductions would be from methane, which has historically been exempt from VOC rules.

Sources:
1. http://72.14.253.104/search?q=cache:w5Ctbf5xgrsJ:www.its.ucdavis.edu/publications/2003/UCD-ITS-RR-03-17E.pdf+emission+factors+%2B+oil+production&hl=en&ct=clnk&cd=16&gl=us or
2. http://www.its.ucdavis.edu/publications/2003/UCD-ITS-RR-03-17E.pdf.
3. http://www.engineeringtoolbox.com/gas-density-d_158.html
4. http://www.epa.gov/gasstar/documents/ll_pneumatics.pdf

SSM 5 - Vacuum Trucks

Brief Summary:
This control measure would reduce organic emissions from vacuum trucks by requiring emission controls on vacuum trucks utilized in liquid clean-up and transfer operations in refineries and at other locations.

Purpose:
Reduce emissions of organic compounds venting from mobile vacuum trucks used to clean up and transfer organic containing liquids.

Source Category:
Area source.

Regulatory Context and Background:
This measure was analyzed in the 1994 Clean Air Plan as Control Measure B6: Control of Emissions from Cleaning Up Organic Liquids. The analysis concluded that the measure would not be cost effective. However, in addition to cleaning up spills, vacuum trucks have been observed in frequent use as part of refinery operations, such as removing water from tank surfaces, cleaning of oil-water separators, and transport of sludge, slop oils and tank bottoms. Further investigation of this source category was recommended as part of the Bay Area 2005 Ozone Strategy, identified as Further Study Measure FS 11, Vacuum Trucks.

At one refinery, it was estimated that over 1,000,000 gallons of hydrocarbon containing liquids were put in vacuum trucks per month, which is the equivalent of approximately 145,000 gallons of hydrocarbons per month. On a volume basis, at least 1.5 gallons of air is emitted for every gallon of vacuum tank capacity. In some cases, emissions from the tanks are controlled by the use of a carbon canister that adsorbs organic vapors as they are emitted from the truck tank, primarily to control odors. Further analysis can more precisely determine the emissions from these activities, emission reductions and costs.

Implementation Actions:
Vacuum trucks are routinely used to transfer organic liquids throughout the District. They operate both from facility to facility and also in dedicated service within the bounds of a facility such as a refinery. Although the trucks are mobile sources, the exclusion from District regulation in Regulation 1 applies only to the engines powering the trucks. Some of these trucks control emissions by carbon adsorption, but this is not universal and usually only employed to control odors.

Additional analysis will be undertaken to more accurately determine the number of vacuum trucks in use and the level of control already employed in practice. Compliance and Enforcement personnel assigned to refineries may be able to facilitate this inventory effort, but the larger equipment providers would need to be queried to determine the extent of vacuum truck use outside of refinery operations. Source testing could determine the efficiency of carbon adsorbers if in use, and overall emission rates.

Potential control requirements could include a requirement to use carbon adsorption when organic liquids are being collected, a sizing requirement for the carbon based on truck capacity, and a requirement to change out the carbon canister at appropriate intervals before the carbon becomes saturated. Other options could include the use of a balance system to route vacuum tank air back into the evacuated vessel.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	6.00	6.00

Emission Reduction Methodology:
The emission reduction estimates are based on discussions with a supplier of vacuum trucks and other tank degassing equipment. There are roughly 200 hours of vacuum truck operation per day based on rough estimates of the number of operating vacuum trucks in the Bay Area (125 trucks at 80% utilization). Assuming that each truck is likely to pull a vacuum for two hours per day, uncontrolled emissions could be as high as 15 tons per day. Assuming that current control is only 50% due to intermittent use and ineffective monitoring and change out of spent carbon canisters, emissions would still be 7.5 tons per day. Implementation of control requirements coupled with improved monitoring and change-out of the canisters could be expected to achieve 90% control of emissions resulting in emissions reductions of 6 tons per day. Additional research will refine this estimate, including a breakdown of the emission constituents. Vacuum trucks clean up a variety of compounds from a variety of sources, including non-organic materials. The mixtures and presence of water may greatly impact the volatility of the material in the tanks.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
If activated carbon is used for control, this media will need to be stripped of organics or reactivated. Reactivation of carbon is an energy intensive process that may result in emissions of organics as well as NOx and CO from combustion if done on site. Alternatively, carbon disposal or reactivation off site would result in combustion emissions from hauling to a waste or regeneration facility.

Cost:
Activated carbon is readily available at costs between $1,100 and $2,000 per ton. Regeneration of spent carbon may be more costly than purchasing new carbon. The loading capacity for the carbon remains to be determined but is likely to be no more than 50% (by weight) and may be as low as 20% (by weight). Using the high estimate for virgin activated carbon with the low loading rate would result in a cost of $10,000 per ton of TOG reduced

($60,000 per day or $21.9 M per year). This does not take into account the costs of regeneration or disposal of spent carbon, but it does use the highest price for new carbon. Using the lower cost estimate and highest loading rate, costs would equal $2200 per ton TOG reduced ($13,200 per day or $4.8 M per year).

Co-benefits:
Reduction in exposure to toxic air contaminants, depending on what liquid is being collected.

Monitoring Mechanisms:
District Compliance and Enforcement staff will monitor adoption of emissions control through facility inspections. Vacuum trucks could be permitted as portable equipment, although they are not equipment subject to the statewide Portable Equipment Registration Program. Vacuum trucks could also be registered with the District to facilitate monitoring and enforcement.

Issues/Impediments:
Further research will be performed to improve the estimates of costs of control, the number of vacuum trucks in operation, as well as the extent that emissions control is already employed. There may also be other means of control that may prove more effective or less costly than carbon adsorption. If control were by means of combustion, the potential for increases in greenhouse gas emissions would need to be evaluated.

Sources:

1. 1994 Clean Air Plan Control Measure B6: Control of Emissions from Cleaning Up Organic Liquids
2. Bay Area 2005 Ozone Strategy, Further Study Measure FS 11, Vacuum Trucks
3. Steve Sellinger, Senior Engineer, Envent Corporation, personal communication 12 May 2005
4. BAAQMD Regulation 8, Rules 2, 5 and 9.
5. Maintenance/Startup/Shutdown (MSS) Permitting Issues, prepared by Sage Environmental Consulting, LP for The Texas Oil and Gas Association Refinery Environmental Committee, 11 June 2007

SSM 6 - General Particulate Matter Emission Limitation

Brief Summary:
Reduce the District's allowable weight rate limitations for particulate matter (PM).

Purpose:
The purpose of this measure is to reduce emissions of particulate matter in order to decrease population exposure and protect public health, both at the regional scale and in impacted communities.

Source Category:
Stationary source.

Regulatory Context and Background:
Particulate matter includes both coarse PM, PM10 or particles with an aerodynamic radius of 10 microns or less, and PM2.5, particles with an aerodynamic radius of 2.5 microns or less. As discussed in both Chapter 1 and Appendix A of the 2010 CAP, current evidence suggests that PM, and especially PM2.5, is the pollutant that imposes the greatest health impact on Bay Area residents. The District has had a particulate matter emission limitation in Regulation 6, Rule 1 since 1960. Reg. 6-1 contains visible emissions standards, concentration rates in terms of weight per volume of exhaust gas, and an allowable emissions rate expressed in terms of weight per weight of material processed, as well as other limits for specialized operations. Other districts have lower limitations. For example, San Joaquin's Rule 4202 allows less than 15 lbs per hour of particulate matter emission for a process weight rate of 20,000 lbs/hr; the South Coast's Rule 405 allows less than 12 lbs/hr. BAAQMD Rule 6-1 allows 19 lbs/hr for a process weight rate of 20,000 lbs/hr.

Implementation Actions:
Amend Regulation 6, Rule 1 to reduce the particulate matter allowable emissions rate.

Emission Reductions:

Pollutants (tons per day)	2012	2020
PM10	0	2.58
PM 2.5	0	0.29

Emission Reduction Methodology:
The 2005 Base Year Emissions Inventory was used to select the potential emissions that might be subject to the particulate emissions rate. Nine categories resulted in 7.79 tpd emissions of total PM. The four largest categories are Concrete Batching, Basic Refining Processes, Stone, Sand, and Gravel (Quarrying) and Other Commercial Industrial Processes. Other categories, such as Cooking and Landfills (fugitive emissions) have not been included although they have significant emissions. If facilities were operating at the current allowable emissions rate and could reduce emissions to the South Coast rate, emissions

reductions would be 2.87 tpd. However, it is not known if all facilities are currently operating at close to the allowable rate. It is likely that many facilities, through the installation of more efficient control equipment reflected in their permit conditions, operate at far lower rates.

Reduction in the allowable weight rate of particulate matter would not be expected to reduce total PM, PM10 and PM2.5 equally, because the smaller particles (those that have the greatest health impact) are the lightest. This could be considered during rule development efforts.

Exposure Reduction:
TBD

Emission Reduction Trade-off:
None expected, although a need to increase control equipment could result in greater electricity use, generating more CO_2 emissions.

Cost:
TBD

Co-benefits:
Reduced particulate matter is associated with improved visibility.

Issues/Impediments:
Further research is needed to determine if existing sources are operating at or already below the allowable emissions rate.

Sources:
1. BAAQMD Regulation 6, Rule 1: General Particulate Matter
2. South Coast Rule 405: Solid Particulate Matter - Weight
3. San Joaquin Valley Unified APCD Rule 4202: Particulate Matter Emission Rate

SSM 7 - Open Burning

Brief Summary:
Consider further limitations on open burning in Regulation 5: Open Burning.

Purpose:
Reduce particulate matter, NOx and VOC emissions from open burning.

Source Category:
Area source.

Regulatory Context and Background:
The District's Regulation 5 prohibits open burning with some exceptions. These exceptions, to allow certain burning on permissive burn days, include burning for hazardous waste reduction; removal of flood debris; marsh, forest and range management; burning of contraband; fire training; and burning of agricultural debris. Burning of agricultural debris is typically limited to a certain time period depending on what is being burned; e.g., crop stubble, orchard prunings, or crops to be replaced. A permissive burn day is called when air pollution from open burning is not expected to adversely impact ambient air quality or downwind populations according to meteorological criteria established by ARB for the Bay Area. However, Regulation 5 does not limit the quantity of material burned for agricultural operations. As indicated by the level of reported complaints, in some cases, burning of large piles of vineyard prunings have significantly impacted populations on marginally permissive burn days.

In addition, in 2008, the District adopted Regulation 6, Rule 3: Wood-burning Devices, which forbids uses of fireplaces and wood stoves on predicted PM excess nights. On at least one occasion in the winter of 2008, agricultural crops were burned on a permissive burn day prior to a non-burn night. Further limits on open burning would reduce PM emissions, including during periods conducive to high PM levels.

Finally, the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) is required, pursuant to CH&SC 41855.5, to develop alternatives to burning agricultural waste. The San Joaquin District has committed to work with the agricultural industry to investigate the feasibility of reducing burning, and the consequent emissions, by up to 50%. No specific feasible alternatives to burning are identified in SJVUAPCD's 2006 PM10 plan.

Implementation Actions:
Amend Regulation 5 to restrict the amount burned on permissive burn days or under certain meteorological criteria.

Emission Reductions:
The SJVUAPCD 2006 PM10 plan addresses alternatives to burning. Based on their estimates, if alternatives to burning agricultural crop waste were available for the Bay Area, emissions could be reduced by up to 0.04 tons VOC per day, 0.01 tons NOx per day, and 0.09 tons PM2.5 per day. However, as discussed above, the control measure could reduce exposure to PM without reducing total emissions if additional meteorological conditions for burning were considered for Regulation 5.

Emission Reduction Methodology:
The emission reductions are based on San Joaquin Valley estimates and the Bay Area source inventory. Estimates for the Bay Area are based on two source categories, Managed Burning and Disposal – Agricultural Burning – Prunings and Field Crops. Emission reductions are estimated from the percentage reduction estimated in the San Joaquin Valley's PM10 Plans for PM and NOx, and a reduction of 35% reduction for VOC was estimated, consistent with the NOx PM reduction.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
Increased composting of agricultural waste could increase emissions from composting operations, a subject of another control measure. However, a reduction of particulate matter in the atmosphere could reduce the number of days that wood burning is prohibited under Reg. 6-3: Wood Burning Devices.

Cost:
TBD

Co-benefits:
Direct reduction in PM, NOx and VOC from open burning.

Issues/Impediments:
Requiring only a part of agricultural waste to be burned may not reduce the total emissions from this source category because the remainder could be allowed to be burned on another day. However, it could result in a reduction in exposure to nearby residents.

Sources:
1. San Joaquin Valley Unified APCD 2003 PM10 Plan
2. San Joaquin Valley Unified APCD 2006 PM10 Plan
3. District emissions inventory, agricultural burning

SSM 8 - Sulfur Dioxide from Petroleum Coke Calcining

Brief Summary:
Limit emissions of sulfur dioxide from coke calcining by requiring a minimum of 80 percent sulfur capture.

Purpose:
Reduce sulfur dioxide and particulate matter emissions.

Source Category:
Stationary source.

Regulatory Context and Background:
Sulfur dioxide emissions are a precursor to fine particulate. Since the District is not in compliance with the federal ambient air quality standard for PM2.5, reductions are needed in PM2.5 and/or PM2.5 precursors. Combined, the two coke calcining kilns at District Plant 22 (ConocoPhillips Carbon Plant) emit 1232 tons per year of sulfur dioxide. The facility has committed to reducing SO2 emissions by 42 tpy to provide offsets for their Clean Fuels Expansion Project. The plant currently operates an abatement device to periodically trim emissions of sulfur dioxide to maintain compliance with the current sulfur dioxide emission limit in Regulation 9, Rule 1 of 400 ppm by volume or 113 kg (250 pounds) per hour, whichever is more restrictive. However, the South Coast AQMD requires a minimum of 80 percent sulfur capture, which is more restrictive than the current District rule requires. Hence, this control measure is intended to replicate the control measure that is in place in the South Coast.

Abatement technology includes dry scrubbing (injecting dry sodium bicarbonate or lime) into the flue gas stream, semi-dry scrubbing (injection a slurry of aqueous sodium bicarbonate or lime) into the flue gas stream, or wet scrubbing (using a sodium bicarbonate or lime slurry to absorb the SO2) from in the flue gas.

Implementation Actions:
Limit emissions of sulfur dioxide from coke calcining operations by requiring at least 80 percent sulfur reduction. This most likely requires a semi-dry flue gas desulfurization technology that has 80 – 90% SO2 removal efficiency.

Emission Reductions:

Pollutants (tons per day)	2012	2020
SO2	0	2.6

Emission Reduction Methodology:
TBD

Exposure Reduction:
TBD

Emission Reductions Trade-offs:
Use of add-on abatement equipment would be expected to increase power demand, indirectly leading to an increase in GHG emissions, mostly CO2, from power generation.

Cost:
Estimated costs for semi-dry flue gas desulfurization is $9 million capital, with an additional $4 million annual operating costs. Total amortized capital and operating costs are $5.7 million per year. Control efficiency is estimated to be at least 80%, reducing emissions by 950 tons per year. Cost effectiveness is estimated at $6000 per ton of SO2 reduced.

Co-benefits:
Reduction of secondary PM formation.

Monitoring Mechanisms:
Source testing, parametric / CEM.

Issues/Impediments:
No impediments have been identified, because the technology is in place at other similar operations.

Sources:
1. South Coast AQMD Rule 1119: Petroleum Coke Calcining Operations – Oxides of Sulfur.

SSM 9 - Cement Kilns

Brief Summary:
This control measure would reduce NOx and SOx emissions from cement kilns as well as reduce toxic air contaminants. There is one cement manufacturing facility in the Bay Area, Lehigh Southwest Cement (plant #17).

Purpose:
Reduce NOx and SOx emissions, mercury and other toxic air contaminants.

Source Category:
Combustion.

Regulatory Context and Background:
This facility is permitted to produce 1.6 million tons of cement clinker per year. In 2007, the facility switched from burning coal as its primary fuel to burning green petroleum coke. At the permitted production rate, the facility is projected to burn 171,000 tons per year of coke. The District approved the fuel switch based on EPA emission factors that indicated NOx was no greater, and all other criteria pollutants were reduced. However, EPA has recently obtained data from other areas indicating emissions are very dependent on the type of coal being used, and the characteristics of green petroleum coke. EPA has proposed additional source testing to validate that there is not an emissions increase associated with the switch. Hence, there will be source testing in the near future while burning coal and while burning coke.

2008 emissions were 1788 tpy (6.8 tpd for days in operation) of NOx and 181 tpy (0.69 tpd for days in operation) of SO2. This indicates an increase in NOx but a decrease in SO2 from coal burning. Further testing will provide better emissions data. 2009 emissions were lower due to production cutbacks.

EPA has recently amended their National Emission Standard for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry (40 CFR 63, Subpart LLL) to reduce emissions of mercury, particulate matter, total hydrocarbons, and hydrochloric acid. The proposed amendments were published in May of 2009, comments received were received through September 2009, and the amendments were finalized in August 2010. The rule sets standards for these pollutants and requires enhanced monitoring equipment and protocols.

Implementation Actions:
Require the use of abatement technology at Lehigh to reduce emissions of NOx, and consider a wet scrubber to reduce emissions of SO2 if any synergies in installing SO2 controls along with NOx controls (or other controls) can be identified.

Emission Reductions:
90% reduction of NOx of 1600 tpy, or 4.38 tpd (6.1 tpd for days in operation).

Pollutants (tons per day)	2012	2020
NOx	0	4.38

In addition to NOX reductions, SSM 9 also has the potential to provide SO2 reductions of 160 tons per year, or 0.44 tpd (0.6 tpd for days in operation). However, because of potential high costs for SO2 controls (see Cost section below), the issue of whether SO2 reductions should be required as part of this measure will be determined during the rule development process. Therefore, SO2 reductions have not been included in evaluating the cost-effectiveness of this measure.

Emission Reductions Methodology:
NOx emissions reductions have been estimated from a 90% emissions factor, consistent with estimates for modern control equipment.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
Depending on the technology selected, NOx reductions may increase GHG emissions, specifically CO2, by reducing efficiency of the process. The installation of either selective catalytic reduction or scrubbers for SO2 control would require additional power to pull gas through the equipment, indirectly causing more CO2 emissions from power generation.

In some modeling scenarios, reduction of NOx from a significant NOx emitting source with high emission rates has been shown to impact the ozone scavenging effect of NO, resulting in higher ozone concentrations in areas within the source's emission plume.

Cost:
To reduce NOx, the estimated cost to retrofit selective catalytic reduction into the flue gas train of the kiln is from $11.0 million capital expenditure, plus another $1.7 million annual operating costs (total annual costs, including amortization, $2.8 M). Control efficiency is estimated to be 90%, reducing emissions by 1,600 tons per year. Cost effectiveness when including amortized capital is $1750 per ton of NOx reduced. Selective Non-Catalytic Reduction (SNCR) technology may also be effective in this application. SNCR costs are approximately half of SCR costs, but only achieve 40 – 50% NOx reduction. Other technologies may be applicable. To operate NOx reduction equipment, particulate may have to first be removed from the flue gas.

As noted in the emission reduction discussion above, this measure may offer potential SO2 reductions, in addition to NOx. However, since it is not yet known whether SO2 reductions will be required, cost-effectiveness calculations for purposes of the CAP are based on NOx reductions only.

To reduce SO2, estimated costs to retrofit an SO2 scrubber into the flue gas train of the kiln is $140 million capital expenditure, plus another $2.7 million annual operating costs. Control efficiency is estimated to be 90%, reducing emissions by 160 tons per year. Cost effectiveness when including amortized capital would be on the order of $150,000 per ton of SO2 reduced.

The EPA NESHAP for cement kilns will require additional control equipment at this facility. As a result, some of the control equipment proposed in this measure may be able to be implemented more cost effectively.

Co-benefits:
Reduced secondary PM formation from NOx and SOx emissions.

Monitoring Mechanisms:
Source testing, CEMs and parametric monitoring.

Issues/Impediments:
The cost of SO2 control appears be a significant impediment unless synergies with NOx control or the NESHAP standards can be identified.

Sources:
1. Emissions from District databank files.
2. Alternative Control Techniques Document Update - NOx Emissions from New Cement Kilns, U.S. Environmental Protection Agency, EPA-453/R-07-006, November 2007
3. Best Available Retrofit Control Technology Assessment TXI Riverside Cement, South Coast Air Quality Management District, August 8, 2008
4. NOx Controls Cost Model, Section 4.2, Chapter 1, U.S. Environmental Protection Agency, EPA/452/B-02-001, January 2002
5. NOx Controls Cost Model, Section 4.2, Chapter 2, U.S. Environmental Protection Agency, EPA/452/B-02-001, January 2002

SSM 10 - Refinery Boilers and Heaters

Brief Summary:
Consider options to further reduce NOx emissions from petroleum refinery boilers and heaters.

Purpose:
Reduce NOx emissions.

Source Category:
Stationary source.

Regulatory Context and Background:
BAAQMD Reg. 9, Rule 10 imposes a daily average NOx limit equivalent to 28 ppmv on refinery heaters that were in service at the time the rule was adopted in 1994. Heaters that subsequently went into service were subject to more stringent NOx limits through the BAAQMD permitting process (BACT) and are not regulated under this rule. Reg 9-10 imposes a daily NOx limit of 150 ppmv on each heater classified as a CO boiler because these devices tend to have higher emissions and because their emissions are more difficult to control, compared to non-CO boilers. Only 3 of the Bay Area refineries operate CO boilers, and there are fewer than ten of these devices.

Because Reg 9-10 required final compliance by 2002 and because it does not apply to new heaters (except for new CO boilers), this rule achieved significant emission reductions through 2002, but has had virtually no effect on refinery heaters emissions since then. Because Reg 9-10 allowed refineries to comply on a daily average basis, they installed NOx controls on the largest and highest emitting heaters. Currently, the majority of refinery heaters have advanced NOx controls (ultra low-NOx burners or SCR) and almost all have at least basic low-NOx burners. The few heaters that have no NOx controls typically have one or more factors that appear to make them less-than-ideal candidates for cost-effective NOx control. These factors are being evaluated by staff to verify their validity.

During meetings with refinery personnel and engineering consultants in July 2009, the refineries presented information regarding projected costs to retrofit remaining uncontrolled boilers with low-NOx burners and SCR and to retrofit low-NOx burner-equipped boilers with SCR. In addition, there are a number of refinery projects currently ongoing that will involve retrofits or replacements of refinery heaters. This will result in an overall NOx reduction, the extent of which is currently being evaluated.

Reg 9-10 is not directly comparable to NOx rules in the other air districts with refinery operations (South Coast AQMD and San Joaquin Valley Unified APCD) because other district rules do not allow refinery averaging as Reg 9-10 does for non-CO boilers, and because these other air districts offer compliance options for the NOx limits in their rules (a regional

NOx cap-and-trade program at South Coast, and an emission fee option in San Joaquin) that BAAQMD does not offer. Nonetheless, both South Coast AQMD and San Joaquin Valley Unified APCD have made BARCT determinations that are more stringent than the current requirements of Reg 9-10 including:

South Coast: heaters <40 MM BTU/hr and >110 MM BTU/hr, and CO boilers
San Joaquin: heaters >110 MM BTU/hr

These BARCT determinations are being evaluated by staff, considering the different compliance options in each air district, to determine to what extent they may be applied to Bay Area refinery heaters.

Implementation Actions:
Reduce NOx emissions limits in Reg. 9-10 for the averaged heaters and the CO boilers. Other options that could be considered include requiring improved performance of some existing NOx controls.

Emission Reductions:
Total NOx emissions from heaters currently subject to Reg 9-7 are 12.0 ton/day (8.0 ton/day at averaged heaters and 4.0 ton/day at CO boilers). Because CO boilers represent a disproportionate source of emissions and because they have a significantly higher emission limit than the other refinery heaters, it is likely that most emission reductions will come from CO boilers. If all CO boiler emissions are reduced to the current BACT level for these devices, then NOx emissions would be reduced by about 2.9 ton/day.

Pollutants (tons per day)	2012	2020
NOx	0	2.9

Emission Reduction Methodology:
An amendment of Reg 9-10 will achieve emission reductions by either reducing the average daily NOx limit for pre-1994, non-CO heaters, or by reducing the NOx limit for CO boilers, or both. A reduction in the limit for pre-1994, non-CO heaters will require that refineries install low-NOx burners, ultra low-NOx burners or SCR on uncontrolled heaters, or else upgrade existing controls to more effective controls (e.g., replace low-NOx burners with SCR). These controls may be applied on whichever heaters provide the most-effective reductions, in order to achieve compliance with the new, average limit. CO boilers at different refineries have significantly different operating conditions (fuel mix, operating temperature), so it is unlikely that the current CO boiler limit can simply be reduced, since control costs will probably vary significantly at different refineries. Instead, different NOx limits will probably have to be applied to different fuels and operating conditions.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
The use of SCR could result in an increase in GHG, specifically CO2 due to increased need for electrical power.

Installation of low-NOx and ultra low-NOx burners may increase emissions of CO at the modified heaters, although CO emissions are expected to remain in compliance with the 400 ppmv limit in the rule.

In some modeling scenarios, reduction of NOx from a significant NOx emitting source with high emission rates has been shown to impact the ozone scavenging effect of NO, resulting in higher ozone concentrations in areas within the source's emission plume.

Cost:
This measure is currently going through the rule development process. Cost estimates will be refined by District staff during the course of the rule development process.

Because NOx controls have already been applied to most refinery heaters, and because there have been no cost break-through in NOx controls since Reg 9-10 was first adopted, any additional NOx reductions are expected to have relatively high cost effectiveness. Also, because each refinery has implemented a different NOx control strategy, any reduction in the average daily NOx limit will result in widely different control costs at each refinery. Although it is expected that each CO boiler arrangement will have a different NOx limit, refineries with CO boilers will also face widely different control costs because CO boilers currently operate over a wide NOx emission range.

Because refinery heaters are larger than typical non-refinery boilers and heaters and because of the complicating factors in refinery heater NOx control, control may be less cost-effective than for NOx reductions on natural gas-fired boilers. These complicating factors include: higher heating value of refinery gas and temporal and constituency variations in refinery gas.

Co-benefits: NOx reductions will also reduce secondary particulate formation.

Monitoring Mechanisms:
Initial source tests, ongoing monitoring with CEMs or periodic source tests.

Issues/Impediments:
Internal and external space limitations at uncontrolled heaters may make the installation of low-NOx burners, ultra low-NOx burners or SCR problematic. Where installation of controls is feasible, these factors may increase the cost of control. Poor or variable fuel quality, as well as the use of high-heating value fuel that results in high combustion temperatures will generally prevent refinery heaters from complying with NOx limits consistent with non-refinery heaters using natural gas fuel.

Sources:

1. U.S. EPA. 1994. "Alternative Control Techniques Document - NOx Emissions from Industrial, Commercial, Institutional (ICI) Boilers." EPA document no. EPA-453/R-94-022.
2. BAAQMD, Draft Amendments to Regulation 9, Rule 10: Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators and Process Heaters in Petroleum Refineries, Workshop Report, 2010.

SSM 11 – Residential Fan Type Furnaces

Brief Summary:
This control measure would reduce oxides of nitrogen (NOx) emissions from residential fan type central furnaces by reducing allowable NOx emission limits on new and replacement furnace installations. This control measure does not address older homes with simple small floor heaters or larger central furnaces for condominiums, apartment buildings, and commercial space heating.

Purpose:
Reduce emissions of NOx from Residential Central Furnaces.

Source Category:
Combustion.

Regulatory Context and Background:
Natural gas fired fan-type central furnaces are used in residential and commercial buildings to provide comfort heating. Most single-family homes and many multi-unit residences have this type of heating equipment. Many older homes, with below floor furnaces, have been retrofitted with this type of forced air heaters. Typically, residential units have burners rated between 50,000 and 175,000 British thermal units per hour (Btu/hr). District Regulation 9, Rule 4 currently limits NOx emissions from fan type residential central furnaces with heat input less than 175,000 Btu/hr. Regulation 9, Rule 4 is a "point-of-sale" type regulation, requiring that any residential furnace offered for sale, installed, or sold must be certified to meet 40 nanograms (ng) of NOx per joule of delivered heat, which is equivalent to an emission concentration of about 55 ppmv at 3% oxygen. Regulation 9, Rule 4: Nitrogen Oxides from Fan Type Residential Central Furnaces was adopted in December of 1983, and has not been amended since that time. South Coast Rule 1111 includes the same NOx limit as does San Joaquin Rule 4905.

Low NOx burners have since been developed for many types of combustion equipment. These burners have been successfully retrofitted to large process heaters and boilers, and are now being designed for smaller combustion devices like residential water heaters. San Joaquin Control Measure S-COM-10 indicates that burners have been developed that achieve a 50% NOx emission reduction, although these burners are not currently commercially available. These low NOx burners can achieve NOx emission rates of about 10 – 14 ng/joule (15 – 20 ppm) of delivered heat for water heaters. This technology can be further adapted for residential space heating, due to the similar configuration of the appliances.

Implementation Actions:
Current low NOx burner technology is capable of meeting 10 – 14 ng/joule. This represents at least a 65 percent NOx reduction potential. This proposal would continue the "point-of-

sale" approach for residential furnaces to minimize the impact on individual homeowners and landlords. Central furnaces have a life expectancy of about 30 years. Should proposed amendments take a replacement, rather than a retrofit or forced retirement approach, NOx reductions will occur over the 30-year replacement cycle, or approximately a two percent NOx reduction each year.

Implementation timing may be lengthy. Efficiency and safety standards were also incorporated into low NOx residential water heaters, requiring significant redesign to meet all the requirements. There appears to be a three- to five-year period from re-design to marketable product for gas appliances.

Emission Reductions:

Pollutants (tons per day)	2012	2020
NOx	0	TBD

The emission reductions from this measure will be phased in as existing furnaces are replaced over the coming 20-30 years. Emissions reductions will be 4.2 tons per day when the measure is fully implemented.

Emission Reduction Methodology:
NOx emissions from residential space heating are included in the emission inventory as a specific category of emissions: *Category 283- Domestic Natural Gas Space Heating.* Base year 2005 emissions are estimated at 8.62 tons per day (tpd). This includes older homes that just have small floor heater units. This emission estimate includes heating devices for large apartment buildings that are larger than 175,000 Btu/hr. A rough estimate of ten percent (of the emissions inventory for this category) is attributed to these floor heaters, and 15% of the total for very large furnaces leaves 75 percent, or 6.5 tpd NOx emissions attributable to residential fan type central furnaces.

The emission reduction estimates are based on implementation only for new installations, or replacement of residential central furnaces. NOx reduction potential is 65 percent of the current 6.5 tpd NOx, or at least 4.2 tpd cumulative over the 30-year replacement cycle.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
Depending on the technology selected, NOx reductions may increase GHG emissions, specifically CO2, by reducing efficiency of the process. This is unlikely for this control measure, however, because efficient low-NOx burners have been developed for similar types of appliances. New forced air heaters will probably be more efficient than the ones they replace, reducing GHG emissions.

Cost:
Control costs are based on the costs of power premixed burners used to reduce emissions for large water heaters and small boilers. These burners are estimated to add an additional $100 to $200 to the capital cost of a furnace. Assuming a 30 year replacement cycle, total added capital cost is $150 million based on replacing 750,000 heaters over the 30 year period. Annual costs are $5.0 million.

The cost estimates above exclude potential advantages of probable improved efficiency for the furnace itself, and the opportunity to improve the efficiency of the fan and heated air ductwork, attractive to a homeowner installing a new furnace because of the potential savings in fuel usage. These cost estimates also exclude the potential to improve the thermal efficiency of the home by taking advantage of combined space / water heating or heat pump technology.

Co-benefits:
There are potential positive benefits of reduced greenhouse gases through improved thermal efficiency of space heating, and potential combined efficiency of space and water heating through re-design of the home energy use systems.

Monitoring Mechanisms:
Manufacturers of residential fan-type furnaces would be required to certify the furnace to a NOx limit of 14 ng/joule. Only certified furnaces could be sold in the District.

Issues/Impediments:
No specific issues or impediments have been identified.

Sources:
1. SCAQMD Rule 1111
2. BAAQMD Regulation 9, Rule 4
3. San Joaquin Valley Ozone Plan, Page 405 – 406, Natural Gas-Fired, Fan-Type Residential Central Furnaces (S-COM-10)

SSM 12 - Large Residential and Commercial Space Heating

Brief Summary:
This control measure would reduce oxide of nitrogen (NOx) emissions from large condominium and apartment building central furnaces, and from commercial space heating through retrofit of low NOx burners.

Purpose:
Reduce NOx emissions from large condominium and apartment building central furnaces, and from commercial space heating.

Source Category:
Combustion.

Regulatory Context and Background:
Natural gas fired fan-type central furnaces are used in residential and commercial buildings to provide comfort heating. Most single family homes and many multi-unit residences have this type of heating equipment. Typically, residential units have burners rated between 50,000 and 175,000 British thermal units per hour (Btu/hr). The District Regulation 9, Rule 4: Nitrogen Oxides from Fan Type Residential Central Furnaces (Rule 9-4) currently limits NOx emissions from fan type residential central furnaces with heat input less than 175,000 Btu/hr. There is currently no regulation of larger central furnaces for condominium or apartment complexes, or commercial space heating. Unregulated combustion devices typically generate 75 to 100 ppm or more NOx.

Low NOx burners have been developed for many types of combustion equipment. These burners have been successfully retrofitted to large process heaters and boilers, and are now being designed for smaller combustion devices like residential water heaters. These low NOx burners can achieve NOx emissions of 14 ng/joule (approximately 20 ppm) of delivered heat for large water heaters. It appears this technology can be further developed for large central furnace and commercial space heating applications, due to similar space and size configurations of the affected units.

NOx emissions from residential space heating are included in the emission inventory as a specific category of emissions: *Category 283 - Domestic Natural Gas Space Heating.* Base year 2005 emissions are estimated at 8.62 tons per day (tpd). This emission estimate includes heating devices for large condominiums and apartment buildings that are larger than 175,000 Btu/hr. A rough estimate of 15 percent of the total for these very large furnaces are responsible for 1.3 tpd of NOx emissions.

In addition, *Category 1590 – Other External Combustion Natural Gas (area sources)* has base year 2005 emissions estimated at 7.03 tpd. Analysis of month-to-month gas consumption data indicates that approximately 24 percent of the natural gas use is for commercial facilities, and 21 percent of the commercial gas use is cyclical from summer to winter. NOx from commercial space heating is estimated to be 0.35 tpd.

Implementation Actions:
Current low NOx burner technology is capable of meeting 14 ng/joule. This represents at least a 70 percent NOx reduction potential. This proposal includes retrofit, and probable registration of large central furnaces for condominium and apartment complexes, and commercial space heaters. These large central furnaces have a life expectancy of about 30 years. This proposal assumes a retrofit strategy for existing large furnace and space heaters. Implementation can take place over a reasonable period of 10 – 15 years, when the furnace reaches half of its potential life span.

Emission Reductions:

Pollutants (tons per day)	2012	2020
NOx	0	TBD

The emission reductions from this measure will be phased in as existing furnaces are replaced over the coming 15-20 years. Emission reductions are expected to be 1.2 tons per day NOx when the measure is fully implemented.

Emission Reduction Methodology:
The emission reduction estimates consider retrofit or replacement of existing large central furnaces and space heaters. NOx reduction potential is 70 percent of the current 1.65 tpd NOx, or at least 1.2 tpd cumulative over the 15-year half life of these devices.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
Depending on the technology selected, NOx reductions may increase GHG emissions, specifically CO2, by reducing efficiency of the process. However, low-NOx burners of the sort used in similar applications do not tend to reduce the efficiency of the appliance noticeably. New forced air furnaces would likely be more efficient than the ones they replace, reducing GHG emissions.

Cost:
Control costs are based on the costs of power premixed burners used to reduce emissions for large water heaters and small boilers. These low-NOx burners are expected to add $500 to the cost of a large furnace replacement ($3000 - $10,000). There are an estimated 50,000 large forced air furnaces in the District, so based on a 30 year expected lifespan, approximately 1667 would be replaced annually. In 15 years, 25,000 of the furnaces will be retrofited with low NOx burners at a cost of $12.5M, resulting in an annual cost of $833,333 a year and a cost effectiveness of $3800 per ton of NOx reduced.

Approximately half the large furnaces may not be retrofitted with low-NOx burners and need to be replaced within 15 years (half their lifespan), the additional replacement capital costs are estimated at $3000, and would amortize to a total of $6.0 M annually. Cost effectiveness for these heaters is $27,400 per ton of NOx reduced. Overall cost effectiveness for this control measure is $15,600 per ton of NOx reduced.

The cost estimates above exclude potential advantages of any improved efficiency for the furnace itself, and the opportunity to improve the efficiency of the fan and heated air ductwork. These cost estimates also exclude the potential to improve the thermal efficiency of a building by taking advantage of combined space / water heating or heat pump technology.

Co-benefits:
There are potential positive benefits of reduced greenhouse gases through improved thermal efficiency of space heating, and potential combined efficiency of space and water heating through re-design of the building energy use systems.

Monitoring Mechanisms:
Manufacturers of space heaters would be required to certify the heater to a NOx limit of 14 ng/joule. Only certified heaters could be sold in the District.

Issues/Impediments:
No specific issues of impediments have been identified.

Sources:
1. SCAQMD Rule 1111
2. BAAQMD Regulation 9, Rule 4
3. San Joaquin Valley Ozone Plan, Page 405 – 406, Natural Gas-Fired, Fan-Type Residential Central Furnaces (S-COM-10)

SSM 13 - Dryers, Ovens, and Kilns

Brief Summary:
This control measure would reduce oxides of nitrogen (NOx) emissions from combustion devices that are currently exempt from the requirements of Regulation 9, Rule 7: *Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters* (Reg 9-7). Reg. 9-7 exempts the following types of combustion devices: kilns, ovens, and furnaces used for drying, baking, heat treating, cooking, calcining, or vitrifying (§9-7-110.6).

Purpose:
Reduce emissions of NOx from kilns, ovens, and furnaces.

Source Category:
Combustion.

Regulatory Context and Background:
The District regulates NOx emissions from a variety of combustion source categories. Reg. 9-7 is a non-industry specific rule that applies to a broad range of combustion devices that heat water or other fluids. Reg. 9-7 includes an exemption for "kilns, ovens and furnaces used for drying, baking, heat treating, cooking, calcining, or vitrifying." Historically, most California air districts that had a general combustion rule similar to Reg. 9-7 also had an exemption similar to that in §9-7-110.6, and did not have a separate rule that applied to these exempt devices. In December 2005 the San Joaquin Valley APCD (SJVUAPCD) adopted Rule 4309 to limit emissions of NOx from dryers, dehydrators and ovens with a rated heat input of 5 MM BTU/hr or more. Rule 4309 was fully implemented in December 2008. In December 2008 the South Coast AQMD (SCAQMD) published a draft of a new rule (Rule 1147) that would limit emissions of NOx from "ovens, dryers, dehydrators, heaters, kilns, calciners, furnaces, crematories, incinerators, heated pots, cookers, roasters, fryers, closed and open heated tanks and evaporators, distillation units, afterburners, degassing units, vapor incinerators, catalytic or thermal oxidizers, soil and water remediation units". This proposed rule has not been adopted.

The draft staff report for proposed SCAQMD Rule 1147 indicates that low-NOx burners are commercially available for all affected devices in the proposed rule.

A database query for permitted combustion devices in this category identified 62 devices with total NOx emissions of 2.1 ton per day (tpd). The cement kiln at Lehigh Southwest Cement (Plant #17) and two coke calciners at the Conoco Phillips Coke Plant (Plant #22) generate approximately 93% of the emissions from this source category. This kiln and calciners are the subject of other proposed control measures. The remaining NOx emissions from this source category are about 0.45 tpd.

Implementation Actions:
Adopt a rule similar to SCAQMD Rule 1147 for this source category.

Emission Reductions:
In the draft staff report for proposed Rule 1147, SCAQMD staff estimated that current, uncontrolled NOx emission rates at devices that would be subject to Rule 1147 range from 110 to 170 ppmv at 3% O2. The proposed NOx limits in this rule range from 30 to 60 ppmv at 3% O2. Small driers, ovens and kilns are assumed to be exempt because NOx reduction would not be cost effective for small devices. If none of these devices in the District has already implemented NOx controls, the emission reduction available by applying the SCAQMD proposed NOx limits ranges from 45% to 80%, or from 0.20 tpd to 0.36 tpd.

Pollutants (tons per day)	2012	2020
NOx	0	0.20

Cost: Low NOx burners are estimated to add $5000 to the cost of a dryer, oven or kiln replacement. Devices of this size and type may not be able to be retrofitted with low-NOx technology. There have been 59 driers, ovens and kilns identified in the Air District, half of which may be exempt because of low fuel usage. For devices unable to be retrofitted, replacement before the end of their useful like may be required. At an estimated cost of $100,000 each, replacement of all devices will cost $3M capital, amortized to $570,000 annually. The SJVUAPCD estimated costs between $7,300 and $22,300 per ton of NOx reduced for Rule 4309. The SCAQMD has estimated costs between $4,000 and $17,000 per ton of NOx reduced for proposed Rule 1147.

Emission Reduction Methodology:
The emissions reductions are derived from South Coast's estimated emissions reductions and the emissions from applicable sources in the Bay Area.

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
Depending on the technology selected, NOx reductions may increase GHG emissions, specifically CO2, by reducing efficiency of the process.

Co-benefits:
NOx is a precursor to secondary PM formation.

Monitoring Mechanisms:
Source tests, monitoring.

Issues/Impediments:
SJVUAPCD Rule 4309 exempts units used to precondition onions and garlic prior to dehydration. Gilroy Foods, Inc. (Plant #11327) has eight sources that could be controlled. It is not known if the rationale for the San Joaquin exemption would apply to these units. Proposed SCAQMD Rule 1147 does not provide a similar exemption.

Sources:
1. SJVUAPCD Rule 4309: http://www.valleyair.org/rules/currntrules/r4309.pdf
2. SCAQMD Proposed Rule 1147: http://www.aqmd.gov/rules/proposed/1147/PR1147Nov408.pdf
3. SCAQMD Proposed Rule 1147 Draft Staff Report: http://www.aqmd.gov/rules/proposed/1147/PR1147DraftStaffReportNov408.pdf

SSM 14 - Glass Furnaces

Brief Summary:
This control measure would reduce NOx emission from gas-fired glass melting facilities.

Purpose:
Reduce NOx

Source Category:
Stationary source.

Regulatory Context and Background:
SJVUAPCD Rule 4354 imposes NOx limits for several types of glass plants: flat glass, container glass, and fiberglass. The limit went to 4.0 lbs NOx / ton of glass in 2008. In 2008, SJVUAPCD adopted further amendments to Rule 4354 that set a standard for container glass of 1.5 lbs NOx / ton effective in 2014.

BAAQMD Regulation 9, Rule 12: Nitrogen Oxides from Glass Melting Furnaces (Rule 9-12) imposes a NOx limit of 5.5 lbs NOx / ton glass. This limit was based on the South Coast limit but also on differences between Bay Area furnaces and South Coast furnaces. The South Coast furnaces are largely end-port furnaces. The operators of the furnaces used electric boost and flame modifications to reduce emissions to meet the SCAQMD limit. The Bay Area has only one facility (Plant 30) that has three glass melting furnaces. These three furnaces are side port furnaces, and flame modification techniques used in the South Coast cannot be used on these furnaces. In addition, the Bay Area furnaces use electric boost to increase production and, therefore, cannot use it to reduce emissions without decreasing production. Limits lower than 4.0 lbs NOx / ton glass have been achieved by an oxy-fuel system operated by Gallo in Modesto, but this plant manufactures glass for Gallo wines and does not sell to the open market. It is unclear whether oxy-fuel combustion is cost-effective in the current market.

Another relatively new technology, the Pilkington 3R process, has been developed since the SCAQMD and BAAQMD rules were adopted in the early 1990's; but it has been used only in flat glass furnaces. It is unknown whether the process will prove to be suitable for container glass furnaces and whether there is any potential for emission reductions.

Of the three Bay Area glass melting furnaces, two of these (S-11, S-12) have explicit NOx emission rate limits (4.0 lb/ton of glass in a 3-hr period) imposed by permit conditions that are more stringent than the current Tier 2 limit in San Joaquin's Rule 4354. However, the Tier 3 limit effective in 2014 (1.5 lb/ton, 30-day average) is more strict than the permit conditions for these two furnaces.

Because San Joaquin has adopted "Tier 3" NOx emission rate limits that are significantly stricter than those in BAAQMD Rule 9-12 or in the permit conditions applicable to Plant 30, further emission reductions at Plant 30 may be able to be obtained. The 2005 Base Year inventory for the source category "glass melting furnaces - natural gas" included 1.42 ton/day of NOx.

San Joaquin's Tier 3 standard represents a 43 percent reduction in NOx emissions compared to the weighted average emission rate (2.65 lb NOx/ton glass) at the three furnaces at Plant 30.

Implementation Actions:
The control measure will be implemented through amendments to Rule 9-12.

Emission Reductions:

Pollutants (tons per day)	2012	2020
NOx	0	0.38

Emission Reduction Methodology:
TBD

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
Depending on the technology selected, NOx reductions may increase GHG emissions, specifically CO2, by reducing efficiency of the process.

In some modeling scenarios, reduction of NOx from a significant NOx emitting source with high emission rates has been shown to impact the ozone scavenging effect of NO, resulting in higher ozone concentrations in areas within the source's emission plume.

Cost:
An oxy-fuel system or selective catalytic reduction are both viable options to reduce NOx. The capital cost for either option is estimated to be approximately $4 M, amortized to $760,000 per year.

Co-benefits:
Reduction in secondary particulate formation

Monitoring Mechanisms:
Source tests and monitoring equipment will be used to enforce emission standards.

Issues/Impediments:
None identified.

1. **Sources**: http://www.valleyair.org/Air_Quality_Plans/docs/AQ_Ozone_2007_Adopted/11%20Chapter%206%20April%202007.pdfhttp://www.valleyair.org/Air_Quality_Plans/docs/AQ_Ozone_2007_Adopted/26%20Appendix%20I%20April%202007.pdf
2. Workgroup Recommendations and Other Potential Control Measures Stationary Combustion Sources Workgroup – Glass/Fiberglass Furnaces, Subhash Shah, New Jersey Department of Environmental Protection, February 22, 2007. http://www.state.nj.us/dep/baqp/rapt/wps/SCS007_fin2.pdf
3. BAAQMD. 1993. Staff Report, Regulation 9, Rule 12, Nitrogen Oxides from Glass Melting Furnaces.
4. SJVUAPCD. 2002. "Final Draft Staff Report, Amendments to Rule 4354 (Glass Melting Furnaces)." SJVUAPCD. Rule 4354.

SSM 15 - Greenhouse Gases in Permitting, Energy Efficiency

Brief Summary:
This control measure would mitigate increases in greenhouse gas (GHG) emissions from new and modified permitted sources, reviewing implementation of energy efficiency measures, where appropriate on new sources subject to the Air District's jurisdiction.

Purpose:
Reduce GHG emissions from new and modified permitted sources.

Source Category:
Stationary source.

Regulatory Context and Background:
Sources that require permits are evaluated according to the District's Permit Handbook and BACT/TBACT Workbook. Projects are ministerial for the purposes of CEQA if the specific procedures, fixed standards and objective measurements established in the Handbook and Workbook apply to the permit application. For larger sources, those for which there is no BACT established in practice for the specific source, the source would not be classified as ministerial and a CEQA evaluation is required.

When reviewing sources for permitting, District staff does not consider GHG emissions. Under existing federal, state and District guidelines, a new source is required to abate criteria pollutants to the maximum extent feasible consistent with other, like sources, or to install the most effective control technology that can be demonstrated to be cost effective.

Implementation Actions:
This control measure could be implemented in two ways. First, some larger projects that are currently considered ministerial could be made to undergo CEQA, specifically to consider mitigation of GHG emissions. This could be accomplished by a change in the Permit Handbook so that some discretion in the evaluation of these permits could be used. Examples of projects that would fall into this category are boilers, steam generators or process heaters with a rated heat input greater than a specified threshold amount.

Second, some ministerial projects could have certain energy efficiency-related measures imposed as standard permit conditions to minimize the amount of GHGs emitted. As an example, combustion devices such as boilers or internal combustion engines that operate at less than a certain size could be required to have a certain manufacturer's efficiency rating.

AB 32, adopted in 2006, requires CARB to adopt regulations to reduce emissions of GHGs from a variety of sources, both large and small. These include traditional stationary sources that have been regulated for emissions of criteria pollutants by air districts in California. In implementing AB 32, CARB may look at a variety of sources, but most attention will be paid to existing sources of GHGs, as the emissions from these sources will have to be reduced to meet the mandates of the law. These include permitted stationary sources such as power plants and refineries, non-permitted stationary sources such as natural gas pipelines, and non-stationary sources such as automobiles. CARB is further required to prioritize sources so as to address the largest GHG emissions first. However, the air districts have permitting authority over stationary sources in California, and, consequently, are best positioned to reduce GHG from new sources at permitted facilities during permit review. Staff can structure any permitting requirements for GHG so that they complement CARB programs, including allowing credit for cap–and-trade or other market-based programs.

Emission Reductions:
Undetermined. This control measure would not reduce existing emissions. It would, like new source review provisions, mitigate increases in GHG emissions from new and modified plants and equipment. As existing equipment ages and is replaced, or new facilities are built, this control measure could help reduce GHGs that would otherwise be emitted. As the control measure could apply across many of the permitted sources required to obtain District permits, it is impossible to estimate the amount of emissions subject to control.

Emission Reduction Methodology:
TBD

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
None identified.

Cost:
Increased efficiency as a permit condition may add costs to new equipment, but energy efficiency measures often pay for themselves within 5 years. Flexibility in permitting could reduce applicant costs while reducing GHGs.

Co-benefits:
The co-benefits of reducing GHG emissions are myriad, from reducing the likelihood of increased global temperatures, sea level rise, increased frequency and severity of storm activity, to impacts on water quality from increased salinity in the delta and damage to infrastructure from flooding. The development of energy efficiency technologies and equipment that controls criteria pollutant and TACs that does not produce secondary GHG emissions may spur green job creation. One possible means of reducing GHG emissions would be increased energy efficiency resulting in energy savings and reduced consumer costs in the long term. An additional benefit of energy efficiency for combustion equipment is the reduction of other combustion contaminants, such as SO2 and PM.

Monitoring Mechanisms:

The success of this control measure would be monitored by examining the emission inventory for increases in criteria pollutants and TACs from permitted sources above what would be expected if this measure were not in place. GHG emissions from permitted sources are tracked as a result of the May 21, 2008 adoption of the GHG fee in Regulation 3, section 334. Trends in GHG emissions from permitted sources would be examined before and after adoption of this measure.

Issues/Impediments:
None identified.

Sources:

1. BAAQMD Permit Handbook: http://www.baaqmd.gov/pmt/handbook/rev02/permit_handbook.htm
2. BAAQMD Regulations 2-2, and 2-5: http://www.baaqmd.gov/dst/regulations/index.htm

SSM 16 - New Source Review Addressing PM2.5

Brief Summary:
This control measure would amend Regulation 2, Rule 2 to address the District's anticipated non-attainment status of the 24-hour PM2.5 National Ambient Air Quality Standard. In addition, more stringent standards may be considered for sources located in areas of sensitive populations as determined by the Community Air Risk Evaluation (CARE) program.

Purpose:
Reduce emissions of PM2.5 from new and modified permitted sources and to address the cumulative air quality impacts of stationary sources on sensitive receptors and impacted communities.

Source Category:
Stationary source.

Regulatory Context and Background:
Existing District rules require that permit applications be submitted for a wide variety of new and modified stationary sources prior to construction so that District staff can complete a review of compliance with applicable air quality requirements. Applicable air quality requirements include rules and regulations adopted by the District, the California Air Resources Board, and the U.S. Environmental Protection Agency. New Source Review (NSR) rules require that new and modified sources utilize the Best Available Control Technology to minimize air pollution impacts. Additional NSR requirements include emission offsets, air quality impact analysis for criteria air pollutants and their precursors, and health risk screening analysis for toxic air contaminants (TACs). The existing District NSR rules are Regulation 2, Rule 2: New Source Review, and Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants.

The Community Air Risk Evaluation (CARE) Program was initiated in 2004 to evaluate and reduce health risks associated with exposures to outdoor toxic air contaminants (TACs) in the Bay Area. The program examines cumulative TAC emissions from point sources, area sources and on-road and off-road mobile sources. District risk reduction activities will be focused on priority communities that have been identified based on sources of TAC emissions, modeled exposure of sensitive populations, and socioeconomic factors.

US EPA designated the Bay Area as a non-attainment area for the national 24-hour PM2.5 standard in December 2009. As a result the Bay Area will need to prepare a PM2.5 SIP plan. We also anticipate that the Air District will need to amend Regulation 2, Rule 2 regarding NSR to reduce emissions of PM2.5 from permitted sources. At that time, District staff may consider whether more stringent permitting requirements should be established for sources of PM2.5 locating in priority communities.

Implementation Actions:
Prepare amendments to Regulation 2, Rule 2: New Source Review pursuant to EPA requirements. During this process, more stringent requirements for sources located in priority communities may be considered. Amendments to Regulation 2, Rule 5 resulting in more stringent permitting requirements for sources of TACs were adopted by the Air District Board of Directors in January, 2010 (see SSM 17). Lessons learned from this process will help implementation of similar requirements for sources of PM2.5 in Regulation 2, Rule 2.

Emission Reductions:
Undetermined. This control measure would reduce increases in PM 2.5 emissions from new and modified plants and equipment. As existing equipment ages and is replaced, or new facilities are built, this control measure would help reduce PM 2.5 that would otherwise be emitted. As the control measure could apply across many of the permitted sources required to obtain District permits, the amount of emissions subject to control and emission reductions have not been calculated at this time.

Emission Reduction Methodology:
TBD

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
None expected, although a need to increase control equipment could result in greater electricity use, generating slightly more green house gas emissions.

Cost:
TBD

Co-benefits:
PM2.5 can contribute significantly to regional haze and reduction of visibility. A particle of 2.5 microns or less in diameter is also a particle of 10 microns or less in diameter. In other words, PM2.5 is a subset of PM10, so a reduction in the former will result in a reduction in the latter.

Monitoring Mechanisms:
The success of this control measure would be monitored by examining the emission inventory for increases in criteria pollutants and TACs from permitted sources above what would be expected if this measure were not in place. In particular, trends in PM2.5 from permitted sources would be examined before and after adoption of this measure. Ongoing monitoring of impacted communities as part of the CARE program also will help gauge the success of this measure.

Issues/Impediments:
Amendments to Regulation 2, Rule 2 to address PM2.5 in general are unlikely to face significant opposition. However, if more stringent rules or requirements are proposed for sources in impacted communities, this would be likely to raise concerns in the regulated community.

Sources:

3. BAAQMD Permit Handbook: http://www.baaqmd.gov/pmt/handbook/rev02/permit_handbook.htm
4. BAAQMD Regulations 2-2, and 2-5: http://www.baaqmd.gov/dst/regulations/index.htm
5. Update on CARE Program and Associated Regulatory Initiatives, Memo to Stationary Source Committee from Jack Broadbent 6 July 2009
6. Draft Concept Paper, *More Stringent Permitting Requirements for Proposed New/modified Stationary Sources of Air Pollution Located in Impacted Communities or in Proximity to Sensitive Receptors.* February 23, 2009.
7. Brian Bateman, April 2009 Presentation given to the CARE Task Force.

SSM 17 - New Source Review for Toxic Air Contaminants

Brief Summary:
This measure describes amendments to District permitting requirements via Regulation 2, Rule 5, New Source Review of Toxic Air Contaminants (TACs), adopted by the Air District Board of Directors on January 6, 2010. For priority communities identified in the Air District's Community Risk Evaluation (CARE) Program, cumulative impacts will be addressed by tracking the toxicity-weighted emissions from all sources in the identified communities (see LUM 5). Incorporation of revisions to Cal/EPA's Environmental Health Hazard Assessment (OEHHA) methodologies into District Health Risk Screening Analysis Guidelines will result in more stringent standards for new and modified sources.

Purpose:
Reduce the cumulative air quality effects of TACs from new and modified stationary sources in the District and develop a periodic reporting mechanism to track toxic air contaminant emissions in CARE Priority Communities.

Source Category:
Stationary source.

Regulatory Context and Background:
Existing District rules require that permit applications be submitted for a wide variety of new and modified stationary sources prior to construction so that District staff can complete a review of compliance with applicable air quality requirements. Applicable air quality requirements include rules and regulations adopted by the District, the California Air Resources Board, and the U.S. Environmental Protection Agency. New Source Review (NSR) rules require that new and modified sources utilize the Best Available Control Technology to minimize air pollution impacts. Additional NSR requirements include emission offsets, air quality impact analysis for criteria air pollutants and their precursors, and health risk screening analysis for TACs. The existing District NSR rules are Regulation 2, Rule 2: New Source Review, and Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants.

The requirements of Regulation 2, Rule 5 are based on the results of a site-specific Health Risk Screening Analysis (HRSA), which is an assessment that describes the possible adverse health effects that may result from public exposure to routine and predictable emissions of TACs. All permit applications for new and modified sources are screened for emissions of TACs. Where the predicted health risks from a proposed project exceed specified threshold levels, the new/modified source(s) must use the Best Available Control Technology to minimize TAC emissions (TBACT). The TBACT and Project Risk standards in Regulation 2, Rule 5 are uniformly applied throughout the District's jurisdiction.

Procedures used for completing HRSAs are based on guidelines adopted by Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHA) for use in the Air Toxics Hot Spots Program. Procedures for assessing health risks are intended to protect sensitive individuals such as children, and individuals with pre-existing health conditions. The Children's Environmental Health Protection Act (Senate Bill 25) established specific requirements for OEHHA to determine whether existing health risk assessment procedures are adequate to protect infants and children from the harmful effects of air pollution. OEHHA has already acted under SB 25 to revise procedures for assessing non-cancer health risks to provide a greater margin of safety for children. Age Sensitivity Factors (ASFs) were adopted by OEHHA on June 1, 2009 to account for inherent increased susceptibility to carcinogens during infancy and childhood, and exposure assessment procedures are expected to be revised by mid-2010. These changes in exposure assessment procedures, when combined with ASFs, will increase estimates of residential cancer risk by a factor of 2 to 3 relative to existing procedures.

The Community Air Risk Evaluation (CARE) Program was initiated in 2004 to evaluate and reduce health risks associated with exposures to outdoor TACs in the Bay Area. The program examines cumulative TAC emissions from point sources, area sources and on-road and off-road mobile sources. Based on sources of TAC emissions, modeled exposure of sensitive populations, and socioeconomic factors, Priority Communities have been identified where District risk reduction activities will be focused.

Implementation Actions:

On January 6, 2010, the Air District Board of Directors adopted amendments to Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants. The amendments incorporate the latest OEHHA health risk assessment methodologies into Health Risk Screening Analyses completed for proposed new/modified permitted sources. These amendments effectively increase the stringency of the standards of Regulation 2, Rule 5. Incorporation of ASFs increases the stringency of cancer risk standards by a factor of 1.7. Incorporation of revised exposure assessment procedures, when combined with the use of ASFs, further increases the stringency of these standards by a factor of 2 to 3. Staff also proposes that cumulative emissions of toxic air contaminants be tracked in CARE communities on a toxicity-weighted basis and reported periodically, as further described in LUM 5.

Emission Reductions:

Undetermined. This control measure would reduce increases of TAC emissions from new and modified plants and equipment. As existing equipment is replaced, or new facilities are built, this control measure would reduce TACs that would otherwise be emitted. As the control measure could apply across many of the permitted sources required to obtain District permits, the amount of emissions subject to control and potential emission reductions have not been calculated at this time. The District will calculate and track emission reductions as the rule is implemented.

Emission Reduction Methodology:
TBD

Exposure Reduction:
TBD

Emission Reduction Trade-offs: None expected, although a need to increase control equipment could result in greater electricity use, generating slightly more greenhouse gas emissions.

Cost:
TBD

Co-benefits:
Reducing TAC emissions will likely result in reduced emissions of TOG, ROG, and possibly particulate matter.

Monitoring Mechanisms:
The District will track cumulative toxicity-weighted risk from affected facilities in Priority Communities along with other sources of emissions. Ongoing ambient monitoring of impacted communities as part of the CARE program also will help gauge the success of this measure.

Issues/Impediments:
On January 6, 2010, the Board of Directors adopted amendments to Regulation 2, Rule 5 including provisions to track cumulative impacts in CARE communities. However, the Board directed staff to evaluate the potential for setting different standards in the CARE communities for permit issuance under this rule.

Sources:

1. BAAQMD Permit Handbook: http://www.baaqmd.gov/pmt/handbook/rev02/permit_handbook.htm
2. BAAQMD Regulations 2-5:
3. http://www.baaqmd.gov/dst/regulations/index.htm
4. Update on CARE Program and Associated Regulatory Initiatives, Memo to Stationary Source Committee from Jack Broadbent 6 July 2009
5. Brian Bateman, April 2009 Presentation given to the CARE Task Force.
6. Proposed Amendments to Regulation 2-5, Workshop Report, July 2009.
7. Brian Bateman, October 2009 Presentation given to the CARE Task Force
8. Update on Proposed Amendments to Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants report to the Stationary Source Committee, October 19, 2009

SSM 18 - Revisions to Air Toxics Hotspots Program

Brief Summary:
Revise the District's Air Toxics Hot Spots program focusing on existing sources of toxic air contaminants.

Purpose:
Revise the District's Air Toxic Hotspots program focusing on existing sources of toxic air contaminants (TACs).

Source Category:
Stationary source.

Regulatory Context and Background:
Applicable air quality requirements related to controlling stationary sources include rules and regulations adopted by the District, the California Air Resources Board, and the U.S. Environmental Protection Agency. In California, air districts have the primary responsibility for controlling air pollution from non-vehicular stationary sources of air pollution. The Air District regulates stationary sources through rulemaking for specific source categories, through its permitting process and New Source Review for new and modified sources, and by administering the Air Toxics "Hot Spots" Program for existing sources.

The Air Toxics "Hot Spots" (ATHS) program is a state program implemented by California air districts. Assembly Bill 2588, the Air Toxics "Hot Spots" Information and Assessment Act, was enacted by the State legislature in 1987. AB 2588 requires companies throughout California to provide information to the public about emissions of TACs, and the impact that those emissions may have on public health. SB 1731, which provided the air districts with the authority to require facilities with significant risks to implement a site-specific risk reduction audit and plan, amended the Act in 1992. Each air district has the authority to establish health risk thresholds for public notification and risk reduction requirements.

The requirements of the ATHS program are based on the results of a site-specific Health Risk Screening Analysis (HRSA), which is an assessment that describes the possible adverse health effects which may result from public exposure to routine and predictable emissions of TACs.

Procedures used for completing HRSAs are based on guidelines adopted by Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHA). Procedures for assessing health risks are intended to protect sensitive individuals such as children, and individuals with pre-existing health conditions. The Children's Environmental Health Protection Act (Senate Bill 25) established specific requirements for OEHHA to determine whether existing health risk assessment procedures are adequate to protect infants and children from the harmful effects of air pollution. As discussed in SSM 17, OEHHA has already acted under SB 25 to revise certain procedures for assessing non-cancer health risks to provide a greater margin of safety for children. OEHHA is currently in the process of revising its cancer risk assessment procedures.

Implementation Actions:
The District will revise its ATHS program for existing facilities to incorporate more stringent risk reduction requirements than are provided in existing District policy. As was previously described, OEHHA is considering revising cancer risk assessment procedures to provide a greater margin of safety for protecting children. Based on discussions with OEHHA staff, it is possible that these revisions could increase calculated residential cancer risks by a factor of three or more relative to existing risk assessment procedures. Due to the potential significance of these revisions in risk assessment methodologies, the District believes that it is prudent to develop the District risk reduction rule concurrent with the OEHHA guideline revisions. OEHHA does not expect that these risk assessment guideline revisions will be finalized for some time, perhaps late in 2010.

Emission Reductions:
TBD

Emission Reduction Methodology:
TBD

Exposure Reduction:
TBD

Emission Reduction Trade-offs:
None expected.

Cost:
TBD

Co-benefits:
Reducing TAC emissions will likely result in reduced emissions of TOG, ROG, and possibly particulate matter.

Monitoring Mechanisms:
The success of this control measure would be monitored by examining the emission inventory for increases in criteria pollutants and TACs from permitted sources above what would be expected if this measure were not in place. Ongoing monitoring of impacted communities as part of the CARE program will help gauge the success of this measure.

Issues/Impediments:
The regulated community not already subject of the current ATHS program may oppose more stringent thresholds for these requirements. Those sources already subject to the notification and risk reduction requirements may be opposed to increased restrictions as a result of lowering these thresholds.

Sources:
1. BAAQMD Permit Handbook: http://www.baaqmd.gov/pmt/handbook/rev02/permit_handbook.htm
2. BAAQMD Regulations 2-5:
3. http://www.baaqmd.gov/dst/regulations/index.htm
4. Update on CARE Program and Associated Regulatory Initiatives, Memo to Stationary Source Committee from Jack Broadbent 6 July 2009
5. Draft Concept Paper, *More Stringent Permitting Requirements for Proposed New/modified Stationary Sources of Air Pollution Located in Impacted Communities or in Proximity to Sensitive Receptors.* February 23, 2009.
6. Brian Bateman, April 2009 Presentation given to the CARE Task Force.

BAY AREA
2010 CLEAN AIR PLAN

VOLUME II

Section B

Mobile Source Measures

September 2010

BAY AREA
AIR QUALITY
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939 Ellis Street
San Francisco, CA 94109
(415) 771.6000
www.baaqmd.gov

MSM A-1 - Promote Clean, Fuel-Efficient Light and Medium-Duty Vehicles

Brief Summary:
The Air District, in cooperation with local businesses, city and county governments, and state and federal agencies, will expand the use of Super Ultra-low Emission (SULEV) and Partial-Zero (ZEV) emission light-duty passenger vehicles and trucks within the Bay Area. Emphasis will be placed on vehicles capable of using renewable, low-carbon fuels.

Purpose:
This measure will reduce emissions of ozone precursors, ROG and NOx, and CO2, a key greenhouse gas. It will also support the renewable and low carbon fuel policies and rules established by the State of California, and implemented by the California Energy Commission and the California Air Resources Board.

Source Category:
Passenger Vehicles and Light-Duty Trucks.

Regulatory Context and Background:
The California Air Resources Board's Low Emission Vehicle standards require car manufacturers to meet increasingly more stringent emission standards for their vehicles. The Bay Area benefits from the LEV-II emission standards whenever a new vehicle replaces an old vehicle that is then scrapped. This measure will focus on accelerating these benefits by supporting early turn-over of the vehicle fleet.

Specifically, this measure will focus on the purchase of light-duty vehicles certified by CARB as meeting the Super Ultra Low Emission Vehicle or Partial Zero Emission Vehicle standards. The SULEV and PZEV standards represent the two cleanest standards for light duty vehicle using internal combustion engines. The SULEV standard was adopted by CARB as part of the LEV-II program and PZEV standards as part of the Zero Emission Vehicle regulation;, both standards apply to MY 2004 and newer vehicles. There is no distinct difference in criteria emissions between gasoline or alternative fuel vehicles rated as either a SULEV or PZEV. In November 2009, CARB staff released a white paper outlining potential changes to the Zero Emission Vehicle regulation. One potential change relevant to this control measure is the establishment of new MY 2014 light-duty vehicle emission standards using PZEVs as the baseline. CARB staff refers to this proposal as "LEV III – Criteria Pollutants." CARB is planning on bringing changes to both the Zero Emission Vehicle and the LEV-III regulations to their Board in November, 2010. The Air District will follow the development of the proposed modifications to both regulations, and may modify the goals of this control measure by increasing support for PZEV vehicles.

The State of California has adopted goals to increase the use of renewable transportation fuels, thereby decreasing petroleum importation and greenhouse gases. This measure supports the statewide goals by making support for renewable-fuel vehicles a high priority for the District's grant programs.

On June 24, 2009, the President signed the *Consumer Assistance to Recycle and Save Act of 2009* into law. In response to the Act, the National Highway Traffic Safety Administration (NHTSA) established the Car Allowance Rebate Program (CARS). This is a $3 billion government program that helps consumers buy or lease a more environmentally friendly vehicle from a participating dealer when they trade in a less fuel-efficient car or truck. Consumers receive a $3,500 or $4,500 discount from a car dealer when they trade in their old vehicle and purchase or lease a new one. While the program is designed to energize the economy by boosting auto sales and put safer, cleaner and more fuel-efficient vehicles on the nation's roadways, many of the eligible new vehicles are certified by CARB at either the SULEV or PZEV emissions levels. The program has been successful; however, the US Congress has not renewed the program for 2010. The Air District and its partners will advocate for continued involvement from the federal government in providing incentives for SULEV and PZEV vehicles.

Implementation Actions:
The BAAQMD and partner agencies will collaborate to:

- Provide incentives for the purchase of SULEV/PZEV or other vehicles.
- Target high-mileage vehicles for fleet turnover, such as delivery vehicles and taxis.
- Initiate and support demonstration projects of renewable fuels from 2010 – 2012, with the goal of wide-spread retail availability by 2020.
- Initiate and support demonstration projects for GHG efficient vehicles and PM emission controls for vehicles.
- Encourage federal participation in incentive programs for light duty vehicles.
- Continue public outreach and education on efficient driving habits and importance of vehicle maintenance for emission controls.

Goals for this measure are as follows:
- By 2012, place up to 10,000 renewable fuel SULEVs and up to 10,000 renewable fuel P-ZEVs into service, primarily in fleets;
- By 2020, place up to 100,000 renewable fuel SULEVs and up to 100,000 renewable fuel P-ZEVs into service, largely in fleets.

Emission Reductions:
This measure will result in the following annual emission reductions (in tons per day) by the end of 2012 and the end of 2020:

Emissions Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.05	0.51
NO_x	0.03	0.29

PM_{10}	0.01	0.20
C02-e	0.00	0.18

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
Emission reductions have been estimated by comparing the incremental difference in emissions between a new vehicle meeting the fleet wide average under the LEV-II emissions standards and the zero mile maximum emission allowable emission rate for a new SULEV or PZEV vehicle. There are no appreciable difference in the emission rates of particulate matter between LEV-II compliant vehicles and SULEV or PZEV vehicles. Emission rates developed by CARB were used in this analysis. The new vehicles are assumed to average 12,000 miles of travel per year.

The estimation of reductions in CO2 emissions is highly dependent upon the fuel type of the purchased vehicles. For the purposes of the current plan, it is assumed that 50% of the new vehicles will be fueled by ethanol obtained from a 80%/20% blend of California corn using the dry mill process and from crop and wood waste using cellulosic processes and 50% will be fueled by natural gas recovered from landfills and bio-digesters. Emission factors reflecting the full-fuel cycle developed by CARB for the Low Carbon Fuel Standard were used in this analysis. Vehicles were assumed to achieve an average fuel economy of 30 miles per gasoline gallon equivalent and consume the equivalent of 400 gasoline gallons per year in fuel.

Exposure Reduction:
To the extent that use of more fuel efficient vehicles or combustion of renewable fuels results in lower levels of toxic emissions from light and medium duty vehicles, exposure will be lessened.

Emission Reduction Trade-offs:
To avoid trade-offs, it will be important to avoid renewable fuels whose full life-cycle impact may result in increased emissions of any criteria pollutant or greenhouse gas.

Cost:
New gasoline and ethanol light duty vehicles certified to the SULEV and PZEV standards generally cost the same as other vehicles on the market. However, vehicles powered by an alternative fuel, such as natural gas, currently sell at a modest price premium. Additionally, an incentive is often required to induce vehicle owners to undertake early replacement of a vehicle. For this measure, it is assumed that an average subsidy of approximately $2,500 per vehicle will be required to accelerate vehicle turnover. The costs of this measure are assumed then to be:

Phase 1: $50 million
Phase 2: $450 million

It is anticipated that the District will provide up to $6 million per year on average towards the accelerated purchase of qualifying vehicles. Additional incentives funds will need to come from state and federal incentive programs, tax refunds and rebates, and private sources.

This control measure focuses only on the purchase and deployment of cleaner vehicles; no costs estimates are provide here for necessary infrastructure. The availability of public and private financing for the development of refueling equipment, especially for locally produced, renewable fuels will need to be considered during the implementation phases of this measure.

Monitoring Mechanisms:

- Vehicle registration data from the Department of Motor Vehicles.
- Fuel sales data from the Franchise Tax Board.
- Progress and Final reports from any Air District grants or incentives.
- Progress and Final reports made available from the Environmental Protection Agency, the Department of Energy, the US Department of Transportation, the CEC and CARB for their alternative fuel, technology advancement and climate change programs.

Issues/Impediments:

- Funding for vehicle subsidies.
- Limited availability of SULEV and PZEV vehicles capable of using renewable, low-carbon fuels.
- Limited availability of renewable, low-carbon fuels.
- Local permitting of bio-refineries.

Sources:

1. California Air Resources Board, (CARB), Low –Emission Vehicle Program, http://www.arb.ca.gov/msprog/levprog/levprog.htm
2. CARB, Title 17, California Code of Regulations Section 95480 *et seq.*
3. CARB, *Resolution 09-31* (Low Carbon Fuel Standard), April 23, 2009. http://www.arb.ca.gov/regact/2009/lcfs09/res0931.pdf
4. CARB, *Proposed Regulation to Implement the Low Carbon Fuel Standard: Volume 1: Staff Report: Initial Statement of Reason*, March 5, 2009.
5. CARB, *Proposed Environmental Analysis Work plan for the California Low Carbon Fuel Standard*, 2009. http://www.arb.ca.gov/fuels/lcfs/120208lcfs_environ.pdf
6. CARB, *Preliminary Discussion Paper – Amendments to California's Low-Emission Vehicle Regulations for Criteria Pollutants – LEVIII*, February 8, 2010. http://www.arb.ca.gov/msprog/levprog/leviii/meetings/030210/lev_iii_discussion_paper_2-10.pdf

7. California Energy Commission, *FINAL Adopted State Alternative Fuels Plan*, December 5, 2007, Publication #CEC-600-2007-011-CMF.
8. California Energy Commission, *Alternative and Renewable Fuel and Vehicle Technology Program Regulations*, May 7, 2008, Publication # CEC-600-2008-013-F.
9. California Energy Commission, Final Regulation Language Alternative and Renewable Fuels and Technologies Program, Title 20, CCR, SECTIONS 3100 – 3108, January 2, 2009.
10. California Energy Commission, *Investment Plan for the Alternative and Renewable Fuels and Technologies Program*, April 2009. Publication #CEC-600-2009-008-CTF.
11. Department of Transportation, National Highway Traffic Safety Administration, *Car Allowance Rebate System (CARS)*, http://www.cars.gov/

MSM A-2 - Zero Emission Vehicles (ZEV) and Plug-in Hybrids

Brief Summary:
The Air District, in cooperation with local businesses, city and county governments, and state and federal agencies, will expand the use of Zero Emission (ZEV) and Plug-in Hybrid (PHEV) passenger vehicles and light-duty trucks within the Bay Area.

Purpose:
This measure will reduce ozone precursors and greenhouse gases.

Source Category:
On-Road Motor Vehicles: Passenger Cars/Light Duty Trucks

Regulatory Context and Background:
In September 1990, ARB adopted a low-emission vehicle regulation whose aim is to drastically reduce pollution from passenger cars and light-duty trucks. As part of the newly created program, the Board included a goal of requiring large auto manufacturers to commercialize vehicles with zero emissions, beginning with 1998 model-year vehicles. The original ZEV program required that 10 percent of new vehicle sales by large manufacturers have zero emissions, starting with 1998 models. The Board modified the program in 1998 and 2001 to allow up to 60 percent of the requirement to be met with vehicles having extremely low emissions and other specific attributes. In 2009 up to 85 percent of the requirements may be met with these vehicles. Vehicles meeting these standards are referred to as “partial zero emission vehicles” (PZEV) and “advanced technology partial zero emission vehicles” (AT-PZEV).

Manufacturers originally planned to meet the ZEV requirements with battery electric vehicles. In 1996, due to cost and performance issues, the ARB eliminated the early (1998) requirements to allow additional time for battery research and development. To ensure a significant market for advanced battery manufacturers, the ARB entered into agreements with manufacturers to place in California roughly 1,800 advanced-battery electric vehicles between 1998 and 2000. The agreements were designed to provide battery developers with the necessary initial production volumes to meet the cost and performance goals needed for commercial production.

CARB’s most recent amendments to the ZEV program in 2008 increased the percentage of ZEVs required in 2012 to 11 percent , with manufacturers being provided additional flexibility to meet their regulatory obligations through sale of plug-in hybrid vehicles and fuel cell vehicles. The ZEV requirement has been implemented by CARB to catalyze efforts to commercialize sustainable transportation. The program has prompted manufacturers to develop extremely clean gasoline, alternative fuel and hybrid electric vehicles. There are currently twenty-one auto manufacturers subject to the ZEV regulation. Six are defined as large volume manufacturers: General Motors, Toyota, Ford, Honda, Chrysler and Nissan. The remaining 15 are intermediate volume manufacturers.

In November 2009, CARB staff released a white paper outlining potential changes to the Zero Emission Vehicle regulation that may be considered by the Air Resources Board. One potential change relevant to this control measure is the establishment of new Green House Gas light-duty vehicle emission standards using AT-PZEVs as the baseline. CARB staff refers to this proposal as "LEV III – Green House Gas." CARB is planning on bringing changes to both the ZEV and the Low Emission Vehicle regulations to their Board in November, 2010. The Air District will follow the development of the proposed modifications to both regulations, and may modify the goals of this control measure by increasing support for battery electric and fuel cell vehicles.

Implementation Actions:

- Commit motor vehicle grant registration funds towards qualifying vehicle purchases and infrastructure development subsidies.
- Partner with private, local, state and federal programs to promote the purchase of battery-electric and plug-in hybrid electric vehicles.
- Partner with private, local, state and federal programs to install and expand public charging infrastructure. Promote existing charging infrastructure. (In August 2010, the Air District allocated $5 million for installation of electric vehicle charging stations in the Bay Area.)
- Support research programs advancing technology for plug-in hybrid, battery electric and hydrogen-fueled vehicles.
- Advocate for increased government subsidies and research programs with local businesses, non-profits and governments through the Bay Area Electric Vehicle Initiative.
- Support the use of renewable electricity in both ZEVs and PHEVs, with additional support for low carbon, renewable fuels in the onboard internal combustion engines in PHEVs.

Goals for this measure are as follows:

- By 2012, place 1,000 ZEVs and 5,000 PHEVs into service, primarily in fleets;
- By 2012, expand regional recharging network with 500 new charging stations;
- By 2020, place 10,000 ZEVs and 100,000 PHEVs into service;
- By 2020, expand regional recharging network with 2,000 new charging stations.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.01	0.18
NO_x	0.01	0.13
PM10	0.01	0.02
$PM_{2.5}$	0.00	0.01

C02-e	0.00	0.30

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
Emission reductions were calculated by assuming that each ZEV and PHEV is in lieu of an average brand new gasoline powered vehicle. For zero emission vehicles, the emission reductions are calculated as the difference between new vehicle emissions and zero emissions in the years 2012 and 2020.

For plug-in hybrid vehicles, it is assumed that the vehicles operate in electric mode for 50% of the annual VMT, or 6,000 miles, and that 75% of the electric power derives from grid supplied electricity stored in batteries, while the remaining 25% of the electricity comes from burning gasoline in the vehicle engine.

Exposure Reduction:
Reduction in the use of gasoline will also reduce public exposure to air toxics, particularly in communities near heavily traveled roads and freeways.

Emission Reduction Trade-offs:
This measure will not increase emissions of any pollutant from motor vehicles; however, to the extent that it helps to increase the number of ZEVs and PHEVs in use within the Bay Area, it may slightly increase emissions of criteria pollutants and greenhouse gases from power plants that generate the required electricity.

Cost:
Cost for the measure is determined by the marginal cost for the cleaner ZEVs and PHEVs over a standard car, plus infrastructure costs. Based on the Air District's 2009 application for federal stimulus funding from the Department of Energy, the marginal or incremental vehicle costs are $12,000 per vehicle and infrastructure is $19,000 per recharging unit on average. Costs to implement are estimated to be:

Phase 1:	Vehicle Costs	$72 million
	Infrastructure	$9.5 million
Phase 2:	Vehicle Costs	$53 million
	Infrastructure	$19 million

It is anticipated that the District will provide up to $6 million per year on average towards the accelerated purchase of qualifying vehicles. Additional incentives funds will need to come from state and federal incentive programs, tax refunds and rebates, and private sources. It is likely that public fleet orders will comprise the bulk of the purchases during the 2010 to 2012 period.

Co-benefits:
The expanded use of newer, cleaner electric powered cars will reduce water pollution and decrease reliance on crude oil for transportation fuel. Benefits of "green" job creation are dependent on commitments to manufacture compliant vehicles within the Bay Area.

Monitoring Mechanisms:
This measure can be monitored via annual vehicle registration data compiled by the DMV, as well as tracking any grant contracts for incentive funding paid out by the Air District.

Issues/Impediments:
- Funding for vehicle subsidies
- Limited availability of ZEV and Plug-in Hybrid vehicles.
- Vehicle price and ongoing maintenance costs
- Battery Technology

Sources:

1. BAAQMD, *Grant Application, U.S. Department of Energy (DOE), National Energy Technology Laboratory, Funding Opportunity: Clean Cities FY09 Petroleum Reduction Technologies Projects for the Transportation Sector, Area Interest #4; Funding Opportunity Number DE-PS26-09NT01236-04; CFDA Number 81.086.* June 2009
2. CARB, *Status Report on the California Air Resources Board's Zero Emission Vehicle Program*, April 20, 2007
3. CARB, *Status and Prospects for Zero Emission Vehicle Technology: Report of the ARB Independent Expert Panel 2007*, April 13, 2007.
4. CARB*, Preliminary Summary of Air Resources Board Action (3/27/08) – Zero Emission Vehicle (ZEV) Program,* April 2008.
5. CARB, *California Hydrogen Highway Network: 2008 Report to the Legislature*, January 2009.
6. CARB, *White Paper: Summary of Staff's Preliminary Assessment of the Need for Revisions to the Zero Emission Vehicle Regulation*, November 25, 2009.
7. CARB, Staff Presentation: Workshop to Discuss Potential Modifications to the Zero Emission Vehicle (ZEV) Regulation, May 3, 2010, Sacramento, California.
8. For a list of existing public EV charging stations in the Bay Area, see http://www.evchargermaps.com/.

MSM A-3 - Green Fleets

Brief Summary:
This control measure consists of three elements: a) development of a green fleet certification as part of the ABAG Green Business Program; b) the promotion of best practices for green fleets through outreach to local governments and business groups, and through grant applicants to promote best practices; and c) potential revisions to the District's Transportation Fund for Clean Air (TFCA) and other grant programs to ensure funding is directed towards fleets meeting GHG performance standards.

Purpose:
This measure will further reduce ozone precursors and greenhouse gases, as well as particulate matter and PM precursors.

Source Categories/Travel Markets Affected:
On-Road Light, Medium, and Heavy-Duty Vehicles

Regulatory Context and Background:
There has been little experience to-date with regulatory efforts requiring cleaner, greener fleets. The South Coast AQMD adopted a number of fleet regulations including: Less-Polluting Street Sweepers, Clean On-Road Light- and Medium-Duty Public Fleet Vehicles, Clean On-Road Transit Buses, Clean On-Road Residential and Commercial Refuse Collection Vehicles, Commercial Airport Ground Access Vehicles (Taxicabs, Shuttles, etc.), Clean On-Road School Buses, and Clean On-Road Heavy-Duty Public Fleet Vehicles. These regulations apply to public and private fleets and require the purchase of mostly natural gas powered vehicles. ARB has a number of recently adopted regulations targeting fleet turnover, clean-up of heavy duty trucks, and truck hybridization research programs.

With regards to voluntary efforts, the federal EPA has promoted its SmartWay program as means for reducing energy usage from long-haul trucking operations. ABAG has a Bay Area-wide Green Business Program which uses a checklist for businesses/agencies to complete. ABAG has customized checklists for businesses, such as hotels, printers, and offices. San Francisco uses a customized Green Business checklist with several vehicle related requirements for businesses. Puget Sound Clean Air Agency has an entire website, http://www.psgreenfleets.org/, devoted to assisting agencies and businesses in creating a green fleet. The website contains grant/incentives resources, a green fleet calculator, and regulatory updates.

Implementation Actions:
Green Fleet Certification – The Air District will coordinate with the ABAG/Bay Area Green Business program to explore development of a "green fleet" certification. The Air District and ABAG will encourage public agencies and the private sector to contract with certified green fleets, and with other certified businesses that implement green fleet practices.

Promote best practices – Green fleet best practices include purchasing low emission vehicles, properly maintaining vehicles, minimizing fleet size, reducing reliance on petroleum based transportation fuels, increasing use of locally produced renewable fuels, and encouraging efficient driving habits. The green fleet toolkit developed by Sustainable Earth Initiatives with funding from the Air District's Climate Protection Grant Program, and the San Francisco Department of Environment's Green Fleet calculator represent excellent examples of best practices to promote.

Incentives/Grants Strategy – Track and assist public agencies in "greening" their fleets. Performance standards for cleaner burning and GHG efficient vehicles may be established for the Air District's grant programs based on ARB's GHG vehicle labeling program and green fleet best practices. The Air District and its partners may utilize the EPA SmartWay program as a source for establishing performance standards for heavy-duty trucks.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.02	0.08
NO_x	0.02	0.10
PM10	0.03	0.07
$PM_{2.5}$	0.02	0.05
C02-e	0.00	0.33

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
Overall, the Air District will aim to achieve emission reductions from fleets in three ways: increase the use of alternative fuels, increase the use of fuel efficient light duty vehicles, and reduced VMT.

For the purposes of calculating potential benefits under the measure, the Air District will work towards the following goals:

2012
- 1,000 diesel trucks begin using a 20% biodiesel fuel blend.
- 400,000 gallons of gasoline fuel saved from the use of more fuel efficient light-duty vehicles.
- 12 million fewer miles driven by light-duty fleet vehicles.

2020
- 5,000 diesel trucks begin using a 20% biodiesel fuel blend.

- 2 million gallons of gasoline fuel saved from the use of more fuel efficient light-duty vehicles.
- 60 million fewer miles driven by light-duty fleet vehicles.

The increased use of biodiesel will contribute to the reduction of PM2.5 and CO2, while the use of more efficient vehicles and the reduction in VMT will reduce NOx, ROG, PM2.5, PM10 and CO2. Emission factors are derived from work by CARB on the low carbon fuel standard and LEV-II program. It is assumed that heavy-duty trucks switching to biodiesel on average are driven 25,000 miles per year with a fuel economy of 5 miles per gallon (mpg). It was also assumed that gasoline savings by improving vehicle fuel economy from 20 mpg to 30 mpg.

Exposure Reduction:
The adoption of "green" practices by automotive fleet operators will reduce gasoline and diesel usage, which in turn will lower exposure to toxic compounds emitted by light duty gasoline vehicles and medium- and heavy-duty diesel trucks.

Emission Reduction Trade-offs:
None. Adoption of green fleet practices should lead to the reduction of all emissions.

Cost:
The development of a green fleet certification element to the Bay Area Green Business program is estimated to cost $250,000 in staff and consultant fees. The promotion of the Green Fleets Toolkit is estimated to cost $300,000 annually in staff, material and advertising.

Co-benefits:
Promoting a Green Fleets program will help to reduce water and noise pollution. This measure should also reduce petroleum usage in the Bay Area.

Monitoring Mechanisms:
- The annual level of effort by Air District and ABAG Staff to promote Green Fleet best practices.
- The annual increase in fleets making use of the Green Fleets Toolkit.
- Development of green fleet standards and a checklist of robust green vehicle requirements for the Bay Area Green Business certification program.

Issues/Impediments:
The main issues are the availability of resources to implement a Green Fleet certification component of the ABAG/Bay Area Green Business Program, as well as promote "best practices" to fleet operators; and interest/acceptance by fleet operators in changing from current practices.

Sources:

1. Association of Bay Area Governments, *Bay Area Green Business Program*, online at http://www.greenbiz.ca.gov/
2. The Sustainable Earth Initiative, et al*., San Francisco Bay Area Green Fleets Toolkit*, February 2009. Available at http://www.sfenvironment.org/downloads/library/clean_fleets_toolkit__greening_commercial_fleet.pdf
3. CARB, *Subarticle 1, sections 95300 to 95312, title 17, California Code of Regulations*
4. CARB, *Heavy Duty Vehicle Greenhouse Gas Emission Reduction Measure,* 2009, http://www.arb.ca.gov/cc/hdghg/hdghg.htm
5. CARB, *Proposed Regulation to Implement the Low Carbon Fuel Standard: Volume 1: Staff Report: Initial Statement of Reason*, March 5, 2009.
6. CARB, *Detailed California-Modified GREET Pathway for Ultra Low Sulfur Diesel (ULSD) from Average Crude Refined in California*, April 22, 2008.
7. CARB, *Detailed California-Modified GREET Pathway for Biodiesel Produced in California from Used Cooking Oil,* July 20, 2009.
8. EPA, SmartWay Program, http://www.epa.gov/smartway/

MSM A-4 - Replacement or Repair of High-Emission Vehicles

Brief Summary:
This control measure proposes enhancements to three long-running programs to control emissions from in-use light-duty motor vehicles: the Air District's Vehicle Buy Back and Smoking Vehicle Assistance Program, and the State's Smog Check program.

Purpose:
The purpose of this measure is to reduce ozone precursors, PM, air toxics, and greenhouse gases from high-emitting vehicles by accelerating the replacement or repair of such vehicles.

Source Category/Travel Market Affected:
On-Road Motor Vehicles Passenger Cars & Light-Duty Trucks

Regulatory Context and Background:
Late-model vehicles that are equipped with recent emission control technologies and properly maintained emit very little ozone precursors or PM. By contrast, older vehicles, or vehicles that are not properly maintained, can emit pollutants at a much higher rate. There are approximately 325,000 pre-1989 model year vehicles on the road in the Bay Area. Although they account for only about 7% of the total vehicle fleet, these older vehicles have much higher emission rates, so that they account for a disproportionate share of total vehicle emissions. Accelerating the replacement or repair of high-emitting vehicles offers a cost-effective strategy to reduce emissions of criteria pollutants and air toxics. In addition, removing older vehicles can help to reduce emissions of CO2.

Vehicle Buy-Back: The Air District has operated a Vehicle Buy-Back (VBB), or scrappage, program since 1996. VBB provides cash to vehicle owners to voluntarily retire old vehicles. Payment per vehicle initially was set at $500; it increased in FY 2006/2007 to $650; and again in 2009 to $1,000. Funding has primarily come from the District's Transportation Fund for Clean Air. This program has led to the early retirement of more than 42,000 older, higher emitting vehicles. The average rate of retirement for the first 10 years of the program was 2,700 vehicles per year; this increased to an average of 7,800 vehicles in the most recent two years, the result of an increased budget and the higher per vehicle payout to vehicle owners and expanded model year eligibility. In February 2009, the Air District also expanded the program to cover model years (MY) 1988 and 1989 vehicles.

The District administers the VBB program based upon guidelines issued by the California Air Resources Board for its Voluntary Accelerated Light-Duty Vehicle Retirement (VAVR) Program. The ARB adopted revisions to the VAVR regulation on December 7, 2006, that incorporate the use of remote sensing devises (RSD) and other technologies to identify high emitting vehicles as possible candidates for voluntary retirement to generate additional emission reductions.

In 2007, the South Coast Air Quality Management District launched its High Emitter Repair or Scrap (HEROS) Program. The HEROS program initially explored the potential benefits of using remote sensing devices to identify gross polluting vehicles operating on local roads and highways, and then offering the vehicles owners cash to either repair or scrap their vehicles. The initial experience with the program has been positive, with the program being expanded in 2009.

Smoking Vehicle Assistance Program: The Air District's program to connect owners of older, polluting vehicles to repair and buy-back programs began in December 1992. Smoking vehicles are identified and reported to the Air District by Bay Area residents through the *1-800-EXHAUST* phone line and the www.smokingvehiclehelp.org website. After a report is made, the Air District contacts the vehicle owner and encourages them to either have the vehicle repaired or retire it through the Vehicle Buy Back Program. Each year an average of 35,000 calls are received reporting vehicles emitting excessive visible exhaust.

Both the Bureau of Automotive Repair (BAR) and the Air District offer assistance programs to owners of older, polluting vehicles. For vehicles that have recently failed the biennial smog check inspection, BAR offers owners up to $500 towards repairs or $1,000 to retire their vehicle. For model year 1989 or older vehicles that have passed the biennial smog check, the Air District offers owners $1,000 to retire their vehicle, as described in the Vehicle Buy-Back discussion above.

Smog Check: Motor vehicle emissions have been subject to controls since 1961, when California adopted a regulation that required new cars to have positive crankcase ventilation – the recycling of crankcase emissions back into the engine instead of the atmosphere. Since then, progressively tighter limits on exhaust have spurred the development of a variety of abatement equipment and systems.

In recognition that keeping the abatement equipment and systems operating at peak efficiency ensures the best results from the emissions controls, the Air District in 1980 proposed an inspection and maintenance program. This proposal eventually was adopted in modified form by the California State Legislature and Smog Check was begun in 1984. Enhancements to the program were adopted in 1996 and phased in to many parts of California, with the enhanced program begun in the Bay Area in 2003.

The Smog Check program is operated by the California Bureau of Automotive Repair, with advice from the California Air Resources Board. South Coast Air District required biennial test of motor vehicles to assure they meet applicable emission standards. The Inspection and Maintenance Review Committee monitors and recommends enhancements to South Coast's program.

In November 2008, the State of California's Inspection and Maintenance Review Committee published a draft report on the current status of the Smog Check program. In this draft report, the Review Committee has made several useful suggestions for additional modifications and enhancements to the California Smog Check program. The recommendations in the report serve as the basis for the proposed advocacy plan in this control measure.

Implementation Actions:
The Vehicle Buy-Back, Smoking Vehicle Assistance, and Smog Check programs have all helped to improve air quality in the Bay Area. Nonetheless, high-emitting vehicles are still a major contributor to air quality problems. The Air District has recently developed a campaign to help strengthen awareness of and responsiveness to the VBB and Smoking Vehicle Assistance programs.

Vehicle Buy Back - The Air District will:

- Consider expanding its marketing of the program through targeted outreach in impacted communities defined through the CARE Program, advertising at Smog Check test sites, specialized or supplemental direct mail solicitation and advertising to owners of pre-1975 vehicles and smog-exempt vehicles, and through the District's Smoking Vehicle Assistance Program.
- Study the potential for including motorcycles in the District's Vehicle Buy Back program.
- Evaluate the possible benefits of offering a higher incentive for vehicles located in priority communities identified through the CARE program.
- Evaluate South Coast Air Quality Management District's experience with a vehicle repair program –$500 for repairs to a vehicle's emission control systems – as an option for the Bay Area.

Smoking Vehicle Assistance Program - The Air District will:

- Continue operation of 1-800-EXHAUST phone line, the www.smokingvehiclehelp.org website, and advertisement campaign;
- Conduct an assessment of the program's effectiveness in reducing emissions. The assessment will consist of follow-up surveys of vehicle owners receiving complaint letters from the Air District; amend the program as warranted.
- Propose program enhancements or revisions as appropriate.

California Smog Check - The Air District will:

- Seek and/or support legislation to enhance the smog check program, e.g., require annual inspections of older model year and of high mileage vehicles, include testing for exhaust particulate matter (PM) in the program; add motorcycles to Smog Check;
- Consider offering incentives to encourage newer model and/or lower mileage vehicle owners to submit their vehicles for annual inspections;
- Consider replicating the SCAQMD's high emitter identification and repair program – HEROS.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	4.37	14.60
NO_x	2.06	6.90
PM10	0.03	0.10
$PM_{2.5}$	0.02	0.07
Benzene	0.09	1.30
1,3 Butadiene	0.02	0.28
Formaldehyde	0.06	0.93
Acetaldehyde	0.04	0.65
C02-e	44.14	147.14

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia).

Emission Reduction Methodology:
Emission reduction estimates for this measure are based on past performance of the Vehicle Buy Back and Smoking Vehicle Assistance Programs.

Estimates of potential benefits from adding motorcycles to the VBB program and implementing a HEROS style remote sensing and repair program are not included; such estimates will be developed as part of the District's review and consideration of these initiatives.

Exposure Reduction:
In general terms, harmful emissions are at their lowest when abatement equipment on a vehicle is well maintained and operating as designed. Programs that remove the oldest, most-polluting vehicles from operation reduce exposure to toxic air contaminants emitted by gasoline vehicles.

Emission Reduction Trade-offs:
Programs that require the destruction of old vehicles may lead to incremental increases in green house gases; that is, the energy required to destroy the old vehicles may not be offset by the generally higher fuel efficiency of new vehicles. Investigation of this potential trade-off will need to be undertaken during the implementation of this measure.

Cost:
Costs associated with increased frequency of testing under the Inspection & Maintenance program, or inclusion of motorcycles in the program, will be borne by the vehicle owners. There would be some costs to the State of California to update tracking and notification systems.

If the Air District decides to replicate the HEROS program, there will be costs involved in deploying remote sensing equipment to identify gross polluting vehicles, establishing systems for notifying vehicle owners, and the cost of repairing or scrapping vehicles. Costs for this effort will be primarily borne by the Air District, although opportunities exist to utilize funds from private firms or other governmental programs.

The cost for the Vehicle Buy Back Program is $1,000 per vehicle, plus overhead to the car scrapping companies that administer the program. At present, the Vehicle Buy Back Program is funded with Mobile Source Incentive Funds, Carl Moyer Program Funds, and the Air District's Transportation Fund for Clean Air.

The annual budget for the Smoking Vehicle Assistance Program is approximately $1 million per year. Funding comes from the Air District's Transportation Fund for Clean Air.

Co-benefits:
Repairing or scrapping gross polluting vehicles will reduce energy consumption, reduce consumer costs, and avoid water pollution (storm water runoff). The expansion of the Smog Check program to annual inspections and inspections of motorcycles, as well as the implementation of a HEROS type program, may lead to the creation of "green" jobs.

Monitoring Mechanisms:
California Smog Check - The primary means for monitoring progress on this measure will be through the California Legislature, and their effort to expand the Smog Check program.

Vehicle Buy Back and Smoking Vehicles - Monitoring will be accomplished through progress and final reports to the Board of Directors on the initiatives described above, through implementation plans, and budget requests for any expansion of the Vehicle Buy Back and Smoking Vehicle Assistance programs.

Expanded use of follow-up surveys for the Smoking Vehicle Assistance Program will allow the Air District to better assess the on-going need for the complaint line.

Issues/Impediments:
- Changes to the Smog Check program require legislative approval.
- An issue for the Smoking Vehicle Assistance Program is the declining incidence of vehicles operating with visible exhaust. Tighter emissions controls, higher mileage warranties, advanced engineering, and fleet turnover have all worked to reduce the likelihood for a vehicle to emit visible exhaust, unless there has been a major failure to an engine system.

Sources:

1. State of California, Inspections & Maintenance Review Committee, *IMRC 2008 Smog Check Review Report*, November 18, 2008. http://www.imreview.ca.gov/reports/index_reports.shtml
2. State of California, Bureau of Automotive Repair, http://www.smogcheck.ca.gov/
3. South Coast Air Quality Management District, *High Emitter Repair or Scrap (HEROS) Program*, http://www.aqmd.gov/news1/2007/remotesensingfactsheet.html

4. Bay Area Air Quality Management District, various annual reports & staff reports on the VBB program.
5. South Coast Air Quality Management District, Final 2007 AQMP, Appendix IV-A, pp 148-155, 2007
6. State of California, Air Resources Board, Voluntary Accelerated Vehicle Regulations, http://www.arb.ca.gov/msprog/avrp/avrpfaq.htm

MSM B-1 - Fleet Modernization for Medium- and Heavy-Duty On-Road Vehicles

Brief Summary:
Between 2010 and 2015, the Air District will directly provide, and encourage other organizations to provide, incentives for the purchase of new trucks that meet the California Air Resources Board's 2010 emission standards for heavy-duty engines. This program is designed to assist truck owners/operators to replace pre-2003 heavy-duty diesel trucks (Class 7 and 8) with new diesel-fueled or natural gas-fueled trucks in advance of requirements of CARB's in-use truck regulation.

Purpose:
This measure will reduce ozone precursors and diesel particulate matter emissions.

Source Category/Travel Market Affected:
Medium and Heavy Duty On-Road Vehicles

Regulatory Context and Background:
Emissions from heavy duty trucks account for nearly 24% of NOx emissions in the Bay Area; they are also a significant source of diesel PM. Since 1988, when the first emission standards for trucks came into effect, trucks have become significantly cleaner. Beginning with the model year (MY) 2010 standards adopted by both CARB and the federal EPA, truck emissions for both particulate matter and NOx will be at near-zero levels.

However, because heavy-duty trucks are kept in service for many years and fleet turnover is slow, it can take a long-time to see the air quality benefits of the new engine standards. In 2008, to accelerate the replacement or retrofit of old trucks, CARB adopted a regulation that requires truck fleets to meet progressively more stringent limits as calculated on a fleet-average basis.

The benefits of the fleet-average regulation can be further accelerated by offering financial incentives to truck owners to replace an existing truck 3-5 years in advance of the regulatory requirements. The Air District currently offers incentives for the purchase of MY 2007 and newer trucks as part of the Carl Moyer Program and other grant programs.

Implementation Actions:
Between 2010 and 2015, the Air District will directly provide and/or work with other entities to provide incentives to accelerate the replacement of up to 5,000 heavy-duty on-road diesel engines in advance of requirements for the ARB in-use heavy-duty truck regulation. In order to maximize reductions in green house gases, priority will be given to the purchase of new trucks fueled by natural gas or locally produced bio-fuels.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.10	0.25
NO_x	5.00	12.5
PM10	0.11	0.28
$PM_{2.5}$	0.03	0.27
Formaldehyde	0.01	0.02
Acetaldehyde	0.02	0.04
C02-e	0.64	233.24

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), Benzene, and 1,3 Butadiene.

Emission Reduction Methodology:
To estimate the emission reductions from the early replacement of heavy-duty diesel trucks, District staff assumed that on average a model year 2000 truck that travels 50,000 miles per year would be replaced by a model year 2010 CARB/EPA compliant truck. The emission reductions represent the difference in emission rates between the old and new trucks. We assumed that of the 5,000 truck replacements targeted under this measure, 3,000 of the new trucks would be fueled by natural gas. We also assumed that 2,000 truck replacements would occur by 2012, with the balance occurring by 2015. Benefits from the early replacement of the trucks would occur over a 3-5 year period.

Exposure Reduction:
This measure will accelerate the health benefits of an adopted CARB regulation by reducing exposure to diesel PM and by reducing NOx emissions that contribute to regional ozone formation. Impacted communities near freeways and roads with significant truck traffic will benefit.

Emission Reduction Trade-offs:
Exhaust controls on diesel trucks meeting the MY 2010 standards may decrease fuel economy, thereby increasing CO2 emissions.

Cost:
The cost to implement this measure will be determined primarily by the level of financial incentive that will be offered to fleet owners to encourage early compliance with the CARB truck regulations. The incentive amount will be determined during the development of the program. An existing fleet modernization program operated through the Carl Moyer Program provides approximately $35,000 per heavy-duty truck.

Based on the current incentive levels, this measure will potentially cost $175 million to implement. It is anticipated that the District will make available up to $10 million per year in incentives for the purchase of new trucks between 2010 and 2015.

Co-benefits:
To the extent this measure is successful in replacing diesel trucks with natural gas or other alternative fuel trucks, there will be a reduction in petroleum usage in the Bay Area. Reductions in the use of petroleum will help reduce stationary source pollution and water pollution.

Monitoring Mechanisms:
The benefits of the program will be monitored via the contracts for the financial incentives. The District will track emission reductions.

Issues/Impediments:
This control measures sets forth enhancements for an existing program and should not give rise to any new obstacles, as long as funding for the incentives is secured.

Sources:
1. BAAQMD, Carl Moyer Incentive Program, www.baaqmd.gov
2. California Air Resources Board, *2008 Carl Moyer Guidelines*, Chapters III and IV, April 22, 2008

MSM B-2 - Low NOx Retrofits in Heavy-Duty On-Road Vehicles

Brief Summary:
Between 2010 and 2015, the Air District will provide incentives to install CARB-verified abatement equipment to reduce NOx emissions from existing on-road heavy-duty truck engines. Emphasis will be placed on bringing existing engines into early compliance with CARB's in-use truck regulation. The Air District will also continue to require software updates to engine control modules in model year (MY) 1993-1998 diesel trucks to reduce excess NOx emissions as a condition of all heavy-duty vehicle retrofit grants. The Air District will work with CARB to evaluate the feasibility of installing or replacing catalytic convertors on gasoline powered heavy-duty vehicles.

Purpose:
This measure will reduce ozone precursors.

Source Category/Travel Market Affected:
Heavy Duty On-Road Vehicles

Regulatory Context and Background:
Electronic control of the operation of truck engines became commonplace in 1994. Electronics allow for more precise control of engine timing and fuel injection; this has provided significant reductions of NOx and PM emissions. Electronic engine control has also opened up opportunities for integration of exhaust abatement devices, such as lean NOx catalysts, NOx absorbers, exhaust gas recirculation and selective catalytic reduction (SCR) systems. In fact, engine manufacturers will be using SCR systems extensively to comply with ARB's MY 2010 NOx standard for new engines. The increasing availability of retrofit devices to reduce NOx from existing engines provides an opportunity for the Bay Area to achieve benefits in advance of historical fleet turnover rates.

Low NOx software upgrade is computer programming for electronic control modules in certain heavy-duty engines that reduces excess emissions of oxides of nitrogen (NOx). The software upgrades were developed by the engine manufacturers as part of a legal settlement with the federal Environmental Protection Agency and ARB. Installing low NOx software can reduce emissions from most model year 1993-1998 California-registered heavy-duty trucks, school buses, motor homes, and interstate vehicles that visit California, with engines manufactured by Caterpillar, Cummins, Detroit Diesel Corporation, Mack/Renault, Volvo and International. CARB's truck and bus regulation requires replacement of 1994-1999 model engines to reduce NOx emissions by January 1, 2013.

Implementation Actions:
The Air District will either directly provide and/or work with other entities to provide cash incentives for the installation of retrofit devices that reduce NOx emissions from 5,000 MY

1994-2006 engines between 2010 and 2015. Targeted technologies include, but are not limited to, exhaust gas recirculation systems and selective catalytic reduction devices.
As a condition of grant incentives, the Air District will continue to require software upgrades to the engine control modules in any MY 1993-1998 on-road engines to install either diesel PM filters and/or NOx retrofit devices. The Air District will also encourage other providers of incentives to incorporate as similar requirement in their grant programs.
The Air District will work with CARB to evaluate the feasibility of installing or replacing catalytic converters on gasoline powered heavy-duty vehicles.

Emission Reductions:

Pollutants (tons per day)	2012	2020
NO_x	0.99	2.98

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: ROG, PM10, $PM_{2.5}$, NH3 (ammonia), Benzene, Formaldehyde, Acetaldehyde, 1,3 Butadiene and CO2-e.

Emission Reduction Methodology:
To estimate the emission reductions from the retrofit of heavy-duty diesel trucks, District staff assumed that on average a model year 2004 truck that travels 50,000 miles per year would be retrofitted with a CARB verified device that achieves sufficient NOx reductions to bring emission levels on par with a model year 2007 diesel engine. The emission reductions represent the difference in NOx emission rates between a MY 2004 and MY 2007 truck. We also assumed that 1,250 truck retrofits would occur by 2012, with the balance occurring by 2015. Benefits from the retrofit of the trucks would occur over a 3-5 year period.

Exposure Reduction:
Efforts to reduce NOx emissions from existing on-road engines will assist in reducing exposure to ozone and secondary particulate matter. Installation of catalytic converters on heavy-duty gasoline engines, if feasible, may reduce exposure to a number of toxic air pollutants present in the exhaust from gasoline engines.

Emission Reduction Trade-offs:
Both the installation of NOx retrofits and the upgrade of the engine control software may reduce the overall efficiency of existing engines, resulting in increases in greenhouse gases, primarily CO2. Additionally, installation of selective catalytic reduction devices could increase emissions of ammonia.

Cost:
The retrofit of heavy duty diesel engines with NOx abatement equipment is estimated to cost $30,000 per engine. District staff anticipates that about 75% of the retrofits will occur between 2013 and 2015 as fleets prepare to comply with NOx requirements in the ARB in-use truck engine regulation. Costs are estimated to be:

Phase 1: $37.5 million
Phase 2: $75 million

It is anticipated that the District will make available up to $3-5 million per year in incentives for the retrofit of existing trucks between 2010 and 2015.

Co-benefits:
This control measure, by focusing on incentives to install retrofit devices, may result in an increase in "green" jobs in the Bay Area, largely at manufacturers of retrofit devices, local truck repair facilities, and diesel engine distributors.

Monitoring Mechanisms:
Progress and Final reports from any Air District grants or incentives.
Progress and Final reports made available from other incentive programs.
Annual reports submitted to ARB under the in-use, on-road truck regulation.

Issues/Impediments:
The main obstacles for this control measure are: a) durability and availability of NOx retrofit devices, and b) ability of retrofit devices to reduce NOx on existing levels to the EPA/CARB 2007 emissions standards.

Sources:

1. California Air Resources Board, Descriptions of various Level 3 Verified Emission Control Devices, http://www.arb.ca.gov/diesel/verdev/level3/level3.htm
2. California Air Resources Board, *Software Upgrade for Diesel Trucks,* http://www.arb.ca.gov/msprog/hdsoftware/hdsoftware.htm
3. Kubsh, Joe, Manufacturers of Emission Controls Association, *Diesel Retrofit Technologies for Combined Reductions of PM and NOx*, November 2008. Available online at http://www.arb.ca.gov/diesel/verdev/wn/jkubsh.pdf
4. Manufacturers of Emission Controls Association, *Emission Control Technologies for Heavy-Duty Trucks and Buses*, 2009. Available online at http://www.meca.org/page.ww?section=Emission+Control+Technology&name=Trucks+%26+Buses
5. Brodrick, C.J., et al., Urea-SCR System Demonstration and Evaluation for Heavy-Duty Diesel Trucks, UCTC No 493, The University of California Transportation Center, Berkeley, November 15, 1999. Available online at http://www.uctc.net/papers/493.pdf.
6. DieselNet, "Johnson Matthey demonstrating retrofit SCR System," posted online on March 26, 2008: http://www.dieselnet.com/news/2008/03jm.php

MSM B-3 - Efficient Drive Trains

Brief Summary:
The Air District will either directly commit and/or work with partner agencies and companies to provide funding to underwrite development and demonstration of hybrid drive trains for medium- and heavy-duty vehicles.

As technologies become commercially available, the Air District will offer cash incentives to accelerate deployment of more efficient vehicles. The Air District will coordinate this effort with the CalStart Hybrid Truck User Group, the California Air Resources Board, the California Energy Commission and other air districts.

Purpose:
This measure will reduce ozone precursors, particulate matter and greenhouse gases.

Source Category/Travel Market Affected:
On-Road Medium and Heavy Duty Vehicles

Regulatory Context and Background:
Since 1988, heavy-duty truck engines have been progressively regulated to reduce harmful emissions of criteria pollutants, such as NOx, PM and ROG. Until recently, however, little effort has been made to reduce greenhouse gas emissions. In response to higher fuel costs, and growing awareness of the need to reduce emissions of CO2 from transportation sources, truck makers, truck owners, and government agencies have been increasing their efforts to develop more efficient drive-trains and power systems for trucks, focusing on electric vehicles, hybrid-electric and hydraulic systems.

In the Bay Area, the Napa Valley Unified School District has been testing a plug-in electric-diesel hybrid system in a school bus; Pacific Gas & Electric has been testing a diesel electric system in maintenance trucks, and others have proposed hybrid systems for transit buses, delivery vehicles and garbage trucks. Freightliner currently offers a diesel electric hybrid for its medium-heavy-duty chassis.

These promising efforts have been fostered largely through the collaborative Hybrid Truck Users Forum operated by the non-profit CalStart consortium. This control measure proposes to build on the existing work by directing financial incentives toward the various field demonstrations being currently operated or proposed by participants in the HTUF program.

Implementation Actions:
The Air District will either directly provide and/or work with partner agencies and companies to provide funding between 2010 and 2015 to underwrite development and demonstration of hybrid drive trains for medium- and heavy-duty vehicles.

As technologies become commercially available, the Air District will either directly and/or work with partner agencies and companies to offer financial incentives to accelerate deployment of more efficient vehicles. The goals for the measure are to place 1000 efficient medium- and heavy-duty trucks on the region's roadways by 2012 and 4000 additional vehicles by 2020.

The Air District will participate in these efforts with the CalStart Hybrid Truck User Forum, the California Air Resources Board, the California Energy Commission, other air districts, local private and public entities and truck manufacturers.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.01	0.05
NO_x	0.29	1.44
PM10	0.01	0.01
$PM_{2.5}$	0.01	0.01
C02-e	0.23	1.14

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), Benzene, Formaldehyde, Acetaldehyde, and 1,3 Butadiene.

Emission Reduction Methodology:
To estimate the emission reductions from this measure, District staff has assumed that the efficient drive trains will result in a 30% reduction in fuel usage per truck. The baseline fuel economy is assumed to be 5.6 mpg. It is assumed that each truck will travel 50,000 miles per year. We also assumed that of the 5,000 truck replacements targeted under this measure, 1,000 will occur by 2012 and 4,000 additional trucks by 2020.

Exposure Reduction:
This control measure is focused on the reduction of greenhouse gases from trucks. However, technologies such as hybrid electric power systems that improve energy efficiency also further reduce criteria pollutants. Reductions in both diesel PM and NOx will reduce exposure to toxic pollutants locally and ozone regionally.

Emission Reduction Trade-offs:
None. Improvements in energy efficiency will reduce all pollutants.

Cost:
There are two parts to the costs for this measure. First, there is an un-estimated amount of costs associated with the development of the hybrid technologies that will go into more efficient drive trains for medium- and heavy-duty vehicles. These costs will be borne by a

variety of private firms and federal, state and local government agencies. Second, there will be incremental costs associated with the purchase of the vehicles with the advanced drive trains. For the purposes of discussion, District staff has assumed the incremental costs will average $20,000 per vehicle between 2010 and 2020.

Phase 1: $20 million
Phase 2: $60 million

The District anticipates making available up to $3 million per year towards both the development and deployment of more efficient drive trains for medium- and heavy-duty vehicles, subject to availability of funding and approval of the District governing board.

Co-benefits:
Development and widespread usage of more energy efficient drive-trains and power systems for trucks will reduce water pollution, save fuel, and increase opportunities for "green" jobs. There is also the potential for reduced business and consumer costs, especially in light of rising petroleum fuel costs.

Monitoring Mechanisms:
Progress and Final reports from any Air District grants or incentives.
Progress and Final reports made available from the CEC and CARB for their alternative fuel, technology advancement and climate change programs.
Reports developed as part of the Calstart Hybrid Trucks Users Group's efforts.
Progress and Final reports made available from the federal EPA, DOT and DOE.

Issues/Impediments:
As with all technology advancement efforts, obstacles for this measure revolve around feasibility, durability and cost of hybrid electric and hybrid hydraulic engine systems. However, since this measure is focused on research and development, any efforts to advance the development of more energy efficient systems will be an advantage.

Sources:

1. CalStart/Weststart, Hybrid Truck Users Forum, http://www.calstart.org/Projects/Hybrid-Truck-Users-Forum.aspx
2. Van Amburg, Bill, CalStart, "Emerging Clean Fuel & Vehicle Technology Options for Fleets: How Fleets Can Pepare and Plan for Change," presented to NAFA Conference, New Orleans, LA, April 27, 2009. Available online at http://www.calstart.org/Libraries/Consulting/Emerging_Clean_Fuel_Vehicle_Technology_Options_for_Fleets.sflb.ashx
3. Lowe, Marcy et al., Center on Globalization Governance & Competitiveness, Manufacturing Climate Solutions, Carbon-Reducing Technologies and U.S. Jobs, Chapter 9, Hybrid Drivetrains for Medium- and Heavy-Duty Trucks, June 10, 2009. Available online at

http://www.cggc.duke.edu/environment/climatesolutions/greeneconomy_Ch9_HybridDrivetrainsforTrucks.pdf

4. Kenworth Trucks brochure, "Kenworth T270 Class 6 and T370 class 7 Medium Duty HYBRID CONVENTIONAL," 2008. http://www.kenworth.com/brochures/T270T370Hybrid.pdf
5. Slezak, Lee, *Annual Progress Report for Advanced Vehicle Technology Analysis and Evaluation Activities and Heavy Vehicle Systems Optimization Program*, United States Department of Energy, Vehicle Technologies Program, 2009
6. Department of Energy and 21st Century Truck Partnership, *Roadmap and Technical White Papers*, 21CTP-003, December 2006.
7. ARB, "Hybrid Truck and Bus Incentive Program (HTIP) Development: Concepts for HTIP Implementation," January 13, 2009 AQIP Working Group. http://www.arb.ca.gov/msprog/aqip/meetings/hyip_wg_discussion_paper_01_13_09.pdf

MSM C-1 - Construction and Farming Equipment

Brief Summary:
The Air District will work to reduce emissions from construction and farming equipment by pursuing the following strategies: a) expenditure of cash incentives between 2010 and 2020 to retrofit engines with diesel particulate filters or upgrade to equipment with electric, Tier III or Tier IV off-road engines; b) work with the California Air Resources Board, the California Energy Commission and others to develop more fuel-efficient off-road engines and drive-trains; and c) work with local communities, contractors, farmers and developers to encourage the use of renewable electricity and renewable fuels, such as biodiesel from local crops and waste fats and oils, in applicable equipment.

Purpose:
This measure will reduce ozone precursors, diesel particulate matter, and carbon dioxide.

Source Category/Travel Market Affected:
Farm and Construction Equipment

Regulatory Context and Background:
Construction and farming equipment contribute approximately 15% of the regional inventory of NOx emissions, and 5% of PM2.5 emissions. Construction equipment is also a contributor to local exposure of diesel PM. Criteria pollutant emissions from the engines – which are primarily diesel – in construction and farming equipment are subject to control under regulations adopted by both California Air Resources Board and the federal Environmental Protection Agency.

The ARB's control of criteria pollutant emissions from off-road engines used in construction and farming equipment was authorized by the California Clean Air Act as codified in the Health and Safety Code sections 43013 and 43018. In 1992, ARB approved initial regulations to control exhaust emissions from heavy-duty off-road compression ignition (CI) engines 175 horsepower (130 kilowatts) and above. These initial standards are referred to as Tier I standards. In 1994, ARB approved the State Implementation Plan (SIP) for ozone containing measures calling for new state and national emission standards for off-road CI engines beginning in 2005.

U.S. EPA promulgated new emission standards for off-road engines in 1998, with ARB adopting parallel standards in 2000. The standards were progressive and phased in through two additional stages which are referred to as Tiers 2 and 3. In 2004, final Tier 4 emission standards were adopted; Tier 4 standards are scheduled to phase in for new engines between 2011 and 2014. The coordinated efforts of ARB, U.S. Environmental Protection Agency, and the engine manufacturers to introduce lower-emission off-road CI engines nationwide will result in substantial air quality benefits in California and the rest of the country.

However, recognizing that construction and farming equipment are long-lived, with existing engines remaining in service for many years, ARB adopted in 2007 a regulation to accelerate reductions of NOx and diesel PM from existing off-road engines between 2012 and 2023 by requiring operators to either install abatement equipment, upgrade to Tier 3 and eventually Tier 4 engines, or to retire older equipment with Tier 1 and 2 engines.[2]

ARB's AB 32 Scoping Plan, adopted in 2008, identified a strategy for reducing CO2 from a variety of sources in California, including construction and farming equipment. ARB's strategies include reducing the carbon content of diesel fuel; promoting alternative, renewable diesel fuels, and investigating ways of increasing fuel economy.

Implementation Actions:
This control measure will primarily focus on assisting fleets to achieve early compliance with the ARB in-use off-road engine control measure and supporting research efforts to develop and deploy more efficient engines and cleaner, renewable fuels for construction and farming equipment.

- Between 2010 and 2020 work to either directly and/or encourage partners to provide incentives for the early deployment of 1000 electric, Tier 3 and 4 off-road engines, as well as installation of 500 verified retrofit devices to control diesel PM. The interim goals for 2012 are 200 new engines and 100 retrofits.
- Between 2010 and 2015, coordinate with ARB and the CEC, as well as construction firms, farmers and others, to support field demonstrations of advanced technology for off-road engines and hybrid drive trains. Targeted technology should be those that reduce both criteria pollutants and greenhouse gases at the same time by focusing on fuel economy and renewable fuels.
- Between 2010 and 2015, provide support for the field demonstration of off-road equipment that runs on renewable electricity and diesel, with an emphasis placed on fuels that can be developed and produced locally.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.04	0.20
NO_x	0.72	3.60
PM10	0.02	0.09
$PM_{2.5}$	0.02	0.09

[2] At its April 22, 2010 meeting, the Air Resources Board directed their staff to develop amendments to the Off-Road In-use regulation to provide regulatory relief to construction firms hard-hit by the economic slump. The initial direction is for staff to provide compliance flexibility for diesel PM , while maintaining a 2014 deadline, and to relax requirements for reducing NOx.

More information is available at http://www.arb.ca.gov/msprog/ordiesel/documents/diesel2010may.pdf

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH_3 (ammonia), Benzene, Formaldehyde, Acetaldehyde, and 1,3 Butadiene.

Emission Reduction Methodology:
To estimate emission reductions for this measure, District staff assumed that the typical projects over the next ten years will consist of the replacement of Tier 1 compliant off-road engines rated at 350 brake horse power-hour with new Tier 4 compliant engines. Each engine is assumed to operate 1,000 hours with an average load factor of 60%. Staff also assumed that for the 2020 goal one-half of the new engines will operate on biodiesel.

Exposure Reduction:
Efforts to reduce diesel PM will reduce exposure of residents and workers in the vicinity of construction sites and farms. Additionally, reduction of NOx emissions will help reduce regional ozone levels/exposure, while reductions in both NOx and diesel PM emissions will contribute to reductions in the directly emitted PM and formation of secondary PM, reducing overall population exposure to fine particulate matter.

Emission Reduction Trade-offs:
The installation of diesel PM filters and other abatement devices generally reduces fuel economy by approximately 3%, and therefore increases emissions of CO_2 by a corresponding amount.

Cost:
District staff assumes that the cost of this measure is equal to the incentive amount offered to get a fleet operator to replace a Tier 1 engine with a Tier 4 engine in advance of the CARB regulation. We estimate the average incentive to be $50,000 per engine. We estimate diesel PM retrofit filters to cost $20,000 per engine. Based on these assumptions, this measure will cost approximately:

Phase 1: $12 million
Phase 2: $41 million

It is anticipated that the District will make available up to $3 million per year in incentives for the purchase of new electric, Tier 3 and Tier 4 engines, as well as the installation of verified diesel PM control devices between 2010 and 2020.

Co-benefits:
New engines for construction and farming equipment are incorporating better control of lubricating oils and unburned fuel droplets from crankcases, resulting in less oil leaking on the ground, thereby reducing harmful water pollution. The development of more energy efficient engines and drive-trains, as well as local development of renewable diesel should both result in energy savings and the creation of “green” jobs.

Monitoring Mechanisms:

- Equipment and engine information submitted to CARB as part of the off-road in-use ATCM.
- Progress and Final reports from Air District grants or incentives.
- Progress and Final reports made available from the CEC and CARB for their alternative fuel, technology advancement and climate change programs.

Issues/Impediments:

- Funding for engine subsidies.
- Interest from fleets in early compliance with CARB's off-road in-use engine air toxic control measure.
- Availability of diesel PM retrofits for construction and farm equipment.

Sources:

1. BAAQMD, Base Year 2005 Emissions Inventory: Summary Report, December 2008
2. BAAQMD, Base Year 2005 Emissions Inventory: Source Categories, December 2008
3. BAAQMD, Source Inventory of Bay Area Greenhouse Emissions, December 2008
4. State of California, Air Resources Board, *Staff Report: Initial Statement of Reasons for Proposed Rulemaking: Proposed Regulation for In-Use Off-Road Diesel Vehicles*, April 2007.
5. State of California, Code of Regulations, Title 13, Section 2449 et seq., 2009
6. State of California, Air Resources Board, Carl Moyer Program: http://www.arb.ca.gov/msprog/moyer/moyer.htm

MSM C-2 - Reduce Emissions from Lawn and Garden Equipment

Brief Summary:
Use of gasoline lawn mowers and leaf blowers contribute to summertime ozone levels primarily through the release of ROG. While progressively more stringent emission standards have reduced pollution from lawnmowers and leaf blowers, sufficient numbers of older two-stroke and four stroke engines remain in use in the Bay Area to warrant Air District efforts to pursue a clean-up program. The Air District will pursue removal of these older engines through voluntary exchange programs that target residential lawn mowers and backpack-style leaf blowers used by professional gardeners and landscapers.

Purpose:
This measure will reduce ozone precursors, particulate matter, toxic air contaminants and greenhouse gases.

Source Category/Travel Market Affected:
Lawn, Garden & Utility Equipment: Gasoline Lawn Mowers and Leaf Blowers

Regulatory Context and Background:
The lawn, garden & utility equipment category is comprised of a wide variety of small engines used in lawn mowers, leaf blowers, chainsaws, trimmers, shredders, stump grinders, commercial turf equipment and other types of equipment that collectively account for slightly more than 5% of the total ROG inventory in the Bay Area. This equipment primarily uses gasoline engines, although there is some diesel and propane powered equipment. Electric powered equipment has begun to gain market share, particularly with lawnmowers, chainsaws, leaf blowers and other small equipment used by homeowners.

The gasoline engines on such small equipment were first regulated in 1995 by the Air Resources Board, with the newest, most stringent regulations becoming effective with the MY 2008 equipment. Staff currently estimates there to be 1.16 million lawnmowers and leaf blowers in the Bay Area, of which approximately 70,000 are two stroke lawnmowers and 258,000 are two-stroke leaf blowers. Two stroke engines generate significantly more air pollution, especially particulate matter, compared to four stroke engines. The Air District conducted lawn mower exchange programs between 1999 and 2006 by offering cash incentives to consumers to purchase electric or mechanical equipment. Residents exchanged slightly more than 7800 two- and four-stroke lawnmowers for new electrical and mechanical mowers. Estimated emission reductions from the program were 5.3 tons per year of ROG, NOx and PM, at an annualized cost-effectiveness of approximately $7,800 per ton. The Air District expended $780,000 to buy down the cost of the new lawnmowers for the participating homeowners, along with additional funds on administration and advertising by the then Public Information and Outreach Division (now the Communication and Outreach Division).

Funding for implementing lawn and garden equipment exchange programs was included in the AB 118 Air Quality Improvement Program (AQIP). The AQIP program is administered by CARB, with assistance from local air districts. The purpose of the AQIP Lawn and Garden Equipment Replacement Project is to encourage further development and deployment of cordless zero-emission lawn and garden equipment. Under this program, up to $250 will be made available for each electric cordless residential lawn mower purchased by a qualified homeowner. In 2009, $1.6 million was awarded to eight air districts; the Bay Area was not among the awardees. It is anticipated that additional AQIP funding will be available in 2010 and 2011.

The South Coast Air Quality Management District periodically conducts exchange programs for "backpack" style leaf blowers used by professional gardeners and landscapers. The program's fourth round of exchanges was conducted in August 2009. Under this program, companies pre-register to exchange up to ten leaf blowers; for each old leaf blower turned in, the company can purchase a new low emission machine at a 50% to 60% discount.

Implementation Actions:
The Air District will:

- Re-establish its exchange program for replacing older gasoline lawnmowers with mechanical push and electrical lawnmowers. The program will target two-stroke engines as an initial priority prior to targeting pre-2008 four-stroke gasoline engines.
- Establish an exchange program for gasoline powered two-stroke "backpack" leaf blowers used by professional gardeners and landscapers.
- Explore options to expand the program to cover chainsaws, trimmers, shredders, stump grinders, commercial turf equipment and other types of lawn mowers. Expansion of the program will depend on the availability of significantly cleaner replacement equipment, costs, equipment turnover rates, and population size.

By 2012: Replace up to 3,000 lawn mowers and up to 5,000 leaf blowers
By 2020: Replace up to 10,000 lawn mowers and up to 50,000 leaf blowers

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.04	0.26
NO_x	0.01	0.01
PM10	0.01	0.07
$PM_{2.5}$	0.01	0.05
C02-e	0.00	0.64

Emission Reduction Methodology:
For this measure, District staff assumed that the typical project would consist of replacing an existing two-stroke 4 hp lawnmower or leaf blower with a new electric or mechanical push lawnmower or an electric or new Tier 3 compliant, four-stroke gasoline leaf blower. Emission factors were taken from the Air Resources Board OFFROAD2007 emissions model.

Exposure Reduction:
Older gasoline engines emit high levels of hydrocarbons, many species of which are listed as air toxics. Exchanging the older equipment with either electric or low-emission new engines will result in reductions in toxic emissions.

Emission Reduction Trade-offs:
This measure will reduce emissions of NOx, ROG, CO, PM and CO2, but because it replaces a piece of gasoline powered equipment with an electric powered equivalent, it will contribute to an incremental increase in electricity production, which may cause slight increases in emissions from power plants.

Cost:
The main cost of this measure is the discount for the new electric lawn mowers and leaf blowers that are provided to program participants. The cost of this program will be shared by the Air District, vendors and the equipment owner. The cost of an electric lawn mower ranges from $200 to $300; the cost of a mechanical push mower ranges from $80 to $140; the cost of an electric leaf blower ranges from $30 to $70. The Air District anticipates seeking up to $2 million per year to fund this measure. In addition to direct cost for rebates on new equipment, additional costs would be incurred by the Air District to manage and advertise the program, and to ensure appropriate disposal of the older equipment that will be retired through the replacement program.

Co-benefits:
Use of push lawn mowers, electric lawn mowers and low-emission leaf blowers will result in reductions in water pollution and fossil fuel use. There will also be consumer savings. New leaf-blowers also operate at lower decibel levels, reducing noise impacts.

Monitoring Mechanisms:
Progress will be measured by tracking the number of older gasoline engines that are removed from service in exchange for mechanical and electric powered equipment.

Issues/Impediments:
The main obstacle is the need to secure funding to implement this measure. While funding is potentially available through the CARB-administered AB 118 program, limitations on the amount available statewide and types of qualifying equipment will mean other sources of funding will be crucial for the success of this control measure. If funding is secured, then the level of interest from residents and professional gardeners in replacing old equipment with new zero and low-emission equipment could also be a limiting factor.

Experience with the earlier lawn mower exchange program from 1999 to 2006 suggests that a program that focuses on offering rebates through the manufacturers instead of an exchange effort will enhance the program's cost-effectiveness and simplify implementation.

Sources:

1. BAAQMD, Base Year 2005 Emissions Inventory: Summary Report, December 2008
2. BAAQMD, Base Year 2005 Emissions Inventory: Source Categories, December 2008
3. BAAQMD, Source Inventory of Bay Area Greenhouse Emissions, December 2008
4. CARB, *Article 1, Chapter 9, Division 3, Title 13, California Code of Regulations*
5. CARB, Initial Statement of Reasons for Proposed Rulemaking: Exhaust and Evaporative Emission Control Requirements for Small Off-Road Equipment and Engines Less Than or Equal to 19 Kilowatts, August 8, 2003
6. CARB, website for AB 118 Lawn and Garden Equipment Replacement Project: http://www.arb.ca.gov/msprog/aqip/lger.htm
7. CARB, Proposed AB 118 Air Quality Improvement Program Funding Plan for Fiscal Year 2009-10, March 23, 2009.
8. CARB, AB 118 Air Quality Improvement Program: FY 2010-11 Funding Plan Discussion Document, 4/1/2010.
9. SCAQMD, *Leaf Blower Exchange Program*, http://www.aqmd.gov/tao/leafblowerexchange.htm

MSM C-3 - Reduce Emissions from Recreational Watercraft

Brief Summary:
Use of four-stroke or two-stroke inboard/outboard engines in pleasure craft contribute to summertime ozone levels primarily through the release of ROG. While progressively more stringent emission standards have reduced pollution from these engines, sufficient numbers of older four- and two-stroke engines remain in use in the Bay Area to warrant Air District efforts to pursue a clean-up program. In addition, new inboard/outboard engines are also more fuel efficient.

Purpose:
This measure will reduce ozone precursors, particulate matter and greenhouse gases.

Source Category/Travel Market Affected:
Recreational Watercraft

Regulatory Context and Background:
The recreational vessel category is comprised of relatively small outboard engines that are mounted to the rear or side of small craft and sailboats, as well as larger inboard engines that are mounted within the vessel and connect to propellers via a shaft. This measure focuses on reducing emissions from the small outboard motors.

Outboard gasoline engines were first regulated in 1995 by the Air Resources Board, with the newest, most stringent regulations becoming effective with the MY 2008 equipment. There are currently an estimated 135,500 inboard/outboard engines in the Bay Area, of which approximately 87,000 or 64% are two-stroke, high-emitting outboard engines. Increasingly stringent emission standards and resulting advances in engineering have made four-stroke gasoline inboard/outboard and electric engines readily available.

Implementation Actions:
The Air District will establish a voluntary exchange program to retire older gasoline-powered four-stroke and two-stroke outboard engines used in small pleasure craft. The Air District is focusing on the replacement of outboard engines under this measure because of the lower replacement costs per engines. The goal of the program will be to:

- Replace up to 3,000 outboard motors by 2012.
- Replace up to 10,000 outboard motors by 2020.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.06	0.02
NO_x	0.01	0.01
$PM_{2.5}$	0.01	0.01
C02-e	0.42	1.38

Emission Reduction Methodology:
Emission reductions have been estimated by comparing the incremental difference in emissions between a new four-stroke 50 horsepower (HP) engine meeting the lowest emission standards and an average MY 2000 two-stroke 50 hp engine. Emission factors and usage rates are from CARB's OFFROAD model. The outboard engines were assumed to operate approximately 1100 hours per year.

Exposure Reduction:
Older gasoline engines emit high levels of hydrocarbons, many species of which are listed as air toxics. Exchanging the older equipment with either electric or low-emission new engines will result in reductions in toxic emissions.

Emission Reduction Trade-offs:
To the extent electric motors are purchased as replacements there will be an incremental increase in the production of electricity, which may incrementally increase emissions of particulate matter and greenhouse gases from power plants.

Cost:
Costs for this measure may be borne by government agencies in the form vouchers to buy-down the price of new motors, disposal of old engines, and program administration. The main cost for consumers will be the balance of the purchase price for a new engine. The Air District has not identified possible funding sources for this measure, but anticipates seeking up to $2-3 million in funding per year.

Co-benefits:
Use of four-stroke engines will decrease water pollution: Two-stroke engines use a gasoline and oil fuel mixture, with unburned fuel being exhausted directly into the water. The increase use of more fuel-efficient electric and four-stroke gasoline engines will reduce oil consumption; the improved fuel economy of newer engines will also reduce fuel costs for consumers.

Monitoring Mechanisms:
This measure will be monitored via the vouchers awarded to participants to purchase a cleaner outboard motor.

Issues/Impediments:
The main issues for this measure are:
- Interest in the public in participating in the voluntary buy-down/exchange program for new outboard engines;
- Availability of monetary incentives from government agencies to fund the program.

Sources:

1. BAAQMD, Base Year 2005 Emissions Inventory: Summary Report, December 2008
2. BAAQMD, Base Year 2005 Emissions Inventory: Source Categories, December 2008
3. BAAQMD, Source Inventory of Bay Area Greenhouse Emissions, December 2008
4. Air Resources Board, OFFROAD2007 Emissions Model, http://www.arb.ca.gov/msei/offroad/offroad.htm
5. South Coast Air Quality Management District, "SCOFFRD-06 -- Accelerated Turnover and Catalyst Based Standards for Pleasure Craft [VOC, NOx, PM]," FINAL 2007 Air Quality Management Plan, June 2007.

BAY AREA
2010 CLEAN AIR PLAN

VOLUME II

Section C

Transportation Control Source Measures

September 2010

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

939 Ellis Street
San Francisco, CA 94109
(415) 771.6000
www.baaqmd.gov

TCM A-1 – Local and Area-wide Bus Service Improvements

Brief Summary:
TCM A-1 will improve transit by sustaining and improving existing service, including new Express Bus or Bus Rapid Transit on major travel corridors, funding the replacement of older and dirtier buses, and implementing the Transit Priority Measures (TPMs) component of the Transportation Climate Action Campaign.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by sustaining and improving bus service throughout the Bay Area. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips.

Regulatory Context and Background:
In its Transportation 2035 Plan, MTC estimates that transit operating and capital replacement costs for Bay Area transit providers are projected to total $138 billion over the next 25 years. This includes $98 billion in operating costs plus $40 billion for capital replacement. Revenues available to address these needs total $113 billion, leaving a shortfall of $25 billion ($8 billion for operations and $17 billion for capital replacement). Bus and other bus capital needs total approximately $13 billion; the Transportation 2035 Plan includes $5 billion in committed funds and $2 billion in discretionary funds towards these needs, leaving a remaining shortfall of $6 billion.

In light of the transit operating and capital replacement shortfalls, the Transportation 2035 Plan also sets forth MTC's commitment to proceed with the Transit Sustainability Project. This Project aims to improve transit's core performance and financially stability as well as identify service productivity improvements that will yield more from the region's investment in transit services. Further, it may help transit operators, each of whom are responsible for their own transit operating and capital budgets, to prioritize and make more cost-effective use of limited transit funds.

Adopted as part of the 2001 Regional Transportation Plan, MTC's Resolution 3434 Regional Transit Expansion Program is an $18 billion, long-term, and multifaceted funding strategy for directing local, regional, state and federal dollars to nearly two dozen high-priority bus, rail and ferry expansions. The bus service expansion projects included in Resolution 3434 are as follows:
- AC Transit Berkeley/Oakland/San Leandro Bus Rapid Transit
- AC Transit Enhanced Bus: Hesperian/Foothill/MacArthur corridors

- Regional Express Bus (multiple transit operators)
- SFCTA/SFMTA Van Ness Avenue Bus Rapid Transit
- VTA Downtown to East Valley Bus Rapid Transit

In 2004, voters passed Regional Measure 2 (RM 2), raising the toll on the seven State-owned toll bridges by $1.00. This extra dollar funds various transportation projects within the region, including express buses that reduce congestion or make improvements to travel on the toll bridges, as identified in SB 916 (Chapter 715, Statutes of 2004).

Adding more service and development of new service concepts (such as enhanced bus, Bus Rapid Transit (BRT), and Regional Express Buses) to better serve existing markets and fill in regional transit gaps are determined by the individual transit operators as revenue permits. Decisions on expanding bus service must address both the needs of commuters as well as low-income, elderly, disabled and youth travelers who do not have access to other travel options. During weekday peak hours in 2006, bus transit provided over 1.3 million seat miles per hour in the Bay Area.[3]

Diesel bus emissions can be reduced by acquiring new heavy-duty clean air vehicles or installing retrofit devices on existing heavy-duty diesel bus engines. MTC has provided $14 million in Congestion Mitigation Air Quality Improvement (CMAQ) funds to retrofit 1,700 diesel buses operated by 12 transit operators; the Air District contributed the required CMAQ match (11.5%) for this project. In addition, since 2003 the Air District's Lower Emission School Bus Program has replaced 84 school buses at a cost of approximately $11.2 million and retrofitted 204 buses with diesel particulate filters at a cost of $1.3 million. The Air District has also spent $7 million on retrofitting diesel transit buses and purchasing alternative fuel transit buses since 2003. The Air District's Advanced Technology Program provides funding to promote new vehicle technologies, such as hybrid heavy-duty trucks and buses.

MTC's Transportation 2035 Plan launched a new program, the Transportation Climate Action Campaign, to reduce the region's carbon footprint. The $400 million campaign includes new funding for Transit Priority Measures. Transit Priority Measures (TPMs) are operational improvements or road-related infrastructure that preserves and improves bus speed and on-time reliability, and reduces variability in travel times and delay of buses. Case studies indicate significant ridership gains can be realized when TPMs are packaged with improvements in headways and other operations improvements (fewer bus stops, unique branding, all-door boarding and pre-paid fares) typically associated with BRT (Koonce, et al 2006). Note that as of December 2009, MTC approved $80 million in the first programming cycle of the new federal transportation act for four primary climate initiatives: 1) Public

[3] Seat miles are a measure of transit capacity and are calculated by multiplying the number of transit vehicle miles traveled by the number of seats in each vehicle. For more information, see Table C-3 in the T2035 Travel Forecast Data Summary (Dec. 2008) available on the MTC website.

Education/Outreach; 2) Safe Routes to Schools, 3) Innovative Grants; and 4) Climate Action Program Evaluation. Funding for TPMs has yet to be identified.

Implementation Actions:
Phase 1 (2012):
MTC to fund:
- The timely replacement of worn-out buses in local transit operator fleets ($900 million)
- Operations of existing services where feasible with available funding ($4 billion)
- Regional Measure 2 Express Bus North and Express Bus South Improvements ($62 million)
- Transit Priority Measures component of the Transportation Climate Action Campaign (includes arterial bus lanes, transit signal priority, queue jumper lanes, and bus bulbs) ($TBD – as noted above, funding for the TPM element of the Transportation Climate Action Campaign has not yet been identified.)

BAAQMD to fund:
- Lower Emission School Bus Program (LESBP) to replace and retrofit school buses. ($45 million)
- The Advanced Technology Program to fund hybrid buses and demonstration projects ($1.5 million)

Phase 2 (2020):
MTC to fund:
- Sustain service of Express Buses as identified in Phase 1 and operations of existing services where feasible with available funding ($72 million)
- The timely replacement of worn out buses in local transit operator fleets as funding becomes available ($2.4 billion)
- Bus Rapid Transit Service on the Telegraph Avenue/International Boulevard/E. 14th Street Corridor ($250 million)
- Bus Rapid Transit Service on the Grand-MacArthur Corridor ($41 million)
- Enhanced Rapid Bus Service in Livermore, Dublin, and Pleasanton (includes higher frequencies, new stops and improved stop amenities) ($14 million)
- Bus Rapid Transit project on Van Ness Avenue (includes dedicated transit lanes, signal priority and pedestrian and urban design upgrades) ($88 million)
- Bus Rapid Transit as Phase 1 in the Santa Clara-Alum Rock Corridor with the potential to convert to light-rail in the future (Santa Clara-Alum Rock Phase 1) ($132 million)
- Transit Priority Measures component of the Transportation Climate Action Campaign (includes arterial bus lanes, transit signal priority, queue jumper lanes, and bus bulbs) ($TBD)

BAAQMD to continue to fund Phase 1 programs:
- Lower Emission School Bus Program (LESBP) to replace and retrofit school buses. ($120 million)

- The Advanced Technology Program to fund hybrid buses and demonstration projects ($4 million)

Supporting Actions by Partner Entities:
- Transit agencies and CMAs to work with MTC as appropriate to implement service improvements.
- School Districts, transit agencies and CMAs to work with BAAQMD to implement diesel emission reduction programs.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.03	0.04
NO_x	0.03	0.04
$PM_{2.5}$	0.001	0.001
PM_{10}	0.005	0.01
CO_2	22.53	71.37
C02-e	23.36	72.80

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
Implementing Express/BRT Service: This analysis uses Transportation 2035 Travel Forecasts data to estimate future ridership due to the expansion of Regional Express Buses, and it uses existing ridership projections for BRT developed by AC Transit, SFCTA, and VTA. Growth factors, based on increases in each transit operator's ridership modeled as a part of the T2035 travel forecasts, are applied to bring the ridership estimates to analysis years 2012 and 2020. Using local data, estimated new ridership is reduced to factor in new riders that are transit dependent and those who drive to access the bus, resulting in the number of vehicle trips reduced. Additional adjustments are made to calculate vehicle miles traveled reduced based on average transit trip lengths and the average distance traveled to the bus stop by non-motorized modes.

Transit Priority Measures: While funding has not yet been identified for TPMs, this emissions analysis assumes a very limited implementation of TPMs in four corridors, specifying an assumed cost of $5 million for two corridors in Phase 1. This analysis uses empirical findings that suggest a 4-7% increase in corridor ridership is reasonable to expect after implementation of TPMs. The average ridership among major bus corridors in the Bay Area is increased by 8-14% in 2012 (assuming TPMs will be implemented on two corridors) and 16-28% in 2020 (assuming TPMs will be implemented on an additional two corridors). Using local data, estimated new ridership is reduced to factor in new riders that are transit dependent and those who drive to access the bus, resulting in the number of vehicle trips reduced. Additional adjustments are made to calculate vehicle miles traveled reduced based on average transit trip lengths and the average distance traveled to the bus stop by non-motorized modes.

Advanced Technology Program: Assumes an average project life of 7 years for each project. Emission reductions estimates are based on emission reductions achieved in previous funding years.

Analysis excludes: maintaining bus fleet and operating existing services, Express Bus North and South capital improvements, enhanced rapid bus in Livermore, Dublin, and Pleasanton, and Lower Emissions School Bus Program.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
Adding diesel retrofit devices to diesel engines may result in a decrease in fuel efficiency. This will thereby cause a modest increase in emissions of carbon dioxide, a greenhouse gas that contributes to climate change. For example, CARB and the EPA estimate that an urban bus with a retrofit device added to reduce emissions of PM and/or NOx would experience a decrease in fuel efficiency of 3.5 percent on average. For an urban bus traveling 20,000 miles per year, this decrease is estimated to result in an additional 4,026 pounds per year of carbon dioxide.

Cost:
Phase 1: $5.0 billion
Phase 2: $3.1 billion

Co-benefits:
- Improved connectivity between transit services and destinations.
- Travel time savings from TPMs and new express/enhanced bus projects that provide faster and/or more direct service between trip origins and destinations.
- Transportation cost savings by providing new bus transit options that may allow some households to own fewer or no cars.
- Community enhancements through creation of more and higher quality transit options and services.
- Provide incentives to jump-start the heavy-duty hybrid bus market and create demonstration projects that increase knowledge about the technological feasibility of hybrid buses.

Monitoring Mechanisms:
- Track capital rehabilitation and replacement using the Regional Transit Capital Inventory (RTCI).

- Track number of diesel buses retrofitted or replaced and emissions benefits associated with these upgrades.
- Track implementation status of express bus or BRT projects.
- Track on-time performance on routes with TPMs.
- Track performance of in-service hybrid buses.

Issues/Impediments:
Implementation of this TCM requires that funding is available for these programs. Due to the current economic recession, cuts in State transit funding, including funds for cleaner buses, reductions in sales tax revenue for transit, Bay Area transit operators are facing challenges to maintain and sustain their existing systems and, in light of financial constraints, are cutting their transit budgets, cutting service, increasing fares, and/or delaying or deferring capital maintenance and service expansions. Thus, maintaining the existing fleet, sustaining existing services, restoring service that has been cut, and expanding service will require new funding. New revenues may be available in the future from higher gas taxes, bridge tolls, and voter approved sales tax revenues in individual counties.

Sources:
1. MTC's Transportation 2035 Plan and Travel Forecasts Data Summary: http://www.mtc.ca.gov/planning/2035_plan/
2. AC Transit's Strategic Vision: A World Class Transit System for the East Bay 2001-2010, http://www.actransit.org/pdf/planning_focus/planning_focus_121.pdf?PHPSESSID=9
3. SFCTA's Van Ness Avenue Bus Rapid Transit (BRT) Feasibility Study, http://www.sfcta.org/content/view/425/252/
4. VTA's Draft Environmental Impact Report (DEIR) for the Santa Clara-Alum Rock Transit Improvement Project (2008), http://www.vta.org/projects/dtev/eir_draft.html
5. Koonce, Peter, Paul Ryus, David Zagel, Young Park, and Jamie Parks (2006). "An Evaluation of Comprehensive Transit Improvements – TriMet's Streamline Program." Journal of Public Transportation, 2006 BRT Special Edition, pp. 103-115, http://www.nctr.usf.edu/jpt/pdf/JPT%209-3S%20Koonce.pdf

TCM A-2 - Local and Regional Rail Service Improvements

Brief Summary:
TCM A-2 will improve rail service by sustaining and expanding existing services and by providing funds to maintain rail-cars, stations, and other rail capital assets. Specific projects for implementation include BART extensions, Caltrain electrification, Transbay Transit Center Building and rail foundation, Capital Corridor intercity rail service, and Sonoma Marin Area Rail Transit (SMART) District commuter rail project.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by sustaining and improving rail service throughout the Bay Area. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips. In addition, it would affect inter-regional travel.

Regulatory Context and Background:
In its Transportation 2035 Plan, MTC estimates that transit operating and capital replacement costs for Bay Area transit providers are projected to total $138 billion over the next 25 years. This includes $98 billion in operating costs plus $40 billion for capital replacement. Revenues available to address these needs total $113 billion, leaving a remaining shortfall of $25 billion ($8 billion for operations and $17 billion for capital replacement). Rail-car and other rail capital needs total approximately $26 billion; the Transportation 2035 Plan includes $11 billion in committed funds and $4 billion in discretionary funds towards these needs, leaving a remaining shortfall of $11 billion.

The Bay Area's rail system includes light-rail (such as Muni Metro and VTA Metro), rapid rail (such as BART), and commuter rail (such as Caltrain, Capitol Corridor and ACE) services. During weekday peak hours in 2006, rail transit provided over 2 million seat miles per hour in the Bay Area[4].

Adopted as part of the 2001 Regional Transportation Plan, MTC's Resolution 3434 Regional Transit Expansion Program is an $18 billion, long-term, and multifaceted funding strategy for directing local, regional, state and federal dollars to nearly two dozen high-priority bus, rail and ferry expansions. The rail service expansion projects included in Resolution 3434 are as follows:

[4] Seat miles are a measure of transit capacity and are calculated by multiplying the number of transit vehicle miles traveled by the number of seats in each vehicle. For more information, see Table C-3 in the T2035 Travel Forecast Data Summary (Dec. 2008) available on the MTC website.

- BART/Oakland Airport Connector
- Tri-Valley Transit Access Improvements to BART
- East Contra Costa BART Extension (eBART)
- BART: Fremont to Warm Springs and Warm Springs to San Jose/Santa Clara
- Caltrain Express: Baby Bullet (Open for service)
- Caltrain Express: Phase 2
- Caltrain Electrification
- Transbay Transit Center (Phases 1 and 2)
- Capitol Corridor Expansion and Enhancements
- MUNI Third Street Light-Rail Central Subway
- ACE Service Expansion
- Sonoma-Marin Rail (SMART)
- Dumbarton Rail
- Downtown to East Valley Light Rail

MTC, in partnership with California High-Speed Rail Authority (CHSRA), Caltrain, and BART, adopted the Regional Rail Plan in September 2007, which included an evaluation of a Bay Area to Central Valley high-speed rail alignment. CHSRA certified the Bay Area to Central Valley Program EIR/EIS in July 2008. The CHSRA is currently proceeding with detailed project-level EIR/EIS for the high-speed train from San Jose to San Francisco. In addition, the CHSRA is currently working with Bay Area and Central Valley transportation agencies (via the Altamont Corridor Partnership Working Group) to implement a joint use regional rail and high-speed rail infrastructure project in the Altamont Corridor.

In November 2008, California voters passed Proposition 1A, the Safe, Reliable High-Speed Passenger Train Bond Act, which includes nearly $10 billion in general obligation rail bond proceeds to help finance construction of a high-speed rail link between San Francisco and San Diego. The Bay Area is slated to receive $408 million for improvements to ACE, BART, Caltrain, SFMTA, and VTA light-rail. In addition, the Bay Area is well-positioned to receive a significant portion of the $8 billion appropriation for high-speed rail included in the American Recovery and Reinvestment Act of 2009 (ARRA).

Seven of the 9 counties have adopted local sales tax measures that fund transportation improvements including rail expansion projects. Most recently, in November 2008, Santa Clara County voters approved the 1/8-cent Measure B to fund operations and maintenance of the BART to San Jose/Santa Clara extension and Sonoma and Marin county voters approved the 1/4-cent Measure Q to fully fund construction and operation of the Sonoma Marin Area Rail Transit (SMART) commuter rail.

Implementation Actions:

Phase 1 (2012)

MTC to fund:

- The timely replacement of worn out rail-cars and other rail capital assets in local transit operator fleets as funding becomes available ($1.8 billion)

- Operations of existing rail services where feasible with available funding ($2 billion)

Phase 2 (2020)
MTC to fund:

- The timely replacement of worn out rail-cars and other rail capital assets in local transit operator fleets as funding becomes available ($4.9 billion)
- Existing rail services where feasible with available funding ($5.3 billion)
- A BART Oakland Airport Connector between Coliseum BART station and Oakland International Airport ($459 million)
- Transit access improvements to BART in the Tri-Valley ($168 million)
- Extension of BART/East Contra Costa Rail (eBART) eastward from the Pittsburg/Bay Point BART station into eastern Contra Costa County ($525 million)
- Extension of BART from Fremont to Warm Springs ($890 million)
- Electrification of Caltrain from Tamien to San Francisco ($626 million)
- Transbay Terminal Phase 1: construct the new Transbay Transit Center Building and rail foundation ($1.2 billion)
- Capitol Corridor intercity rail service (includes increased track capacity, rolling stock and frequency improvements ($108 million)
- Sonoma Marin Area Rail Transit District (SMART) commuter rail project ($1.1 billion)
- Acquisition of right-of-way for ACE rail service between Stockton and Niles Junction, complete track improvements between San Joaquin County and Alameda County, and expand Alameda County station platforms ($150 million)
- Extension of BART from Fremont (Warm Springs) to San Jose/Santa Clara ($7.6 billion)
- Electrification of Caltrain line from Tamien Station to Gilroy ($140 million)
- Extension of Caltrain Express service (Phase 2): design and implement safety elements related to signal communication and positive train control; and implement system-wide level boarding program and terminal improvements ($427 million)
- Transbay Terminal Phase 2: extend Caltrain to the new Transbay Terminal ($3 billion)
- Capitol Corridor: Phase 2 enhancements (includes grade separations at High Street, Davis Street and Hesperian Street) ($89 million)
- Extension of Third Street Light-Rail line from north of King Street to Clay Street in Chinatown via a new Central Subway ($1.6 billion)
- Conversion of Bus Rapid Transit (BRT) to light-rail transit in the Santa Clara-Alum Rock corridor (Santa Clara-Alum Rock Phase 2) ($327 million)
- Commuter rail service on the Dumbarton Bridge ($301 million)
- High-Speed Rail: fund supporting infrastructure for ACE, BART, Caltrain, MUNI and VTA ($408 million)

Supporting Actions by Partner Entities: Transit, CMAs, airports and other agencies to work with MTC as appropriate to implement service improvements.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG		0.15

NO_x	0.15
$PM_{2.5}$	0.03
PM_{10}	0.04
Ammonia (NH3)	0.12
CO_2	506.29
C02-e	516.00

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
This analysis uses existing ridership projections for rail developed by transit operators for each project. Growth factors, based on increases in each transit operator's ridership modeled as a part of the Transportation 2035 travel forecasts, are applied to bring the ridership estimates to analysis year 2020 (analysis does not assume completion of any rail projects by 2012). Using local data, estimated new ridership is reduced to factor in new riders that are transit dependent and those who drive to access rail, resulting in the number of vehicle trips reduced. Additional adjustments are made to calculate vehicle miles traveled reduced based on average transit trip lengths and the average distance traveled to the rail station by non-motorized modes.

This analysis excludes estimates of emissions reduced from maintaining existing rail services and transit access improvements to transit access improvements to BART in the Tri-Valley, Caltrain electrification, extension of Caltrain to the Transbay Terminal, and supporting infrastructure for high-speed rail.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $3.8 billion
Phase 2: $30.1 billion

Co-benefits:
- Improved connectivity between transit services and destinations
- Travel time savings from providing new rail services that provide faster and/or more direct service between trip origins and destinations.
- Transportation cost savings by providing new rail transit options that may allow some households to own fewer or no cars.

- Community enhancements through creation of more and higher quality transit options and services.

Monitoring Mechanisms:
Track implementation status of rail projects.

Issues/Impediments:
Implementation of this TCM requires that funding is available for these programs. Due to the current economic recession, cuts in State transit funding, and reductions in sales tax revenue for transit, Bay Area transit operators are facing challenges to maintain and sustain their existing systems and, in light of financial constraints, are cutting their transit budgets, cutting service, increasing fares, and/or delaying or deferring capital maintenance and service expansions. Thus, maintaining the existing fleet, sustaining existing services, restoring service that has been cut, and expanding service will require new funding. New revenues may be available in the future from higher gas taxes, bridge tolls, and voter approved sales tax revenues in individual counties.

Environmental clearance, right-of-way availability and costs, funding for the capital, operating and maintenance costs and level of public support are major impediments to sustain, improve, upgrade, and expand rail services.

Sources:
1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/

TCM B-1 - Freeway and Arterial Operations Strategies

Brief Summary:
TCM B-1 will improve the performance and efficiency of freeway and arterial systems through operational improvements. These improvements include implementing the Freeway Performance Initiative (FPI), the Bay Area Freeway Service Patrol (FSP), and the Arterial Management Program.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by improving the efficiency of existing freeways and roadways throughout the Bay Area. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips.

Regulatory Context and Background:
Caltrans manages freeway operations through a comprehensive system for surveillance (traffic detectors, CCTV cameras), communication with motorists (traffic advisory signs) and system control (ramp meters, incident management). Through its Transportation Management Center (TMC), Caltrans is able to collect and process traffic information; to detect incidents as reported by freeway cameras, loop detectors in the freeway pavement, motorist calls and other sources; and to respond to incidents.

The Freeway Performance Initiative (FPI) aims to maximize the efficiency and improve the management and reliability of the existing freeway infrastructure, while limiting traditional expansion of the system to only the most essential locations. FPI addresses both recurrent daily traffic that comes from the surge of commuters using the freeways during rush hours and non-recurrent congestion that results from unanticipated incidents and blockages of highway lanes. In fact, half of the total congestion experienced in the Bay Area is caused by vehicle breakdowns, vehicular accidents, material spills and other incidents. In performance assessments of infrastructure packages evaluated during the development of Transportation 2035 Plan, MTC found that FPI is the most cost-effective means to deal with traffic congestion in the region.

In its Transportation 2035 Plan, MTC set-aside $1.6 billion over the next 25 years to implement FPI. FPI includes (a) Traffic Operations Systems (TOS): full deployment of monitoring and surveillance systems and implementation of ramp metering on the region's entire freeway network to improve efficiency and maximize use of the freeway system's available capacity; (b) TOS replacement: consistent maintenance and periodic replacement of infrastructure to ensure a fully functioning system; (c) Arterial coordination and management: coordination with and optimization of major arterials to maximize efficiency of the freeway system; and (d) Performance monitoring: monitoring to measure progress in freeway performance.

Arterial management includes traffic signals, signing and pavement marking, access management, parking management, and traffic calming. Over 3,500 of the Bay Area's 7,000+ traffic signals are part of coordinated systems. An additional 1,700 signals are close enough to be included in coordinated systems, but most local agencies cannot afford to interconnect their signals. Based on feedback from local traffic engineers, their greatest unmet needs involve resources and expertise for traffic signal timing and funding for the operation and maintenance of Smart Corridors. Most cities have not been able to meet these needs since the dot.com bust in 2001.

MTC has been investing in arterial management for over 20 years through the Traffic Engineering Technical Assistance Program (TETAP) and the Regional Signal Timing Program (RSTP). Between 2004 and 2009, over 3,500 traffic signals have been retimed, yielding 10 percent savings in travel time and fuel consumption, 7 percent reductions in mobile source emissions, and a benefit: cost ratio of 34:1. Similarly, since its inception in 1993, TETAP has funded over 250 operations and safety studies.

The Bay Area FSP is a joint project of the Metropolitan Transportation Commission Service Authority for Freeways and Expressways (MTC SAFE), the California Highway Patrol (CHP) and Caltrans. The service is provided by private tow truck companies, and during the hours of operation, the vehicles and drivers are exclusively dedicated to patrolling their freeway beat. Currently, a fleet of 83 trucks patrols some 550 miles of the Bay Area's freeways. Patrol routes are selected based on several factors, including a high rate of traffic and congestion, frequent accidents or stalls, and lack of shoulder space for disabled vehicles. The program is intended to augment the MTC SAFE network of motorist-aid call boxes in the nine Bay Area counties.

Implementation Actions:

Phase 1 (2012)

MTC to implement the following actions ($155 million):

- Through FPI, fill gaps in TOS infrastructure.
- Through FPI, install ramp meters at entrance ramps.
- Through the RSTP, coordinate traffic signals and continue to update timing plans. Arterial management strategies will consider and prioritize transit needs.
- Maintain the current level of FSP service which involves patrolling 540 miles of the Bay Area freeways. By 2012, FSP anticipates a reduction of up to ten trucks from the FSP fleet. Note that the FSP service levels are subject to change though the freeway miles covered are unlikely to be significantly affected.

Phase 2 (2020)
MTC to implement the following actions ($TBD):

- Through FPI, conduct routine replacement of TOS infrastructure at the end of its useful life.
- Through FPI, install additional TOS infrastructure.
- Through FPI, install additional ramp meters at entrance ramps and monitor and adjust meter timing as appropriate.
- Through the RSTP, coordinate additional traffic signals and continue to update timing plans.
- Expand FSP on I-280 from SR 92 to SR 85 in San Mateo and Santa Clara counties.

Supporting Actions by Partner Entities: Local governments, Caltrans, CMAs and transit agencies to work with MTC as appropriate to implement service improvements.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.99	1.06
NO_x	3.25	3.83
$PM_{2.5}$	0.12	0.16
PM_{10}	0.18	0.24
Ammonia (NH3)	0.07	0.09
Benzene	0.02	0.02
Formaldehyde	0.01	0.01
Acetaldehyde	0.01	0.01
CO_2	2,403.08	3,303.24
C02-e	2,451.00	3,369.30

Emission Reduction Methodology:
This analysis includes emissions reductions associated with implementation of the Freeway Performance Initiative (FPI), the Freeway Service Patrol (FSP), and the Regional Signal Timing Program (RSTP). These three components are calculated separately. The Freeway Performance Initiative uses model output from the Transportation 2035 Vision Analysis which compared four different investment scenarios on a range of performance objectives: 1) Baseline, 2) Freeway Performance (Freeway Operational Improvement) 3), High-Occupancy/Toll (HOT) Lanes Network And Express + Local Bus, and 4) Regional Rail and Water Transit. The net difference between air quality emissions associated with the Baseline and the Freeway Performance scenarios are used to determine emissions reductions associated with the project. Emissions reductions are estimated for year 2012 and 2020 based on 2035 model output. The Freeway Service Patrol uses a benefit-cost model developed by Caltrans with the cooperation of the 13 local agencies that operate the FSP programs around the state. Emission reductions were last calculated for the 2004-05 fiscal year. Similarly, estimates for the regional signal timing program use a benefit-cost model in which the general methodology, fuel consumption factors, and health costs of motor vehicle emissions are based on Caltrans' California Life-Cycle Benefit/Cost Analysis

Model; estimates are calculated using the average benefits from 64 projects involving 1975 retimed traffic signals. For both FSP and RSTP, the 2004-05 emissions reductions are used to estimate 2012 and 2020 emissions reductions.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Trade-offs:
ARB's motor vehicle emissions factors indicate that tailpipe emission rates for ROG, NOx, PM, and CO2 are lowest when vehicles travel in the 30-50 mph speed range. The estimated emission reduction benefits for this measure are based on the anticipated improvement in average vehicle speed due to expected reduction in congestion in the affected corridors. While the regional travel model estimates transportation emissions due to temporal, spatial and mode shifts resulting from increased roadway capacity, the potential emission reduction benefits of this measure may be eroded if reduced travel time in these corridors encourages additional vehicle travel or changes in land uses that would result in longer vehicle trips. To address this issue, the Air District will perform an independent analysis to evaluate the long-term impacts of this measure on vehicle travel and emissions.

Cost:
Phase 1: $ 155 million
Phase 2: $ TBD million

Co-benefits:
- Health and economic savings for both businesses and travelers from reduced congestion.
- Improved travel times, reduced fuel consumption and fewer collisions from retiming signals.
- Reductions in fuel usage, improved safety for stranded motorists, reductions in secondary accidents and improved motorist travel times from FSP services.

Monitoring Mechanisms:
- Track mobility (how well the corridor moves people and freight), reliability (the predictability of travel times), and safety as part of the comprehensive FPI corridor studies.
- Track savings in travel time, fuel consumption, and air emissions on a project-by-project and on an annual basis for Arterial Management Program.
- Collect detailed assist data and motorist experience information for Freeway Service Patrol services. The assist data is used by Caltrans to calculate benefit-cost ratios, fuel-savings, and pollutant reductions.

Issues/Impediments:
By making more efficient use of existing capacity, the FPI should help to improve air quality by reducing peak period congestion, as well as incident-related delay, on the Bay Area's freeways. However, ramp-metering may provide a greater travel time savings for vehicles making longer trips. Levinson and Zhang (2006) found that: "Ramp meters are particularly helpful for long trips relative to short trips… trips longer than three exits in length benefit, while many trips 3 exits or less are hurt by ramp meters." Reducing travel time for long distance commuters could, at least in theory, encourage longer commutes from residential locations in the periphery of the region. If this were to occur, it could erode the air quality benefits of this measure over time.

Local jurisdictions may be concerned that ramp meters will spill over onto local streets and disrupt their arterial operations (although these impacts are most often mitigated prior to the operation of the ramp meters through protocols for the ramp metering timing or local street improvements to accommodate the ramp queues).

Where arterial signal coordination requires cooperation of multiple jurisdictions, the negotiations can take time to resolve both technical and policy issues.

Installation and replacement of TOS infrastructure, retiming traffic signals, and expansion of FSP is constrained by the availability of funding.

Sources:
1. MTC's Transportation 2035 Plan and Travel Forecasts Data Summary: http://www.mtc.ca.gov/planning/2035_plan/
2. MTC's Arterial Management Program: http://www.mtc.ca.gov/services/arterial_operations/
3. MTC's Transportation 2035 Vision Analysis: http://www.mtc.ca.gov/planning/2035_plan/tech_data_summary_report.pdf
4. SAFE's Freeway Service Patrol Program: http://www.mtc.ca.gov/services/fsp/
5. Levinson, David and Lei Zhang (2006). "Ramp Meters on Trial: Evidence from the Twin Cities Metering Holiday" *Transportation Research Part A: Policy and Practice*, Volume 40, Issue 10, pp. 810-828.
6. Levinson, David and Lei Zhang (2003). "Relationships between Ramp Metering and Sprawl" Draft working paper available through the University of Minnesota Http://nexus.umn.edu/Papers/RampMetersSprawl.pdf.

TCM B-2 - Transit Efficiency and Use Strategies

Brief Summary:
This measure will improve transit efficiency and make transit more convenient for riders, through continued operation of 511 Transit, and full implementation of Clipper (formerly "Translink") fare payment system and the Transit Hub Signage Program.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by improving transit efficiency and use through financial incentives, improved real-time transit service information, coordinated fare payment and collection, and improved transit connectivity. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect intraregional travel on transit, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips.

Regulatory Context and Background:
Public transit services in the Bay Area are operated by 26 agencies, each with its own budget, policies, procedures, service plan and operating practices tailored to its immediate service area. The agencies do not always coordinate effectively with neighboring service areas for purposes of facilitating seamless regional travel and customer service.

Since 2002, the Bay Area's telephone and Web-based 511 traveler information service provides up-to-the-minute, on-demand transportation-related information that supports transit riders throughout the nine-county region. On the phone, 511 provides direct transfers to over two dozen transit agencies and various paratransit providers as well as real-time transit departure predictions for SF Muni and BART. It will expand to cover other agencies that develop real-time capabilities. On the web, 511 offers a transit trip planner which allows users to create itineraries for their trips, including trips requiring transfers between transit agencies. The project also has a call center interface used by transit agencies to provide trip-planning information to customers over the phone. The 511 web service also provides schedules, route maps, information on fares and passes, and service announcements. In the near future, a personalized MY 511 service on the phone and the web will allow users to save trips for real-time departure predictions. The Bay Area system has received nearly 25 million calls since 2002, and averages 100,000 transit-related calls and over 1.3 million transit itinerary requests each month. In light of a planned 50 percent decrease in 511 Transit project funding starting in FY 2014, as well as potential project impacts due to recent State Transit Assistance budget reductions, the project will assess possible approaches to reduce ongoing operational costs such as further automating data transfer/processing from the region's over two dozen transit agencies and/or scaling back project functionality/features provided to the public.

Clipper offers transit riders a convenient and secure way to pay fares on multiple transit systems. The Clipper system reduces the hassle associated with paying transit fares using exact change, multiple tickets and paper transfers. The reloadable Clipper card stores value in the form of electronic cash (e-cash), which is accepted by all participating agencies, and transit passes. Clipper has been available on all AC Transit and Dumbarton Express buses and on all Golden Gate Transit and Ferry routes since November 2006. Clipper is currently operating on all San Francisco Muni routes, but Muni is encouraging only limited use of the system by the public in order to closely monitor the system's performance and customer response. Furthermore, Clipper is fully installed on the Caltrain system, and Caltrain will begin encouraging the public to use the system once an employee testing phase is complete. Clipper use by BART customers began in August 2009, and use by Santa Clara VTA and SamTrans customers will begin in 2010. Clipper will also be available for use at a limited number of San Francisco Municipal Transportation Agency (SFMTA) parking garages on a pilot basis in 2010. When fully implemented, Clipper ® will serve more than 600,000 transit riders every day.

A number of programs provide services to Bay Area employers to facilitate use of pre-tax purchases of transit tickets and other transit benefits. (See discussion re: transit benefit ordinances in TCM C-1.) Transit riders can apply their transit benefits directly to their Clipper card. The Clipper program is also working with AC Transit and a number of housing developers to offer transit benefits to residents of new transit-oriented housing developments.

MTC prepared the Transit Connectivity Plan to improve passenger transfers between connecting transit systems. Aside from reinforcing the importance of 511 Transit and Clipper to improve transit system-wide, several key issues emerged, including (a) lack of wayfinding signage to guide transit riders between systems and to their final destinations; (b) lack of information about connecting services such as schedules, fares and routes; (c) lack of real-time transit departure information; (d) disconnects in schedule coordination; (e) lack of "last mile" services for riders to get to/from mainline transit service such as shuttles, pedestrian access, bicycle parking or taxis; and (f) few hub amenities such as weather protection, restrooms and security measures. MTC, in partnership with transit operators, will implement the Hub Signage Program to address wayfinding signage, transit information and real-time transit information recommendations at 21 transit hubs and 3 airports. Transit operators will lead implementation of other Plan recommendations over time (no cost assumption in TCM).

Implementation Actions:
Phase 1 (2012)
MTC to:

- Operate and maintain 511 Transit ($10 million)

- Deploy, operate and maintain Clipper on Bay Area transit agencies ($59 million)
- Provide pre-tax and other transit benefits through Clipper ($5 million)
- Implement, operate and maintain Transit Hub Signage Program ($3 million)

Phase 2 (2020)
MTC to:

- Operate and maintain 511 Transit ($18 million)
- Operate and maintain Clipper on Bay Area transit agencies ($117 million)
- Provide pre-tax and other transit benefits through Clipper (assume cost is absorbed in Clipper budget)
- Operate and maintain Transit Hub Signage Program ($10 million)

Supporting Actions by Partner Entities:

- Local governments and transit agencies to work with MTC on the Transit Hub Signage Program.
- Local governments, CMAs, transit agencies and other agencies to work with MTC to deploy, operate and maintain Clipper and 511 Transit.
- Local governments are encouraged to implement programs that offer residents, students and employees free or discounted transit passes, such as Santa Clara's Ecopass program, and other innovations to encourage transit use.

Pollutants (tons per day)	2012	2020
ROG	0.004	0.006
NO_x	0.005	0.007
$PM_{2.5}$	0.00	0.00
PM_{10}	0.00	0.00
CO_2	6.01	10.01
C02-e	6.12	10.21

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: PM2.5, PM10, NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emissions Reduction Methodology:
This analysis uses a "transit efficiency" elasticity of 0.651; that is, every 1% increase in "transit efficiency" will result in a 0.651% increase in ridership. This elasticity was selected based on an analysis of output from the Transportation 2035 travel forecasts that examined change in mode share given a reduction of in-vehicle travel time by transit and wait time for transit, both by 20%. Reductions of this magnitude were selected based on review of empirical studies that examined how information improvements affect passengers' perceived and actual wait time and travel time (Litman 2008). This elasticity was then applied to a share of the entire transit market (ranging from 2.7% to 3.4% in Phase 1 and 3.4% to 5.4% in Phase 2), which was estimated based on the current share of transit riders that use the 511 Transit Trip Planner 3.4%; and scaling by 100-125% in Phase 1 and by 125%

to 200% in Phase 2 to assume additional impact from the other elements of the TCM beyond the 511 transit trip planner. Using local data, estimated new ridership is reduced to factor in new riders that are transit dependent and those who drive to access the bus, resulting in the number of vehicle trips reduced. Additional adjustments are made to calculate vehicle miles traveled reduced based on average transit trip lengths and the average distance traveled to the bus stop by non-motorized modes. Note: this analysis excludes impact and costs associated with Clipper as there is insufficient empirical research regarding the travel impacts associated with implementation of universal fare card payment systems.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Trade-offs:
None identified.

Cost:
Phase 1: $77 million
Phase 2: $145 million

Co-benefits:
- Improved transit customer experience
- Travel time savings

Monitoring Mechanisms:
- Monitor customer use of 511 web and phone features to obtain transit schedule, route and fare information as well as real-time transit departure times. Monitor use of 511 Transit data by third party Information Service Providers
- Monitor customer use of Clipper card and Clipper market penetration
- Track number of people receiving transit benefits through Clipper
- Track completion of sign installation (way-finding, transit information displays, real-time transit) at each of 21 hubs and 3 airports

Issues/Impediments:
Implementation of this TCM requires that funding is available for these programs. In addition, technological issues, institutional support, and market penetration are factors that may impede full implementation of 511, Clipper and other transit connectivity improvements.

Sources:
1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/

2. Litman, Todd (2008). "Valuing Transit Service Quality Improvements." *Journal of Public Transportation*, Vol. 11, No. 2, pp. 43-63. http://www.nctr.usf.edu/jpt/pdf/JPT11-2Litman.pdf.

TCM B-3 - Bay Area Express Lane Network

Brief Summary:
TCM B-3 will seek to price travel demand on Bay Area highways by developing and implementing a seamless, regionally-managed Express Lane Network throughout the Bay Area and improving regional transit service. This system will offer free-flowing conditions for carpools, buses and toll payers by adjusting tolls based upon the level of congestion.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx, by improving the efficiency of and managing congestion on existing freeways throughout the Bay Area through the use of express lanes, and by generating revenues to make corridor improvements such as improved regional transit. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips.

Regulatory Context and Background:
Bay Area highway congestion is the second-worst in the nation; regional travel is slow and unreliable. The carpool lane system, which has been under construction for over 30 years, is fragmented by gaps. If we rely on traditional funding sources, these gaps will not be fully closed for many decades due to the lack of funds, making carpools and transit less effective.

Currently, the Bay Area is authorized to develop and implement only a handful of express lane projects in Alameda and Santa Clara counties. The first such projects, on Interstates 580 and 680, are now under construction and are scheduled to open in 2010/2011.

MTC will seek authority to implement the regional Express Lane Network under existing law:

- California Streets and Highways Code Section 149.7 empower the California Transportation Commission (CTC) to authorize two express lane facilities in Northern California.
- The California Transportation Finance Authority, created in 2009, is empowered to grant local and regional agencies the authority to issue toll revenue bonds and implement express lane project.

. Key features will include:

- A management and operations structure involving the BATA, the county Congestion Management Agencies, Caltrans, and the California Highway Patrol.
- Conversion of 500 miles of existing or fully funded HOV lanes to express lanes.

- Construction of 300 miles of new express lanes, including 200 miles of gap closure and 100 miles of outward expansion. The outward expansion segments are:
  - I-80 SOL: I-505 to Yolo County Line – 28 miles
  - I-80 SOL: Air Base to I-505 – 18 miles
  - I-580 ALA: Greenville to San Joaquin County Line – 17 miles
  - US 101 SCL: Cochrane to SR 25 – 30 miles
- Qualifying carpools and public transit use network free of charge; non-carpoolers pay toll (collected electronically).
- Free-flowing traffic for carpools, buses and toll payers maintained by adjusting tolls as congestion rises and falls.
- Toll revenue pays for construction, operation, maintenance and enforcement of the Express Lane Network, with remaining net revenue available for additional transportation improvements, including public transit, in network corridors. Current law requires net revenue from express lanes be spent in the corridor in which it was generated.

The Express Lane Network will be built in phases; the first phase will likely include primarily HOV conversions, followed by gap closures, with the last segments being the outward extensions.

MTC expects that the express lanes will be operated on a full-time (24/7) basis when tolling is introduced in a corridor, subject to further evaluation.

Implementation Actions:
Phase 1 (2012)
MTC will implement the following express lane projects ($2.7 billion)[5]:

- Existing Express Lane projects under development on I-680 (Sunol), I-580, SR 85 and US 101, including the SR 237/I-880 direct connector
- I-680 corridor from the I-680/SR 24 interchange south
- I-880 corridor in Alameda and Santa Clara counties
- I-80 in Alameda and Contra Costa
- Portions of US 101 in Marin and Sonoma County
- SR 87 in Santa Clara County
- I-280 in Santa Clara County
- Bridge approaches (SR 84, SR 92, and on I-680 and I-80)
- SR 237 in Santa Clara
- I-80 between Air Base and I-680
- I-80 between I-680 and the Carquinez Bridge

Phase 2 (2020)

[5] Assumes project implementation during Phase 1/Phase 2 time horizons. The actual implementation year is subject to change based on the Bay Area Express Lane implementation plan.

The outward expansion projects (see list in Regulatory Context and Background section above) identified in Phase 2 are included subject to additional air quality analysis to determine if they will be beneficial for air quality.
MTC to implement the following express lane projects ($1 billion):

- SR 4 in Contra Costa County
- US 101 North (Novato Narrows) in Marin and Sonoma counties
- US 101 SM: Millbrae to Whipple – 22 miles
- I-80 SOL: I-505 to Yolo County Line – 28 miles
- I-80 SOL: Air Base to I-505 – 18 miles
- I-580 ALA: Greenville to San Joaquin County Line – 17 miles
- US 101 SCL: Cochrane to SR 25 – 30 miles
- I-680 in Solano County
- I-580 between 238 and I-680

Supporting Actions by Partner Entities: Local governments, transit agencies, Caltrans, and CMAs to work with MTC as appropriate to implement express lane projects while implementing or maintaining express bus service and land uses supportive of transit.

Pollutants (tons per day)	2012	2020
ROG	0.86	0.82
NO_x	1.34	1.11
$PM_{2.5}$	0.28	0.37
PM_{10}	0.66	0.9
Ammonia (NH3)	0.11	
Benzene	0.02	
Formaldehyde	0.01	
Acetaldehyde	0.01	
CO_2	1855.00	2551.50
C02-e	1892	2602.53

Emission Reduction Methodology:
This analysis uses model output from the Transportation 2035 Vision Analysis which compared four different investment scenarios on a range of performance objectives: 1) Baseline, 2) Freeway Performance (Freeway Operational Improvement, 3) High-Occupancy/Toll (HOT) Lanes Network And Express + Local Bus, and 4) Regional Rail and Water Transit. The net difference between air quality emissions associated with the Baseline and the High-Occupancy/Toll and Express/Local Bus scenarios are used to determine emissions reductions associated with the project. Emissions reductions are reduced to factor out the emissions reductions associated with expanded transit service (which is modeled in TCMs A-1 and A-2). The estimated emissions reductions are interpolated for year 2012 and 2020 from 2006 and 2015 estimates.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
Implementing the express lane network and providing express bus service in these corridors should reduce freeway congestion and decrease motor vehicle emissions in the near term. ARB's motor vehicle emissions factors indicate that tailpipe emission rates for ROG, NOx, PM, and CO2 are lowest when vehicles travel in the 30-50 mph speed range. The estimated emission reduction benefits for this measure are based on the anticipated improvement in average vehicle speed due to expected reduction in congestion in the affected corridors. However, this measure will also increase vehicle capacity on segments within some of these corridors. While the regional travel model estimates transportation emissions due to temporal, spatial and mode shifts resulting from increased roadway capacity, the potential emission reduction benefits of this measure may be eroded if the increased capacity in these corridors encourages additional vehicle travel or changes in land uses that would result in longer vehicle trips. To address this issue, the Air District will perform an independent analysis to evaluate the long-term impacts of this measure on vehicle travel and emissions.

Cost:
Phase 1: $2.7 billion
Phase 2: $1 billion

Co-benefits:
- Travel time savings.
- Generation of net toll revenue for corridor improvements.

Monitoring Mechanisms:
- Track miles of express lanes implemented.

- Track average vehicle speeds in both express lanes and general travel lanes (changes in congestion).
- Track changes in Vehicle Hours of Delay.

Issues/Impediments:
Implementation of this TCM requires that funding is available for these programs.
In addition, legislation is required to give BATA the authority to finance, develop and operate the Bay Area Express Lane Network. AB 744 (Torrico) is currently being considered by the State Legislature.

The network includes a variety of design challenges due to both environmental, geographic, and development constraints.

There is mixed public opinion regarding value pricing, with concerns about the impact on existing carpoolers, potential environmental impacts, the use of network net revenues, and charging for the use of the highway.

The program calls for rapid implementation of a large network of managed lanes, which will require significant resources and institutional support from a number of agencies.

Sources:
1. MTC's Transportation 2035 Plan and Travel Forecasts Data Summary: http://www.mtc.ca.gov/planning/2035_plan/
2. MTC's Bay Area Express Lane page: http://mtc.ca.gov/planning/hov/
3. MTC's Transportation 2035 Vision Analysis: http://www.mtc.ca.gov/planning/2035_plan/tech_data_summary_report.pdf

TCM B-4 - Goods Movement Improvements and Emission Reduction Strategies

Brief Summary:
Goods movement is a critical component of the Bay Area's economic and transportation system, and a significant contributor to air quality issues. Exposure to diesel pollution from goods movement greatly impacts the health of residents near ports, rail yards, distribution centers, and roads with high truck volumes. Investing in the Bay Area's trade corridors and continuing to offer incentives for diesel engine owners to reduce emissions will address existing air quality issues as well as help the region to prepare for continued growth in this important sector of our economy.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx, and diesel particulate matter associated with goods movement by investing in the Bay Area's trade corridors and by providing incentive funding for diesel equipment owners to purchase cleaner-than-required vehicles and equipment. In addition, some projects implemented through this measure will reduce emissions of greenhouse gases. The District will endeavor to meet the California Air Resources Board (ARB) 2007 Goods Movement Action Plan goal to reduce goods movement emissions to the greatest extent possible and at least back to 2001 levels by year 2010.

Travel Market Affected:
This measure would affect all goods movement activity within the region.

Regulatory Context and Background:
Goods movement is a critical component of the Bay Area's economic and transportation system. Whether it is delivering construction materials or consumer goods to the growing population, or exporting electronics and food throughout the world, a robust goods movement system is essential for both business and residents to function and thrive in the Bay Area.

Exposure to diesel pollution from goods movement operations greatly impacts the health of community residents near ports, rail yards, distribution centers, and roads with high truck volumes. Analysis by the Air District has found that emissions of diesel particulate matter (PM) account for 80 percent of the risk from toxic air contaminants (TACs) in the Bay Area. Twenty-two percent of the total California population living in close proximity to goods movement corridors is located in the Bay Area. This population is exposed to approximately 20 percent (or 5.6 tons per day) of the total PM and 20 percent (or 124 tons per day) of the total NOx emission from goods movement statewide.

Nearly 40 percent of the region's economic output is in manufacturing, freight transportation, and the warehouse and distribution businesses. For example, the Port of Oakland is one of the nation's busiest container ports, and although cargo volumes are currently down due to the economic recession, projections show cargo volumes at the Port and throughout the region and state will grow significantly over the next 20 years. The Port of Oakland plays a particularly important role in supporting the state's agricultural sector, providing the primary means of transporting produce from the Central Valley to the Pacific Rim. Goods movement businesses create over 10 percent of regional employment. More than 80 percent of the goods movement in the Bay Area involves trucking in several major corridors: Interstates 80, 580, and 880 and U.S. Highway 101.

In November 2006, California voters approved Proposition 1B, a $19.9 billion transportation infrastructure bond. Proposition 1B included a $2 billion Trade Corridors Improvement Fund (TCIF) to improve goods movement infrastructure statewide. In 2008 the state augmented the program to nearly $2.5 billion and programmed just over $3 billion for high-priority goods movement projects. A coalition of regional agencies in Northern California, representing 23 counties and the three major ports, was able to secure $825 million for 14 Northern California transportation projects that are to be in construction by 2013. Nearly $585 million of this total will fund seven key Bay Area goods movement projects.

Proposition 1B also included $1 billion for a Goods Movement Emissions Reduction program. The BAAQMD is responsible for developing various programs for the bond, including a diesel truck replacement program.

In addition, the California Air Resources Board (ARB) 2007 Goods Movement Action Plan seeks to meet five specific goals for addressing the air pollution associated with goods movement, including reducing "total statewide international and domestic goods movement emissions to the greatest extent possible and at least back to 2001 levels by year 2010."

In the Transportation 2035 Plan, MTC allocated $45 million toward the District's Goods Movement Emission Reduction Program, which aims to reduce particulate matter emissions and health risks by replacing and/or retrofitting up to 800 port and general regional goods movement trucks currently operating along the Bay Area's priority trade corridors.

Since 2003, the District has spent approximately $55.6 million on projects through the Carl Moyer Program. These funds purchased cleaner-than-required on-road, off-road, marine, rail, and agricultural equipment.

In addition, since 2003, the District has spent approximately $18 million on projects through the Transportation Fund for Clean Air (TFCA) that reduce pollution from on-road trucks that move goods, including port trucks, garbage and street sweepers, and construction dump trucks. Beginning in 2009, the District will set aside $1.5 million in TFCA funds a year. These dollars will fund the Advanced Technology Program, which will provide grants for heavy-duty hybrid trucks and demonstration projects.

The California Air Resources Board (CARB) has adopted rules that require owners of diesel trucks and equipment, including those associated with goods movement, such as on-road trucks and harbor craft, to limit emissions from their fleets. The federal government has also taken action to limit emissions from locomotive engines. Although these regulations will require that equipment meets stringent standards, anticipated growth in goods movement over the next 20 years may offset much of the benefits that these regulations will achieve. Thus, incentive programs offered through the District are designed to provide emission reductions that go beyond reductions required by CARB. For example, regulations require upgrades to equipment in future years; the District incentive programs offer funds for engine owners to upgrade equipment in advance of these regulations, thereby funding emission reductions that are not yet mandated. Incentive programs can also offer funds for reduction of pollutants that are not required, for example, NOx and ROG reductions, when only PM reductions are required. In sum, although CARB (and federal) requirements will result in substantial emission reductions from the goods movement sector, incentive funding can be used to speed up these reductions or generate additional emission reductions that would otherwise not occur.

Implementation Actions:

Phase 1 (2012)

BAAQMD to implement:

- State-funded diesel emission reduction incentive programs, including the Carl Moyer Program and Proposition 1B Goods Movement program ($144 million)
- Replacement or retrofit of port and general goods movement trucks operating in the region via Goods Movement Emission Reduction Program, (subject to availability of funding)
- The TFCA-funded Advanced Technology Program to fund hybrid heavy-duty trucks and demonstration projects ($1.5 million a year).

Phase 2 (2020)

MTC to implement the following seven Proposition 1B Trade Corridors Improvement Fund (TCIF) projects ($585 million):

- 7th Street Grade Separation
- I-80 Eastbound,Cordelia Truck Scales Relocation
- Martinez Subdivision Rail Corridor Improvements
- San Francisco Bay to Port of Stockton Channel Dredging
- I-580 Eastbound Truck Climbing Lane
- I-880 Improvements at 23rd and 29th Avenues
- Outer Harbor Intermodal Terminals

BAAQMD to continue implementation of:

- Goods Movement Emissions Reduction Program to replace or retrofit up to 800 port and general goods movement trucks operating in the region ($45 million)
- State-funded diesel emission reduction incentive programs ($384 million)

Supporting Actions by Partner Entities:

- Local governments, Ports, goods movement businesses and other agencies to work with the District to implement grant programs that fund diesel emission reduction programs.
- Local government, Ports, Caltrans and other agencies to work with MTC as appropriate to implement TCIF projects.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG		0.59
NO_x		4.81
$PM_{2.5}$		0.06
PM_{10}		0.28
Diesel PM		0.12
Benzene		0.01
Formaldehyde		0.05
Acetaldehyde		0.09
CO_2		3966.08
C02-e		4045.00

Emission Reduction Methodology:
Diesel emission reduction program emission reduction estimates are based on emission reductions achieved in past funding years.

Proposition 1B TCIF Projects: Emissions reductions were estimated as a part of the project application for TCIF funds. Growth factors were applied to emissions reduction estimates to bring them to analysis year 2020.

Exposure Reduction:
The District and California Air Resources Board (CARB) studies show that 80% of the risk from toxic air contaminants in the Bay Area comes from diesel particulate emissions. This measure addresses this air quality problem by reducing emissions from vehicles and equipment used in goods movement. This measure directly addresses air quality in impacted communities.

Emission Reduction Trade-offs:
Adding diesel retrofit devices to diesel engines may result in a decrease in fuel efficiency, thereby increasing emissions of carbon dioxide. For example, CARB and the EPA estimate that a heavy-heavy duty (HHD) diesel truck with a retrofit device added would experience a decrease in fuel efficiency of 3.5 percent on average. By District staff computations, for a

HHD truck traveling 30,000 miles per year, this decrease is estimated to result in an additional 4,382 pounds per year of carbon dioxide.

Cost:
Phase 1: $146 million
Phase 2: $1 billion

Co-benefits:
- Energy/fuel cost savings from more efficient and reliable engines.
- Economic benefits from faster, more efficient goods movement.

Monitoring Mechanisms:
- Completion of major project milestones for TCIF projects.
- Changes in Vehicle Hours of Delay (VHD) on TCIF corridors.
- Number of goods movement trucks retrofitted or replaced through the Goods Movement Emission Reduction program, and amount of emissions reduced through these retrofits/replacements.
- Number of grants and amount of money awarded through Carl Moyer Program and the Alternative Technology Program, emissions reduced through these grants.

Issues/Impediments:
In designing and implementing goods movement efficiency measures, care should be taken to avoid creating induced demand for goods movement that could increase emissions.

High costs to reduce emissions from aging goods movement equipment and infrastructure may be burdensome for the private sector. For example, large diesel trucks, some of which stay on the road for many years and are replaced at a slow rate, often operate on very small profit margins.

Funding availability may constrain the implementation of goods movement emission reduction programs.

Technological issues may be a limiting factor in retrofitting and replacing on- and off-road mobile sources due to technical capabilities, availability and rate of deployment.

Under existing guidelines, incentive funding can only be made available for projects that reduce emissions that are surplus and not required by existing regulation. As CARB regulations that require owners of diesel engines to replace or retrofit these engines are phased in over the next several years, the number of engines that are eligible for incentive funding will decrease. Therefore, it may be difficult to achieve the same amount of emission reductions through the existing incentive programs. However, since diesel engine owners will be required to reduce emissions by CARB regulations, the Bay Area will still benefit from cleaner diesel operations.

The uncertain state of the economy may limit the number of diesel equipment owners willing to enter into contracts to receive incentive funding because it commits them to monitoring and use requirements.

Sources:

1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/
2. MTC's Goods Movement Initiatives 2009 Update: http://www.mtc.ca.gov/planning/2035_plan/Supplementary/T2035_Goods_movement_update.pdf
3. ARB's Goods Movement Emission Reduction Program: http://www.arb.ca.gov/bonds/gmbond/gmbond.htm
4. BAAQMD's Strategic Initiatives: http://www.baaqmd.gov/Divisions/Strategic-Incentives.aspx
5. ARB's Carl Moyer Memorial Air Quality Standards Attainment Program: http://www.baaqmd.gov/Divisions/Strategic-Incentives/Carl-Moyer-Program.aspx

TCM C-1 - Voluntary Employer-Based Trip Reduction Programs

Brief Summary:
This measure will support voluntary efforts by Bay Area employers to encourage their employees to use alternative commute modes, such as transit, ridesharing, bicycling, walking, telecommuting, etc.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by reducing commute trips, vehicle miles traveled, and vehicle emissions. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would primarily affect commute trips, which were 23% of total weekday person-trips and about 40% of weekday vehicle miles traveled for personal (non-commercial) travel in 2006 in the Bay Area.

Regulatory Context and Background:
While commute trips make up only about one-quarter of person trips they tend to be longer distance trips and they make up most peak hour trips when traffic congestion is worse. For these reasons, reducing commute vehicle trips can have a significant impact on reducing congestion and improving air quality.

Employees may choose to drive to work for a variety of reasons:

- Workplaces that are not near transit.
- Barriers to ridesharing (see TCM C-3).
- Lack of pedestrian or bicycle connectivity to transit.
- Lack of "first mile" or "last mile" connectivity at origin or destination.
- Lack of bicycling amenities such as bicycle racks/lockers or showers at transit stations or workplaces.
- Lack of information regarding other travel options.
- Availability of free (or underpriced) vehicle parking.

Since 1996, Senate Bill 437 has prohibited mandatory employer trip reduction programs. However, many employers participate in these types of program on a voluntary basis.

511 Rideshare is one component of 511, MTC's regional transportation information program, which provides a suite of services to facilitate carpooling, vanpooling, taking transit and bicycling. These programs are designed to remove some barriers identified above. 511 Rideshare and congestion management agencies (CMAs) conduct outreach to employers, providing information and encouragement to implement programs that will influence employees to use alternate modes of transportation. 511 Rideshare services and tools include: consultations, marketing and outreach, work site events, employee surveys,

density maps, relocation assistance, online ridematching, vanpool formation and support, commute incentives, and employer referrals. (For additional elements of 511 Rideshare, see TCM C-3).

MTC, through 511 Rideshare, provides funds to each of the 9 county CMAs to conduct outreach to employers in their county. Employer outreach focuses on describing and marketing each of the rideshare services and tools provided by 511 (described above), encouraging implementation of trip reduction programs, as well as informing employers of county-level incentives (see TCM C-3).

BAAQMD administers the Spare the Air program, encouraging individuals to take actions to improve air quality on days when air quality is forecasted to be unhealthy. On summer days with unhealthy levels of ground-level ozone forecast, individuals are encouraged to take transit, carpool, and/or curb driving. As a part of this program, employers participating in the Spare the Air Employer Network designate coordinators to inform their workforce of impending Spare the Air days, educate employees about the ways individuals can improve air quality, and motivate them to take action. BAAQMD provides educational information, incentives and support to participating employers.

Since 2003, BAAQMD's Transportation Fund for Clean Air (TFCA) program has allocated $117 million for local projects that reduce motor vehicle emissions in the Bay Area. TFCA is funded by a surcharge on motor vehicle registration fees paid within BAAQMD's jurisdiction. The surcharge revenues are to be used to implement specific transportation control measures that are developed and adopted in BAAQMD's Clean Air Plans and are pursuant to the requirements of the 1988 California Clean Air Act. Programs funded by TFCA include regional and local rideshare programs, vanpool/buspool programs, bicycle lockers, rack and parking stations, bicycle paths and lanes.

The Bay Area Clean Air Partnership (BayCAP) ran a shuttles project from 2001 - 2006. The major employer and business organizations involved in BayCAP saw untapped potential for shuttle expansions in the Bay Area. Private sector entities saw the project as an opportunity for a public/private partnership to improve air quality. The shuttles project was funded by BAAQMD with the goals of increasing the Bay Area shuttle ridership, improving partnerships among public agencies, providing technical support and networking information, and improving policy-maker understanding of Bay Area shuttle programs. As Bay Area population grows and public transportation agencies expand service, we will need new shuttles to serve new stations and handle increased overall passenger loads.

Federal law and IRS regulations allow employers to provide transit passes to their employees on a pre-tax basis up to $230 per month; this substantially reduces the out-of-pocket cost of transit to employees. Many employers already make this benefit available to their employees, either by providing free or subsidized passes to their employees, or by allowing the employee to purchase a transit pass with pre-tax dollars. The employer also benefits by not having to pay payroll taxes on the cost of the transit pass. In fall 2008 the

City of San Francisco adopted a Commute Benefits Ordinance which requires employers with 20 or more employees to offer employees the opportunity to purchase transit passes with pre-tax dollars. By expanding the number of employers who offer transit benefits, the ordinance should help to retain and increase transit use for commute trips. This is especially important in the current economic environment in which transit agencies have been forced to impose significant fare increases to compensate for cuts in public funding and reduced farebox revenues.

Implementation Actions:

Phase 1 (2012)

- MTC to continue to implement employer elements of 511 Rideshare ($2 million).

BAAQMD to:

- Continue to implement employer elements of the Spare the Air program, evaluate program effectiveness, and implement new ideas to expand the scope and improve the effectiveness of the program at workplaces ($6 million). Note that the costs associated with this program are accounted for under TCM C-3.
- Continue to provide TFCA funding for shuttle/feeder buses ($9 million).
- Support legislation to maintain and expand incentives for employer programs, such as tax deductions and credits.
- Encourage local cities to adopt transit benefit ordinances, similar to the ordinances that have been adopted by the cities of San Francisco, Richmond, and Berkeley.
- Support legislation to empower air districts and/or local governments to adopt employer-based trip reduction requirements. (This item is also addressed in the CAP Leadership Platform.)
- Encourage employers and other entities to utilize webcasting and related technologies to reduce travel for business meetings.
- Consider implementing a program similar to the (2001-2006) BayCAP shuttle program. The new program could include any or all of the following elements:
  - Encourage coordination between the private and public sector.
  - Study and implement a consistent regional shuttle program.
  - Encourage the integration of shuttles in regional rail plans and in the planning process.
  - Encourage the expansion of current shuttle operations.
  - Promote the benefits of shuttles to employers, employees, transit operators, and regional agencies.
  - Study alternative access modes to regional transportation stations/hubs, specifically frequent shuttle/feeder buses, from under used parking lots.
  - Study and promote the concept of rapid shuttles using park and ride parking capacity to meet the same need as transit hub parking structures.
  - Work with large housing developments to provide guidance and implement rapid shuttles as an alternative to driving.

Phase 2 (2020)

- MTC to sustain employer elements of 511 Rideshare and CMA programs ($17 million).
- BAAQMD to sustain other Phase 1 actions ($40 million).

Supporting Actions by Partner Entities:

- Congestion Management Agencies will continue to implement employer element of CMA programs.
- Local governments are encouraged to require mitigation of vehicle travel as part of new development approval, adopt transit benefits ordinances in order to reduce out-of-pocket transit costs to employees, and develop innovative ways to encourage rideshare, transit, cycling and walking for work trips.
- Transit agencies and shuttle providers should continue to implement and expand shuttle and feeder bus service to complement fixed routes transit service and reduce the demand for parking at transit stations.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.08	0.07
NO_x	0.10	0.07
$PM_{2.5}$	0.00	0.00
PM_{10}	0.03	0.04
Ammonia (NH3)	0.01	0.01
CO_2	94.73	103.82
C02-e	97.00	105.90

In addition to the pollutants shown above, this measure will reduce emissions of the following air toxics by less than 0.01 tons per day: benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:

Employer elements of 511 Rideshare: This analysis uses a calculation of vehicle trips and vehicle miles traveled reduced through outreach to employers as a part of a previous analysis conducted by 511 Rideshare staff to estimate the combined impacts of travel demand management programs, both for those implemented by MTC and by local partners such as CMAs without double counting any impacts at both the county and regional level. The ratio of trips reduced to total employment in FY 2006-07 (the year the analysis was carried out) is then applied to projected employment levels in 2012 and 2020.

This measure also includes emission reductions based on TFCA funding for shuttle buses. The estimate from this program is based on emission reductions from previous years of the program.

Note that the emission reductions associated with the Spare the Air program are accounted for under TCM C-3.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $ 17 million
Phase 2: $ 57 million

Co-benefits:
- Reduced travel costs for employees.
- Reduced costs in provision of parking for employers.

Monitoring Mechanism:
- Track number of employers contacting 511 Rideshare for employer services offered.
- Track number of employees served by BayCAP and regional shuttle programs and emission reduced.
- Number of grants and amount of money awarded through TFCA Program and emissions reduced through grants.
- Track municipalities implementing commute benefit ordinances.

Issues/Impediments:
Pursuant to Section 40717.9 of the California Health & Safety Code, the Air District cannot require employers to implement trip-reduction programs. Since the Air District must rely on voluntary participation, this limits the ability to expand employer participation. The current economic downturn and cost of implementing trip reduction programs may also limit employer's willingness to participate. However, future legislation may repeal or revise Section 40717.9 of the California Health & Safety Code, or provide new incentives for employer-based trip reduction programs.

Implementation of this TCM requires that funding is available for this program. Potential lack of funding would preclude MTC, CMAs, county transportation authorities, cities, etc., from implementing this TCM as described.

The BayCAP Shuttles Project identified key barriers that must be addressed if the region is to expand its shuttle system and increase transit ridership, including:
- No consistent regional shuttle program.
- Shuttles are not yet seen as an integral part of the regional rail network.
- Lack of on-going regional funding (TFCA funding is only regional funding available for shuttles).
- Most shuttles are at the work-end; very little experimentation with home end shuttles.

- With certain notable exceptions such as Caltrain/SamTrans/VTA, shuttles are not high priority and shuttles programs are not institutionalized at most transit agencies.
- Some transit agencies see shuttles as competition for fixed route services.

Sources:

1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/
2. South Hayward BART Development, Design and Access Plan: http://www.bart.gov/docs/planning/SouthHaywardDevelopDesignAccessPlanpartA.pdf
3. Bay Area 2005 Ozone Strategy: http://www.baaqmd.gov/Divisions/Planning-and-Research/Plans/Bay-Area-Ozone-Strategy/2005-Bay-Area-Ozone-Strategy.aspx
4. San Francisco County Transportation Authority. Draft Strategic Analysis Report: "The Role of Shuttle Services in San Francisco's Transportation System." November 17, 2009. http://www.sfcta.org/images/stories/Planning/Shuttles/ShuttleSAR_Draft_PnP111709.pdf.

TCM C-2 - Safe Routes to Schools and Safe Routes to Transit Programs

Brief Summary:
This measure will facilitate safe routes to schools and transit by providing funds and working with transportation agencies, local governments, schools, and communities to implement safe access for pedestrians and cyclists. Likely projects will include implementation of bicycle facilities, such as lanes, routes, paths, and parking, and improvements to pedestrian facilities, such as sidewalks/paths, benches, reduced street width, reduced intersection turning radii, crosswalks with activated signals, curb extensions/bulbs, buffers between sidewalks and traffic lanes and streets trees.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by improving bicycle and pedestrian access to schools and transit throughout the Bay Area. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
The Safe Routes to School component of this measure would affect school trips, which were 6% of total person trips in 2006, and trips to transit stops. The Safe Routes to Transit component of this measure would affect transit trips, which were 5.2% of total person trips in 2006.

Regulatory Context and Background:
Safe Routes to School is a state, regional and local program that encourages children to walk or bicycle to school by removing barriers such as lack of infrastructure, unsafe facilities that result in uninviting walking and bicycling conditions, and lack of education and enforcement programs aimed at children, parents and the community at large. In 2006, home-based grade school trips in the Bay Area accounted for nearly 1.3 million trips/day, or 6 percent of total personal trips. Safe Routes to School reduces vehicle trips to school and parents' vehicle trips to work, who may be able to switch to another mode if they do not need to drop their children off at school.

The State of California's Safe Routes to School program was established in 1999 by Assembly Bill 1475, and in 2007, legislation was passed (Assembly Bill 57) to extend the program indefinitely. Project funding has been issued for 7 two-year funding cycles, the selection of Cycle 8 projects for FY 2008-09 and FY 2009-10 is underway, and the program will continue to issue calls for projects on a bi-annual basis. Examples of Bay Area projects funded in Cycle 7 include:

- New traffic signals with countdown pedestrian heads, crosswalks, radar speed feedback signs and education activities near Ocean View Elementary School in Alameda County;
- Construction of a segment of the Lions Creek Trail for bicyclists and pedestrians, outreach and education activities near Antonio Del Buono Elementary School in Santa Clara County; and

- Installation of in-pavement lighted crosswalk, curb ramps, safety lighting, signing and striping near Windsor High School in Sonoma County.

SAFETEA established a federal Safe Routes to School program between 2005 and 2009. The federal program advises Safe Routes to School projects to include five components, "the Five Es" – engineering, education, enforcement, encouragement and evaluation. Two cycles of federal funding were issued. Examples of Bay Area projected funded include:

- Installation traffic calming features by extending curbs, narrowing an intersection, and installing a pedestrian crossing signal near Mill Valley Middle School in Marin County; and
- Funding to conduct walkability audits/workshops, focus groups, meetings with teacher and parent groups, assemblies, outreach, on-site technical assistance with local bicycle/pedestrian champions, and pedestrian educational presentations at schools in Western Contra Costa County.

In 2004, voters passed Regional Measure 2, raising the toll on the seven State-owned toll bridges by $1.00. This extra dollar funds various transportation projects within the region, including the Safe Routes to Transit program.

Safe Routes to Transit is a program that funds bicycle and pedestrian planning and capital projects that facilitate walking and bicycling to regional transit, thereby reducing vehicle trips to transit. While removing vehicle trips to transit may have only small impacts on reducing vehicle miles traveled, these reductions have more significant impacts in reducing vehicle engine starts, which are a significant source of total vehicle emissions. The Safe Routes to Transit program is funded by MTC and administered by TransForm and the East Bay Bicycle Coalition. To date nearly $8 million has been awarded to over 20 capital and planning projects. Example projects funded include:

- Planning for Balboa Park Ocean Avenue pedestrian/bicycle connections in San Francisco;
- Capital improvements to provide safe pedestrian/bicycle routes to Ed Roberts Campus/Ashby Bart in Berkeley; and
- Capital funds to provide electronic bicycle lockers at BART stations.

MTC's Transportation 2035 Plan launched a new program, the Transportation Climate Action Campaign, to reduce the region's carbon footprint. The $400 million campaign includes new funding for Safe Routes to School and Safe Routes to Transit. These funds will supplement the available federal, state, regional and local sources committed to these sources, which are currently oversubscribed, to meet the high demand for funding for these types of projects. Note that as of December 2009, MTC approved $80 million in the first programming cycle from the new federal transportation act for four primary climate initiatives: 1) Public Education/Outreach; 2) Safe Routes to Schools; 3) Innovative Grants; and 4) Climate Action Program Evaluation. Of the $80 million, the Safe Routes to Schools program received $17 million in funding. Funding has not yet been identified for the Safe Routes to Transit program.

Implementation Actions:

Phase 1 (2012)
MTC to:

- Continue to award Regional Measure 2-funded Safe Routes to Transit Program funds ($23 million)
- Implement the Safe Routes to Schools Program component of the Transportation Climate Action Campaign ($17 million)

Phase 2 (2020)

- MTC to pursue additional funding for Safe Routes to School and Safe Routes to Transit ($ TBD)

Supporting Actions by Partner Entities: CMAs, transit agencies, local governments, schools, and communities to work with MTC to implement safe access for pedestrians and cyclists to schools and transit.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.01	0.01
NO_x	0.01	0.01
$PM_{2.5}$	0.00	0.00
PM_{10}	0.00	0.00
CO_2	8.02	17.51
C02-e	8.18	17.86

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: PM10, PM2.5, NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
Safe Routes to School: This analysis assumes increases in home-based grade school walk trips by 25-35% and increases in home-based grade school bicycle trips by 60-70%, ranges based on previous analyses of Safe Routes to School travel outcomes from the State of California's Safe Routes to School programs. Because the amount of funding expected to be available for Safe Routes to School programs will not be sufficient to fund programs at all the elementary and middle schools in the Bay Area, the 25-35% increase in walk trips and the 60-70% increase in bike trips are only applied to 2.7% of grade school trips in 2012 and 5.3% of grade school trips in 2020. VMT reduced is then calculated based on an assumed average walk-to-school distance of 0.5 miles and an assumed bike-to-school distance of 2 miles.

Safe Routes to Transit: Because there is very little empirical research estimating the impacts of Safe Routes to Transit-type improvements on travel outcomes, this analysis is grounded in findings of one empirical study (Cervero 2001) that presents "walk-to-transit" elasticities ranging from .161-.230 for increases in sidewalk miles; that is, a 1% increase in the ratio of sidewalk miles to road miles results in a .16% to .23% increase in the probability of walking to transit. This analysis assumes a 0.5% increase in this ratio in 2012 and a 1% increase in this ratio in 2020. It also assumes a comparable increase in bicycle infrastructure and anticipated increase in the probability of bicycling to transit; although the relationship documented in the study is only for walk trips, the analysis extends the relationship to bicycle trips as results from any more suitable studies were not found. These changes in walk-to-transit and bicycle-to-transit trips are then multiplied by a 2 mile bicycle access/egress distance and a 0.7 mile walk access/egress distance to calculate vehicle miles reduced.

This analysis assumes $17 million in SRTS and $10 million SR2T funds available in Phase 1 (though no funding has yet been identified for SR2T), and an additional $10 million for each program in Phase 2.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $ 40 million
Phase 2: $ TBD

Co-benefits:
- Improved safety/reduced pedestrian-motor vehicle and bicycle-motor vehicle accidents.
- Improved public health/reduced obesity.
- Reduced travel costs.

Monitoring Mechanisms:
- Track the number of new Safe Routes to School programs and the change in number of bicycle and walk trips to school at schools with Safe Routes to School programs
- Track the number of new Safe Routes to Transit Projects

Issues/Impediments:
Implementation of this TCM requires that funding is available for these programs. The Safe Routes to School and Safe Routes to Transit programs receive a high volume of grant applications and have only limited amount of funds to award to projects. While funding for these programs have been identified in the short-term, many of these sources will sunset in the future. However, the new federal transportation bill could include additional funding for

Safe Routes to School and Transit. New funds may also be available from higher gas taxes, bridge tolls, and voter approved sales tax measures in individual counties.

Sources:

1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/
2. Safe Routes to School Safety & Mobility Analysis: Report to the California Legislature: http://www.saferoutespartnership.org/media/file/SR2S_Final_Report_3_1_07.pdf
3. Cervero, Robert (2001). "Walk-and-Ride: Factors Influencing Pedestrian Access to Transit." *Journal of Public Transportation,* Vol. 3, No. 4, pp. 1-23.

TCM C-3 - Ridesharing Services and Incentives

Brief Summary:
This measure will promote ridesharing services and incentives through the implementation of the 511 Regional Rideshare Program, as well as local rideshare programs implemented by Congestion Management Agencies. These activities will include marketing rideshare services, operating the rideshare information call center and website, and providing vanpool support services. In addition, this measure includes provisions for encouraging car-sharing programs where appropriate.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by reducing single occupancy vehicle trips through the promotion of rideshare services and incentives throughout the Bay Area, and car-sharing programs where feasible. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
The ridesharing component of this measure would primarily affect commute trips, which were 23% of total weekday person-trips and approximately 40% of weekday vehicle miles traveled for personal travel in 2006 in the Bay Area. Car-sharing programs are more likely to affect discretionary trips for shopping, errands, business and recreational purposes.

Regulatory Context and Background:

Ridesharing
While commute trips make up only about one-quarter of person trips, they tend to be longer distance trips and they make up most peak hour trips when traffic congestion is worse. For these reasons, reducing vehicle trips to workplaces can have a significant impact on reducing congestion and improving air quality.

Barriers to ridesharing include:
- Difficulty for individuals in identifying others who both live and work proximate to them.
- Difficulty in setting up the logistics of a vanpool (such as establishing driver(s), shared payment for gas and other costs, identifying parking places, etc.).
- Needing to factor in travel time to pick-up other carpoolers.
- Needing flexibility to change travel schedule due to emergencies.

511 Rideshare is MTC's regional rideshare program, providing a suite of services to facilitate carpooling and vanpooling online (511.org) and by telephone (511). These programs help remove some barriers to ridesharing identified above, provide additional incentives for ridesharing, and include:
- A regional ridematching system which connects commuters who live and work near one another (for employer elements of 511 Rideshare see TCM C-1).

- Information and incentives for carpools and vanpools, including gas cards for carpoolers, seat subsidies for vanpoolers, and prizes for both types of ridesharing.
- CMAs, county transportation authorities, cities and counties provide a range of different incentives to encourage non-single occupant vehicle commute trips. Eligibility requirements and types of incentives available vary and include (or will include) the following[6]:
- Alameda County: guaranteed ride home in emergencies.
- ACE Rail: guaranteed ride home in emergencies for those who hold monthly ACE Rail passes.
- 511 Contra Costa: guaranteed ride home in emergencies, discounted vanpool fare for new vanpoolers, cash incentives for vanpool drivers who sustain a vanpool for one year, gift card incentives for carpool participants, complimentary transit tickets for commuters who currently drive alone.
- Marin County: incentives for new vanpools and guaranteed ride home.
- Napa County: guaranteed ride home in emergencies, gas cards for new back-up vanpool drivers, gas cards for new vanpools.
- San Francisco County: preferential vanpool parking, guaranteed ride home in emergencies, carpool parking permits.
- San Mateo County: guaranteed ride home in emergencies, gas cards for carpool participants, discounted vanpool fare for new vanpoolers, discounted purchase and installation costs for employers to provide bike racks/lockers, free transit coupons for new riders, free lunchtime taxi service.
- Santa Clara County: EcoPass Transit annual transit pass on South Bay transit systems (for participating employers), preferential parking for 4+ carpools.
- Solano County: guaranteed ride home in emergencies, gas cards for new back-up vanpool drivers, gas cards for new vanpools, discounted bicycle purchase.
- Sonoma: guaranteed ride home in emergencies, free 2+ carpool parking in downtown garages, reduced cost transit passes.

Car-Sharing

Car-sharing allows people to forgo or reduce the number of cars in their household and rely on other modes for most of their trips, but still have convenient access to a car when needed for occasion use. There are currently two car-sharing organizations in the Bay Area: City Carshare is a nonprofit organization and Zipcar, (which merged with Flexcar in 2007) is a for profit corporation. Members join for a monthly fee, pay an hourly use fee that includes gasoline, and can schedule use of a car over the internet. Car-sharing has been available in the Bay Area since 2001, but has a longer history in Europe. Members can pick up cars at locations around San Francisco and the east bay, including Oakland, Alameda, Berkeley, Albany, El Cerrito, and in Palo Alto at Stanford University. The advantages to car-sharing include:

[6] See 511 Rideshare's Commute Rewards and Incentives: County Incentives webpage at http://rideshare.511.org/rideshare_rewards/county.asp.

- Fixed costs are lower than owning a car. Zipcar members report an average savings of approximately $500 a month when they join Zipcar compared to owning their own car. These fixed costs include car payments, licensing, garage fees, insurance, and maintenance.
- Regardless of how often an owner uses a car, there are high fixed costs to owning a car and lower marginal costs, such as fuel and parking charges. Because of the ratio of fixed costs to marginal costs, car owners tend to use their private auto for trips that could be served by other less polluting transportation modes, including transit, walking and biking. In contrast, car sharing has lower fixed costs and higher marginal costs. This encourages members to use other transportation modes when available and convenient. Overall, car-sharing encourages members to reduce their total number of vehicle trips by taking advantage of other modes of travel.
- For low income people, car-sharing can augment transit, walking and bicycle trips to make occasional trips carrying cargo or outside the transit system's service area.
- Car-sharing service is also available to businesses. This can help Bay Area businesses save money otherwise spent on maintaining, insuring and garaging a fleet of cars.

Implementation Actions:
Phase 1 (2012)
MTC to implement the following actions ($17 million):

- Continue to provide 511 RideMatch service and implement website enhancements including a trip-tracking tool, functionality for administration of employer-based and local agency-based incentives, a quick search matching tool, and improved interface functionality for employers.
- Continue to provide rideshare support services, including call center services, program marketing and materials and vanpool support services.
- Continue administration of 511 Rideshare Rewards annual campaign and provision of incentives for carpools and vanpools.
- Implement incentive programs sponsored by congestion management agencies, county transportation authorities, cities and counties, and transit agencies.
- Encourage the expansion of car-sharing services.

BAAQMD will encourage car-sharing, as appropriate, as a potential CEQA and ISR mitigation measure.

Phase 2 (2020)
Sustain Phase 1 programs ($47 million)

Supporting Actions by Partner Entities:

- Local governments, CMAs, and employers to encourage ridesharing and create incentives to promote ridesharing.
- CMAs that support existing local rideshare programs to continue to fund these programs.
- Caltrans to identify and develop new Park and Ride sites as needed.

- Explore the option to encourage or require new projects to include dedicated car-sharing parking spaces and car-sharing services in-lieu of required parking spaces.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.09	0.06
NO_x	0.10	0.05
$PM_{2.5}$	0.01	0.01
PM_{10}	0.01	0.02
Ammonia (NH3)	0.03	0.03
CO_2	150.03	170.03
C02-e	153.00	173.43

In addition to the pollutants shown above, this measure will reduce emissions of the following air toxics by less than 0.01 tons per day: benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
This analysis uses a calculation of vehicle trips and vehicle miles traveled reduced through rideshare services and incentives as a part of a previous analysis conducted by 511 Rideshare staff to estimate the combined impacts of travel demand management programs, both for those implemented by MTC and by local partners such as CMAs without double counting any impacts at both the county and regional level. The ratio of trips reduced to total employment in FY 2006-07 is then applied to projected employment levels in 2012 and 2020.

The estimated emission reductions do not include any reductions from car-sharing programs.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $17 million
Phase 2: $47 million

Co-benefits:
- Reduced travel costs for employees through ridesharing and for Bay Area residents, businesses and visitors through car-sharing.

- Reduced costs in provision of parking for employers.
- Support additional options for residents who seek to reduce their dependence on private vehicles for environmental and financial reasons.

Monitoring Mechanisms:
- Track number of carpools and vanpools matched through the 511 RideMatch service
- Track number of carpools and vanpools participating in 511 Rideshare Rewards program

Issues/Impediments:

Ridesharing
Surveys and focus groups indicate that many commuters need flexibility in their daily trips to conduct errands, or pick-up and drop-off children. This reduces the market for carpooling and vanpooling as traditional participation requires fixed schedules among participants. Incentive programs such as guaranteed ride home programs, which are available to most Bay Area employees, and/or encouraging participants to try carpooling once or more per week can alleviate this impediment.

Potential lack of funding would preclude MTC, CMAs, county transportation authorities, cities, etc., from delivering this TCM as scoped.

Employer support of ridesharing programs, which complement the regional services and incentives, are limited by the economic downturn.

Car-Sharing
Car-sharing works best in dense urban areas; it may not be viable in all parts of the Bay Area.

Sources:
1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/
2. http://www.citycarshare.org/
3. http://www.zipcar.com/

TCM C-4 - Conduct Public Outreach & Education

Brief Summary:

This measure will encourage Bay Area residents to make choices that benefit air quality by educating the public about the health effects of air pollution and the air quality benefits of choosing transportation modes that reduce motor vehicle use, such as carpooling, vanpooling, taking public transit, biking, walking, and telecommuting. BAAQMD will implement this measure through the Spare the Air (STA) Every Day campaign and the Spare the Air episodic program ("STA Alerts"). In addition, MTC and BAAQMD in partnership will implement the outreach component of the Transportation Climate Action Campaign. Implementation actions include marketing and incentive programs to alert the public to the connection between air pollution and motor vehicle usage, and promoting the benefits of reducing single-occupant motor vehicle use every day, and in particular on poor air quality days when BAAQMD issues a STA Alert.

Purpose:

This measure will reduce emissions of the key ozone precursors, ROG and NOx, by educating the public about air quality in the Bay Area and encourage residents, employers and local governments to make choices that have a positive effect on air quality, particularly regarding transportation and consumer activities. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:

This measure would target all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips. The Spare the Air program emphasizes reduction in morning commute trips. In addition, this measure may help to reduce emissions from the use of consumer products, lawn and garden equipment, recreational watercraft, etc.

Regulatory Context and Background:

Public education and outreach are an important part of the overall strategy to reduce motor vehicle travel and emissions. The BAAQMD administers several public education programs, including Spare the Air (STA) Every Day and the Spare the Air Alert programs. The BAAQMD encourages voluntary actions that reduce air pollution throughout the year.

The STA Every Day Program is the backbone of the BAAQMD's efforts to encourage the public to take direct action to reduce emissions and improve air quality. Since motor vehicles are the leading source of ozone forming emissions in the Bay Area, efforts to reduce vehicle travel, particularly on days with Spare the Air Alerts, can help avoid exceedances of federal and state standards. STA Every Day includes the following components:

- Outreach Program

  - STA Alert notifications via media channels, alert notification sign up lists, and the employer program.
  - Advertising campaign through print, billboards, TV ads and website ads.
  - Media outreach through news programs and community based outreach channels, such as newsletters.
  - Outreach at community events, such as county fairs.
  - Coordination with MTC/511.
- Employer Program (see TCM C-1)
- Community Resource Teams
  - Local civic groups, agencies, businesses and environmental organizations meet regularly and work collaboratively to implement projects that promote cleaner air. Team members, with BAAQMD support, are responsible for developing and carrying out local projects.
  - Currently there are nine STA Resource Teams meeting and working together within the Bay Area's nine counties.
- Youth Programs
  - *Protect Your Climate* curriculum which includes 16 lessons for 4th and 5th grade students that focus on air pollution, energy, waste reduction and transportation.
  - *Clean Air Challenge* curriculum, a science-based curriculum which includes experiments that help students understand air pollution and climate change.
  - *Cool the Earth*, a greenhouse gas reduction program for K-8th grade students and their parents.
  - *As the World Warms*, a classroom supplement including news stories and puzzles on climate change for elementary aged students.
  - Development of the *eCO2 Commute Challenge* Project Manual, a tool to help high schools students become a part of the solution to climate change by taking action in their schools to reduce greenhouse gas emissions from student commutes by promoting walking, biking, riding the bus and carpooling.
  - Air District staff make presentations in the classroom as requested by teachers.

MTC's Transportation 2035 Plan launched a new program, the Transportation Climate Action Campaign (TCAC), to reduce the region's carbon footprint. The campaign, which will be implemented by MTC and the BAAQMD in partnership, includes funding for outreach activities to educate Bay Area residents about how they can reduce emissions of greenhouse gases (and criteria air pollutants) on an everyday basis. The outreach campaign will feature multiple outreach messages directly linked to action programs, incentives, projects, policies and advocacy focused on two complementary themes: 1) Smart Driving/Vehicles: actions to reduce emissions of greenhouse gases on a per-mile basis via driving behaviors and vehicle improvements as discussed above, and 2) Smart Traveling: actions to reduce emissions of greenhouse gases by promoting alternatives to driving: e.g., transit, biking, walking, carpooling and telecommute. Note that as of December 2009, MTC approved $80 million in the first programming cycle of the new federal transportation act for four primary climate initiatives: 1) Public Education/Outreach; 2) Safe Routes to Schools; 3) Innovative Grants;

and 4) Climate Action Program Evaluation. Of the $80 million, the public education/outreach element received $10 million in funding.

Implementation Actions:
Phase 1 (2012)
- MTC and BAAQMD to implement outreach component of Transportation Climate Action Campaign ($10 million).
- BAAQMD to implement Spare the Air Every Day Campaign including STA Alerts, employer program, community resources team, and youth programs ($6 million).

Phase 2 (2020)
- MTC and BAAQMD to continue implementing outreach component of Transportation Climate Action Campaign ($TBD).
- BAAQMD to continue implementing Spare the Air Every Day Campaign including STA Alerts, employer program, community resources team, and youth programs ($16 million).

Supporting Actions by Partner Entities: Local governments, transit agencies, CMAs, schools, media outlets, and businesses are encouraged to participate in the campaign.

Emission Reductions:

The STA Every Day and TCAC programs will result in the following emission reductions, expressed in tons per day.

Pollutants (tons per day)	2012	2020
ROG	0.02	0.01
NO_x	0.02	0.01
$PM_{2.5}$	0.00	0.00
PM_{10}	0.00	0.00
CO_2	38.99	46.96
C02-e	40.42	47.90

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
Emission reductions estimates are based on aggregated survey information collected after STA Alerts. The STA Alert data shows that 5 percent of the surveyed population changed travel behavior due to the alert. These individuals were more likely to forgo discretionary (non-work) vehicle trips than work trips. This travel behavior data was then applied to STA Every Day and TCAC programs based on the assumption that the STA Every Day program would result in a behavior change at one-tenth the rate (0.5%) of the episodic Spare the Air

program. This is a conservative assumption: the program may provide greater emission reductions.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $13 million
Phase 2: $16 million

Note that 3 million of the funds available for the TCAC Program are accounted for under TCM C-5.

Co-benefits:
This measure raises the awareness of the public about the causes of and solutions to the air pollution problem. People who choose to change their travel or other behaviors in response to a voluntary request for a STA Alert may reduce vehicle use or change other polluting activity on a regular basis, as advocated in the STA Every Day and TCAC programs.

Monitoring Mechanisms:
BAAQMD will continue to conduct surveys of travel behavior in response to STA Alerts, possibly expanding this activity to include STA Every Day and the TCAC programs.

Issues/Impediments:
Implementation of this TCM requires that funding is available for these programs. In addition, because the Spare the Air program is voluntary in nature, its effectiveness depends on the cooperation of the general public.

Sources:
1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan
2. BAAQMD's Spare the Air Program: http://www.sparetheair.org/

TCM C-5 - Smart Driving

Brief Summary:
Pollutant emissions rates vary based on the speed a vehicle is traveling. The emission/speed relationship varies for each pollutant, but emission rates generally are lowest in the 30-45 mile per hour mph range. Vehicles traveling on Bay Area freeways at speeds above 65 mph emit significantly more ROG, NOx and greenhouse gases (GHGs) than cars and trucks traveling at speeds between 35 and 55 mph. This measure focuses on public education to encourage drivers to observe posted speed limits and adopt other fuel efficient driving practices, supplemented by more rigorous enforcement of speed limits, especially to reduce high-speed driving on freeways.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx, by reducing high speed driving. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips. In addition, this measure would primarily address freeway travel within the Bay Area.

Regulatory Context and Background:
Further Study Measure 3 in the Bay Area 2001 Ozone Attainment Plan provides a foundation for this control measure. In response to FSM 3, MTC conducted an analysis on emissions created by vehicles traveling over 65 mph on freeways. This analysis shows that by limiting passenger car travel to 65 mph, there is a potential to reduce VOC by 1 to 2.8 tons per day and NOx by 0.9 to 1.9 tons per day, if applied throughout the Bay Area. Approximately 60% of Bay Area driving (VMT) takes place on the freeway system and, based on Caltrans speed monitoring data, 34% of freeway driving occurs at speeds over 65 mph. Therefore, by addressing over-the-limit freeway driving, this measure could achieve a significant amount of emission reductions. A vehicle driven at 75 mph consumes approximately 40% more fuel and emits 35% more emissions than one driven at 60 mph.

There are a variety of techniques known as “smart driving”, “green driving”, or “eco-driving” that increase the fuel efficiency of auto travel, thereby reducing emissions and saving money; these include:

- Avoiding quick starts and aggressive driving
- Reducing highway speeds (55 mph is the most efficient speed for fuel consumption)
- Using overdrive and cruise control
- Avoiding driving in rush hour
- Using air conditioning sparingly

- Reducing idling
- Reducing drag by removing roof racks, tow-hook carriers, and other items that cause wind resistance
- Removing heavy unneeded items from cars (e.g. golf clubs)
- Properly maintaining vehicles including maintaining optimal tire pressure

In Europe there have been several measures that address the relationship between travel speed and traffic safety, climate effects and air quality. Some of the measures that have been undertaken addressed speed reduction, improved speed enforcement, speed alerts, and driver education. A program to promote “ecodriving” has been implemented by several European countries. Program details vary among countries, but generally the focus is on driving school curriculums, fuel saving devices in vehicles, purchasing behavior, and vehicle maintenance. Evaluation of this program has shown positive benefits in traffic safety, GHG reductions and improved air quality.

Implementation Actions:
Phase 1 (2012)

- BAAQMD and MTC to encourage smart driving as a part of the outreach component of the Transportation Climate Action Campaign (see TCM C-4).

As resources permit, BAAQMD will:

- Coordinate and implement programs with business (e.g., tire companies, insurance companies, driving schools, and vehicle manufacturers) and public agencies.
- Implement and coordinate curriculum with high schools (Driver’s Ed) and driving schools.
- Promote/implement a voluntary certification program with fleet operators that could be used as a marketing tool, utilizing the Sustainable Earth Initiative’s Green Fleets Toolkit, which was produced with a grant from the BAAQMD.
- Evaluate and potentially promote and implement a program to purchase and install fuel consumption feedback devices in vehicles for a nominal price. Devices are available now for various vehicle models and allow drivers to get real-time information about fuel consumption. Access to this information may influence drivers to practice fuel-saving behavior, such as driving the speed limit, maintaining a steady speed, and avoiding unnecessary acceleration and braking.
- Explore and potentially establish with CHP and others agencies such as MTC and/or ARB a partnership to 1) enhance enforcement of freeway speed limits on an on-going daily basis and 2) emphasize the importance of complying with posted speed limits on Spare The Air days, including use of variable message boards on roadways and public outreach messaging.

Phase 2 (2020)

- MTC and BAAQMD to continue Phase 1 activities

Supporting Actions by Partner Entities: Local governments, transit agencies, CMAs, school districts, other agencies, media outlets and businesses will be encouraged to join BAAQMD and other partners to create an innovative campaign to connect smart driving with climate protection.

Pollutants (tons per day)	2012	2020*
ROG	0.08	
NO_x	0.17	
$PM_{2.5}$	0.01	
PM_{10}	0.01	
CO_2	176.00	
C02-e	180.00	

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

* 2020 emission reductions are not available at this time.

Emission Reduction Methodology:
The emissions reduction estimate for this measure is based on the following assumptions:

- 35% o freeway travel occurs at speeds over 65 mph
- Of the 65 mph + driving, 50% occurs at 70 mph and 50% at 75 mph
- Speed would be reduced to 65 mph
- The actions described in this measure would reduce five percent of over-the-limit speeding (65 mph for light vehicles and 55 mph for heavy-duty vehicles).

The appropriate emission/speed factors were applied to the above assumptions to calculate the emissions reductions.

It should be pointed out that these assumptions are very conservative. The portion of high-speed driving on freeways may well exceed 35% and many drivers may exceed 75 mph. Using the same assumptions described above, if we assume that all freeway driving in excess of 65 mph were reduced to the 65 mph limit, the reductions would be on the order of 1.6 tpd of ROG, 3.3 tpd of NOX, and 3500 tpd of CO2.

Exposure Reduction:
To the extent that freeway corridors are a major source of emissions in many impacted communities, reducing high speed driving should help to reduce emissions of ROG, NOx, PM, and CO2 in these corridors and throughout the Bay Area.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $ 3 million ($1 million per year)

Phase 2: $ TBD

Implementation of this measure will be funded as part of the public outreach campaign described in TCM C-4. It is not yet known how much of this funding will be used to promote speed moderation. However, for purposes of estimating the cost-effectiveness of this measure, we estimate $1 million per year.

Co-benefits:

- Economic benefits from fuel savings to individual drivers and to the Bay Area economy as whole. If all high-speed freeway driving were eliminated, based on the conservative assumptions described above, this would save approximately 360,000 gallons of gasoline and diesel per day in the Bay Area, yielding a cost savings greater than $1 million per day.
- Reduced/less frequent servicing, maintenance and repair costs that result from reduced wear and tear of various vehicle components (i.e. tires, clutch, and engine).
- Economic savings from reduced costs associated with automobile crashes. According to the National Highway Traffic Safety Administration (NHTSA) speeding is a significant contributing factor to traffic crashes. Based on 2007 data, the NHTSA estimates that nationally speeding related crashes have a $40.4 billion cost to society. In a 2008 Bay Area study, the American Automobile Association estimated that the total cost of car crashes (fatalities and injuries) is $2.7 billion.

Monitoring Mechanisms:

- While monitoring changes in behavior can be difficult, voluntary programs may be monitored by participation rates.

Issues/Impediments:

Implementation of this TCM requires that funding is available for this program. In addition, this program requires collaboration between multiple agencies. Finally, at present the public is accepting of high-speed driving. This TCM requires that the public begin to recognize the consequences of high-speed driving.

Sources:

1. American Automobile Association. Crashes vs. Congestion: http://www.aaaexchange.com/Assets/Files/2008107142430.CrashesVs.Congestionl.pdf
2. BAAQMD. 2001 Ozone Attainment Plan: http://www.baaqmd.gov/Divisions/Planning-and-Research/Plans/Ozone-Attainment-Plans/2001-Ozone-Attainment-Plan.aspx
3. European Transport Conference 2007: The effects of speed measures on air pollution and traffic safety: http://www.etcproceedings.org/paper/the-effects-of-speed-measures-on-air-pollution-and-traffic-safety.

4. Dijkema, et al. 2008. Air Quality Effects of an urban highway speed limit reduction: http://www.sciencedirect.com.
5. Gauderman, et al. 2007. Effect of exposure to traffic on lung development from 10 to 18 years of age. www.thelancet.com.
6. http://www.ecodrive.org/. Ecodriven Campaign Catalogue for European Ecodriving & Traffic Safety Campaigns.
7. UK Safe and Efficient Driving. http://www.safed.org.uk/About.htm

TCM D-1 - Bicycle Access and Facilities Improvements

Brief Summary:
TCM D-1 will expand bicycle facilities serving employment sites, educational and cultural facilities, residential areas, shopping districts, and other activity centers. Typical improvements include bike lanes, routes, paths, and bicycle parking facilities. This TCM also includes improving bicycle access to transit and supporting the annual Bike to Work event.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by sustaining and improving bicycle access and facilities throughout the Bay Area. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to the airport; and school trips.

Regulatory Context and Background:
Bicycles are an inexpensive and widely available type of zero emissions vehicle. Bicycles are well-suited to a wide range of trips in urban settings. In urban contexts, bicycles compete well with cars and transit in terms of door-to-door travel time. Bikes can be combined with public transit for longer trips and trans-bay trips. Cities such as Palo Alto, Davis, Seattle, and Portland have demonstrated that bicycle use can be integrated into local transportation networks.

Improved bicycling facilities increase perceived and actual safety of travel by bicycle as well as its overall attractiveness, encouraging more travel by this mode. The average trip length for all personal trips in the Bay Area is just under 3 miles, a distance short enough for travel by bicycle. In addition, improved bicycle facilities can encourage park-and-ride users to shift modes to bike-and-ride. Bicycle improvements encourage mode shift for shorter trips, which are a majority of total personal trips. The average weekday trip length for all personal travel in the Bay Area in 2006 was 2.95 miles. Of total personal trips in 2006, 21% of trips were less than one mile, 18% were between 1 and 2 miles, 12% were between 2 and 3 miles, and 8% were between 3 and 4 miles.

Many barriers exist that prevent more bicycle trips. In particular, parts of the Bay Area lack bicycling routes that include features such as lower speed limits, bicycle lanes or other facilities, loop detectors that detect bicyclists waiting at red lights, and other complete street features.

MTC's Regional Bicycle Plan for the San Francisco Bay Area, 2009 Update was created to focus regional bicycle-related funding on high-priority bicycle facilities that serve regional trips. The Plan defines a Regional Bicycle Network made up of key routes in each county. The Plan was updated in 2009 and was adopted as a part of MTC's Transportation 2035 Plan. MTC created the Regional Bicycle Working Group to implement the Regional Bicycle Plan. The Working Group's activities include data collection and analysis; collaboration with transit operators to provide bike parking at stations; and marketing and outreach.

In July 2006, MTC adopted Resolution 3765 to encourage the routine accommodation of bicyclists and pedestrians in projects that are funded by MTC regional discretionary funds. To implement the resolution, MTC developed a Routine Accommodation Checklist Policy, requiring project sponsors to consider the needs of bicyclists and pedestrians in project design.

In its Transportation 2035 Plan, MTC committed $1 billion in funding over the next 25 years for the Regional Bicycle Program.

The Bicycle Facility Program (BFP) is a component of BAAQMD's Transportation Fund for Clean Air (TFCA) grant program that provides funding to reduce motor vehicle emissions through the implementation of new bicycle facilities in the San Francisco Bay Area. Since 2003, BAAQMD has awarded approximately $14.6 million towards bicycle facility projects in the Bay Area.

MTC has created the Safety Toolbox, a website that provides tools for preventing collisions, injuries and fatalities, and encouraging walking and bicycling through partnerships between multiple disciplines, multiple jurisdictions, and the public. The site includes information on engineering and maintenance (e.g. design standards and review), law enforcement (e.g. police stings or photo enforcement to identify motorists who violate pedestrian right-of-way crossing streets), planning (e.g. pedestrian- and bicycle-friendly local policies), community involvement (e.g. local jurisdiction pedestrian and bicycle advisory committees), school districts (e.g. Safe Routes to School), and public health (e.g. health promotion).

The Transportation Development Act (TDA) is a quarter-cent sales tax that is imposed statewide in California for transportation purposes. A share of this money, TDA Article 3, goes to fund pedestrian and bicycle projects. To obtain TDA funding from MTC, local jurisdictions must have Bicycle Advisory Committee to plan and prioritize funding for bike projects.

A special issue in the bicycle community is the provision of bike lanes on the Bay bridges. Bay bridges with bicycle lanes currently include the Golden Gate, Carquinez, Antioch, and Dumbarton Bridges. The New East Span of the San Francisco-Oakland Bay Bridge and the new Benicia Bridge will also have bicycle lanes. Caltrans completed a feasibility study to install bicycle lanes on the west span of the Bay Bridge in 2001 and Bridge and Toll Authority (BATA) is currently preparing a Project Study Report (PSR) to update this analysis. In particular, it will identify a new cost estimate and update the engineering and design for the touchdown points on Yerba Buena Island and on Rincon Hill in San Francisco.

Bicycle projects are also funded as a part of MTC's Transportation for Livable Communities (TLC) program (see TCM D-3).

The regional FOCUS program (described in TCM D-3) also seeks to create communities that meet the day-to-day needs of residents in a bicycle-friendly environment.

The State of California also funds bicycle projects through its Bicycle Transportation Account (BTA) which is expected to allocate $7.2 million statewide in FY 2009-10.

Many Bay Area counties also fund bicycle projects though their local option sales tax expenditure plans. These counties include:

- Alameda: 5% of revenues, measure sunsets in 2022
- Contra Costa: 1.5% of revenues, measure sunsets in 2025
- Marin: 3.5%, measure sunsets in 2025
- San Mateo: 3%, measure sunsets in 2033
- Sonoma: 4%, measure sunsets in 2025

Implementation of bike sharing programs is on the rise around the globe. A number of cities, such as Paris and Montreal, have successfully implemented bike sharing programs.

Implementation Actions:

Phase 1 (2012)

To improve bicycle access and facilities, MTC will:

- Fund bicycle improvements through the Regional Bicycle Program that are a part of the Regional Bikeway Network ($19.5 million – Note: As of December 2009, MTC approved $19.5 million in the first programming cycle of the new federal transportation act for the Regional Bicycle Program).
- Apply the Routine Accommodations Checklist Policy to projects funded by regional discretionary sources.
- Continue to fund bicycle projects with TDA Article 3 funds ($0.4 million).
- Continue to fund and promote annual Bike to Work event ($0.5 million).
- Continue to provide bicycle education and information dissemination via 511 Bicycle website, including the BikeMapper tool ($0.3 million).

BAAQMD will:

- Continue to fund bicycle projects with TFCA funds through the Bicycle Facilities Program (BFP) ($1.8 million).

ABAG will:

- Continue to work with local jurisdictions and special districts to advocate for the completion of the 500-mile Bay Trail, a planned recreational and commute corridor that, when complete, will encircle San Francisco and San Pablo Bays with a continuous network of bicycling and hiking trails. The Bay Trail provides easily accessible recreational opportunities, as well as key transportation linkages.

Phase 2 (2020)
MTC will:
- Pursue additional funding for the Regional Bikeway Network ($ TBD).
- Continue to fund bicycle projects with TDA Article 3 funds ($1.4 million).
- Continue to fund and promote annual Bike To Work event ($1.2 million).
- Continue to provide bicycle education and information dissemination via 511 Bicycle website, including the BikeMapper tool. ($0.9 million).

BAAQMD will:
- Continue to fund bicycle projects with TFCA funds through the Bicycle Facilities Program (BFP) ($4.8 million).
- BAAQMD will encourage MTC to meets its T2035 commitment to provide $1 billion in funding for the Regional Bicycle Program.
- MTC, BAAQMD and ABAG will sustain other Phase 1 programs.

Supporting Actions by Partner Entities**:**
- Cities and counties should implement their bicycle plans, provide a comprehensive network of bicycle lanes, routes, and pathways, and provide secure bicycle parking.
- Local governments, including park districts and other special districts, should continue to build, operate, and maintain bicycle facilities.
- Local governments are encouraged to require bicycle access and amenities as a condition of approval of new development projects, and to require secure bicycle parking in existing public and private parking lots and office buildings.
- Local governments should consider using a broader approach to measure roadway performance that considers cyclists and pedestrians as well as motor vehicles, rather than relying on Level of Service (LOS) that is solely based on motor vehicle throughput.
- Caltrans, Congestion Management Agencies and local governments should implement “complete streets” policies to ensure that cyclists and pedestrians are safely accommodated on all streets and roads.
- Transit agencies should implement policies and maintain and expand facilities to accommodate bicycles on rail transit, buses and ferries.
- Local governments should consider implementing bicycle-sharing programs.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.00	0.01
NO_x	0.00	0.00
$PM_{2.5}$	0.00	0.00
PM_{10}	0.00	0.00
CO_2	4.36	9.93
C02-e	4.44	10.13

This measure will also reduce emissions of the following pollutants by less than 0.01 tons per day: ROG, NOX, PM2.5, PM10, NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
This analysis uses a methodology developed using data collected around cycling facilities in the cities of Minneapolis and Saint Paul, Minnesota, to estimate use of a new cycling facility, as well as to estimate how much use is generated by the new facility versus how much is generated by existing cyclists changing routes (see Krizek et al 2006). Because the funds expected to be available to fund the RBN will not be sufficient to build the whole network, this analysis assumes 3% of the unbuilt network will be built by 2012 and 6% will be built by 2020. Using the estimated number of employed residents within ¼ mile, ½ mile, and 1 mile buffers around the unbuilt portion of the RBN and the regional bicycle commute share, the existing number of cycling commuters is estimated. The number of new commuter cyclists is then estimated based on multipliers applied to the number of existing bicycle commuters in each buffer. New cycling trips for non-work purposes are estimated based on the ratio of bike commute trips to bike non-work trips. Vehicle trips reduced is then estimated by assuming 63% of all new cycling trips will replace car trips, and vehicle miles traveled reduced is estimated by assuming a 4.54 mile average bicycle commute distance and a 2 mile average bicycle non-work trip distance. This analysis excludes emissions reductions associated with funding via TFCA, TDA Article 3, Bike to Work Day, and the provision of bicycling information via 511.org.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
2012: $22.5 million
2020: $8 million

Co-benefits:
- Improved safety/reduced bicycle-motor vehicle accidents.
- Improved public health/reduced obesity.
- Reduced travel costs.

Monitoring Mechanisms:
- Track new miles of the Regional Bikeway Network constructed and projects funded through the BFP.

Issues/Impediments:
Bicycle use is limited by factors such as physical ability, terrain, weather, and the need to carry cargo. Personal safety concerns may also prevent some people from switching modes to bicycle. Improving bicycle facilities and public education for bicyclists and drivers can increase perceived and actual safety.

Implementation of this TCM requires that funding is available for these programs.
At present, funds for bicycle improvements are limited and funds to implement the bridge portion of the Regional Bikeway Network have not been identified.

Sources:
1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/
2. MTC's Regional Bicycle Plan for the San Francisco Bay Area 2009 Update: http://www.mtc.ca.gov/planning/bicyclespedestrians/MTC_Regional_Bicycle_Plan_Update_FINAL.pdf
3. MTC's Safety Toolbox at http://mtc.ca.gov/planning/bicyclespedestrians/
4. Krizek, Kevin, et al 2006. *NCHRP Report 552: Guidelines for Analysis of Investments in Bicycle Facilities.* Washington D.C.: Transportation Research Board.: http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_552.pdf.
5. League of American Bicyclists report on the City of Davis Bicycle Plan: http://www.bikeleague.org/programs/bicyclefriendlyamerica/communities/bfc_davis.php
6. League of American Bicyclists report on the City of Portland Bicycle Plan: http://www.bikeleague.org/programs/bicyclefriendlyamerica/communities/bfc_portland.php.

TCM D-2 - Pedestrian Access and Facilities Improvements

Brief Summary:
TCM D-2 will improve pedestrian facilities and encourage walking by funding projects that improve pedestrian access to transit, employment and major activity centers. Improvements may include sidewalks/paths, benches, reduced street width, reduced intersection turning radii, crosswalks with activated signals, curb extensions/bulbs, buffers between sidewalks and traffic lanes, and street trees.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by encouraging walking throughout the Bay Area. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; and school trips.

Regulatory Context and Background:
Improved pedestrian facilities increase perceived and actual safety of walking on trips as well as the overall attractiveness of walking, encouraging more travel by this mode. About one-fifth of all personal trips are less than a mile, a short enough distance to walk. In addition, improved pedestrian facilities can encourage park-and-ride users to shift modes to walk-and-ride.

Many barriers exist that prevent people from taking more walk trips. In particular, low levels of pedestrian travel can be attributed to low density, single-use land use patterns and development of streets, roads and development projects that lack adequate attention to the pedestrian environment.

Pedestrian improvements encourage mode shift for shorter trips, especially those less than a mile. In 2006, 21% of total weekday personal trips were less than one mile. In addition, for longer trips pedestrian improvements encourage transit users who access transit by car to switch to accessing transit by walking.

These types of barriers can be overcome through a variety of techniques, including:

- Ensuring the design and placement of buildings in new developments provide amenities such as sidewalks/paths, benches, and landscaping; minimize setbacks from street; and provide entrances near sidewalks and transit stops (as well as retrofitting existing developments/streets to include these features).
- Providing an integrated street network with direct routes for pedestrians and ensuring easy pedestrian access between neighboring developments, as well as downtowns, commercial areas and community centers.

- Locating and designing parking so pedestrians have direct, attractive access (see TCM E-2)
- Promoting pedestrian-friendly land uses (see TCM D-3).
- Using street design standards that enhance pedestrian safety and comfort through measures such as reduced street width, reduced turning radii, crosswalks with activated signals, curb extensions/bulbs, buffers between sidewalks and traffic lanes, streets trees, etc.

MTC's Regional Pedestrian Committee was created in 2001. The Pedestrian Program works at the regional and community level to make walking a safe, convenient, and healthy activity by using the best engineering, public education, and law enforcement practices to minimize pedestrian injuries and fatalities.

MTC has created the Safety Toolbox, a website that provides tools for preventing collisions, injuries and fatalities, and encouraging walking and bicycling through partnerships between multiple disciplines, multiple jurisdictions, and the public. The site includes information on engineering and maintenance (e.g. design standards and review), law enforcement (e.g. police stings or photo enforcement to identify motorists who violate pedestrian right-of-way crossing streets), planning (e.g. pedestrian- and bicycle-friendly local policies), community involvement (e.g. local jurisdiction pedestrian and bicycle advisory committees), school districts (e.g. Safe Routes to School), and public health (e.g. health promotion).

Pedestrian projects are funded as a part of MTC's Transportation for Livable Communities (TLC) program (see TCM D-3).

The Transportation Development Act (TDA) is a quarter-cent sales tax that is imposed statewide in California for transportation purposes. A share of this money, TDA Article 3, goes to fund pedestrian and bicycle projects.

Since 2003, BAAQMD has awarded smart growth projects that improve conditions for pedestrians with approximately $6 million in funds (see TCM D-3).

In 2006, MTC prepared the Bay Area Pedestrian Districts Study to encourage and improve pedestrian planning in the Bay Area. The Pedestrian Districts Study advances the use of pedestrian districts as a concept for creating better pedestrian environments in the Bay Area. Through the development of the pedestrian district typologies and real-life case studies, the study identifies the types and costs of pedestrian facilities that have the greatest impact on improving the pedestrian environment. This study is one tool that cities and counties can use in planning for pedestrian improvements.

Pedestrian projects are also subject to MTC's Routine Accommodation Checklist Policy (see TCM D-1).

The regional FOCUS program (described in TCM D-3) also seeks to create communities that meet the day-to-day needs of residents in a pedestrian-friendly environment.

Implementation Actions:
Phase 1 (2012)
MTC to:
- Continue to fund pedestrian safety and facility improvements with TLC funds (see TCM D-3) and through Safe Routes to School and Safe Routes to Transit programs (see TCM C-2).
- Continue to fund pedestrian projects with TDA Article 3 funds ($0.6 million).

BAAQMD to:
- Continue to fund projects that enhance pedestrian facilities through TFCA funds (referred to as Smart Growth and traffic calming in TFCA guidelines, see TCM D-3).

ABAG to:
- Continue to work with local jurisdictions and special districts to advocate for the completion of the 500-mile Bay Trail, a planned recreational and commute corridor that, when complete, will encircle San Francisco and San Pablo Bays with a continuous network of bicycling and hiking trails. The Bay Trail provides easily accessible recreational opportunities, as well as key transportation linkages.

Phase 2 (2020)
- MTC to continue to fund pedestrian projects with TDA Article 3 funds ($1.8 million).
- BAAQMD to continue to fund projects that enhance pedestrian facilities through TFCA funds (referred to as Smart Growth and traffic calming in TFCA guidelines, see TCM D-3).

Supporting Actions by Partner Entities:
- Cities and counties should provide a comprehensive network of facilities, including sidewalks, pathways and provide for pedestrian access in their development plans.
- Local governments are encouraged to require pedestrian access and amenities as a condition of approval of new development projects, such as street trees, furniture, lighting, shelter for transit patrons and inviting environments for walking.
- Local governments should consider using a broader approach to measure roadway performance that considers cyclists and pedestrians as well as motor vehicles, rather than relying on Level of Service (LOS) that is solely based on motor vehicle throughput.
- Local governments should adopt land use policies that support more compact, infill development to make neighborhoods more walkable.
- Caltrans, Congestion Management Agencies and local governments should implement “complete streets” (aka “routine accommodation”) policies to ensure that cyclists and pedestrians are safely accommodated on all streets and roads.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.00	0.01
NO_x	0.00	0.00
$PM_{2.5}$	0.00	0.00
PM_{10}	0.00	0.00
CO_2	1.72	4.26
C02-e	1.79	4.35

This measure will also reduce emissions of the following pollutants by less than 0.01 tons per day: ROG, NOX, PM2.5, PM10, NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
By providing safer and more connected walking routes, funding new pedestrian infrastructure will encourage additional walk trips which would previously have been made by car. Because the location and type of pedestrian improvements that will be made with anticipated future TDA Article 3 and TFCA funds are undefined, the expected travel outcome impact is difficult to quantify. This analysis uses outputs from the more defined RBN investment and anticipated outcomes as a proxy to estimate changes in pedestrian travel. The ratio of the amount of money invested in the RBN relative to the percentage increase in cycling trips expected is applied to the amount of funds anticipated to be spent on pedestrian infrastructure to estimate the percent increase in pedestrian trips. An average walk distance of 0.7 miles is applied to determine the number of vehicle miles reduced.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $0.6 million
Phase 2: $1.8 million

Co-benefits
- Improved safety/reduced pedestrian-motor vehicle accidents.
- Improved public health/reduced obesity.
- Reduced travel costs.

Monitoring Mechanisms:

- Track number of pedestrian projects funded through TLC and TDA.

Issues/Impediments:

Implementation of this TCM requires that funding is available for these programs.
In addition, long distances, inclement weather, and concerns with safety may all reduce the desirability of pedestrian travel.

Sources:

1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/
2. MTC's Safety Toolbox: http://www.mtc.ca.gov/planning/bicyclespedestrians/safety/policies.htm

TCM D-3 - Local Land Use Strategies

Brief Summary:
TCM D-3 will support and promote land use patterns, policies, and infrastructure investments that support higher density mixed-use, residential and employment development near transit in order to facilitate walking, bicycling and transit use.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by promoting land use patterns, policies, and infrastructure investments that support higher densities and job creation near transit that facilitate walking, bicycling and transit use. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips.

Regulatory Context and Background:
A significant body of research has demonstrated the relationship between land use and travel behavior. People who live in areas with higher densities; a mix of residential, retail and office uses; with well-designed pedestrian, bicycle and transit infrastructure; and that are proximate to transit service have distinctly different travel behavior. They take more transit, bicycle, and walk trips and drive shorter distances, resulting in reduced vehicle miles traveled per household. For example, key findings from MTC's Station Area Residents Survey (STARS) Report include the following:

- People who live within ½ mile of a rail or ferry station are four times as likely to use transit as people living farther than ½ mile from a rail/ferry stop.
- Individuals living and working within ½ mile of a rail/ferry stop use transit for 42% of their work commute trips, whereas those who neither live nor work within ½ mile of a station use transit for only 4% of their work commute trips.
- Households within ½ mile of rail stations/ferry generate about half of the vehicle miles traveled of their suburban and rural counterparts.
- People who live within ½ mile of rail or ferry walk about half the time for all short trips (less than one mile), whereas residents who live greater than ½ mile away walk for only about one quarter of short trips.

The National Research Council concludes that "the most reliable studies estimate that doubling residential density across a metropolitan area might lower household VMT by 5 to 12 percent, and perhaps by as much as 25 percent, if coupled with higher employment concentrations, significant public transit improvements, mixed uses, and other supportive demand management measures."

Land use is directly regulated at the local level by local governments. Cities and counties adopt local general plans, specific plans and zoning ordinances. As local governments support focused growth, these documents will be updated to promote land use patterns with increased densities and mixed land uses, focus development around transit stops, strengthen downtowns and community centers, and promote infill development and reuse/redevelopment of underutilized land.

Since 2003, BAAQMD has awarded smart growth and arterial management projects with approximately $17.5 million in funds.

Local parking policies also impact travel behavior and offer an opportunity to encourage non-auto trips (see TCM E-2).

In July 2005, MTC adopted a landmark Transit-Oriented Development (TOD) Policy. The TOD Policy ties regional discretionary funds for new transit extension projects (funded via Resolution 3434) to supportive land uses. This policy establishes targets for new housing units in each transit corridor and calls for station area plans and corridor working groups to help achieve the housing targets. Station area plans to meet the housing targets must be adopted by local municipalities prior to receiving MTC discretionary funding for construction of Resolution 3434 funds. MTC has provided over $10 million in funding to date to Station Area Planning grant recipients.

ABAG, MTC, BAAQMD and BCDC administer FOCUS, a voluntary, local jurisdiction-led effort to identify future locations for infill development and for the preservation of critical habitat and open space. Through this process over 60 local government entities have identified well over 100 Priority Development Areas (PDAs). PDAs are areas near transit with a mix of housing, jobs, services, and stores to meet the day-to-day needs of residents in a pedestrian- and bicycle-friendly environment. The adopted PDAs offer the chance to house over 50% of the region's 25-year housing needs on 3% of the land within the existing built environment. In addition, 98 Priority Conservation Areas have been designated as areas for protection and preservation.

Furthermore, regional agencies are committed to securing financial incentives and providing technical assistance to designated PDAs and PCAs. A few examples of funding opportunities made available to PDAs to date are the Transportation for Livable Communities Program (described below), $229 million in Proposition 1C funds award by the Department of Housing and Community Development to 21 Bay Area communities (20 of the 21 communities are PDAs), $7.5 million in Station Area Planning grants were awarded to PDAs, and $100,000 from an Environmental Justice grant was awarded to PDAs seeking to engage community members on the topic of displacement due to development in their community. In addition, the BAAQMD's grant program, Transportation Fund for Clean Air, offers additional points to proposed projects that are located in PDAs and Potential PDAs.

MTC's Transportation for Livable Communities (TLC) program offers capital grants to cities, counties, and transit agencies to construct projects that support compact development near transit. Since the inception of the TLC program in 1998, MTC has funded 67 planning projects totaling $2.5 million and 84 capital projects totaling $85 million. In its Transportation 2035 Plan, MTC allocated $2.2 billion to TLC over the next 25 years. MTC has developed new TLC program guidelines that direct funding to PDAs and allow a broader set of eligible expenditures that are focused on providing the best possible incentives for TOD. As of December 2009, MTC approved $85 million in the first programming cycle of the new federal transportation act for the Transportation for Livable Communities Program. In July 2010, the MTC Commission approved an additional $44 million in TLC funding for 22 projects as part of the second programming cycle.

Bay Area transit agencies are also working to encourage transit-oriented development. For example, by means of its Community Design and Transportation (CDT) program the Santa Clara Valley Transportation Authority encourages mixed-use development, access to transit, and multi-modal travel.

BART continues to advance Transit-Oriented Development (TOD) in partnership with local jurisdictions, communities and selected developers, based upon a revised TOD Policy adopted by the BART Board of Directors in 2005. Nearly all of the BART station areas are in PDAs. Two-thirds of the 43 BART stations have some type of station area planning or development activity underway. Grand openings are anticipated in 2010 for the Ed Roberts Campus at the Ashby BART Station, and for the latest mixed-use phase at the Pleasant Hill BART Station.

Senate Bill 375, signed into law in September 2008, requires metropolitan planning organizations (MPOs) to develop a Sustainable Communities Strategy (SCS) element in their long-range transportation plans to reach greenhouse gas (GHG) reduction targets specified by the California Air Resources Board (CARB). The SCS adds three new elements to the plan: 1) a land-use component that identifies areas within the region to house all of the population in the region; 2) a resource and farmland protection component; and 3) a demonstration of how the development pattern and the transportation network can work together to reduce GHG emissions. In the Bay Area, the provisions of Senate Bill 375 will apply to the successor plan to Transportation 2035, scheduled for adoption in 2013. MTC and ABAG will need to work closely with local and regional agency partners to implement SB 375. SB 375 requires CARB to adopt regional GHG reduction targets for emissions associated with the automobile and light truck sector by September 30, 2010. CARB proposed draft GHG emission reduction targets in June 2010. The targets are expressed as percent reduction in per capita emissions relative to 2005. The draft targets for the San Francisco Bay Area are 5% - 10% by 2020 and 3% - 12% by 2035. CARB will issue final targets in September 2010.

MTC distributes funds to each of the nine county congestion management agencies (CMAs) in the Bay Area for transportation planning, programming and transportation/land use coordination. The interagency funding agreements for FY 2010-12 will include language that encourages county planning activities to support climate protection and reduce VMT.

Implementation Actions:
Phase 1 (2012)
MTC to:
- Award funds through new TLC program to support transit-supportive land uses in FOCUS PDAs ($85 million).
- Implement the TOD Policy for Resolution 3434 Regional Transit Expansion Program.
- Award Station Area Planning Grants to fund city-sponsored planning efforts for areas around future stations of Resolution 3434 projects and for other transit projects in PDAs.

BAAQMD to:
- Continue to fund smart growth projects through TFCA program ($3 million).
- Work with local agencies to implement the revised BAAQMD CEQA guidelines. The revised guidelines establish thresholds of significance for greenhouse gases (GHGs) adopted by the BAAQMD Board of Directors in June 2010 (see LUM 2 - Updated CEQA Guidelines and Enhanced CEQA Review).
- Issue guidance for local general plan updates, as well as guidelines to help local jurisdictions address air quality and population exposure issues related to infill development.

Regional agencies to:
- Continue to collaborate with local agencies to implement the FOCUS program and Priority Development Areas under the leadership of the Joint Policy Committee and ABAG.
- Begin developing the SCS pursuant to the requirements of SB 375.

Phase 2 (2020)
Sustain Phase 1 programs ($TBD)

Supporting Actions by Partner Entities:
- Local governments are encouraged to update general plans and area plans to promote infill development and support land use that allows residents and workers to walk, bicycle, and take transit to reach destinations, instead of relying on private automobiles.
- Local governments are encouraged to revise parking standards required for new development and update parking policies. (See TCM E-2)
- Transit agencies are encouraged to work with local governments and developers to create mixed-use transit-oriented developments in proximity to transit stations and key bus routes.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.26	0.60
NO_x	0.31	0.72
$PM_{2.5}$	0.15	0.35
PM_{10}	0.58	1.35
Ammonia (NH3)	0.16	0.00
Benzene	0.01	0.00
CO_2	856.50	1998.94
C02-e	873.63	2038.92

Emission Reduction Methodology:
As a part of the Transportation 2035 travel forecast process, MTC evaluated the impact that pricing and land use policies would have on achieving regional performance objectives, including improving air quality. In order to evaluate the impact that a more compact development pattern would have on regional travel, MTC used an alternative growth scenario developed by ABAG that goes beyond the Projections 2007 demographic forecast to balance jobs and housing and target growth in existing communities near transit. This land use alternative reflects considerable shifts in regional growth to existing employment and housing centers, areas projected to have either household or employment growth, and areas with existing and/or planned transit. The alternative scenario also assumes fewer in-commuters from neighboring regions by accommodating approximately 37,000 more households within the Bay Area. The emissions reductions estimated as a part of the travel forecasts are interpolated for year 2012 from 2010 and 2015 estimates. ABAG's alternative growth forecast is a good proxy to examine transportation impacts from land use changes; however, the provisions described in this TCM are not expected to result in the precise population/employment distribution used for this analysis. Because the alternative forecast houses an additional 37,000 households within the Bay Area, additional air quality benefits are anticipated from households that would otherwise have located in the Central Valley, but work in the Bay Area. However, because these forecasts are at a regional level, the additional benefits associated with housing this portion of the population regionally are not taken into account in this emissions reduction estimate.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $ 88 million
Phase 2: $ TBD

Co-benefits:

- Reduced travel costs.
- Reduced greenhouse gases, particulate matter, and toxic air containments.
- Community enhancements through revitalized downtowns, transit centers, and other major activity nodes.
- Closer integration of transportation and land use.
- Increased access to jobs, services, and stores.
- Improved public health by reduced driving and increased walking and biking.

Monitoring Mechanisms:

- Track funds awarded to and completion of station area plans, TLC projects, projects within PDAs, and TFCA and other grant dollars spent to support and promote land use patterns, policies, and infrastructure investments that support higher density mixed-use, residential and employment development near transit.

Issues/Impediments:

Land use changes and new development occur slowly and are directly regulated by local jurisdictions, not regional agencies. In addition, higher density development can raise neighborhood concern over impacts on traffic, parking, localized air pollution, and other impacts. However, FOCUS, TLC, and MTC's TOD Policy all provide incentives that can help to overcome some of these challenges. In addition, as Senate Bill 375 implementation begins, CEQA-relief incentives for projects consistent with the region's land use strategy to reduce greenhouse gas reductions may also reduce both the time and costs associated with this type of development.

Sources:

1. MTC's Transportation 2035 Plan and Travel Forecasts Data Summary: http://www.mtc.ca.gov/planning/2035_plan/
2. FOCUS: http://www.bayareavision.org/
3. Station Area Residents Survey (STARS) Report (September 2006) http://www.mtc.ca.gov/planning/smart_growth/stars/index.htm.
4. National Research Council. "Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions," (August 2009).
5. BART TOD initiatives: http://www.bart.gov/about/planning/station.aspx

TCM E-1 - Value Pricing Strategies

Brief Summary:
TCM E-1 will pursue implementation of value pricing strategies such as tolling on trans-bay bridges and cordon pricing recommendations from San Francisco County's Mobility, Access, and Pricing Study.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx, by managing travel demand during congested conditions and improving regional bus service through value pricing on the Bay bridges and in San Francisco. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips.

Regulatory Context and Background:
Value pricing (which is also known as congestion pricing) refers to varying road tolls wherein higher prices are set at congested times and locations and lower prices are set at less congested times and locations for purposes of reducing peak-period traffic volumes to optimal levels. Tolls can vary based on a fixed schedule, or they can be dynamic, meaning that rates change depending on the level of congestion that exists at a particular time. Value pricing serves as a demand management strategy on existing roadways to avoid the need to add capacity. In addition, value pricing can raise needed revenues for a wide-range of transportation improvements, including public transit.

The Federal Highway Administration's (FHWA) Value Pricing Pilot (VPP) program, which was initially authorized in the Intermodal Surface Transportation Efficiency Act (ISTEA) and most recently renewed under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), encourages implementation and evaluation of value pricing pilot projects to manage congestion on highways through tolling and other pricing mechanisms. Three Bay Area transportation agencies have received VPP funding to study value pricing, including area road charging and parking pricing in San Francisco, express lanes on I-580 and I-680 in Alameda County, and pricing strategies in Santa Clara County.

The San Francisco County Transportation Authority (SFCTA) is currently conducting a Mobility, Access, and Pricing Study (MAPS) to examine the feasibility of value pricing in San Francisco, following receipt of a $1 million VPP study grant from the FHWA. Refined pricing scenarios under evaluation include combining fees on gateway crossings with additional fees on downtown cordon and fees on crossings in the northeast corner of San Francisco. The SFCTA expects to present the final study recommendations in the fall of 2010.

MTC is pursuing legislation via AB 744 (Torrico) to authorize a Bay Area Express Lane Network to deliver congestion relief and public transit funding. Because of this, the HOV (high occupancy vehicle) occupancy requirements on Bay Area bridges must be made consistent with HOV occupancy requirements on adjacent freeways so that the region's bridges and express lane network form a unified system (see TCM B-3).

In January 2010, the Bay Area Toll Authority (BATA) increased the toll on the seven state-owned toll bridges in the Bay Area to pay for the completion of the Toll Bridge Seismic Retrofit Program. Under the new toll pricing structure for the Bay Bridge, which went into effect on July 1, 2010, , motorists pay a $6 toll during peak hours, a $4 toll during non-peak hours, and a $5 toll on weekends. BATA staff will evaluate the value pricing on the Bay Bridge and provide a report to the BATA Oversight Committee on an annual basis after value pricing is implemented.

Implementation Actions:

Phase 1 (2012)

- MTC will assist SFCTA in implementing recommendations of the Mobility, Access, and Pricing Study in San Francisco (if applicable and feasible).

Phase 2 (2020)

- MTC will consider time-of-day pricing on trans-Bay bridges as a part of future bridge toll increases. If the value pricing on the Bay Bridge is successful, value pricing may be considered for application to other bridges in the region, if feasible.
- MTC will continue to assist SFCTA in implementing recommendations of the Mobility, Access, and Pricing Study in San Francisco (if applicable and feasible).

Supporting Actions by Partner Entities:

- Local governments, CMAs and transit agencies are encouraged to partner with MTC to implement value pricing.
- SFCTA will implement recommendations of the Mobility, Access, and Pricing Study in San Francisco (if applicable and feasible).

Emission Reduction:

Pollutants (tons per day)	2012
NO_x	0.02
CO_2	9.68
C02-e	9.87

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: PM10, PM2.5 and NH3 (ammonia). Emission reduction estimates for year 2020 will be determined at a later date, depending upon whether value pricing is extended to include other trans-Bay bridges.

Emission Reduction Methodology:

The emissions reduction methodology is based on the 2009 study, "San Francisco-Oakland Bay Bridge Congestion Pricing – Phase 1" prepared for the Bay Area Toll Authority. This analysis examines the effect of congestion pricing on traffic demand, mode shift and time-of-day shift.

The study determines that the most likely scenario is a 4.7% mode shift from single occupancy travel to other modes, during both the AM and PM peak periods, resulting in the emission reductions reported above.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $26 million per year
Phase 2: TBD.

The cost of $26 million per year is based on the estimated number of vehicles that will pay the additional $2 per vehicle congestion surcharge during AM & PM peak periods on weekdays.

Co-benefits:
- Generation of new funds for multi-modal transportation improvements.
- Travel time savings.

Monitoring Mechanisms:
- Track whether new legislative authority is granted SFCTA to implement its MAPS strategies.
- Track implementation status of SFCTA's MAPS strategies.

Issues/Impediments:
There is mixed public opinion regarding value pricing, with concerns about the impact on existing carpoolers, potential environmental impacts, the use of net revenues, and charging for the use of the highway and bridges.

Sources:
1. FHWA's Value Pricing Program, http://ops.fhwa.dot.gov/tolling_pricing/value_pricing/index.htm
2. San Francisco County Transportation Authority: www.sfmobility.org
3. BATA: http://apps.mtc.ca.gov/meeting_packet_documents/agenda_1433/5a_tollincreaserecommendationmemo.pdf

4. Cambridge Systematics. “San Francisco-Oakland Bay Bridge Congestion Pricing – Phase 1 Final Report.” October 7, 2009.

TCM E-2 - Promote Parking Policies to Reduce Motor Vehicle Travel

Brief Summary:
Parking policies and practices have a profound impact on vehicle travel and mode choice, as well as land use patterns and the quality of the built environment. Parking policies are also an important tool in implementing focused growth strategies. This control measure outlines how the Air District, in cooperation with its regional agency partners, will 1) take actions at the regional level to implement parking policies that will benefit air quality, and 2) encourage and support local agency parking policies to reduce motor vehicle travel and promote focused growth.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by implementing parking policies that support in-fill and transit-oriented development, and reduce vehicles miles traveled, and vehicle emissions through increased transit use, walking and bicycling. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips.

Regulatory Context and Background:
Local governments have traditionally implemented parking policies that provide plentiful parking. Although "free" parking is often provided, there are both direct and indirect costs associated with all parking. Parking policies and zoning codes that promote an oversupply of parking contribute to sprawl-like growth and undermine infill and transit-oriented development.

Promoting parking policy reform will require political leadership in combination with technical assistance, resources, and incentives and disincentives. Cities and counties have direct authority over parking policies. However, regional agencies can assist local governments by providing technical resources, recommending best practices, and leading by example in adopting internal and external policies.

Many cities base their minimum parking requirements on guidelines in the *Parking Generation* manual published by the Institute of Transportation Engineers with little consideration to the location of the land use. The recommended parking ratios in the guidelines are geared toward meeting peak demand for parking in single-use suburban locations with little transit access. Applying these same parking guidelines to more dense, mixed-use areas well served by transit leads to an oversupply of parking, which in turn serves as a disincentive for people to choose other transportation modes over private vehicles.

An oversupply of parking and ineffective parking management policies creates a number of adverse impacts. For example, parking in dense areas requires using high-value land for parking lots and structures. The high cost of land and construction to build parking drives up development costs. Construction costs for structured parking can range from $30,000 to $60,000 per parking spot. These costs are typically hidden in purchase prices and rents. This exacerbates the shortfall of affordable housing in the Bay Area, creates obstacles to transit-oriented development, and reduces the land available for other uses.

Second, parking supply and the quality of design both influence streetscapes and walk-ability. For example, the pedestrian friendliness of a commercial main street compared to a strip mall depends in part on parking design. In a typical big box strip mall, large stores are surrounded by sprawling parking lots and people tend to drive and re-park from store to store rather than walk. In contrast, a commercial main street with street parking, or parking behind stores, creates a more pedestrian-friendly environment where people are more likely to park once and walk from store to store. Areas where stores are oriented to the street and parking does not dominate the streetscape are also more accessible to bicyclists, and help reduce motor vehicle travel.

Paved parking areas also contribute to local urban heat island effects, which raises local temperatures. Higher temperatures lead to higher levels of ozone and particulate matter, increase energy use for cooling, and can create health risks for sensitive populations. Paved, impermeable parking surfaces also add to water quality problems including storm water pollution run-off, flooding vulnerability, and reduced groundwater recharge.

Effective parking management can encourage alternative transportation modes, support carpooling and car-sharing, and improve vehicle travel efficiency, thus reducing vehicle miles traveled and emissions. Best practice parking policies and strategies include:

- Coordinated parking policies within jurisdictions and on a regional scale
- Coordinated parking pricing that encourages shorter-term curb parking and longer-term off-street parking
- Parking design guidelines to promote walk-ability
- Unbundled parking from residential and commercial rents
- Parking cash-out by employers
- Parking technologies such as real-time parking information and parking payment devices
- Parking financing such as a parking tax or fee and incentives or rebates
- Parking assessment districts
- Reduced parking requirements in coordination with requirements for transit passes and other transportation demand management strategies (TDMs), such as shuttles, for new developments and/or implementation of parking maximums
- Shared parking between land uses with different patterns of demand

Donald Shoup's book, *The High Cost of Free Parking* describes the consequences of nonmarket rate parking pricing and strategies to reform parking policy in much greater detail.

Examples of effective parking policies can be found in Bay Area cities. The San Francisco Metropolitan Transportation Agency (SFMTA) is implementing SFPark, a variable rate parking pricing strategy to effectively manage curb, lot, and structured parking spaces. The variable rate will be determined by location, time of day, and day of week. This project is funded through a U.S. Department of Transportation program grant. Prices will be adjusted to direct short-term parking to street parking and longer-term parking to lots and garages.

The City of Redwood City adopted a downtown parking plan and a parking ordinance to allow for periodic adjustment of downtown meter rates. Rates are based on achieving a parking utilization rate of 85 percent.

A number of local governments have reduced parking requirements for new development in conjunction with TDMs, including the cities of San Jose, Berkeley, and San Mateo.

MTC has provided technical information on parking to local agencies. In 2007, MTC conducted a parking policy study with the purpose of developing best practices and modeling tools. The study resulted in several key products including:
- Toolbox/handbook for parking best practices and strategies that support transit oriented development for local governments.
- Parking demand model that can be customized for local conditions.
- Detailed case studies of parking policies for 10 Bay Area cities.
- Parking training seminar for local governments hosted by MTC.

The Joint Policy Committee (JPC) has identified regional parking policies as a priority area in its climate action strategy. MTC, in leading this effort, is preparing a report, "Regional Parking Strategies for Climate Protection," to outline a set of regional parking reform strategies and actions to reduce greenhouse gas emissions. The JPC is in the process of developing regional parking policies. Strategies may include: leading by example, incorporating parking policies into current and conditions for forthcoming regional grants to local jurisdictions (e.g. TLC, Climate Change, Station Area Plans) with regional monitoring, engaging congestion management agencies as partners for climate protection, using or extending existing regulations to parking, conditioning distribution of regional discretionary transportation funding to local jurisdictions on implementation of specified parking management policies/practices, funding parking programs with a regional gas tax, and advocating for elimination of federal tax subsidy for employee parking.

Implementation Actions:
Phase 1 (2012)
- Regional agencies will participate in the Joint Policy Committee (JPC) consideration and adoption of regional parking strategies.
- Regional parking strategies will consider using parking fees to improve transit and other alternative modes of travel, such as biking and walking.

MTC will:

- Provide technical assistance to local jurisdictions such as consultant assistance for individual cities through the TOD Technical Assistance Program (TOD TAP) and offering best practices workshops
- Develop Transportation 2035 Climate Change guidelines regarding capital support for innovative parking strategies.
- Incorporate parking issues into the broader public outreach program for climate action.
- Continue support for State and Federal bills to reduce subsidies for parking.
- Support other BAAQMD efforts described below as relevant and feasible.

BAAQMD will:

- Work with partners to explore ways to provide financial incentives to cities and counties to implement parking policies.
- Work with partners to consider the air quality impacts associated with free parking as part of the District's Indirect Source Review (ISR) Rule development. The District is currently developing an ISR and anticipates rule adoption in 2011. Parking supply and policies may be considered as performance standards in the ISR development.
- Identify appropriate grant opportunities that can be applied to implementing parking policies.
- Make implementation of such policies a condition for receiving certain funds that are awarded at the regional agencies' discretion.
- Implement the District's revised CEQA Guidelines which were released in June 2010, including CEQA thresholds adopted by the BAAQMD Board of Directors on June 2, 2010. The updated CEQA Guidelines include guidance and tools to evaluate the air quality impacts of parking practices. In addition, in providing comment on CEQA analyses to lead agencies, the Air District will continue to recommend that lead agencies require parking best practices as a condition of project approval.
- Highlight parking best practices in its best practices web portal. The District has partnered with the Institute for Local Government to develop a best practices web portal to serve as an information clearinghouse for Bay Area local governments seeking to implement climate protection actions.
- Working with partners, will consider funding a parking technology demonstration projects. Demonstration projects may include providing real-time parking information, pay-by-phone parking, a parking hotline program where people call in advance for automated information on available parking, or related car-sharing or bike-sharing technology project. The goal would be to better understand the potential for these projects to create mode shifts and therefore reduce emissions.
- With its partners promote implementation of parking cash-out programs and advocate for legislation to strengthen and expand the reach of the California parking cash-out law enacted in 1992, including advocating appropriate legislative actions to improve the parking cash-out program, such as identifying potential financial incentives for parking cash-out programs, and recommending that parking cash-out programs be required as a condition of approval in environmental review processes.

ABAG will:

- Integrate parking best practices into its FOCUS program, through technical assistance and other resources provided to local governments.
- ABAG and MTC to administer Station Area Planning grants to FOCUS Priority Development Areas and Resolution 3434 stations that encourage adoption of TOD-oriented parking management strategies in final area plans.

Phase 2 (2020)

- MTC, BAAQMD, and ABAG will continue Phase 1 actions.

Supporting Actions by Partner Entities:

- SFMTA will implement SFpark.
- Local agencies are encouraged to adopt innovative parking strategies, including:
  - Eliminate or reduce minimum parking requirements.
  - Limit the supply of off-street parking in transit-oriented areas.
  - Encourage developers and property owners to unbundle the price of parking spaces from rents and purchase prices.
  - Promote shared parking by different users.
  - Implement market-rate pricing for off-street parking and consider residential permit programs to alleviate spillover concerns.
  - Implement performance-based pricing for curb parking in high-use areas.
  - Implement parking assessment districts that use revenue from street parking to fund pedestrian and streetscape improvements.
  - Adopt design guidelines and policies to minimize surface area for parking.
  - Implement car-sharing and bike-sharing programs in appropriate locations in exchange for reduced parking requirements, and provide as a benefit to renters.
  - Encourage a coordinated parking policy approach among jurisdictions to minimize spillover to other jurisdictions and fears of unfair competition.

Employer-Based Actions:

- Employers, in partnership with regional agencies and in particular BAAQMD, can work to reduce motor vehicle travel by promoting and implementing parking cash-out programs.
- Business groups can work with regional partners to encourage employers to voluntarily implement parking cash out programs, and/or develop other parking best practices.

Emission Reduction:

Pollutants (tons per day)	2012	2020
ROG	0.18	0.16
NO_x	0.19	0.16
$PM_{2.5}$	0.02	0.03
PM_{10}	0.02	0.05
Ammonia (NH3)	0.05	0.15
CO_2	288.00	553.00

$C0_2$-e	294.00	564.06

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:
This measure encompasses a wide range of potential actions by various regional and local agencies, to promote parking policies to reduce motor vehicle travel. The specific combination of strategies and actions that will be implemented has not yet been determined, so the potential emission reductions for this measure cannot be predicted with any degree of confidence as yet. For purposes of estimating potential emission reductions from parking measures we have analyzed the potential emission reductions that might be achieved if parking fees were to be imposed at Bay Area worksites. However, it should be emphasized that employer parking fees are not proposed as part of this measure. Rather, this is used as an example for purposes of estimating potential emission reductions, because analysis of employer parking fees was previously performed and therefore available.

The employee parking fee emission reduction methodology uses empirical findings that support a relationship between employee parking prices and vehicle work trip rates for the Bay Area (Harvey and Deakin, 1997). This data suggests that a $3.18 employee parking fee will result in a 1.65% decline in vehicle work trips. Based on Transportation 2035 Travel Forecast data, BAAQMD estimated that this charge has the potential to eliminate approximately 62,400 vehicle trips in 2012, and approximately 120,600 vehicle trips in 2020.

This analysis does not take into account that funds raised by parking pricing can be re-invested into the transportation system to improve access to transit and other alternative modes of travel, such as bicycle and pedestrian travel to further promote transit use.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $1.4 billion/year. If a fee as described above were imposed on all employer-provided parking in the region, this would result in costs of approximately $1.4 billion to employees who continue to park in employer-provided lots. However, as noted above, such a fee is not proposed as part of this measure.
Phase 2: $1.4 billion/year

Co-benefits:

- Generation of parking revenues.
- Improved housing affordability.
- Conservation of energy.
- Improved water quality / reduced storm water run-off.
- Promotion of more efficient use of land.
- Increased transit ridership, walking, and cycling.
- Enhanced community design and quality of life.
- Cost savings to those providing parking cash-out program.
- Reduced cruising and associated congestion and vehicle emissions.
- Reduced health risks from vehicle emissions and enhanced walkability.
- Potential to use any revenue generated by parking fees to fund improvements to transit and other alternative modes of travel.

Monitoring Mechanisms:

- A panel of academic researchers, including Donald Shoup, will conduct a program evaluation of SFpark.
- MTC will track legislative actions related to parking policies.

Issues/Impediments:

Local government parking reform can be impeded by limited resources and technical expertise, especially in small municipalities. These jurisdictions can seek technical assistance from MTC. Technical assistance may include: training seminars, sharing of best practices across municipalities, and development of outreach and education materials for developers and the public.

Parking policies are a highly political issue on the local level. Local governments may be reluctant to adopt parking reforms due to lack of political will; fear that businesses will protest; fear that their city will be at a disadvantage with competitors in neighboring cities without similar parking reforms; and concern that the process will be stalled due to protests from businesses and residents. Since parking costs are often hidden in rents and purchases, residents may not understand the basis or need for parking reform.

Local governments develop local parking policies based upon local needs and priorities. Willingness to implement policies consistent with regional parking policies will vary among these entities.

Sources:

1. MTC Parking Study including presentations and resource documents: http://www.mtc.ca.gov/planning/smart_growth/parking_study.htm
2. MTC Regional Parking Strategies for Climate Protection by Nelson\Nygaard Consulting Associates, May 2009
3. SFMTA's SFpark program: http://www.sfmta.com/cms/psfpark/sfparkindx.htm
4. Shoup, Donald. *The High Cost of Free Parking.* Washington D.C.: APA Planners Press, 2005.

TCM E-3 - Implement Transportation Pricing Reform

Brief Summary:
Motor vehicle travel imposes a variety of costs on society, including air pollution, that are not fully reflected in the price that drivers currently pay to own and operate a vehicle. Transportation pricing strategies can provide a powerful mechanism to reduce motor vehicle travel, traffic congestion, and tailpipe emissions of criteria pollutants and greenhouse gases. This control measure proposes that the Air District and its regional agency partners collaborate to develop and implement a regional transportation pricing policy strategy.

Purpose:
This measure will reduce emissions of the key ozone precursors, ROG and NOx by implementing transportation pricing policies in the Bay Area through establishment of a regional pricing task force to evaluate transportation pricing policy options and coordinated implementation of a regional transportation pricing strategy. In addition, the measure will reduce emissions of particulate matter, air toxics and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel; passenger and commute trips to airports; and school trips.

Regulatory Context and Background:
Transportation pricing, if well conceived and implemented, can help to achieve some or all of the following objectives:

- Reduce total vehicle trips and VMT.
- Reduce traffic congestion.
- Reduce emissions of criteria pollutants and greenhouse gases.
- Generate revenues that can be used for a variety of purposes, including support for public transit and alternative modes of transportation.
- Increase use of alternative transportation modes, such as transit, rideshare, walking and biking.

In its Transportation 2035 (T2035) Plan adopted in April 2009, MTC highlighted the importance of transportation pricing to help achieve the performance objectives defined in the Plan.

Transportation pricing mechanisms that may be available at the regional or local level include:

- High-occupancy toll (HOT) lanes – see TCM B-3.
- Value pricing, including variable bridge tolls, congestion pricing of roadways, or zone pricing (e.g. downtown tolls) – see TCM E-1.

- Parking pricing – see TCM E-2.
- Gas tax or fee: This could include imposing a gasoline tax or fee at the regional level (MTC has existing authority to place a regional gas tax measure on the ballot in Bay Area), and/or helping to build support for higher gas taxes at the state and federal levels.
- Diesel tax or fee: Revenues from higher diesel fuel taxes could be used to reduce NOx and particulate matter emissions from older heavy duty diesel trucks, which may stay on the road for many years due to the durability of their engines. Funds could go to help offset the cost of purchasing new vehicles, repowering existing vehicles with cleaner engines, or retrofitting trucks with aftermarket devices that significantly reduce NOx and particulate matter.
- VMT fee: As an alternative to gas or diesel taxes, a fee could be levied based on vehicles miles traveled, i.e., the annual miles that a vehicle is driven.
- Pay-as-you-drive vehicle insurance: Pay-as-you-drive insurance premiums would be more sensitive to the number of miles an individual drives, thereby offering vehicle owners an incentive to cut back on miles driven.
- Emission-based vehicle registration fees: Vehicle registration fees could be used to influence the purchase choices of new vehicles. Annual fees would be based on vehicle emission characteristics and the amount of annual driving that is conducted (which would be assessed at the time the vehicle undergoes a Smog Check). The fees would be used in turn to pay for various air quality programs, such as Voluntary Accelerated Vehicle Retirement programs (VAVR), fixing emission controls on mid-aged vehicles, incentives to tune up vehicles prior to the next smog season, financial assistance to low income families that would face hardships with costly tune-ups, and other programs.
- Feebates: Feebates, incentives for purchasing fuel efficient vehicles, could be offered to consumers for choosing fuel efficient vehicles over other vehicles. Funding from feebates could come from the emission-based vehicle registration fee noted above.

Implementing transportation pricing policies will require political leadership, public support, and coordination among the Bay Area's regional agencies and local jurisdictions. Although the potential benefits of transportation pricing are significant, there are major obstacles as well. The technical means are available to implement several value pricing strategies; the constraints are primarily political. The universe of potential pricing mechanisms is well defined, and pricing measures have been included in Bay Area air quality plans since 1991. The real challenge is how to develop and execute a clear strategy to implement transportation pricing in the Bay Area.

Transportation pricing policies must identify and address equity concerns, specifically those that disproportionally affect low-income drivers and impacted communities. These concerns should be addressed early in the development process. Effective pricing modeling, measures to minimize disproportionate impacts, public outreach, and monitoring of pricing policies equity issues should be incorporated into pricing strategies.

Implementation Actions:

The Air District and MTC will collaborate with their regional agency partners, under the auspices of the Joint Policy Committee, to establish a regional transportation pricing task force. The task force will be charged with:

- Developing a public engagement and input process, and coordinating with key stakeholders.
- Defining goals and outcomes.
- Developing evaluation criteria based upon those goals.
- Analyzing the various pricing options based upon the criteria.
- Identifying and advocating for any necessary enabling legislation.
- Recommending a regional transportation pricing strategy and an action plan to implement the strategy, including policies regarding reinvesting transportation fees to improve transit service and other alternative modes, such as biking and walking.

A regional transportation pricing strategy can help to inform and complement the Sustainable Communities Strategy that will be developed as part of the next update of the Regional Transportation Plan in 2013.

Supporting Actions by Partner Entities:
Local governments, businesses, insurance providers, and other public and private entities are encouraged to develop and implement policies to ensure that user costs to own and operate motor vehicles reflect the full environmental and social costs related to vehicle use. This can be pursued via value pricing of the roadway network (see TCM E-1), parking policies (see TCM E-2), and other pricing measures, such as those described in the "Background" section above.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.12	0.06
NO_x	0.12	0.06
$PM_{2.5}$	0.01	0.01
PM_{10}	0.02	0.02
Ammonia (NH3)	0.07	0.07
CO_2	184.00	200.00
C02-e	188.00	204.00

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emission Reduction Methodology:

This measure describes a variety of potential pricing policies and strategies to reduce motor vehicle emissions. The specific combination of strategies and actions that will be endorsed by the proposed regional transportation pricing task force cannot be predicted with any degree of confidence at this time. For purposes of estimating potential emission reductions from this measure, we have analyzed the potential emission reductions that might be achieved by means of a regional gas tax increase, as described below. We use the regional gas tax as an example because studies have been performed that demonstrate the relationship between higher gas fees and a reduction in vehicle trips and therefore vehicle miles traveled. However, it should be emphasized that such a fee is only one pricing option that may be evaluated by a regional task force and is not explicitly being proposed as part of this measure; rather, it is provided here as an example to illustrate the potential impact of pricing measures in reducing motor vehicle travel and emissions.

The regional gas tax emission reduction methodology uses empirical findings that support a relationship between a gasoline tax increase and decreased trip rates (US EPA). This data suggests that a 1% increase in tax would result in a 0.9% decrease in vehicle trips. At a cost of $3.01 a gallon, an increase of $0.30 per gallon was assumed. This is a 10% increase in tax.

Based on Transportation 2035 Travel Forecast data, we estimate that this charge has the potential to eliminate approximately 127,100 vehicle trips in 2012, and approximately 138,300 vehicle trips in 2020. The vehicle trips eliminated include work and non-work trips and it is assumed that 25% percent would be work trips, and 75% percent would be non-work trips. Based on these assumptions, the number of miles and emissions reduced was then estimated.

This analysis does not take into account that funds raised by a gasoline tax can be re-invested into the transportation system to improve access to transit and other alternative modes of travel, such as bicycle and pedestrian travel.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $470 million/year. If gas taxes were increased by $0.30 per gallon as described above, this would result in costs of approximately $470 million per year to Bay Area residents, based on current gasoline consumption data. However, as noted above, such a fee is not proposed as part of this measure.
Phase 2: $500 million/year

Co-benefits:
- Generate revenues that could be invested in supporting transit, other alternative modes of travel, and transit-oriented development.

- Increase transit ridership, walking, and cycling.
- Reduce health risks from vehicle emissions and enhanced walk-ability.

Monitoring Mechanisms:
Progress will be monitored by tracking the progress and outcomes of the Regional Pricing Task Force. An initial work product of the Task Force will be to identify milestones and schedule for their process.

Issues/Impediments:
Transportation pricing reform may be controversial. Any proposal will need to consider equity impacts.

Sources:
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2. Victoria Transport Policy Institute, http://www.vtpi.org/
3. Rand Corporation, 2009. "Equity and Congestion Pricing." http://www.rand.org/pubs/technical_reports/TR680/.
4. U.S. Environmental Protection Agency, "Technical Methods for Analyzing Pricing Measures to Reduce Transportation Emissions," Table 2.2. August 1998. http://www.epa.gov/OMS/stateresources/policy/transp/tcms/anpricng.pdf
5. UC Davis, Institute of Transportation Studies, "Feebates: A Complementary Strategy for Reducing GHG from Vehicles*."* May 2010 http://pubs.its.ucdavis.edu/publication_detail.php?id=1400

BAY AREA
2010 CLEAN AIR PLAN

VOLUME II

Section D

Land Use and Local Impact Measures

September 2010

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

939 Ellis Street
San Francisco, CA 94109
(415) 771.6000
www.baaqmd.gov

LUM 1 - Goods Movement

Brief Summary:
This control measure aims to reduce emissions and population exposure related to movement of freight in the Bay Area by means of incentives, enforcement, research, strategic partnerships, and outreach. Regional components of this measure will focus on reducing truck use by encouraging a shift to other modes of freight transport by supporting pilot projects and research, as well as working with partner agencies to promote land uses patterns and distribution systems (roadways, logistic systems) that result in less vehicle miles traveled. At the local level, this measure includes targeted enforcement of ARB diesel regulations, outreach to businesses and fleets operating in goods movement corridors to encourage turnover to cleaner engines, and installation of signage to indicate trucks routes and anti-idling regulations. This measure also calls for advocating for container fees to be imposed on goods transported through Bay Area ports to fund strategies to offset goods movement emissions.

Purpose:
The purpose of this measure is to 1) reduce human exposure to diesel emissions from goods movement in the near term and 2) develop and support long-range strategies and partnerships to reduce emissions from the movement of freight in the Bay Area. A key objective of this measure is to reduce air quality impacts related to goods movement in communities identified by the Air District's Community Air Risk Evaluation (CARE) program.

Source Category/Travel Market Affected:
Heavy and medium duty diesel trucks, locomotives and rail, dockside emissions from ships.

Regulatory Context and Background:
The Bay Area is home to a robust and varied economy, including the nation's fourth largest Port and five refineries, and serves as a major gateway for Pacific Rim trade. I-880, I-101, and I-80 freeways are heavily used to transport goods and intersect major metropolitan areas of Western Contra Costa/Richmond, East San Francisco, parts of the South Bay and Alameda County/West and East Oakland. Sensitive receptors and vulnerable populations near these goods movement corridors have been identified through the District's Community Air Risk Evaluation Program as being disproportionally impacted by elevated concentrations of toxic air contaminants, when compared to other areas of the Bay Area. The District has an important role to play in addressing these goods movement corridors as part of fulfilling its mission to protect the public's health and the environment.

The delivery of raw materials and finished products to factories, distribution centers and stores represents a significant segment of the Bay Area's emissions inventory. An extensive State and federal regulatory program will reduce criteria and toxic emissions from these sources down to very low levels per engine over the next 5-10 years. Over the past few years, ARB has adopted regulations consistent with their Goods Movement Emissions

Reduction Plan (GMERP) goal of reducing diesel emission by 85% by 2020. These regulations have addressed: on road drayage trucks, locomotives, harbor craft, ocean going vessels, and off-road equipment.

In addition, regional plans which address the Bay Area's goods movement infrastructure and air pollutant emissions include the Regional Transportation Plan 2035 (RTP), Goods Movement Initiative 2009, and the Port of Oakland's Maritime Air Quality Improvement Plan (MAQIP). Projects identified in these plans will soon be implemented to address numerous impacts associated with the projected increase in goods movement (See TCM B-4).

However, the rate and extent of the decline in goods movement related emissions in the Bay Area will be dictated by how quickly the region can turn over the heavy/medium duty diesel fleet with new technologies and low emission engines. This will in part depend on the Bay Area's growth in population, economic activity, and local development patterns.

Despite the recent economic slump, the volume of goods movement in the region is expected to increase rapidly in the next several decades. The Port of Oakland's Maritime Air Quality Improvement Plan projects a 100% increase in volume of trade by 2020 under its low growth scenario. Notwithstanding uncertainty around economic trends and localized effectiveness of impending state diesel regulations and local plans, this increase will have implications for regional air quality.

This measure is intended to complement ARB's diesel emission reduction regulations as well as Bay Area plans to ensure that the region develops a comprehensive strategy to reduce emissions from the goods movement sector, and protect and improve public health in communities that are disproportionally impacted by goods movement emissions.

Implementation Actions:

Regional Implementation Actions:

- Lead a Collaborative Regional Effort – Continue working with regional partner agencies, transportation stakeholders, and impacted communities in a collaborative regional process to articulate and advance a regional strategy for goods movement in the Bay Area, with a focus on air quality, health, and climate protection. This will include activities already underway, such as the Air District's Green Ports Initiative and the Port of Oakland's Maritime Air Quality Improvement Plan (MAQIP).

- Identify Strategies for Mode Shift – Examine opportunities to shift freight transport from truck to rail and barge in order to reduce emissions and exposure associated with movement of freight in the Bay Area. The District will consider participating in projects where mode shift can be beneficial to local and regional air quality, such as the "marine highway," a project to move freight by barge and tugboat between the Port of Oakland and the Port of Stockton. At the same time, the Air District will promote measures to reduce existing emissions and localized exposure associated with rail and barge, such as retrofitting or replacing older switcher locomotives, hostlers, and cargo-handling equipment.

- Efficiencies in Distribution Systems (roadways, logistic systems) – Assess current freight distribution systems and routes for major transport modes, and make recommendations for increasing travel efficiencies to reduce emissions. Areas of evaluation may include truck movements on regional highways and local roads between seaports, airports, warehousing/distribution centers, and other magnet sources, and operational and/or design improvements to facilitate more efficient goods movement.

- Best Practices for Goods Movement Land Uses – Warehousing and Distribution Centers. MTC's *Goods Movement Initiatives 2009* highlights a need to preserve land within the Bay Area core for goods movement businesses such as warehousing and distribution in order to decrease trip lengths and emissions associated with goods movement distribution. This may have implications for areas identified as impacted communities by the Air District, because many of these communities are located along the Bay Area's major trade corridors. In order to avoid or mitigate population exposure to emissions from goods movement, the District will work with regional partners and impacted communities to identify and disseminate best practices to promote good air quality, and public health and safety in neighborhoods where goods movement facilities are situated adjacent to residential land uses. Best practices may include site design, zoning, industry operating practices and technological innovations. Best practices will be evaluated based on their ability to promote public health while encouraging infill development, particularly in FOCUS Priority Development Areas. This work will complement efforts by the FOCUS program to address the role of employment centers in smart growth.

- Container Fees – The District will advocate for container fees to be imposed on goods passing through Bay Area ports to be used for environmental mitigation. Fees should be assessed to reflect the air quality impacts that result from goods movement activities, including PM, ozone precursors, air toxics and greenhouse gases. Funds will be used to improve air quality in areas most impacted by goods movement activities.

- Partnerships and Demonstration Projects – The District will work with regional partners and stakeholders to identify, evaluate, and implement innovative projects that reduce emissions and exposure associated with goods movement. Demonstration projects are intended to spark long-range changes in freight movement and technology use that will result in reduced vehicle miles traveled emissions, and human exposure to harmful emissions. Such projects may include implementing cold- ironing (shorepower) infrastructure at Bay Area ports in advance of ARB regulations in order to eliminate ship idling while docked, utilizing liquefied natural gas (LNG) to provide shorepower, promoting the use of LNG to power drayage fleets, funding new switcher engines at Bay Area railyards, measures to reduce emissions related to magnet sources, and continuing to work in partnerships such as the Green Ports initiative. These efforts will focus on CARE communities, and will be discussed with the CARE Task Force.

Local Implementation Actions:

- Collaborative enforcement - The Air District is developing a diesel enforcement program whereby inspectors enforce ARB's diesel air toxics control measures (ATCMs) specifically targeting impacted areas identified by the CARE program along two major Bay Area trade corridors. Initial enforcement activity will be focused on diesel truck idling and drayage trucks and will expand to include other ATCMs as they become applicable, including cargo handling equipment, truck refrigeration unit (TRU) enforcement, Gen Set enforcement, and off-road construction equipment. The District will also encourage local jurisdictions to create mechanisms for community-based actions to enforce ARB's anti-idling regulation, such as working with community groups to identify idling hotspots and to improve systems for responding to community concerns.

- Systematic outreach and incentives program for independent and fleet truck operators – The District will continue and enhance outreach efforts to independent and fleet truck operators regarding available funds for installing retrofit devices on and/or replacing their trucks. The Air District will continue to operate a trailer at the Port of Oakland to inform truck drivers about ARB's applicable anti-idling ATCMs, emission reducing technologies and fuels, and targeted incentives program in efforts to reduce emissions from the Port and along the I-880 corridor.

- Signage and truck routes – Air District staff will facilitate discussions with county planning departments, county public health departments, local businesses and industries, and community groups to assist in the planning process to identify suitable truck routes in and around impacted communities. Signage will then be placed to discourage idling and promote truck movements along non-residential arterial roads to reduce human exposure.

- Centralizing truck services and overnight parking – Support the Port of Oakland and Alameda County Congestion Management Agency (ACCMA) efforts to move essential truck services from within the impacted communities on to or near Port property or away from residential areas. In a recent survey conducted by the ACCMA, most truck driver access residential areas to repair their truck, to access the public scales, to obtain food or fuel, or to park until their next delivery. By having these services available at a centralized location away from residents, trucks will reduce vehicle miles traveled to these services and also drive less in residential communities thereby reducing emissions and exposure to residents.

Emissions Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.01	0.36
NO_x	1.71	6.00

$PM_{2.5}$	0.22	0.48
PM_{10}	0.02	0.20
SO_2	0.00	0.02
CO_2	2511	4116
C02-e	2561	4198

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: NH3 (ammonia), benzene, 1,3 butadiene, formaldehyde, and acetaldehyde.

Emissions Reduction Methodology:
This measure encompasses a range of potential actions by various regional agencies to address emissions from goods movement. The specific combination of strategies and actions that will be implemented has not yet been determined, so the potential emission reductions for this measure cannot be predicted with any degree of confidence as of yet. For purposes of estimating potential emission reductions we have analyzed the reductions that might be achieved by 2020 if the region successfully implements programs that address mode shift, distribution system efficiencies, container fees, and enhanced regulation enforcement.

For example, if implemented by 2020 we estimated that:

- Shifting from trucking to cleaner goods movement modes could lead to a 25% decrease in pollution from estimates for 2020 based on projected goods movement by truck.
- Increased distribution system efficiencies could lead to a 2% decrease in pollution.
- A container fee program could raise funds for clean technology grants, resulting in additional pollution reductions similar to those associated with current BAAQMD grant programs.
- A combined regulation enforcement effort between CARB and the District could increase truck regulation compliance and decrease pollution.

Exposure Reduction:
The District and California Air Resources Board (CARB) studies show that 80% of the risk from toxic air contaminants in the Bay Area comes from diesel particulate emissions. This measure addresses this air quality problem by reducing emissions from vehicles and equipment used in goods movement. This measure directly addresses air quality in impacted communities.

Emission Reduction Trade-offs:
Adding diesel retrofit devices to diesel engines may result in a decrease in fuel efficiency, thereby increasing emissions of carbon dioxide. For example, CARB and the EPA estimate that a heavy-heavy duty (HHD) diesel truck with a retrofit device added would experience a decrease in fuel efficiency of 3.5% on average. By Air District staff computations, for a HHD

truck traveling 30,000 miles per year, this decrease is estimated to result in an additional 4,382 pounds per year of carbon dioxide.

Cost:
Phase 1: $14.5 million/year
Phase 2: $14.5 million/year

Co-benefits:
- Energy/fuel cost savings from more efficient and reliable engines.
- Economic benefits from faster, more efficient goods movement.

Monitoring Mechanisms:
Regional Initiative Outcomes and Benchmarks:
- Progress in continued regional collaborative process focused on goods movement and clean air: stakeholders convened, meetings, outcomes.
- Evaluation of efforts and results to promote shifts in freight transport mode, and infrastructure needed to support mode shift.
- Analysis of air quality exposure impacts associated with current highway truck routes along trade corridors compared to alternative routes.
- Survey of existing best practices in areas where goods movement impacts residential communities to reduce health risks (as well as noise and safety impacts).
- Legislation for container fees for Bay Area ports.
- Annual report on emissions reduction resulting from innovative technologies and projects implemented through partnerships and demonstration projects.
- Summarize and highlight project successes and promote further adoption in the freight movement industry.

Local Initiative Outcomes and Benchmarks:
- Record of violations issued by District staff under collaborative enforcement agreement with ARB.
- Status reports on collaborative enforcement.
- Annual report listing applications for retrofit replacement submitted, funds awarded, and projects implemented.
- Report on needs assessment for signage and number of signs installed.
- Report from community planning process for San Jose, East Oakland, and San Leandro truck routes.

Issues/Impediments:
- Staffing and resources.
- Determining emissions reductions from cooperative enforcement of ARB's regulations.
- Developing regional buy-in for a regional task force for goods movement.

Sources:

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4. MTC's Transportation 2035 Plan, http://www.mtc.ca.gov/planning/2035_plan/
5. MTC's Goods Movement Initiatives 2009 Update, http://www.mtc.ca.gov/planning/2035_plan/Supplementary/T2035_Goods_movement_update.pdf
6. Goods Movement Plan ARB, http://www.arb.ca.gov/gmp/docs/gmap-1-11-07.pdf
7. CARE Report on TAC, http://www.baaqmd.gov/CARE/documents/care_p1_findings_recommendations_v2.pdf
8. ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling, http://www.arb.ca.gov/msprog/truck-idling/truck-idling.htm
9. New Regulation to Significantly Reduce Emissions From Existing On-Road Diesel Vehicles, http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm
10. Mobile Cargo Handling Equipment at Ports and Intermodal Rail, http://www.arb.ca.gov/ports/cargo/cargo.htm
11. ARB's PERP Regulation, http://www.arb.ca.gov/portable/perpact/perpactarchive.htm
12. ARB's Harborcraft Regulation, http://www.arb.ca.gov/ports/marinevess/harborcraft.htm
13. ARB's Drayage Truck Regulation, http://www.arb.ca.gov/msprog/onroad/porttruck/porttruck.htm
14. ARB's TRU Regulation, http://www.arb.ca.gov/diesel/tru/documents/faq121708.pdf
15. Ocean Going Vessels Regulation, http://www.arb.ca.gov/ports/marinevess/marinevess.htm
16. Railyard MOU, http://www.arb.ca.gov/railyard/railyard.htm
17. Smartway Transport Partnership, http://epa.gov/smartway/
18. Cooperative Enforcement Document, February 17, 2009 California Air Resources Board

LUM 2 - Indirect Source Review

Brief Summary:
The Air District will develop an indirect source review (ISR) rule to reduce construction and operating emissions and population exposure associated with new or modified land uses in the Bay Area. The measure is intended to address potential increases in air pollutant emissions related to economic and population growth in the region. Indirect sources are development projects that generate or attract motor vehicle trips and area source emissions. The rule may also address other sources of emissions, such as fireplaces, home heating and cooling and landscape maintenance equipment. The District will consider the legal issues, political acceptability, local government acceptability, enforceability, staffing or other resources needed when defining the scope of the ISR.

Purpose:
The purpose of indirect source review is to reduce emissions and population exposure associated with new or modified land use development in order to attain ambient air quality standards and protect public health. An ISR rule may also achieve co-benefits by reducing emissions of greenhouse gas.

Source Category/Travel Market Affected:
On-road and off-road mobile emission sources are the main source categories targeted by this measure. However, space heating, landscape maintenance and wood burning emission source categories could also be included.

Regulatory Context and Background:
The California Clean Air Act (CCAA) explicitly grants air districts authority to adopt and implement regulations to reduce or mitigate emissions from indirect and area wide sources of air pollution and that air districts can require the use of measures which reduce the number or length of vehicle trips (Health and Safety Code §40716(a)(1)). Based on CCAA enabling legislation, it is the intent of the Legislature "that districts shall endeavor to achieve and maintain state ambient air quality standards…by the earliest practicable date. In developing attainment plans and regulations to achieve this objective, districts shall consider the full spectrum of emissions sources and focus particular attention on reducing the emissions from transportation and area wide emission sources (H&SC §40910)." The CCAA also states that this ISR authority does not limit or supersede local land use authority of cities and counties. Other relevant ISR sections in the CCAA include: 40717(g), 40918(a)(4), and 42311(g).

The federal Clean Air Act authorizes states to include ISR programs in their state implementation plan under the federal Clean Air Act ((Section 110(a)(5)(42 USC 7410)).

Varying degrees and forms of ISR rules have been implemented in air districts throughout California, including Colusa County, Great Basin Unified, Imperial County, Mendocino

County, Placer County, Sacramento, San Joaquin, and Shasta County. Some of these rules are strictly cost recovery mechanisms for air districts to recoup the costs associated with CEQA review while others encourage new development to implement on-site emission reduction strategies or require applicants to pay an off-site mitigation fee.

In 2005, the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) adopted Rule 9510 as an ISR rule. The rule applies to residential, commercial, industrial, office and recreational development projects above a certain size (e.g., 50 residential units or 2,000 square feet of commercial space). Development projects must reduce their construction and operational emissions to be below two tons per year of NOx and PM_{10} through onsite mitigation or pay an off-site mitigation fee. The fee formula is structured to encourage on-site mitigation measures. SJVUAPCD uses the fees to fund off-site mitigation projects that reduce NOx and PM_{10} emissions. To date, the air district has mostly funded off-site projects that include retrofitting or replacing engines in on road and off road vehicles and agriculture equipment.

Imperial County APCD adopted Rule 310, Operational Development Fee, in 2007. It assesses a per square foot fee on all new commercial development and a per unit fee on residential development above 4 units at the point of application for a building permit. Project proponents have the option to either provide on and off site mitigation, pay the mitigation fee, or do a combination of both. Fees collected are used to fund mitigation projects that reduce ozone precursors and PM_{10}.

Sacramento Metropolitan Air Quality Management District and South Coast Air Quality Management District are each currently developing ISR rules for their jurisdictions. Both air districts committed to adopting an ISR rule as part of their state implementation plan to reduce ozone precursors.

The Air District identified the potential for an ISR rule as a further study measure in the *Bay Area 2005 Ozone Strategy*. Further Study Measure 18: Indirect Source Mitigation Program (FS-18) states that the Air District will evaluate ways to reduce emissions from new and existing land uses. Air District staff has determined that due to EPA's adoption of new health based national ambient air quality standards, the successful implementation of the San Joaquin APCD's ISR and Imperial County APCD's ISR, an Indirect Source Review Rule should be brought to the Air District's Board of Directors for consideration.

Implementation Actions:

- The District could adopt a rule that sets air quality performance standards for new and modified development.
- Fees could be assessed for projects that exceed thresholds.
- Standards and fees would be structured to provide incentives for projects located and designed to minimize emissions.
- To initiate the ISR rulemaking process, the Air District has convened a broad-based stakeholder workgroup comprised of representatives from local governments, the

building industry, developers, realtors, other business representatives, and representatives of environmental organizations and community groups.
- District staff will consult with the stakeholder group regarding the scope, structure, and applicability of the ISR rule, and the basis for any fees associated with the rule.
- Details regarding administration of the rule will be determined via the rule-making process.

Emission Reduction:

Pollutants (tons per day)	2012	2020
ROG	0.30	0.30
NO_x	0.24	0.24
$PM_{2.5}$	0.11	0.11
PM_{10}	0.47	0.47
Diesel PM	0.18	0.18
Benzene	0.01	0.01
Formaldehyde	0.01	0.01
CO_2	333.43	333.43
$C0_2$-e	340.00	340.00

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: SO_2 (sulfur dioxide), 1,3 butadiene, and acetaldehyde.

Emission Reductions Methodology:
The emissions reduction methodology for this measure is based on methodology developed and reported by the San Joaquin Valley APCD (SJVAPCD) Indirect Source Review (ISR) program. The SJVAPCD methodology requires the payment of mitigation fees for projects that will result in 2 tons of NOx or 2 tons of PM emissions a year or more. This District, based on our CEQA database, estimated for years 2010 through 2020 the number of projects that may be subject to the ISR program. The emission reductions above estimate the results if 15% of emissions from new construction are mitigated through off-site mitigations.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions. This measure will also reduce localized population exposure to air pollution.

Emission Reduction Trade-offs:
None identified.

Cost:
Phase 1: $1.4 million/year
Phase 2: $1.4 million/year

These costs represent only those associated with the payment of off-site mitigation fees, not the costs developers may incur implementing on-site measure to reduce their project's emissions.

Co-benefits:

- Improved project design and planning.
- Public health benefits from reduced emissions, improved pedestrian access, and use of green building elements.
- Reduced GHG emissions from motor vehicles, building energy use, and other sources.

Monitoring Mechanisms:
Air District staff will work with the stakeholder group and the public through workshops to identify the most efficient mechanism to monitor implementation of the ISR.

Issues/Impediments:
The ISR needs to be developed to encourage less auto dependent development, to reduce regional VMT and not create an administrative burden on local land use planning. The ISR will need to take into consideration the implementation of measures for AB32 and SB375.

Sources:

1. 2005 Ozone Strategy, Volume II, Appendix E, Further Study Measure 18
2. Memo to Mobile Source Committee, September 11, 2007: *2005 Ozone Strategy Further Study Measure 18: Indirect Source Mitigation Program*
3. SCAQMD ISR: http://www.aqmd.gov/rules/proposed/2301/index.html
4. SJVAPCD ISR Web site http://www.valleyair.org/ISR/ISRHome.htm
5. SMAQMD 2009 Ozone Plan, page 7-21, IS-1 IS-2 http://www.arb.ca.gov/planning/sip/planarea/sacsip/sacplanozone2009.pdf
6. Larry Robinson, Joe Carl, SMAQMD, personal communication
7. Imperial Valley Rule 310 Operational Development Fee - http://www.co.imperial.ca.us/ag/Departments/Air%20Pollution/Forms%20&%20Documents/Rule%20310%20Mitigation%20Project%20Report%20Package.pdf http://www.imperialcounty.net/ag/Departments/Air%20Pollution/WORKSHOPS/Past%20Workshops/Rule%20310/Rule%20310%20Public%20Committee%20Nomination%20Ad.doc
8. 2008 Annual Report on the District's Indirect Source Review Program, SJVUAPCD http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2008/June/Item%2013/GVB%20Agenda%20Item%2013.pdf
9. Socioeconomic analysis SJVUAPCD http://www.valleyair.org/ISR/Documents/RULE_9510_AppendixF.pdf
10. Survey of ISRs from SCAQMD http://www.aqmd.gov/rules/proposed/2301/pr2301_is_program_matrix_20090224.pdf

LUM 3 - Updated CEQA Guidelines and Enhanced CEQA Review

Brief Summary:
The Air District recently took action to update its California Environmental Quality Act (CEQA) guidelines to provide guidance on evaluating air quality impacts of development projects and local plans, determining whether an impact is significant, and mitigating significant air quality impacts related to new or modified projects. The updated guidelines include revised thresholds of significance for criteria pollutants and toxic air contaminants, and newly-adopted thresholds of significance for greenhouse gas emissions, adopted by the Air District Board of Directors in June 2010. In addition to issuing revised CEQA guidelines, the District will also strengthen its existing CEQA review program, as resources permit, by increasing the number of CEQA documents that District staff reviews and by quantifying estimated reductions in emissions of criteria pollutants, air toxics, and greenhouse gases from the District's CEQA program.

Purpose:
The purpose of this measure is to reduce emissions associated with new development in order for the region to attain state and national ambient air quality standards, reduce local impacts, reduce greenhouse gases, and improve health outcomes in the region.

Source Category/Travel Market Affected:
This measure would affect new development in the Bay Area subject to the environmental review process as defined by the California Environmental Quality Act.

Regulatory Context and Background:
The California Environmental Quality Act (CEQA) was adopted in 1970 and intended to inform policy-makers and the public about potential environmental effects of a project; identify ways to reduce adverse impacts; offer alternatives to the project; and enhance public participation in the planning process. The District participates in the CEQA review process in several capacities. The District provides guidance to Lead Agencies, consultants, and other parties regarding air quality analyses of project and plans conducted pursuant to CEQA. The District acts as a Lead Agency when it has the primary authority to implement or approve a project, such as a District Clean Air Plan or Rule. The District acts as a Responsible Agency when it has discretionary authority over a project, but does not have the primary decision-making authority of a Lead Agency. In this capacity, the District consults with the Lead Agency regarding potential impacts and may recommend project alternatives or mitigation measures to lessen any potentially significant air quality impacts. As a Commenting Agency, the District reviews environmental documents prepared for development proposals and plans in the Bay Area and provides comments to Lead Agencies regarding the adequacy of the air quality analysis and mitigation measures.

Implementation Actions:
Key implementation actions include the following:

- Update CEQA guidelines; provide revised thresholds of significance and mitigation measures, including new thresholds that address particulate matter and greenhouse gases.
- Conduct outreach to local jurisdictions, consultants, developers, and community members to introduce revised CEQA guidelines and environmental review process and provide technical assistance to lead agencies.
- As described in LUM 4, pursuant to the CEQA thresholds for air toxics, the District will encourage local jurisdictions to develop Community Risk Reduction Plans to reduce public exposure to air toxics and PM, and provide technical assistance in developing these plans, including assistance in developing community engagement plans that create effective channels for public participation to inform and implement the plans.
- Expand CEQA commenting by the Air District:
  - Review CEQA documents prepared for Bay Area projects, evaluate their consistency with the District's Guidelines, and recommend mitigation measures as appropriate.
  - Estimate the emission reductions achieved based on the implementation of mitigation measures recommended by the District.
  - Provide on District's CEQA website a log of CEQA comment letters accessible to the public.
- Develop and implement a monitoring plan for the District's CEQA review program:
  - Develop a database of projects that have been commented on and track implementation of mitigation measures.
  - Conduct regular reviews to evaluate CEQA program performance in achieving its goals and to recommend potential improvements to the program.
  - Review Mitigation Monitoring and Reporting Plans of CEQA documents prepared in the Bay Area.

Emission Reduction:

Pollutants (tons per day)	2012	2020
ROG		0.44
NO_x		0.35
$PM_{2.5}$		0.16
PM_{10}		0.67
Diesel PM		0.26
Benzene		0.01
1,3 Butadiene		0.01
Formaldehyde		0.01
CO_2		438.50
CO_2-e		447.00

No emission reductions are estimated for 2012. In addition to the pollutants shown above for year 2020, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: Ammonia (NH3) and acetaldehyde.

Emissions Reductions Methodology:
The emissions reduction methodology for this measure is based on the District's CEQA database and new development projections for years 2010 through 2020. We estimated the unmitigated emissions for the new land use projects expected over this time period that would be subject to CEQA. We then assumed that the enhanced CEQA program would result in approximately 20% of the total unmitigated emissions from new land development would be reduced through the implementation of feasible mitigation measures on projects that would not have otherwise mitigated their project's emissions.

Exposure Reduction:
This measure will reduce region-wide population exposure to air pollutants based on the estimated reduction in emissions.

Emission Reduction Trade-offs:
None identified.

Cost:
Lead agencies currently prepare air quality analyses in CEQA documents. Air District staff does, and will continue to, provide technical assistance. This measure is not expected to significantly increase or decrease these review costs. However, this analysis does not consider the costs developers may incur preparing environmental analyses or implementing mitigation measures to reduce their project's emissions.

Co-benefits:
This control measure will result in long term adoption of cleaner, greener building practices in the Bay Area, as municipalities, developers, and their consultants adopt green building practices, build closer to transit nodes and job centers, and incorporate travel demand management into their projects and plans.

Monitoring Mechanisms:
Annual performance reviews of program.

The District will report to the CARE Task Force and other interested parties on progress in developing and implementing Community Risk Reductions Plans.

Issues/Impediments:
Implementing the Air District's revised CEQA guidelines will require working with local agencies to help them understand and apply the new guidelines. The District will perform outreach and provide tools and assistance to local agencies to ensure that the guidelines are properly applied. .

Sources:
1. Draft CEQA Thresholds Options Paper
2. Survey of CEQA Thresholds
3. LUM 4 - Land Use Guidance

Brief Summary:
Local land use decisions have direct impacts on air quality and population exposure to air pollutants. This measure summarizes programs and resources that the Air District will make available to local agencies to help them develop goals, policies and implementation measures that will improve air quality, reduce motor vehicle travel and emissions, and reduce population exposure to air pollutants. With its regional partners, the Air District is committed to assisting local governments to include smart growth principles and climate protection elements in their general plans to reduce criteria pollutants and greenhouse gas emissions.

Purpose:
The purpose of this measure is to provide resources to local governments that support local land use patterns to reduce mobile source emissions and population exposure to toxic air contaminants and reduce emissions related to energy use and waste disposal.

Source Category:
This measure will address emissions related to land use patterns and vehicle miles traveled (light–duty, medium-duty, and heavy-duty vehicles), as well as emissions related to energy use and waste disposal.

Regulatory Context and Background:
Local land use strategies and decisions will play a key role in determining whether the Bay Area can achieve our air quality and climate protection goals as our population and economy continue to grow. Because general plans prescribe land use patterns that shape growth in cities and counties for 20 years or more, they represent the most effective mechanisms to reduce vehicle miles traveled, vehicle emissions, and population exposure to toxic air contaminants.

California's Office of Planning and Research recommends that local governments update their general plans every ten years. Approximately ten Bay Area local governments are currently in the process of updating their general plans. The majority of these local governments are integrating smart growth principles and climate protection strategies into their update.

Within the Bay Area, there are approximately 50 cities that have not updated their general plan since 2000. Therefore, within the next several years, nearly half of the Bay Area's 110 local governments can be expected to update their general plan. This presents an opportunity for Bay Area local governments to incorporate smart growth and climate protection policies in their general plans in order to reduce emissions from motor vehicle travel over the long term, while also reducing population exposure to air pollutants.

Implementation Actions:
Link with District Functions: The Air District is implementing a number of programs and projects that can help to inform general plan updates.

- CEQA Guidelines: In June 2010 the Air District updated its CEQA Guidelines to assist lead agencies in analyzing air quality impacts. The update contains numerous mitigation measures and general plan policies to implement smart growth principles, minimize construction emissions, and reduce population exposure to air pollutants.
- CARE Program: The Community Air Risk Evaluation (CARE) program, initiated in 2004, evaluates and reduces health risks associated with exposures to toxic air contaminants (TACs) in the Bay Area. The program's main objectives are to: identify health risks from exposure to TACS, assess population exposures; identify TAC sources and impacted communities; and develop and implement mitigation measures.
- Clean Air Communities Initiative (CACI): This initiative is a multifaceted approach to address health concerns in communities disproportionally impacted with poor air quality and to minimize the effects of land use decisions on cumulative air impacts. CACI will bring to bear regulations, incentives, enforcement, public education, and technical studies to improve air quality.
- Community Risk Reduction Plans (CRRPs): The District will work with cities and counties to develop Community Risk Reduction Plans (CRRPs) to reduce population exposure to air toxics and PM, particularly in impacted communities identified through the CARE program. The District will provide technical assistance in preparing these plans, including assistance in developing community engagement plans that create effective channels for public participation to inform and implement the plans. The CRRPs should provide comprehensive plans for defined areas, including public engagement processes, emission inventories, numerical goals or targets, risk modeling, emission reduction measures, and monitoring mechanisms.
- Indirect Source Review Rule: As described in LUM 2, the Air District is in the early phases of developing an Indirect Source Review (ISR) regulation to reduce air pollutant emissions from new or modified development. It is anticipated that the ISR will provide incentives to design and locate new and modified development to minimize associated emissions.
- Climate Protection Grants: The District's climate protection grant program provided funding to local governments developing climate action plans or integrating climate protection strategies into general plans.
- Provide Best Practice Guidance: The Air District has, and will continue, to provide general plan guidance and best practices resources to local governments. In addition, where appropriate, the Air District encourages local jurisdictions to consult with the "Air Quality and Land Use Handbook: A Community Health Perspective," published by the California Air Resources Board.

- Best Practices Web Portal: In partnership with the Institute for Local Government, the Air District has developed a web portal highlighting best practices for local governments to use for their own climate action plans and general plans. The portal enables local governments to search for a wide variety of best practices and upload information on their own success stories. This tool is available at http://www.ca-ilg.org/SFBayClimate.

- CAPCOA Resource Documents: CAPCOA (California Air Pollution Control Officers Association) published two separate documents useful to local governments updating their general plans: 1) *Model Policies for Greenhouse Gases in General Plans* (May 2009), a resource for local governments to incorporate general plan policies to reduce greenhouse gas emissions; 2) *CEQA & Climate Change* (January 2008), a resource for evaluating and addressing greenhouse gas emission in CEQA review. In addition, CAPCOA is preparing a document entitled *Quantifying Greenhouse Gas Emissions: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures*. This report, scheduled for release by September 2010, will include quantification methodologies and estimated reductions from a wide variety of GHG mitigation measures.

- Regional Agency Collaboration: The Air District's regional agency partners provide a number of resources to help local governments implement smart growth principles. Resource tools include MTC's parking toolkit, Transportation for Livable Communities (TLC) capital grants; and the multi-agency FOCUS program that directs incentives, including funds for land use planning and capital infrastructure, to Priority Development Areas (PDAs), which are locally-identified infill development opportunity areas near transit.

Expand Assistance to Local Governments: To further enhance its support to local governments, the Air District may implement some or all of the following actions.

- Present Workshops: The Air District will consider conducting a number of workshops to assist local governments in addressing air quality and climate change in their general plan updates.

- Identify Innovative Funding Mechanisms: Lack of financial resources is a major constraint on the ability of local jurisdictions to conduct comprehensive long-range planning. Therefore, the Air District will collaborate with its regional partners to identify innovative funding mechanisms to help jurisdictions address air quality and climate change in their general plans.

- Tailor Best Practices to Local Needs: Guidance for general plans must recognize that our communities are diverse and that no single policy prescription would be appropriate in all cases. Communities that lack transit infrastructure have different challenges than cities with strong transit and/or the potential for transit-oriented development. The Air

District will consider developing tools catered to a variety of community types to reform their development patterns and reduce emissions.

- Track Local Government Progress: The Air District will consider monitoring and tracking progress of general plan updates and climate action plans. Monitoring mechanisms may include: tracking the number of climate action plans and emission reduction targets integrated in general plans; and assisting local governments in developing biennial GHG emission inventories to encourage them to track local progress.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.08	0.09
NO_x	0.08	0.10
$PM_{2.5}$	0.01	0.02
PM_{10}	0.01	0.03
CO_2	136.27	346.58
$C0_2$-e	139.00	353.51

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: Diesel PM, sulfur dioxide (SO_2), ammonia (NH3), benzene, 1,3 butadiene, formaldehyde and acetaldehyde.

Emissions Reductions Methodology:
The emissions reduction methodology is based on methodology in ABAG's report *Projections 2009: What If?* The District estimated that if all General Plan updates in the Bay Area over the next five years emphasized compact development, there would be a 1% reduction in light-duty vehicle miles traveled (VMT) due to changes in land use patterns and increased use of transit. This decline in VMT translates into reductions in emissions, as shown in the table above.

Exposure Reduction:
This measure will provide guidance to local jurisdictions in assessing health impacts associated with new development and in implementing mitigations to reduce population exposure to air pollutants related to land use projects that generate toxic emissions and land use projects that are impacted from existing emission sources.

Emission Reduction Trade-offs:
None identified.

Cost:
Costs would vary. Available resources would be determined through the District's budget process.

Co-benefits:

This measure will 1) foster collaboration with local governments, resulting in more wide spread and effective implementation of this and other District programs, and 2) provide public health benefits, since focused development is more conducive to walking and bicycling.

Monitoring Mechanisms:

Program success will be monitored using:

- Database tracking Bay Area general plan updates including air quality / climate friendly policies and/or elements and emissions reductions quantified in environmental review process, number of climate action plans and emission reduction targets integrated in general plans.
- Tracking local government participation in and satisfaction with land use and air quality web or workshop resources offered by the District.
- Monitoring of ISR and CEQA programs as stated in LUM 2 and LUM 3.
- The District will report to the CARE Task Force and other interested parties on progress in developing and implementing Community Risk Reductions Plans.

Issues/Impediments:

The availability of staff resources to implement the actions identified in this measure is likely to be the main challenge to successful implementation.

Sources:

1. Governor's Office of Planning and Research, California Planners' Book of Lists, http://opr.ca.gov/index.php?a=planning/publications.html#pubs-C
2. CEQA Guidelines and Greenhouse Gases, http://opr.ca.gov/index.php?a=ceqa/index.html
3. California Air Pollution Control Officers (CAPCOA) CEQA and Climate Change White Paper, http://www.capcoa.org/CEQA/CAPCOA%20White%20Paper.pdf
4. CAPCOA Model Policies for Greenhouse Gases in General Plans (May 2009), http://www.capcoa.org/modelpolicies/CAPCOA%20Model%20Policies%20for%20Greenhouse%20Gases%20in%20General%20Plans%20-%20June%202009.pdf
5. Air Quality and Land Use Handbook: A Community Health Perspective, (April 2005), http://www.arb.ca.gov/ch/handbook.pdf
6. ABAG 2009 Projections: What If? http://www.abag.ca.gov/rss/pdfs/whatif.pdf

LUM 4 - Land Use Guidance

Brief Summary:
Local land use decisions have direct impacts on air quality and population exposure to air pollutants. This measure summarizes programs and resources that the Air District will make available to local agencies to help them develop goals, policies and implementation measures that will improve air quality, reduce motor vehicle travel and emissions, and reduce population exposure to air pollutants. With its regional partners, the Air District is committed to assisting local governments to include smart growth principles and climate protection elements in their general plans to reduce criteria pollutants and greenhouse gas emissions.

Purpose:
The purpose of this measure is to provide resources to local governments that support local land use patterns to reduce mobile source emissions and population exposure to toxic air contaminants and reduce emissions related to energy use and waste disposal.

Source Category:
This measure will address emissions related to land use patterns and vehicle miles traveled (light–duty, medium-duty, and heavy-duty vehicles), as well as emissions related to energy use and waste disposal.

Regulatory Context and Background:
Local land use strategies and decisions will play a key role in determining whether the Bay Area can achieve our air quality and climate protection goals as our population and economy continue to grow. Because general plans prescribe land use patterns that shape growth in cities and counties for 20 years or more, they represent the most effective mechanisms to reduce vehicle miles traveled, vehicle emissions, and population exposure to toxic air contaminants.

California's Office of Planning and Research recommends that local governments update their general plans every ten years. Approximately ten Bay Area local governments are currently in the process of updating their general plans. The majority of these local governments are integrating smart growth principles and climate protection strategies into their update.

Within the Bay Area, there are approximately 50 cities that have not updated their general plan since 2000. Therefore, within the next several years, nearly half of the Bay Area's 110 local governments can be expected to update their general plan. This presents an opportunity for Bay Area local governments to incorporate smart growth and climate protection policies in their general plans in order to reduce emissions from motor vehicle travel over the long term, while also reducing population exposure to air pollutants.

Implementation Actions:
Link with District Functions: The Air District is implementing a number of programs and projects that can help to inform general plan updates.

- CEQA Guidelines: In June 2010 the Air District updated its CEQA Guidelines to assist lead agencies in analyzing air quality impacts. The update contains numerous mitigation measures and general plan policies to implement smart growth principles, minimize construction emissions, and reduce population exposure to air pollutants.

- CARE Program: The Community Air Risk Evaluation (CARE) program, initiated in 2004, evaluates and reduces health risks associated with exposures to toxic air contaminants (TACs) in the Bay Area. The program's main objectives are to: identify health risks from exposure to TACS, assess population exposures; identify TAC sources and impacted communities; and develop and implement mitigation measures.

- Clean Air Communities Initiative (CACI): This initiative is a multifaceted approach to address health concerns in communities disproportionally impacted with poor air quality and to minimize the effects of land use decisions on cumulative air impacts. CACI will bring to bear regulations, incentives, enforcement, public education, and technical studies to improve air quality.

- Community Risk Reduction Plans (CRRPs): The District will work with cities and counties to develop Community Risk Reduction Plans (CRRPs) to reduce population exposure to air toxics and PM, particularly in impacted communities identified through the CARE program. The District will provide technical assistance in preparing these plans, including assistance in developing community engagement plans that create effective channels for public participation to inform and implement the plans. The CRRPs should provide comprehensive plans for defined areas, including public engagement processes, emission inventories, numerical goals or targets, risk modeling, emission reduction measures, and monitoring mechanisms.

- Indirect Source Review Rule: As described in LUM 2, the Air District is in the early phases of developing an Indirect Source Review (ISR) regulation to reduce air pollutant emissions from new or modified development. It is anticipated that the ISR will provide incentives to design and locate new and modified development to minimize associated emissions.

- Climate Protection Grants: The District's climate protection grant program provided funding to local governments developing climate action plans or integrating climate protection strategies into general plans.

- Provide Best Practice Guidance: The Air District has, and will continue, to provide general plan guidance and best practices resources to local governments. In addition, where appropriate, the Air District encourages local jurisdictions to consult with the "Air

Quality and Land Use Handbook: A Community Health Perspective," published by the California Air Resources Board.

- Best Practices Web Portal: In partnership with the Institute for Local Government, the Air District has developed a web portal highlighting best practices for local governments to use for their own climate action plans and general plans. The portal enables local governments to search for a wide variety of best practices and upload information on their own success stories. This tool is available at http://www.ca-ilg.org/SFBayClimate.

- CAPCOA Resource Documents: CAPCOA (California Air Pollution Control Officers Association) published two separate documents useful to local governments updating their general plans: 1) *Model Policies for Greenhouse Gases in General Plans* (May 2009), a resource for local governments to incorporate general plan policies to reduce greenhouse gas emissions; 2) *CEQA & Climate Change* (January 2008), a resource for evaluating and addressing greenhouse gas emission in CEQA review. In addition, CAPCOA is preparing a document entitled *Quantifying Greenhouse Gas Emissions: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures*. This report, scheduled for release by September 2010, will include quantification methodologies and estimated reductions from a wide variety of GHG mitigation measures.

- Regional Agency Collaboration: The Air District's regional agency partners provide a number of resources to help local governments implement smart growth principles. Resource tools include MTC's parking toolkit, Transportation for Livable Communities (TLC) capital grants; and the multi-agency FOCUS program that directs incentives, including funds for land use planning and capital infrastructure, to Priority Development Areas (PDAs), which are locally-identified infill development opportunity areas near transit.

Expand Assistance to Local Governments: To further enhance its support to local governments, the Air District may implement some or all of the following actions.

- Present Workshops: The Air District will consider conducting a number of workshops to assist local governments in addressing air quality and climate change in their general plan updates.

- Identify Innovative Funding Mechanisms: Lack of financial resources is a major constraint on the ability of local jurisdictions to conduct comprehensive long-range planning. Therefore, the Air District will collaborate with its regional partners to identify innovative funding mechanisms to help jurisdictions address air quality and climate change in their general plans.

- Tailor Best Practices to Local Needs: Guidance for general plans must recognize that our communities are diverse and that no single policy prescription would be appropriate in all cases. Communities that lack transit infrastructure have different challenges than cities with strong transit and/or the potential for transit-oriented development. The Air District will consider developing tools catered to a variety of community types to reform their development patterns and reduce emissions.

- Track Local Government Progress: The Air District will consider monitoring and tracking progress of general plan updates and climate action plans. Monitoring mechanisms may include: tracking the number of climate action plans and emission reduction targets integrated in general plans; and assisting local governments in developing biennial GHG emission inventories to encourage them to track local progress.

Emission Reductions:

Pollutants (tons per day)	2012	2020
ROG	0.08	0.09
NO_x	0.08	0.10
$PM_{2.5}$	0.01	0.02
PM_{10}	0.01	0.03
CO_2	136.27	346.58
$C0_2$-e	139.00	353.51

In addition to the pollutants shown above, this measure will reduce emissions of the following pollutants by less than 0.01 tons per day: Diesel PM, sulfur dioxide (SO_2), ammonia (NH3), benzene, 1,3 butadiene, formaldehyde and acetaldehyde.

Emissions Reductions Methodology:
The emissions reduction methodology is based on methodology in ABAG's report *Projections 2009: What If?* The District estimated that if all General Plan updates in the Bay Area over the next five years emphasized compact development, there would be a 1% reduction in light-duty vehicle miles traveled (VMT) due to changes in land use patterns and increased use of transit. This decline in VMT translates into reductions in emissions, as shown in the table above.

Exposure Reduction:
This measure will provide guidance to local jurisdictions in assessing health impacts associated with new development and in implementing mitigations to reduce population exposure to air pollutants related to land use projects that generate toxic emissions and land use projects that are impacted from existing emission sources.

Emission Reduction Trade-offs:
None identified.

Cost:
Costs would vary. Available resources would be determined through the District's budget process.

Co-benefits:
This measure will 1) foster collaboration with local governments, resulting in more wide spread and effective implementation of this and other District programs, and 2) provide public health benefits, since focused development is more conducive to walking and bicycling.

Monitoring Mechanisms:
Program success will be monitored using:
- Database tracking Bay Area general plan updates including air quality / climate friendly policies and/or elements and emissions reductions quantified in environmental review process, number of climate action plans and emission reduction targets integrated in general plans.
- Tracking local government participation in and satisfaction with land use and air quality web or workshop resources offered by the District.
- Monitoring of ISR and CEQA programs as stated in LUM 2 and LUM 3.
- The District will report to the CARE Task Force and other interested parties on progress in developing and implementing Community Risk Reductions Plans.

Issues/Impediments:
The availability of staff resources to implement the actions identified in this measure is likely to be the main challenge to successful implementation.

Sources:
7. Governor's Office of Planning and Research, California Planners' Book of Lists, http://opr.ca.gov/index.php?a=planning/publications.html#pubs-C
8. CEQA Guidelines and Greenhouse Gases, http://opr.ca.gov/index.php?a=ceqa/index.html
9. California Air Pollution Control Officers (CAPCOA) CEQA and Climate Change White Paper, http://www.capcoa.org/CEQA/CAPCOA%20White%20Paper.pdf
10. CAPCOA Model Policies for Greenhouse Gases in General Plans (May 2009), http://www.capcoa.org/modelpolicies/CAPCOA%20Model%20Policies%20for%20Greenhouse%20Gases%20in%20General%20Plans%20-%20June%202009.pdf
11. Air Quality and Land Use Handbook: A Community Health Perspective, (April 2005), http://www.arb.ca.gov/ch/handbook.pdf
12. ABAG 2009 Projections: What If? http://www.abag.ca.gov/rss/pdfs/whatif.pdf

LUM 5 – Reduce and Track Health Risk in Impacted Communities

Brief Summary:
This measure describes a set of complementary actions and programs that comprise key elements of the Air District's strategy to reduce emissions and population exposure in impacted communities as identified by the Air District's Community Air Risk Evaluation (CARE) Program. Key elements of this measure include:

- The District will establish a system to track cumulative health risks associated with emissions from stationary, mobile, and area sources in order to help monitor progress in reducing population exposure to toxic air contaminants and to fine particulate matter (PM2.5) in impacted communities.
- The District will revise rules to tighten requirements in order to reduce emissions of air toxics and particulate matter from existing sources via its Air Toxics "Hot Spots" Program and from new sources via its New Source Review rules. See SSM 16, 17, and 18 for additional description of these rule revisions.

Purpose:
The purpose of this measure is to address the cumulative air quality impacts of emissions of toxic air contaminants and directly-emitted PM2.5 from stationary, mobile, indirect sources, magnet sources, and area sources in impacted communities.

Source Category/Travel Market Affected:
The risk tracking system will address the full range of emissions sources. This includes stationary sources subject to the District's permitting regulations, as well as mobile sources and area sources.

Regulatory Context and Background:
Applicable air quality requirements related to controlling stationary sources include rules and regulations adopted by the District, the California Air Resources Board, and the U.S. Environmental Protection Agency. In California, air districts have the primary responsibility for controlling air pollution from non-vehicular stationary sources of air pollution. The Air District regulates stationary sources through rulemaking for specific source categories, through its permitting process and New Source Review process for new and modified sources, and by administering the Air Toxics "Hot Spots" Program for existing sources.

New Source Review (NSR) requires that new/modified sources utilize the Best Available Control Technology to minimize air pollution impacts. The existing District NSR rules are Regulation 2, Rule 2: New Source Review, and Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants. Additional Air District NSR requirements include emission offsets, air quality impact analysis for criteria air pollutants and their precursors, and health risk screening analysis for toxic air contaminants (TACs).

The Air Toxics "Hot Spots" (ATHS) program is a state program implemented by California air districts. Assembly Bill 2588, the Air Toxics "Hot Spots" Information and Assessment Act, was enacted by the State legislature in 1987. AB 2588 requires facilities throughout California to provide information to the public about emissions of TACs, and the impact that those emissions may have on public health. The Act was amended in 1992 by SB 1731, which provided air districts with the authority to require facilities with significant risks to implement a site-specific risk reduction audit and plan. Each air district has the authority to establish health risk thresholds for public notification and risk reduction requirements.

Regulation 2, Rule 5 and the ATHS program in many cases require the preparation of a site-specific Health Risk Screening Analysis (HRSA), which is an assessment that describes the possible adverse health effects which may result from public exposure to routine and predictable emissions of TACs. All permit applications for new and modified sources are screened for emissions of TACs. Where the predicted health risks from a proposed project exceed specified threshold levels, the new/modified source(s) must use the Best Available Control Technology to minimize TAC emissions (TBACT). The TBACT and Project Risk standards in Regulation 2, Rule 5, are uniformly applied throughout the District's jurisdiction.

Procedures used for completing HRSAs are based on guidelines adopted by Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHA) for use in the Air Toxics Hot Spots Program. Procedures for assessing health risks are intended to protect sensitive individuals such as children, and individuals with pre-existing health conditions. The Children's Environmental Health Protection Act (Senate Bill 25) established specific requirements for OEHHA to determine whether existing health risk assessment procedures are adequate to protect infants and children from the harmful effects of air pollution. OEHHA has already acted under SB 25 to revise certain procedures for assessing non-cancer health risks to provide a greater margin of safety for children, and revisions to cancer risk assessment procedures are expected to be proposed in late 2009, with final action anticipated in 2010.

Implementation Actions:
Specific components of this measure are described below.

• The District will track the maximum cumulative health risks related to toxic air contaminants and directly-emitted PM2.5 from the full range of emission sources in the impacted communities defined by the CARE program. To do so, the District will compile detailed local emissions inventories of toxic air contaminants and directly-emitted PM2.5, and perform modeling of local concentrations of these pollutants, and track changes in emissions, concentrations, and population exposures over time. In addition to toxic air contaminants and directly-emitted PM2.5, District staff will evaluate the technical feasibility of including additional criteria pollutants in the risk-tracking system.

• Amendments to Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants, were adopted in January 2010, as described in Stationary Source Measure 17.

• District staff will propose amendments to Regulation 2, Rule 2: New Source Review to address PM2.5, as described in Stationary Source Measure 16.

• The District will consider revising the District's Air Toxics "Hot Spots" Program for existing facilities to incorporate more stringent risk reduction requirements than are provided in existing District policy. See description of Stationary Source Measure 18. As discussed above, OEHHA is considering revising cancer risk assessment procedures to provide a greater margin of safety for protecting children. Based on discussions with OEHHA staff, it is possible that these revisions could increase calculated residential cancer risks by a factor of three or more relative to existing risk assessment procedures. Due to the potential significance of these revisions in risk assessment methodologies, the District believes that it is prudent to develop potential revisions to the District's Hot Spots program concurrent with the OEHHA guideline revisions. OEHHA does not expect that these risk assessment guideline revisions will be finalized for some time, perhaps late in 2010.

• District staff will continue developing and implementing source-category-specific rules to reduce emissions and risk in impacted communities. An example is SSM1: Metal-Melting Facilities, a control measure contained in this draft control strategy which will further control emissions from foundries and metal forging facilities. District staff will assess other source types and facilities throughout the region as candidates for source-category-specific rules. In the context of the CARE program and developing CRRPs, District staff will perform analysis to identify the major sources of emissions and risks in impacted communities. The results of this effort will help to identify the need for more stringent regulations that would reduce emissions from sources in impacted communities and throughout the District as a whole.

• As described in LUM 4, the District will encourage local jurisdictions to develop Community Risk Reduction Plans to reduce public exposure to air toxics and PM, and provide technical assistance in developing these plans, including assistance in developing community engagement plans that create effective channels for public participation to inform and implement the plans.

Emissions Reductions:
The cumulative impacts tracking system described above will not provide any direct emission reductions. The estimated emission reductions for SSMs 16, 17, and 18 are provided in the descriptions of those control measures. Therefore, no emission reductions are directly attributed to LUM 5.

Emissions Reductions Methodology:
See "Emission Reductions" section above.

Exposure Reduction:
This measure has been specifically developed with the objective of reducing population

exposure to emissions of air toxics and directly-emitted PM2.5 from stationary, mobile, and area sources of emissions.

Emission Reduction Trade-offs:
No trade-offs are anticipated for this measure.

Cost:
- Monetary costs to industry to install BACT to achieve reduced emissions and risk levels.
- Monetary costs to District to develop regulations, track cumulative risk levels in impacted communities, inform and educate the regulated community and to enforce.

Co-benefits:
- Since many TACs are also reactive organic gases (ROG), any localized reductions in TACs will provide co-benefits by helping to reduce ambient ozone levels. Also, reductions in emissions of diesel PM will help to reduce ambient levels of PM2.5 and PM 10.

Monitoring Mechanisms:
- On-going monitoring in impacted communities to measure changes in air quality, pollutant concentrations, and exposure.
- Findings from the cumulative risk-tracking system will be made available the on District website, including local emissions inventories of toxic air contaminants and directly-emitted PM2.5 for CARE communities, and modeling results regarding local concentrations of, and population exposures to, these pollutants.
- The District will report to the CARE Task Force and other interested parties on progress in developing and implementing Community Risk Reductions Plans.

Issues/ Impediments:
- The District will need to allocate resources to track changes in emissions of TACs in impacted communities.

Sources:
1. July 6, Memo to Stationary Source Committee from Brian Bateman, Update on CARE Program and Associated Regulatory Initiatives.
2. Draft Concept Paper, *More Stringent Permitting Requirements for Proposed New/modified Stationary Sources of Air Pollution Located in Impacted Communities or in Proximity to Sensitive Receptors.* February 23, 2009.
3. Bateman, April Presentation given to the CARE Task Force.

LUM 6 - Enhanced Air Quality Monitoring

Brief Summary:
The Air District will evaluate and enhance its capabilities, as resources permit, to monitor air quality on a region-wide basis, as well as on a localized basis in the impacted communities identified under the District's Community Air Risk Evaluation (CARE) program.

Purpose:
The purpose of this measure is to provide the Air District with sufficient ambient air quality monitoring data needed to inform 1) its efforts to improve air quality in impacted communities and 2) its air quality planning and modeling programs.

Source Category/Travel Market Affected:
Not applicable.

Regulatory Context and Background:
The Air District's Air Monitoring Program operates a network of 28 air monitoring stations, consistent with state and federal air monitoring requirements, designed to 1) provide the data required to determine the Bay Area's attainment status for both National and State ambient air quality standards; 2) provide air quality data to the public in a timely manner; and 3) support air pollution research and modeling studies. Additionally, a network of air toxic monitors collects data to ensure permit conditions are met at stationary sources and for State and National regulatory programs. The *BAAQMD 2008 Air Monitoring Network Plan* describes recent and planned changes and improvements to the District's air monitoring network.

In recent years the Air District has undertaken initiatives, such as the Community Air Risk Evaluation (CARE) program and the Clean Air Communities Initiative, to analyze pollution exposure at a more localized level and identify communities that are disproportionately impacted by air pollution. In many cases, these communities correspond to areas identified as priority development areas (PDAs) under FOCUS—the region's development and conservation strategy. The FOCUS strategy encourages infill development in PDAs to promote smart growth and reduce sprawl. The data and information generated from these new initiatives allows the District to implement more targeted policies and programs to reduce emissions and exposures in these communities.

The Air District has developed limited enhanced monitoring capabilities of key pollutants to gather more complete data to better assess local air quality conditions based upon the resources available. As an example, the Air District recently located a portable monitoring trailer in West Berkeley and Benicia to measure local air quality, and launched a mobile air monitoring van to assist in developing local pollutant concentrations across the West Oakland community to help identify local sources. Such efforts generally require a minimum of one year of data collection to effectively characterize an area's air quality.

These efforts are resource intensive, requiring expensive instrumentation, specialized operators, coordination among many Air District staff, and long site-development and set-up times.

Implementation Actions:
Depending on available resources, specific components of expanded monitoring would include:

- Ensure representative air quality data is being collected in the impacted communities identified under the CARE program. This effort would require review of the existing monitoring network with respect to the impacted communities to ensure that appropriate long term air quality data is being collected.
- Enhance monitoring of local air quality by collecting more information about pollutant concentrations and exposure at localized levels. This effort would be focused around microenvironments that may have significant local emission sources that could be assessed through the use of temporary monitors.
- Partner with County Health Departments to identify areas of poor air quality and collaborate with the community on ways to potentially measure and reduce exposure and emissions from local and regional sources.
- Perform on-going diagnostic analysis of the monitoring network, surveying the utility and effectiveness of monitoring locations and pollutants monitored while ensuring that the existing network continues to meet all federal and state requirements. This could help to verify air quality modeling inputs and predicted concentrations, which in turn would provide a more comprehensive and representative air quality profile of the Bay Area.

Emission Reductions:
Control measure does not directly reduce emission but supports emissions reduction programs.

Emission Reduction Methodology:
Not applicable.

Exposure Reduction:
Control measure does not directly reduce exposure but supports exposure reduction efforts.

Emission Reduction Trade-offs:
None.

Cost:
Costs would vary depending on the extent of enhanced monitoring implemented. Available resources would be determined through the District's budget process.

Co-benefits:
Not applicable.

Monitoring Mechanisms:
Track enhancements to local and regional air monitoring capabilities.

Issues/ Impediments:
Enhanced air quality modeling will require additional resources, including purchase of new instrumentation, equipment maintenance, and additional staff with technical expertise in atmospheric chemistry, and background and familiarity with monitoring equipment.

Sources:
1. BAAQMD 2008 Air Monitoring Network Plan

BAY AREA
2010 CLEAN AIR PLAN

VOLUME II

Section E

Energy and Climate Measures

September 2010

BAY AREA
AIR QUALITY
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DISTRICT

939 Ellis Street
San Francisco, CA 94109
(415) 771.6000
www.baaqmd.gov

ECM 1 - Energy Efficiency

Brief Summary:
This control measure consists of three components: 1) provide education and outreach to increase energy efficiency in residential and commercial buildings and industrial facilities, 2) provide technical assistance to local governments to adopt and enforce energy efficiency building codes, and 3) provide incentives for increasing energy efficiency at schools.

Purpose:
Decreasing the amount of energy consumed in the Bay Area through increased efficiency and conservation will reduce the amount of fossil fuels, such as natural gas, needed to produce the electricity that the region uses. This will, in turn, decrease the production of greenhouse gases and criteria pollutants emitted by combustion of fossil fuels.

Source Category Affected:
The emission source affected by this measure is primarily electricity production for commercial and residential buildings and industrial facilities.

Regulatory Context and Background:
The California Global Warming Solutions Act, or AB32, signed into law in 2006, requires the State of California to reduce greenhouse gas emissions to 1990 levels by 2020. In support of this goal, the California Air Resources Board "encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State in commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020." According to the Air District's 2008 Source Inventory of Bay Area Greenhouse Gas Emissions, approximately fifty percent of the region's greenhouse gas emissions are produced through energy used in residential and commercial building, industrial facilities and electricity generation. The Bay Area cannot meet the challenge of AB32 without reducing energy use in buildings and industry.

Energy production at and for residential, commercial, industrial and other buildings is also a significant source of criteria pollutants such as NOx and PM. Improved energy efficiency can reduce these emissions from power plants, boilers, furnaces, etc.

PUC Strategic Plan: In September 2008, the California Public Utilities Commission (CPUC) adopted the state's first Long Term Energy Efficiency Strategic Plan, presenting an integrated framework of goals and strategies for saving energy from government, utilities and the private sector in the 2009 to 2020 period. Goals in the Strategic Plan include:

- All new residential construction in California will be zero net energy by 2020;
- All new commercial construction in California will be zero net energy by 2030;
- The Heating, Ventilation, and Air Conditioning (HVAC) industry will be reshaped to ensure optimal equipment performance; and

- All eligible low-income homes will be energy efficient by 2020.

Title 24: In California, energy efficiency requirements for new construction are addressed through Title 24 of the California Code of Regulations. Part 6 of Title 24, the California Energy Code, contains energy conservation standards applicable to all residential and non-residential buildings throughout California. In April of 2008, the California Energy Commission adopted new standards for Title 24, with the intent of decreasing energy use and greenhouse gas emissions throughout the state. The 2008 update is expected to achieve 13-15% energy savings in residential buildings and 8% savings in commercial buildings compared to the 2005 standards. The 2008 standards took effect on January 1, 2010.

Progress in energy efficiency will be essential to achieve our greenhouse gas reduction goals. Comprehensive green building programs that include standards for energy efficiency and third party verification of building performance are critical to this objective. The most effective role for the District is to complement and build on the requirements embedded in the 2008 update of the Title 24 standards. One such gap is in the enforcement of Title 24. A study conducted by EDAW on behalf of the City of Seattle concludes that, as building codes and standards become more complex, there is a critical need for education and outreach to ensure that the codes are properly implemented and enforced.

Recently, public schools have been taking advantage of low interest financing provided by a variety of federally backed zero (or near zero) interest bonds to develop energy efficiency and renewable energy projects. In many cases, this type of financing can make energy projects revenue positive for the school districts. These energy savings can reduce the overall carbon emissions from schools and provide additional revenue to school districts. Energy efficiency and renewable energy projects can be more complicated than the typical construction projects school districts are used to, and many school districts lack the in-house capacity to evaluate and implement energy projects themselves. However, there are a growing number of sources that can provide assistance to school districts to design and carry out energy-related projects, such as California High Performance Schools (CHPS), Coalition for Adequate School Housing (CASH), or the California School Board Association (CSBA).

Implementation Actions:
This control measure consists of three components:

- Provide education and outreach, as resources permit, to increase energy efficiency in residential and commercial buildings and industrial facilities, including distributing information on state and local energy programs to permitted sources, and researching the newest methodologies and tools for quantifying GHG emissions from building energy use;
- Provide technical assistance to local governments to adopt and enforce energy efficiency building codes and green building ordinances, including distribution of model ordinances and collaboration with the California Energy Commission to convene building inspector trainings on new Title 24 regulations;

- Provide information and incentives, as resources permit, to increasing energy efficiency at schools, through the District's existing outreach and community grant programs.

Emission Reductions:
It is estimated that all actions in this control measure will result in a 1% reduction in electricity use in the Bay Area which draws from the results to date from local green building ordinances. The Air District's *2008 Source Inventory of Greenhouse Gas Emissions* provides current levels of energy use and resulting CO2 emissions.

ABAG projects an approximately 28% increase in Bay Area population from 2005 – 2035. From 2005 – 2020, this increase will be approximately 14%. Using the District's *Source Inventory,* the total electricity use is first expanded to incorporate this estimated growth, and then an estimated savings from the control measure implementation actions is applied. The *Source Inventory* uses 2007 data, so instead of applying the full 14% increase (representing an increase from 2005 – 2020), an adjusted increase of 12% has been applied.

After applying the increase due to population growth, a 1% decrease is calculated.

Emissions are in short tons/day (metric tons/day for CO_2):

Daily Energy Use	**CO2**	**PM 10**	**PM 2.5**	**ROG**	**NOx**	**SO2**	**CO**
149,474 MWh	43,099	28	28	4.2	46	40	57
2020 Projection*	48,270	32	32	4.7	52	44	64
1% Reduction	483	0.32	0.32	0.05	0.52	0.44	0.64

*12% increase over 2007 data

How Emissions Reductions Were Estimated:
Factors for greenhouse gas emissions from electricity use are based solely on the amount of energy used. Factors for criteria air pollutant emissions, on the other hand, are based not just on the amount of energy used, but also on the specific technology being utilized. Therefore, it is far more complicated to develop an emissions factor for criteria pollutants, and the numbers in the table above should be treated as general estimations and not specific projections.

Coefficients to translate electricity into CO2 emissions were taken from the California Climate Action Reserve General Reporting Protocol, version 3.1. Electricity coefficients for PM, ROG, NOx, SO2 and CO were derived by Air District staff based on regional averages of emissions factors from power plants in the region.

Exposure Reduction:
This measure could help to reduce exposure in impacted communities that are located near power plants, particularly "peaker plants", due to the reduction in electricity use.

Emission Reduction Trade-offs:
This control measure is designed purely to reduce energy consumption, so there would be no direct emission trade-offs. There might be indirect emissions associated with the production and delivery of some energy efficient technologies.

Cost:
Investing in energy efficiency is almost always cost-effective because there is a direct return on the investment in the form a reduction in energy expenditures. Numerous state- and utility-sponsored incentive programs exist which provide rebates or financing for purchasing and installing energy efficient technologies. In addition, innovative financing strategies such as the Berkeley PACE model (formerly Berkeley FIRST), have emerged which negate the need for upfront capital investments on the part of building owners.

According to the CEC's Energy Consumption Data Management System, residential electricity use represents approximately 29% of all electricity use in the Bay Area. The table below outlines the net savings to building owners from investing in energy efficiency. The per household cost and savings numbers reflect averages between the cost estimates of new green building policies in San Francisco and Sonoma County, as reported to the CEC.

	Per Household	Total
Incremental annual cost*	$96	$27,945,600
Annual savings	$165	$48,031,500
Net Savings	$69	$20,085,900

*Total incremental cost of $1,929 amortized over 20 years

Co-Benefits:
Reducing the use of fossil fuels in grid-tied electricity production brings a number of co-benefits to a community, including:

- improved air quality near power plants (due to reduced production)
- Increased reliability of power supply and cost
- energy savings
- financial savings through reduced energy usage
- green job creation (local manufacturers/suppliers/contractors for installing technologies)

Monitoring Mechanisms:
The overall goal of the measure is to reduce fossil fuel use through the direct use of grid-tied electricity. Monitoring and evaluating progress will be measured by:

- Reduction in electricity use (information from PG&E)
- Number of businesses and residents reached, in site visits, meetings, through mailings and other methods of information distribution (tracked by District)
- Number of building inspectors and operators receiving enforcement training on Title 24 (reported to District by CEC)

- Number of permitted sources seeking technical assistance, funding or other assistance from state and federal agencies for energy efficiency as a result of District's information provision (will be tracked through a response survey included in the information packets)
- Reduction in electricity use from permitted sources (reported through permitting process)

Issues/Impediments:
It is not anticipated that there would be significant impediment due to the voluntary nature of this control measure.

Sources:
1) *"'Re-commissioning' Leans on Education",* A. Lee Chichester, NEMI Research Report
2) "Source Inventory of Greenhouse Gas Emissions" Bay Area Air Quality Management District, December 2008
3) *Seattle New Building Energy Efficiency Policy Analysis: Case Study California Title 24 Energy Code*; EDAW (11/2004); http://www.seattle.gov/environment/documents/GBTF_NewBldg_Title24_Case_Study.pdf
4) http://www.dsa.dgs.ca.gov/Code/title24.htm
5) http://www.seattle.gov/environment/documents/GBTF_NewBldg_Title24_Case_Study.pdf
6) http://ag.ca.gov/globalwarming/pdf/green_building.pdf
7) http://www.energystar.gov/index.cfm?c=heat_cool.pr_hvac
8) http://www.cpfund.ca/pdf/the-jobs-connection.pdf

ECM 2 - Renewable Energy

Brief Summary:
This control measure consists of two components: 1) promote incorporation of renewable energy sources into new developments and redevelopment projects, and 2) foster innovative renewable energy projects through provision of incentives. Note: In addition, as part of the Further Study Measure entitled "Enhancement to Energy Measures," the District will evaluate the cost-effectiveness of solar thermal technology for consideration as a potential solar hot water heating rule.

Purpose:
Promoting the production and use of renewable energy in the Bay Area will reduce the portion of fossil fuel-based energy needed to produce the electricity that the region consumes. This will, in turn, decrease the greenhouse gases and criteria pollutants emitted by combustion of fossil fuels.

Source Category Affected:
The emission sources affected by this measure are primarily natural gas combustion associated with electricity production for commercial and residential buildings and industrial facilities.

Regulatory Context and Background:
The California Global Warming Solutions Act, or AB32, signed into law in 2006, requires the State of California to reduce greenhouse gas emissions to 1990 levels by 2020. In support of this goal, the California Air Resources Board "encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State in commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020." According to the Air District's 2008 Source Inventory of Bay Area Greenhouse Gas Emissions, approximately fifty percent of the region's greenhouse gas emissions are produced through energy used in residential and commercial building, industrial facilities and electricity generation. The Bay Area can not meet the challenge of AB32 without reducing energy use and/or using renewable energy in buildings and industry.

There are two primary approaches to increasing renewable energy: change the fuel mix from which grid-tied electricity is produced; or replace grid-tied electricity with 100% renewable electricity produced through distributed generation such as solar panels, micro wind turbines, or onsite cogeneration.

Changes to the electricity fuel mix are most efficiently made upstream, at the utility level. The State of California has an aggressive "renewable portfolio standard" that requires publicly-held electric utilities to provide electricity that is produced from 20% renewable energy sources by 2010. The AB32 Scoping Plan adopted by the California Air Resources Board calls for this renewable energy target to increase to 33% by 2030.

A downstream approach to increasing the use of renewable energy is to promote non-fossil fuel-based energy technologies, such as solar thermal panels, solar photovoltaic (PV) panels, cogeneration systems that use waste heat or waste methane, micro-sized wind turbines, etc.

Implementation Actions:
Control measure consists of two components:
- Promote renewable energy sources in new developments and redevelopment projects as an emissions offset option included in both the District's new Indirect Source Review Rule, and as a mitigation measure within the CEQA process (promoted, in part, through the District's CEQA Guidelines)
- Foster innovative renewable energy projects and approaches through existing and new incentive programs (e.g. expand the Berkeley PACE program (formerly Berkeley FIRST), replicate Solar Sonoma County's streamlining of incentives policies)

Emission Reductions:
Currently, the Bay Area has 132 megawatts (MW) of installed solar power. The California Public Utilities Commission oversees the California Solar Initiative, which has a statewide program goal of installing 3,000 MW of new solar power by 2020. Current statewide capacity is 515 MW, reflecting a 482% increase over current capacity. Applying this increase to current Bay Area capacity would indicate that by 2020, installed capacity in the Bay Area would be in the neighborhood of 636 MW.

It is estimated that the implementation actions in this control measure would increase installed solar capacity in the Bay Area by approximately 1-5% above and beyond the goals set by the California Solar Initiative. This would result in additional installed capacity of 64 MW, which would offset grid-tied electricity.

Emission reductions are in short tons/day (metric tons/day for CO_2)

Solar Capacity Increase	**Annual MW**	**MT CO_2**	**PM10**	**PM2.5**	**ROG**	**NO_x**	**SO_2**	**CO**
10% by 2020	64	0.05	<.01	<.01	<.01	<.01	<.01	<.01

How Emission Reductions were Estimated:
Factors for greenhouse gas emissions from electricity use are based solely on the amount of electricity used. Factors for criteria air pollutant emissions, on the other hand, are based not just on the amount of energy used, but also on the specific technology being utilized at the power plant. Therefore, it is far more complicated to develop an emissions factor for

criteria pollutants, and the numbers in the table above should be treated as general estimations and not specific projections.

Coefficients to translate electricity use into CO2 emissions were taken from the California Climate Action Reserve General Reporting Protocol, version 3.1. Electricity coefficients for PM, ROG, NOx, SO2 and CO were derived by Air District staff based on regional averages of emissions factors from power plants in the region.

The 10% estimate for increased solar capacity is a conservative estimate which draws from the results to date from local solar promotion programs.

Exposure Reduction:
This measure could help to reduce exposure in impacted communities that are located near power plants, particularly "peaker plants", due to the switch in electric load from grid-tied to distributed electricity generation.

Emission Reduction Trade-offs:
Emissions are created through the production and transport of renewable energy technologies (solar PV panels, etc.). Life-cycle criteria pollutant and other emissions, such as sulfur dioxide, nitrogen oxide and lead, associated with solar panels are due primarily to raw material extraction and energy consumption in the manufacturing process.

Cost:
The cost of renewable energy can vary widely, depending on available rebates, tax credits and other incentives, the energy needs of the building, and other factors. The payback period for solar PV systems is long (approximately 15-20 years), but may decrease if net metering laws change (see discussion on AB 560 below). In addition, innovative financing strategies such as the Berkeley PACE model (formerly Berkeley FIRST), have emerged which can reduce or negate the need for upfront capital investments on the part of building owners.

The cost of including onsite renewable energy generation in buildings would be born by building and property owners. Potential long-term savings would accrue to property owners as well. In the example below outlining the cost and savings of a typical 2.5 kW PV system, the payback period is approximately 19 years.

Net cost of solar 2.5 kW PV system

	Costs/Credits	Balance	10% increase (25,600 systems)	Annual cost over 10 years
Up-front capital cost	$20,000	$20,000	$512,000,000	
State rebate	-$6,500	$13,500		
Federal tax credit	-$4,050	$9,450		
Final cost		$9,450	$241,920,000	$24,192,000

Savings

	2.5 kW system	10% increase (25,600 systems)
Annual electricity savings	4,000 kWh	102,400 MWh
Average cost per kWh	12.5 cents	
Annual cost savings	$500	$12,800,000
Annual cost (over 10 years)	$945	$24,192,000
Annual net cost	$445	$11,392,000

Applying these cost and savings figures to the region-wide program outlined in this control measure would result in a total net cost of $11,392,000.

Co-benefits:
Replacing grid-tied electricity with renewable energy brings a number of co-benefits to a community, including:

- improved air quality near power plants (due to reduced production)
- Increased reliability of power supply and cost
- energy savings, including savings by reducing distribution losses between power plants and the end user
- financial savings through reduced energy usage
- green job creation (local manufacturers/suppliers/contractors for installing technologies – e.g., the world's largest solar cell manufacturer is in Palo Alto)

Monitoring Mechanisms:
The Air District will use existing staff resources to track the amount of solar PV and solar thermal capacity installed in the Bay Area by monitoring organizations which report on these statistics, such as the PUC and the California Solar Initiative.

Issues/Impediments:
It is not anticipated that there would be significant impediment to the voluntary approach described in component (1). Significant impediments to implementation of the incentive-based component to this control measure (2) are not anticipated, however, provision of financial incentives would be dependent upon the availability of adequate financial resources.

Under California's net-metering law, the electric utility is required to "buy back" any electricity generated by a customer-owned generator as measured by an electric meter that can measure the flow of electricity in both directions. At the end of the year, the electric utility calculates the amount of electricity distributed to the grid by the customer and reduces the customer's annual bill by the amount of electricity generated by the customer. In California, utilities currently only have to offer net metering until the load served by net metering represents 5% of the utilities' total load. This limitation creates a general impediment to widespread installation of solar power by limiting its cost-effectiveness.

The many emerging market-based and legislative approaches and responses to financing renewable energy are making this a very dynamic policy field. The Air District will continue to track policy developments in order to most effectively design its programs and activities.

Sources:

1. "Source Inventory of Bay Area Greenhouse Gas Emissions", Bay Area Air Quality Management District, December 2008.
2. "Emissions from Photovoltaic Life Cycles", V.M. Fthenakis, H.C. Kim, and E.A. Alsema, *Environmental Science and Technology*, 2008.
3. AB560 Bill Analysis, California State Legislative Council
4. http://www.cpuc.ca.gov/PUC/energy/Renewables/
5. http://www.oregon.gov/ODOT/HWY/OIPP/docs/solar_panel_lifecycle.pdf
   http://www.leginfo.ca.gov/pub/09-10/bill/asm/ab_0551-0600/ab_560_cfa_20090508_122502_asm_floor.html

ECM 3 - Urban Heat Island Mitigation

Brief Summary:
The control measure includes regulatory and educational approaches to reduce the "urban heat island" (UHI) phenomenon by increasing the application of "cool roofing" and "cool paving" technologies.

Purpose:
The purpose of this control measure is to mitigate the urban heat island phenomenon. Reducing UHI effects can help to reduce ozone levels, as well as emissions of particulate matter (PM), air toxics and greenhouse gases related to energy consumption for air conditioning and cooling. In addition, it can help to offset temperature increases related to global warming.

Source Category Affected:
The sources of emissions affected by this control measure are primarily associated with electricity generation for buildings and evaporative emissions from automobiles.

Regulatory Context and Background:
As urban areas develop, natural, permeable surfaces and vegetation are replaced by impermeable structures and paved surfaces. This development transforms the area into a drier micro-environment, which absorbs, rather than reflects, the heat of the sun. Thus, urban heat islands are created, which can be up to 10^0 F hotter than natural background temperatures.
Factors that contribute to UHI formation include the following:

- Many man-made surfaces are composed of dark materials that absorb and store the sun's heat.
- Buildings, industrial processes, motor vehicles and people produce anthropogenic heat.
- Loss of trees and vegetation due to urbanization causes a reduction in cooling from evapo-transpiration.
- Urban structures can form canyons that reduce ventilation and trap heat.

Elevated temperatures caused by UHIs can accelerate the formation of ground level ozone, or smog, and can contribute to adverse health impacts, such as respiratory and heat-related ailments. Higher temperatures can also result in increased electricity use to cool buildings. Mitigation methods include increasing the reflectivity of built surfaces, such as roads, parking lots and rooftops, increasing tree-cover and natural vegetation (for shading and the cooling effect of evapo-transpiration), and increasing ventilation.

Cool Paving: On average, about 12% of an urban city's land area is devoted to parking lots. This number can be even higher in suburban communities.

Many parking lots are resurfaced every 5-10 years. The amount of parking lot construction and re-surfacing that occurs in the Bay Area provides a significant opportunity to increase albedo (reflectivity) while providing ancillary benefits such as an extended life of the paved surface and storm water benefits associated with use of porous paving.

The hottest pavements tend to be impermeable and dark in color, with solar reflectance values (albedo) under 25%. These pavements can heat to 150^{o}F or more on hot days. Utilizing cool paving techniques can reduce this temperature by 30^{o}F or more. There are two ways to make pavements cooler: 1) by increasing albedo, and 2) by increasing their ability to store and evaporate water.

Cool Roofs: Most existing flat roofs have an albedo (reflectivity) of only 10 to 20 percent of sunlight. These roofs absorb much of the remaining solar radiation and heat up the buildings they cover. Cool roofing technologies, such as lighter or more reflective paint, coatings, membranes, shingles or tiles, can increase a roof's albedo, on average, to about 50-60%. A 2000 study by Lawrence Berkeley National Laboratory revealed a 13-18% reduction in air conditioning-related electricity use in residential and commercial buildings in San Jose due to the application of cool roof strategies.

While cool roofing reduces the need for air conditioning during periods of heat, it can have an opposite impact during periods of cold by reflecting solar radiation away from the buildings, requiring an increase in heating during winter months. In most locations, the balance of these two effects results in a net reduction in energy use. However, in some locations, there may not be an energy reduction benefit from the application of cool roof technologies. Air District staff will continue to follow research efforts in this area.

Implementation Actions:
Control measure consists of the following components:
- Promote building code requirements for new construction or re-roofing/roofing upgrading for commercial and residential multi-family housing to meet specific "cool roof" standards.
- Include minimum "cool roof" standards for new commercial and residential multi-family housing construction and re-roofing or roofing upgrades in specified areas as mitigation measures under the District's CEQA Guidelines and ISR rule.
- Develop and promote adoption of a model zoning ordinance for "cool paving" standards to be met when existing parking lots undergo re-surfacing.
- Provide training for public works staff and private construction/paving companies on benefits of and how to meet new cool paving standards.
- Encourage construction of new and re-surfacing of existing parking lots and other paved surfaces to meet minimum reflective and permeable surface standards by including this as a mitigation measure under the District's CEQA Guidelines and ISR rule.
- Perform outreach to cities and counties to make them aware of the benefits of cool roofing and cool paving, and of new tools available.

- Provide training for building inspectors on benefits of and how to meet new cool roofing standards.

Emission Reductions:
Lawrence Berkeley National Laboratory's (LBNL) Heat Island Group conducted a study of the impacts that surface lightening of rooftops and pavement, combined with tree shading, might have on the Los Angeles air basin. The study found that the widespread application of these combined activities could achieve a decrease in ambient air temperature of 3°C. Half of this temperature reduction is due to albedo (roofs and pavement) and half to trees.

While no similar study has been conducted for the Bay Area, the results can be applied to similar temperature zones, such as San Jose and the Diablo Valley. This reduction in ambient air temperature would result in a reduction in electricity use to cool buildings. While no empirical studies have been conducted for the Bay Area, studies of individual buildings by LBNL, the Florida Solar Energy Center, and others have shown that energy savings on the order of 20% to 30% are commonly achieved with a cool roof surface.

Contra Costa County, Napa County, Santa Clara County and approximately half of Solano County are expected to be the most appropriate locations for applications of cool roofs in the Bay Area Air Quality Management District's jurisdiction due to their warmer temperatures and higher use of air conditioning. It is assumed that cool roofs in these counties would reduce air conditioning-related electricity use by 20%.

Emission reductions are in short tons/day (metric tons/day for CO2)

Source Category	MWh	CO2 (MT)	PM10	PM2.5	ROG	Nox	SO2	CO
Electricity	80	23	0.015	0.15	<0.01	0.03	0.02	0.03

Emission Reduction Methodology:
Factors for greenhouse gas emissions from electricity use are based solely on the amount of electricity used. Factors for criteria air pollutant emissions, on the other hand, are based not just on the amount of energy used, but also on the specific technology being utilized at the power plant. Therefore, it is far more complicated to develop an emissions factor for criteria pollutants, and the numbers in the table above should be treated as general estimations and not specific projections.

Coefficients to translate electricity use into CO2 emissions were taken from the California Climate Action Reserve General Reporting Protocol, version 3.1, using the most recently CCAR-approved coefficient for PG&E (for year 2007). Electricity coefficients for PM, ROG, NOx, SO2 and CO were derived by Air District staff based on regional averages of emissions factors from power plants in the region.

Estimations for electricity used for air conditioning in the selected counties was taken from the Energy Information Administration's (EIA) 2001 Residential Buildings Energy

Consumption Survey and the California Energy Commission's (CEC) 2006 California Commercial End-Use Survey. Data on energy consumption by county and by sector from the CEC's Energy Consumption Data Management System was used to estimate the amount of electricity used for air conditioning that occurred in these counties.

Exposure Reduction:
This measure would help reduce smog formation by reducing the ambient air temperature, particularly in areas that experience excessive heat. It would be especially effective in reducing population exposure in those areas of the Bay Area that experience higher daily ambient temperatures, like San Jose, Concord, and San Leandro/East Oakland.

Emission Reduction Trade-offs:
It is unlikely that this measure would increase any emissions appreciably. However, caution would have to be taken in compiling the technology specifications to ensure that products that could produce toxic emissions during their use are not recommended.

Cost:
Cool roofs deflect some desired heat gain during the winter. In general, though, cool roofs result in net energy savings, especially in areas where electricity prices are high.

Although costs will vary greatly depending on location and local circumstances, the cost premium for cool roofs versus conventional roofing materials ranges from zero to 5 or 10 cents per square foot for most products, or from 10–20 cents for a built-up roof with a cool coating used in place of smooth asphalt or aluminum coating.

A California study found that cool roofs provide an average yearly net savings of almost 50 cents per square foot. This number includes the price premium for cool roofing products and increased heating costs in the winter as well as summertime energy savings, savings from downsizing cooling equipment, and reduced labor and material costs over time due to the longer life of cool roofs compared with conventional roofs.

A 2007 study titled "California Rooftop Photovoltaic (PV) Resource Assessment and Growth Potential by County," conducted by Navigant Consulting for the CEC's PIER program provided estimated roof space for the residential and commercial sectors within the selected counties. An estimated cost of 10 cents per square foot was used to calculate the cost of applying cool roof technologies to this potential roof space. Assuming a cool roof penetration program rate of 10%, we estimated upfront capital cost of $7,600,637 for the residential sector and $2,311,504 for the commercial sector.

	Residential	Commercial	Total
Upfront Capital Costs	$7,600,637	$2,311,504	$9,912141
Annual Savings	$38,003,185	$11,557,521	$49,560,706
Net Annual Savings	$30,402,548	$9,246,017	$39,648,565

To estimate the electricity cost savings that would be achieved in the residential sector, we again reference the California Energy Commission's Energy Consumption Data Management System for the amount of expenditures in California for electric Air Conditioning in 2007. This was then scaled down based on the share of statewide electricity used by the selected counties, and reduced by 80% to arrive at the amount of electricity use that would be avoided by cool roofs. We largely used the same methodology for the commercial sector, except that we did not have actual expenditure data. Instead, we consulted the Energy Information Administration's Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State report to find the average retail price of electricity. This was then applied to the scaled down air-conditioning electricity consumption data.

Co-Benefits:
Heat island mitigation measures bring a number of co-benefits to a community, including:

- improved air quality
- improved public health (lower risk of respiratory and heat-related ailments)
- energy savings
- financial savings through reduced energy usage
- green job creation (local suppliers/contractors for installing technologies)

Monitoring Mechanisms:
Monitoring and evaluating progress could include:

- Tracking how many cool roof building codes are adopted
- Measuring increases in square footage of cool roofs, both in new construction and existing buildings
- Measuring increases in square footage of cool parking lots

Issues / Impediments:
Advocating for building code requirements that include "cool roof" standards for re-roofing/roofing upgrades may raise concerns about a potential increase in up-front costs among some stakeholders, such as the construction and development industries or local governments. Similar requirements for "cool paving" may also raise concerns due to a lack of information on the availability and sourcing of these technologies and products. By promoting and encouraging adoption of these types of policies, the Air District will facilitate demonstration of the actual cost benefits of such policies and work toward overcoming these barriers.

Sources:
1) Cool Houston: A Plan for Cooling the Region (2004)
2) Heat Islands: Understanding and Mitigating Heat in Urban Areas; Gartland (2008)
3) California Energy Commission, http://www.energy.ca.gov/title24/coolroofs/
4) http://www.energy.ca.gov/title24/coolroofs/documents/QUESTIONS-ANSWERS_BUILDING-OWNERS.PDF
5) USEPA, http://www.epa.gov/heatisland/

6) Consumer Energy Center, http://www.consumerenergycenter.org/coolroof/faq.html#faqs-04
7) Cool Roof Rating Counsel, http://www.coolroofs.org/coolroofing.html; http://www.autolife.umd.umich.edu/Environment/E_Casestudy/E_casestudy2.htm; http://www.concretenetwork.com/pervious/environ_benefits.html
8) California Energy Commission. Energy Consumption Data Management System. Available online: http://ecdms.energy.ca.gov/elecbycounty.aspx
9) Energy Information Administration, 2001. Residential Buildings Energy Consumption Survey (RECS), Consumption and Expenditure Data Tables. Available online: http://www.eia.doe.gov/emeu/recs/recs2001_ce/2001tblce.html
10) California Energy Commission, March 2006. California Commercial End-Use Survey. Publication # CEC-400-2006-005, Table 8-2, p.153. Available online: http://www.energy.ca.gov/ceus/
11) Navigant Consulting, Inc. 2007. California Rooftop Photovoltaic (PV) Resource Assessment and Growth Potential by County, California Energy Commission, PIER Program. CEC-500-2007-048. Available online: https://norman.baaqmd.gov/exchweb/bin/redir.asp?URL=http://www.energy.ca.gov/2007publications/CEC-500-2007-048/CEC-500-2007-048.PDF
12) Energy Information Administration, November 2009. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State, Available online: http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_b.html

ECM 4 - Shade Tree Planting

Brief Summary:
The control measure includes voluntary approaches to reduce the "urban heat island" phenomenon by increasing shading in urban and suburban communities through planting of (low VOC-emitting) trees and preservation of natural vegetation and ground cover.

Purpose:
The purpose of this control measure is to reduce ozone precursors, criteria pollutants (ozone, NO_2, PM10, SO_2) and greenhouse gases by mitigating the urban heat island phenomenon.

Source Category Affected:
The sources affected by this control measure include electricity generation as well as evaporative emissions from mobile sources.

Regulatory Context and Background:
As discussed in the Urban Heat Island control measure, due to their impermeable structures and paved surfaces, as well as a lack of vegetation, urban areas tend to absorb, rather than reflect, the sun's heat. These urban heat islands can be up to 10^0 F hotter than natural background temperatures. These elevated temperatures can accelerate the formation of ground level ozone, or smog. They can also result in increased electricity use to cool buildings. In addition, parked cars can release emissions from the vehicle's carburetor or fuel system. These "evaporative emissions" increase as ambient temperatures rise.

Planting trees through a comprehensive urban forestry program that includes goal-setting and ongoing management of the urban tree canopy can mitigate the urban heat island phenomenon and conserve energy use in three principal ways:

- Shading reduces the amount of the sun's energy absorbed and stored by built surfaces
- Transpiration converts moisture to water vapor and thus cools by using solar energy that would otherwise result in heating of the air
- Wind-speed reduction reduces the movement of outside air into interior spaces and conductive heat loss where thermal conductivity is relatively high (e.g., glass windows)

In addition, urban trees provide the following air quality and climate protection benefits:

- Absorbing gaseous pollutants (ozone, nitrogen oxides) through leaf surfaces
- Absorbing CO2 (carbon sequestration)
- Intercepting particulate matter (e.g., dust, ash, dirt, pollen, smoke)
- Reducing emissions (GHGs and criteria pollutants) from power generation by reducing energy consumption

- Releasing oxygen through photosynthesis
- Reduce evaporative emissions in parking lots
- Street trees also enhance conditions for pedestrians and cyclists, thus supporting alternatives to the automobile.

The Sacramento Municipal Utility District (SMUD) shade tree program has a goal to plant 500,000 trees in Sacramento. The tree planting program was found to produce net benefits from air conditioning savings. Three scenarios were assumed (base, highest, and lowest benefits) based on the SMUD program and a Best Available Control Technology cost analysis was performed to determine if shade trees planted in residential yards can be a cost effective means to improve air quality. Annual planting and maintenance costs, pollutant deposition, and biogenic hydrocarbon emissions were estimated over a 30-year period with existing models.

Some tree species emit volatile organic compounds (VOCs) which contribute to the formation of ground level ozone, particularly in hot weather. It is important for tree planting programs to carefully select the species to be planted, opting for low VOC-emitting species.

Implementation Actions:
Control measure consists of the following components:
- Include tree planting standards for new developments in specified areas as mitigation measures under the District's CEQA Guidelines and ISR rule
- Promote adoption of a model municipal tree planting ordinance, including tree planting in parking lots
- Provide information via outreach materials, presentations and workshops to local government planning and public works department staff on how to maximize air quality, GHG and public health benefits of municipal tree planting programs, including promoting the Bay-Friendly Landscape Guidelines
- Provide information on and encourage the use of low VOC-emitting tree species for new planting and, as appropriate, replanting
- Monitor the outcomes and findings of current tree planting programs, such as the Air District Climate Protection Grant to Urban ReLeaf for tree planting and air quality monitoring in West Oakland.

Emission Reductions:
Implementation actions #1 (include as mitigation options under CEQA and ISR) and #2 (promote municipal tree planting ordinances) are estimated to increase the Bay Area's tree canopy by 1% over the next 10 years, from the current 29% of land cover to 30%.

Increase in Canopy cover (%)	Canopy cover (%)	# of Trees	Increase in # of Trees
Baseline = 0	29	41,172,735	0
Ten year goal = 1	30	42,593,715	1,420,980

The table below illustrates the annual energy savings and emission reduction benefits of planting an average medium sized deciduous tree, in this case a Cherry Plum tree, in a residential neighborhood. Benefits are given for 1,420,980 ten year old trees (representing a 1% increase in existing tree canopy).

Emission reductions are in short tons/day (metric tons/day for CO2)

	MWh	**CO2 (MT)**	**PM10**	**PM2.5**	**ROG**	**NOx**	**SO2**	**CO**	**BVOCs**
Benefits for 1,420,980 trees	85,259	67.56	0.04	0.04	<0.01	0.07	0.062	0.09	-0.002

Emission Reduction Methodology:
Even low-voc trees will result in some release of biogenic VOC. This has been factored into the emission reduction estimates, and these emissions are listed as BVOCs in the table above.

The 1% target for increasing tree canopy is a more conservative, reduced target taken from the report, *"State of the Urban Forest: San Francisco Bay Area Progress Report"*, published by the Center for Urban Forest Research in 2007. This report examines a 3% increase in tree cover. Estimated energy savings were also taken from this report. In quantifying the emission reductions from this measure, coefficients to translate electricity into CO2 emissions were taken from the California Climate Action Reserve General Reporting Protocol, version 3.1. Electricity coefficients for PM, ROG, NOx, SO2 and CO were derived by Air District staff based on regional averages of emissions factors from power plants in the region.

Exposure Reduction:
This measure would reduce smog formation by reducing the ambient air temperature, particularly in areas that experience excessive heat. The measure would also reduce local air pollution by decreasing the accumulation of ozone precursors and PM due to the absorptive ability of trees.

Emission Reduction Trade-offs:
Caution must be taken in compiling the list of recommended species for planting to ensure that only low-VOC emitting trees are recommended. Planting deciduous trees ensures that there is no cooling dis-benefit in cooler months.

Cost:
According to the report, "*City of Berkeley, California Municipal Tree Resource Analysis"*, prepared by the Center for Urban Forest Research in 2005, the energy reduction benefits of the City of Berkeley's tree planting program are approximately $15 per tree. Applying these

benefits and costs to the Bay Area as a whole (and planting a total of 1,420,980 trees) creates the following results:

	Per Tree	Total(1)
Total benefits	$15	$21,314,700
Total costs	$65	$92,363,700
Net cost	$50	$71,049,000
Cost-benefit ratio	4.3	

1. This table represents the benefits and costs of planting 1,420,980 trees in the Bay Area.

In this analysis, benefits come from reduced net energy use due to shading.

Co-Benefits:
Tree planting brings a number of co-benefits to a community and the region.

Regional benefits:
- reduced urban heat island effect
- improved air quality
- improved public health (lower risk of respiratory and heat-related ailments)
- green job creation (tree planting and maintenance)

Local benefits:
- reduced energy use in buildings
- financial savings through reduced energy usage
- reduced storm water run-off
- increased community livability/quality of life
- enhanced bike and pedestrian environments
- increased property values

In the *"State of the Urban Forest: San Francisco Bay Area Progress Report"*, the Center for Urban Forest Research estimates that approximately 90% of the monetary benefits achieved by urban tree planting programs are due to increased property values.

Monitoring Mechanisms:
Monitoring and evaluating progress will be done by:
- Tracking local tree planting ordinances and tree planting programs

Issues/Impediments:
Due to the voluntary nature of this measure, significant impediments to implementation are not anticipated.

Sources:
1) *Cool Houston: A Plan for Cooling the Region* (2004)
2) *Heat Islands: Understanding and Mitigating Heat in Urban Areas*; Gartland (2008)

3) "Estimating Cost Effectiveness of Residential Yard Trees for Improving Air Quality in Sacramento, California, Using Existing Models," E. Gregory McPherson, Klaus I. Scott, James R. Simpson, USDA Forest Service, Pacific Southwest Research Station, Davis, CA, October 1997.
4) "City of Berkeley, California, Municipal Tree Resource Analysis," Scott E. Maco, E. Gregory McPherson, James R. Simpson, Paula J. Peper, Qingfu Xiao, USDA Forest Service, Pacific Southwest Research Station, Davis, CA, March 2005.
5) *"State of the Urban Forest: San Francisco Bay Area Progress Report,"* Jim Simpson, Greg McPherson, Chad Delany, Center for Urban Forest Research, USDA Forest Service, PSW Research Station, Davis, CA; June 20, 2005.
6) *"Actualizing microclimate and air quality benefits with parking lot tree shade ordinances,"* McPherson, E.G., J.R. Simpson and K.I. Scott. 2001.
7) *Parking Lot Shading Guidelines*, City of Davis Municipal Code, Section 40.25.100,
8) California Energy Commission, http://www.energy.ca.gov/title24/coolroofs/; http://www.energy.ca.gov/title24/coolroofs/documents/QUESTIONS-ANSWERS_BUILDING-OWNERS.PDF
9) USEPA, http://www.epa.gov/heatisland/
10) Consumer Energy Center, http://www.consumerenergycenter.org/coolroof/faq.html#faqs-04
11) Cool Roof Rating Counsel, http://www.coolroofs.org/coolroofing.html
12) http://www.autolife.umd.umich.edu/Environment/E_Casestudy/E_casestudy2.htm
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BAY AREA
2010 CLEAN AIR PLAN

VOLUME II

Section F

Further Study Measures

September 2010

BAY AREA
AIR QUALITY
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939 Ellis Street
San Francisco, CA 94109
(415) 771.6000
www.baaqmd.gov

FSM 1 - Adhesives and Sealants

Brief Summary:
This further study measure would research the emission inventory for this source category and seek to reconcile discrepancies with the inventories of other districts in the State and to determine if VOC limits found in South Coast AQMD rules are feasible and effective in the Bay Area.

Purpose:
Reduce emissions of VOC from the use of some categories of adhesives and sealants.

Source Category:
Area Source.

Further Study Measure Description:
In 2003 and early 2004, the ARB, San Joaquin, Sacramento and Bay Area districts jointly undertook a rule comparison project for a number of source categories, including adhesives and sealants. The South Coast AQMD rule for adhesives appears to be the most stringent, particularly for architectural adhesives. Architectural adhesives encompass a wide variety of adhesives used in residential and commercial construction: carpet adhesives, flooring adhesives, subfloor adhesives, tile adhesives, drywall adhesives, and multipurpose construction adhesives. The South Coast VOC limits range from 50 to 150 grams per liter (g/l) for various categories of architectural adhesives.

In 1998, the ARB and California districts developed Reasonably Available Control Technology/Best Available Retrofit Control Technology (RACT/BARCT) VOC limits for adhesives and sealants. RACT/BARCT VOC limits range from 100 to 250 g/l for various categories of architectural adhesives. The Bay Area rule, Regulation 8, Rule 51: Adhesive and Sealant Products, meets the BARCT limits in the ARB document.

In the rule comparison discussions, significant differences in inventory between the districts emerged. Specifically, the San Joaquin District has almost no area source adhesive emissions, which includes the architectural adhesives, whereas the Bay Area inventory has over 9 tons organic emissions per day from area source adhesives. When Bay Area staff developed Regulation 8, Rule 51: Adhesives and Sealants, the area source inventory was derived from the Rauch Guide to the US Adhesives and Sealants Industry, by the Rauch Associates, Inc., originally the 1990 edition. This should be updated.

Since Reg. 8-51 was last amended, in 2002, the comparable South Coast rule, Rule 1168, has been amended twice. Consequently, the South Coast has a number of VOC limits for adhesives and sealants that are lower than the Bay Area's. Some VOC limits that are appropriate for southern California, such as subfloor adhesives, may not be feasible for the Bay Area. However, lower limits should be investigated for feasibility.

Sources:

1. California Air Resources Board. 1998. "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Adhesives and Sealants."
2. South Coast AQMD, Rule 1168
3. South Coast AQMD. 2002. "Final Staff Report: Proposed Amended Rule 1168-Adhesives and Sealants"
4. South Coast AQMD. 2000. "Staff Report: Proposed Amended Rule 1168-Adhesives and Sealant Applications"
5. TIAX. 2003. Sacramento Regional Clean Air Plan Update: Control Measure D3.
6. Walnut, F., TACC International. 2003. Personal Communication.

FSM 2 - Reactivity in Coatings and Solvents

Brief Summary:
Consider photochemical reactivity for the architectural coatings or other coatings categories. This approach targets volatile organic compounds (VOCs) with the greatest ozone forming potential, rather than treating all VOCs equally. Reformulation options may be greater and potential ozone formation less with a reactivity-based strategy, because there is a wide range of reactivity between VOC species.

Purpose:
Reduce emissions of VOCs with the greatest ozone-forming potential from various coatings operations and solvents.

Source Category:
Area source.

Further Study Measure Description:
The District regulates coating operations and solvent use in over 20 district regulations through VOC limits and operational requirements. Because coatings and solvents are manufactured in a consistent manner, it is possible to regulate the amount of VOCs and other compounds that are used to formulate these products. This is the rationale behind developing mass-based VOC limits for coatings and solvents.

When coatings are applied they release organic compounds. Different organic compound species react in the atmosphere to produce different amounts of ozone. The ozone forming potential is called reactivity. A coating containing small amounts of a highly reactive compound could form more ozone than a coating with a greater amount of low-reactive compounds. The relative difference in ozone forming ability is called the "relative reactivity."

EPA deems organic compounds that form no more ozone than ethane to be "negligibly reactive." Since that original listing, EPA has designated about 50 compounds as negligibly reactive, many of which are chlorinated or fluorinated compounds, and has excluded these compounds from the federal regulatory definition of VOC. In fact, there is a scale of ozone reactivity among compounds, with some creating many times the amount of ozone as others for each gram of the compound that is emitted. Since the initiation of mass-based VOC limits in the 1970's, considerable research has gone into characterizing the relative reactivity of organic compounds commonly used in paints and as solvents.

The traditional mass-based approach has led to significant reductions in VOC emissions, and improvements in air quality. However, the ability to get further reductions on a mass basis may be limited, as technological limits inherent in coating and solvent formulation are approached. Consequently, a reactivity-based approach may be a better option and may allow coating formulators more flexibility to reduce ozone-forming impacts of their products and ultimately, progress towards attainment with state and federal ozone standards.

Sources:

1. Staff Report: BAAQMD Regulation 8, Rule 3: Architectural Coatings, May 2009.
2. Workshop Report: BAAQMD Regulation 8, Rule 45: Motor Vehicle and Mobile Equipment Coating Operations, June 2008.
3. Final Approved Suggested Control Measure for Architectural Coatings, ARB, February 2008.
4. Technical Support Document for the Proposed Suggested Control Measure for Architectural Coatings, ARB, September 2007.
5. 2005 Architectural Coatings Survey, Final Report, ARB, December 2007.

FSM 3 - Solvent Cleaning and Degreasing Operations

Brief Summary:
Reduce emissions of VOCs from solvent cleaning and degreasing operations by implementing control measures based on ARB's statewide study.

Purpose:
Reduce VOC emissions.

Source Category:
Area Source.

Further Study Measure Description:
Cold cleaning describes the use of a cleaning solution in a tank or container into which a part to be cleaned is immersed, or a remote reservoir cleaner that pumps some cleaning solution over a part to be cleaned that then drains back into the reservoir. Wipe cleaning involves wetting a rag, cloth or paper with a cleaning solution and wiping grease or soils from a part by hand. California Districts have either a 25 g/l or a 50 g/l VOC standard for solvent used in cold cleaners and for wipe cleaning. The BAAQMD standard in Regulation 8, Rule 16 is 50 g/l, and wipe cleaning standards in various surface coating rules (Reg. 8, Rules 4, 14, 19 and 31) have a 50 g/l standard. More recently amended rules (Reg. 8, Rules 20, 32 and 45) have incorporated a 25 g/l wipe cleaning standard. This further study measure would investigate whether a 25 g/l VOC standard in Reg. 8-16 and in 50 g/l limit surface coating rules would significantly reduce emissions.

Based on work conducted in 2002, when Reg. 8-16 was last amended, a 25 g/l VOC standard would only result in 0.022 tons/day emissions reductions, and only 0.023 tons/day for wipe cleaning. This is in part due to differences in how emissions are calculated between districts.

In 2007, ARB initiated a research project, conducted by Professor Bill Welch and researchers at the University of California at Riverside, to develop a statewide emissions inventory for solvent and wipe cleaning. The final report of that project, originally scheduled for completion in spring, 2009, has not yet been released.

Sources:
1. Staff report, Proposed Amendments to Regulation 8, Rules 4, 14, 19, 31, 43, BAAQMD, Oct. 2002
2. Staff Report, Proposed Amendments to Reg. 8, Rule 16: Solvent Cleaning Operations, BAAQMD, Sept. 2002
3. Welch, Bill, University of California at Riverside, College of Engineering – Center for Environmental Research and Technology, e-mails and survey drafts, Sept. 2007 through June, 2008.

FSM 4 - Emissions from Cooling Towers

Brief Summary:
Research ways to reduce VOC emissions from cooling towers in refineries.

Purpose:
Reduce VOC emissions.

Source Category:
Stationary source.

Further Study Measure Description:
The emission inventory for refinery cooling towers shows 0.45 tons/day organic emissions, based on cooling water throughput from cooling towers with District permits. AP-42 emission factors of 6 lbs organic emissions per million gallons water throughput were used in this calculation. This assumes organic compound leaks into the cooling water system are not minimized. However, if leaks are minimized, the AP-42 emission factor is 0.7 lb organic emissions per million gallons water. Further study is needed to determine whether leaks from cooling towers are currently minimized and whether there is any potential for emission reductions from regulations.

This further study measure has been initiated. The Texas Commission on Environmental Quality has adopted a regulation requiring monitoring of and limiting emissions from cooling towers at refineries and chemical plants in the Houston – Galveston area. This rule, including a test method, limits emissions of highly reactive VOC's (HRVOC). HRVOC is the basis for the SIP in the Houston – Galveston area. District staff developed a test method to replicate cooling tower emissions and has sought feedback on the method from the refinery representatives. The next step will be to establish a correlation between EPA test method 8015, which quantifies non-halogenated organic compounds in water. From there, the need for further action can be assessed.

Sources:
1. 30 TAC Chapter 115, Subchapter B and H, Cooling Towers, Texas Commission on Environmental Quality
2. BAAQMD 2005 Final Adopted Ozone Strategy, Vol. 2, January 2006
3. Compilation of Air Pollution Emission Factors (AP-42), US EPA, 1995

FSM 5 - Equipment Leaks

Brief Summary:
Research ways to reduce VOC emissions from equipment leaks through remote sensing technologies and other methods.

Purpose:
Reduce VOC emissions.

Source Category:
Stationary Source

Further Study Measure Description:
In 2003 and early 2004, ARB, San Joaquin, Sacramento and Bay Area districts jointly undertook a rule comparison project for a number of source categories, including valves and flanges. Valves and flanges are typically found at refineries and chemical plants, but are also found in other petroleum and gas production facilities. The review found that the Bay Area's existing Regulation 8, Rule 18: Equipment Leaks, is the most stringent regulation in the state. Reg. 8, Rule 18 was amended on January 21, 2004 to fulfill the provisions of control measure SS-16 from the 2001 Ozone Attainment Plan. During that rule development process, staff identified a number of different areas for potential future study to further reduce emissions from valves and flanges. One area recommended for further review was incorporating remote sensing technologies to identify the largest leaking components in the leak detection and repair (LDAR) program. Remote sensing could enhance the effectiveness of existing LDAR programs by identifying leaks sooner and in a manner that is less time consuming and labor intensive. Remote sensing could also expand the applicability of LDAR programs to areas currently not covered by existing rules, such as pipelines. Remote sensing technology is currently not able to detect the low levels required for compliance with Regulation 8, Rule 18, but it could supplement or enhance existing programs or allow more frequent compliance screening of remote valves.

Sources:
1. BAAQMD 2005 Final Adopted Ozone Strategy, Vol. 2, January 2006
2. Staff Report, Proposed Amendments to Regulation 8, Rule 18: Equipment Leaks, January, 2004, BAAQMD

FSM 6 - Wastewater from Coke Cutting

Brief Summary:
Review coke cutting operations to determine if emissions reductions can be achieved from the resulting wastewater.

Purpose:
Reduce VOC emissions.

Source Category:
Stationary source.

Further Study Measure Description:
Refineries operate high pressure water pumps to remove or "cut" coke from coking drums. During the investigation of Further Study Measure FS 9: Refinery Wastewater Systems in the 2001 Ozone Plan, it was noted that coke cutting operations at some facilities generated significant quantities of wastewater. This wastewater, at elevated temperatures, is often recycled. The wastewater from coke cutting is not part of the refinery wastewater collection and treatment system. One possible method of control would be to include coke cutting wastewater in the existing collection and treatment system. Additional research needs to be conducted to determine whether coke cutting wastewater contains significant quantities of VOC and whether there is any potential for emissions reductions from these operations. Because of these uncertainties, it is recommended that coke cutting operations be studied.

This further study measure is currently under way. In addition to the two refineries that have traditionally used this coke cutting operation, Tesoro has added a delayed coker and is now also using this process.

Sources:
1. BAAQMD 2005 Final Adopted Ozone Strategy, Vol. 2, January 2006
2. Draft Technical Assessment Document: Potential Control Strategies to Reduce Emissions from Refinery Wastewater Collection and Treatment Systems, CARB and BAAQMD, Jan., 2003

FSM 7- SO2 from Refinery Processes

Brief Summary:
Review refinery processes to identify opportunities to reduce SO2 emissions.

Purpose:
Reduce SO2 emissions.

Source Category:
Stationary source.

Further Study Measure Description:
The District's emissions inventory indicates that significant quantities of SO2 are emitted from refinery processes. In 2007, Basic Refining Processes (Category 10) emitted 23.8 tons SO2 per day. Other refinery combustion processes (categories 298, 299 and 301) emitted an additional 9.4 tons per day. This is roughly half of the SO2 emissions in the District, and by far the majority of those from stationary sources.

SO2 is a precursor to secondary fine particulate matter formation, and the District is not in attainment for the federal and state PM2.5 standards. Consequently, a reduction in SO2 emissions would help the District toward attainment of PM2.5 standards.

The basic process used in refineries to remove sulfur from oil has not changed in many years. Hydrogen is added to oil (hydrotreating) which converts the sulfur to hydrogen sulfide (H2S), which is then absorbed from the oil with diethanolamine or monoethanolamine. It is then stripped out of the DEA or MEA and combusted to produce elemental sulfur. Regulation 9, Rule 1: Sulfur Dioxide, limits SO2 emissions from fluid catalytic cracking units and fluid cokers to 1000 ppm, limits SO2 emissions from sulfur recovery plants to 250 ppm, and requires 95% removal of H2S from refinery fuel gas. Reg. 9-1 and the various refinery units could be examined to see if additional reductions are feasible.

Sources:

1. BAAQMD Emissions Inventory

FSM 8 - Reduce Emission from LPG, Propane, Butane, and other Pressurized Gases

Brief Summary:
Reduce emissions of LPG, propane, butane and other pressurized organic gases by requiring tanks and relief valves to be gas tight, prohibiting venting during tank filling, and establishing a leakage allowance for hoses.

Purpose:
Reduce VOC emissions.

Source Category:
Area source.

Further Study Measure Description:
The Air District already enforces gas tight requirements at stationary sources for a variety of operations, including refineries and bulk terminals. This control measure would apply similar standards to LPG, propane and butane tanks, prohibit venting from filling of such tanks, and would set a leakage allowance for hoses used in these operations.

Typically, liquid pressurized gases should occupy no more than 80 to 85 percent of the volume of a tank to allow for liquid expansion if a tank gets heated (such as by sunlight). These containers have a bleed valve, which is sometimes used to indicate to the person filling the container when the level of liquid in the tank is at the “full” level (80 to 85 percent full by volume). Containers can be safely refilled without venting by filling to a final weight or by filling to a final liquid volume using a tank gage.

California propane demand is estimated to be about 120,000 barrels per day. If Bay Area demand is 20% of that (although it may be less due to the availability of natural gas) and losses average 1%, losses equal 240 barrels per day. This is equivalent to 21.4 tons per day of propane losses. In addition, it has been estimated that up to 10 tons per day of LPG may be vented in the Bay Area.

A report on a research project at CARB in March, 2009 indicated that technological solutions were available and cost effective.

A further study measure would consider a gas tight standard for propane and other tanks; a prohibition on the filling of a container where the pressure differential for refilling is generated by venting the receiving container; a prohibition on venting to determine if the container is adequately filled; and a leakage allowance for new hoses sold in conjunction with pressurized gas containers.

Such a measure could impact:

- standard containers, such as 20# cylinders and forklift fuel tanks, refilled at high volume central locations
- fleet refueling at large facilities (i.e., forklift tank refueling)
- large stationary pressurized gas containers

Sources:

1. Maximus™ SFI – Measurement and Reduction of Gas Outage Gauge Emissions, the ADEPT Group, Inc. California Air Resources Board, Chair's Air Pollution Seminar, March 19, 2009

FSM 9 - Greenhouse Gas Mitigation in BACT and BACT Determinations

Brief Summary:
Consider flexibility in BACT/TBACT determinations in order to reduce secondary green house gas (GHG) emissions from abatement devices.

Purpose:
Reduce GHG emissions.

Source Category:
Stationary source.

Further Study Measure Description:
New source review regulations, including BAAQMD Regulation 2, Rule 2, mitigate increases from new and modified permitted sources of air pollution for criteria pollutants by making applicants install Best Available Control Technology (BACT) and/or obtain offsets for the emissions increases. In addition, the District's toxic new source review rule, Regulation 2, Rule 5, requires installation of toxic best available control technology (TBACT) for new and modified sources of toxic air contaminants (TACs) where the source risk exceeds a certain health risk level, and denies a permit where the source risk exceeds a greater health risk level.

Currently, District Regulations do not consider GHG emissions. Under existing federal, state and District guidelines, a source required to abate organic emissions can be required to install a highly efficient incinerator to abate those emissions to the maximum extent feasible, even if a relatively large amount of supplemental fuel is required to achieve a high organic destruction efficiency.

The District could advocate for flexibility in BACT/TBACT determinations when a permit application triggered BACT/TBACT and was not ministerial. In these determinations, discretion is allowed on implementation of control equipment, but implementation must be consistent with a maximum reduction in criteria pollutants. With the agreement of EPA and ARB, a lower level of emissions control could be considered if the alternative would emit large amounts of GHGs. Flexibility in BACT/TBACT determinations would require agreement of EPA and ARB, and potentially changes in regulations.

Sources:

8. BAAQMD Permit Handbook:
   http://www.baaqmd.gov/pmt/handbook/rev02/permit_handbook.htm
9. BAAQMD Regulations 2-2, and 2-5:
   http://www.baaqmd.gov/dst/regulations/index.htm

FSM 10 - Further Reductions from Commercial Cooking Equipment

Brief Summary:
Consider reducing emissions from commercial wok cooking, and solid fueled cooking devices such as wood fired pizza ovens.

Purpose:
Reduce PM emissions.

Source Category:
Area source.

Further Study Measure Description:
In 2007, the District adopted a rule to limit emissions from commercial conveyorized and under-fired charbroilers, Regulation 6, Rule 2: Commercial Cooking Equipment. The rule requires the use of control equipment on these cooking devices if certain amounts of beef are cooked. In 2008, the Association of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) tested and developed emissions factors for a number of appliances. The greatest amount of particulate matter came from a solid fueled broiler cooking hamburger and a Chinese wok cooking chicken breast in peanut oil.

The ASHRAE study indicated that the wok cooking emitted the greatest amount of particulate matter, as measured below the ventilation hood, but a breakdown of particle sizes indicated that most of the particulate weight was PM greater than 10 microns in diameter, it is likely that much of this large particulate matter is deposited on the grease filter, in the exhaust stack on the roof. For wok cooking, however, particles in the smaller size ranges (PM10 to PM2.5, PM2.5 and condensable vapors) were still significant. They total 51.7 lbs particulate matter per 1000 lbs food cooked, the second highest of the cooking appliances tested.

In addition, concern has been expressed about the use of wood fired pizza ovens and other cooking devices that are not underfired broilers. Typically, pizza in a wood-fueled oven is placed on a floor or platform, the pizza does not generate particulate matter or organic emissions from contact with the flame. The particulate matter of concern is generated directly by burning wood.

The number of commercial wok cooking appliances in the District has not been determined. Control equipment similar to those used for underfired charbroilers could control the emissions, but the cost effectiveness for wok cooking has not been investigated. For pizza ovens, and other solid-fueled cooking devices, an inventory needs to be established. A broader range of control equipment may be available, but cost effectiveness needs to be determined.

Sources:

1. ASHRAE Study 745-RP, 2008
2. BAAQMD Regulation 6, Rule 2: Commercial Cooking Equipment

FSM 11 - Magnet Source Rule

Brief Summary:
The District will explore as a further study measure the viability of developing a magnet source rule to reduce mobile source emissions from some or all of the types of facilities described below. Emphasis would be given to facilities in impacted communities as identified though the District's CARE program.

Purpose:
The purpose of this measure would be to reduce emissions and population exposure associated with magnet sources.

Source Category:
Transportation emissions.

Further Study Measure Description:
The term "magnet sources" refers to new and existing facilities that attract or generate a high volume of activity or usage of mobile sources of emissions, such as cars, trucks, off-road equipment, etc. Magnet sources can include airports, seaports, warehouses, distribution centers, shopping centers, and other facilities that generate mobile source emissions of criteria air pollutants, toxic air contaminants and greenhouse gases.

District staff are currently developing an indirect source review (ISR) regulation to mitigate the impacts of growth and new development in the Bay Area – see control measure LUM-2. A magnet source rule would be designed so as to complement the ISR regulation.

The District will evaluate the feasibility of developing a magnet source rule. Potential requirements could include calculating and reporting of emissions, estimating health risks and local impacts, developing plans to comply with ARB mobile source regulations, and development of additional emission reduction strategies. Issues to be considered include how to define a "magnet source," which types of sources and pollutants to focus on, specific emission reduction and other requirements, how a magnet source rule would be implemented and enforced, how to quantify emissions produced by magnet sources, potential mechanisms to reduce emissions and population exposure, and how a magnet source rule could supplement the emission reductions expected from ARB's diesel air toxics control measures over the next 5 to 10 years.

FSM 12 - Wood Smoke

Brief Summary:
The Air District will continue to study the impacts of its existing rules regarding wood burning and open burning, in order to develop more effective methods to implement, promote, enforce, and possibly expand, existing rules.

Purpose:
Reduce particulate matter emissions from wood smoke.

Source Category:
Area source.

Further Study Measure Description:
Fine particulate matter (PM) is a serious health concern; these particles can pass through the nose and throat, lodge deep within the lungs, and enter the bloodstream. Residential wood-burning represents the largest source of fine PM in the Bay Area, accounting for up to 30-40% of fine PM during peak pollution days. The Bay Area is home to 1.4 million fireplaces and woodstoves.

In order to protect Bay Area residents from the public health impacts of wood smoke pollution, on July 9, 2008 the Air District adopted a wood-burning rule (Regulation 6, Rule 3) that prohibits the use of wood-burning devices such as fireplaces, woodstoves, or pellet stoves, when air quality is forecast to be unhealthy and a *Winter Spare the Air Alert* is in effect. As defined in the rule, the *Winter Spare the Air* season runs from November 1 through the end of February.

The primary focus during the first year of rule implementation was to educate the public about the new rule, how to comply and the rule's relevance to public health. The *Winter Spare the Air Alert* advertising and outreach campaign utilized TV, print, billboard, radio, direct mail, public events, door-to-door canvassing and the Air District website. The District's No Burn phone line received over 500,000 calls. Enforcement focused on providing information to residents on how to comply with the rule, issuing warning letters to first-time violators who did not comply, and developing enforcement action for repeat violators.

For the 2008/2009 season, eleven *Winter Spare the Air Alerts* were issued. Data indicates that household wood burning was reduced by approximately 50% throughout the entire season[7]. Nevertheless, the national 24-hour ambient air quality standard (35 ug/m^3) was exceeded at one or more air monitoring site on 13 days during the winter of 2008/09.

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[7] *Winter Spare the Air Study: 2008-2009 Winter Wood Smoke Season*, Bay Area Air Quality Management District, March 2009, p. 30.

Seven of the alert days still exceeded the standard. It should also be noted that although the District's wood burning rule and the Winter Spare the Air program are focused on reducing exceedances of the 35 ug/m^3, some individuals may suffer health effects even when PM concentrations are below PM air quality standards.

In addition to residential wood burning, the District has limited agricultural burning in order to control emissions of fine particulate matter. The District will continue to study its current rules regarding wood and agricultural burning to develop rules and strategies to better protect public health. The District's PM emission inventory also indicates that PM emissions from commercial cooking are a significant source of PM emissions (see FSM #10 re: cooking).

Potential actions that the District will evaluate and may implement in future years include:

- Continue to work with local governments to adopt the District's model wood smoke ordinance (40 local governments in the Bay Area have adopted an ordinance as of February 2010);
- Evaluate the trigger level for declaring a *Winter Spare the Air Alert (*the threshold is currently 35 ug/m^3);
- Expand the *Winter Spare the Air Alert* education and outreach campaign;
- Continue to analyze monitoring data and refine models on PM2.5;
- Evaluate and modify enforcement response with increasing penalties for repeat violators for enhanced effectiveness;
- Evaluate and potentially revise current exemptions in Regulation 5: Open Burning, and Regulation 6: Particulate Matter;
- Consider revising Regulation 6, Rule 3 to incorporate any new changes to the federal New Source Performance Standard, Subpart AAA for new residential wood heaters;
- Evaluate the feasibility of requiring an upgrade or replacement of existing fireplaces and/or wood stoves when an existing home is sold or changes ownership;
- Evaluate the impact of modified definitions and exemptions in Regulation 6, Rule 3;
- Consider amending Regulation 6, Rule 3 to reduce unnecessary solid-fuel burning; and
- Consider amending Regulation 6, Rule 3 to apply to outdoor as well as indoor wood-burning devices.

FSM 13 - Energy Efficiency and Renewable Energy

Brief Summary:
Fossil fuel combustion to produce the energy that powers our factories, offices, and homes, and other buildings is a major source of emissions of greenhouse gases, criteria pollutants, and air toxics. District staff will evaluate and prioritize potential measures or policies that the District could pursue to reduce energy consumption and promote renewable energy, taking into consideration factors such as the District's legal authority to adopt regulations or fees, the overall regulatory context, potential enforcement mechanisms, in-house experience and expertise, and available resources. Measures that will be evaluated include regulations, partnerships, and market-based mechanisms.

Purpose:
The purpose of this Further Study Measure is to determine whether and how the Air District can play a constructive role in energy efficiency and renewable energy.

Source Category:
Area source.

Further Study Measure Description:
It will be increasingly important to curb fossil fuel use in order to stem the threat of climate change. The Air District has not traditionally addressed energy use in its regional air quality plans or its stationary source rules. However, given the growing threat of local impacts from climate change, including the threat that higher temperatures will degrade our air quality, the District is now exploring how it can use its existing authority to help reduce fossil fuel use by the buildings sector. In many cases the use of fossil fuels is indirect; for example, through the use of electricity produced by burning fossil fuels. Fossil fuel combustion is a major source of criteria air pollutant emissions as well as greenhouse gases.

Potential actions that the District will evaluate and may implement in future years include:
- Research the existing regulatory structure to determine the extent of District authority over building energy use, such as requiring energy audits of commercial and/or industrial buildings;
- Research the interface between Air District authority and implementation measures in the AB32 Scoping Plan;
- Adopt a rule to require installation of solar hot water heating systems in all new residential construction;
- Adopt a rule to require new commercial and residential swimming pools to be heated with solar power;
- Study opportunities to reduce energy use at petroleum refineries and other industrial facilities;

- Collaborate with public agencies, such as the California Public Utilities Commission and the California Energy Commission, to promote energy efficiency, potentially including energy pricing policies to reduce demand on an on-going and/or episodic basis;
- Consider additional actions, such as discouraging the sale or use of "vampire appliances" that consume energy even when not in use.

Sources:

1. http://www.cpuc.ca.gov/PUC/energy/DistGen/solarhotwater.htm

FSM 14 – Winery Fermentation

Brief Summary:
Review emissions generated by fermentation at wineries to determine if reductions can be achieved.

Purpose:
Reduce VOC emissions.

Source Category:
Stationary source.

Further Study Measure Description:
In 2005, the San Joaquin district adopted a rule to control emissions from wineries. The rule applies to wineries that emit over 10 tons/year of organic emissions (primarily ethanol) based on formulae in the rule. The rule requires a reduction of fermentation emissions of 35%, which may include payment of an emission mitigation fee. The rule also requires that storage tanks of 5000 gallon size or greater be equipped with a pressure/vacuum valve and kept at a temperature of no greater than 75^{o} F. San Joaquin staff estimated that 18 wineries would be subject to the rule, 14 of which were major stationary sources subject to federal Title V permits. The rule is anticipated to reduce emissions from wineries by 0.6 to 0.7 tons per day from a total inventory of 2.1 tons per day ROG.

The BAAQMD inventory for winery emissions is 0.78 tons ROG per day. The San Joaquin estimates 109 wineries in the San Joaquin district. In the Bay Area, there are over 300 wineries in Napa County alone that collectively account for about 60% of the Bay Area winery emissions. Further research will have to be done to determine whether any of the Bay Area wineries meet the San Joaquin threshold of 10 tons ROG emissions per year, or whether cost-effective controls could be applied to Bay Area facilities.

Sources:
3. Rule 4694: Wine Fermentation and Storage Tanks, San Joaquin Valley Unified Air Pollution Control District, December 15, 2005.
4. Memorandum to Governing Board re: Rule 4694, Crow, David L., San Joaquin Unified Air Pollution Control District, December 15, 2005.

FSM 15 - Composting Operations

Summary:
This measure would consider reductions in organic emissions from Composting Operations.

Purpose:
Reduce emissions of organic compounds from composting operations.

Source Category:
Area source.

Further Study Measure Description:
This measure will consider whether it is feasible to reduce emissions, both ROG and GHG, from composting operations, in cooperation with the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD), South Coast Air Quality Management District (SCAQMD) and Mojave Desert Air Quality Management District. In addition, feasible reductions in ammonia and particulate matter will be explored. In 2003, the SCAQMD adopted Rule 1133.2: Emission Reductions from Co-composting Operations, to limit emissions of both ROG and ammonia. As part of its 2005 Extreme Ozone Attainment Demonstration Plan, SJVUAPCD identified composting and biosolids operations as a source category for emission reductions (Control Measure J). SJVUAPCD adopted Rule 4565, Biosolids, Animal Manure, and Poultry Litter Operations on March 15, 2007 to limit ROG emissions from operations involving the management of biosolids, animal manure, or poultry litter, similar to SCAQMD's Co-composting Rule 1133.2. In 2008, SJVUAPCD initiated a field study to determine emissions factors from a variety of composting methodologies. A final report is due to be issued in the spring of 2010.

Emission mitigation measures may be proposed based on SJVUAPCD Rule 4566 and SCAQMD Rule 1133. These measures, combined with the results of the San Joaquin field study will determine if it is feasible to control composting emissions. In addition, objectives of the Regional Water Quality Control Board and the Integrated Waste Management Board will be integrated into the study measure.

Sources:
1. Mojave Desert Air Quality Management District Technical Report, Feasibility Analysis for Composting and Related Operations, dated 10/22/2007
2. San Joaquin Valley Unified Air Pollution Control District, Preliminary Draft Staff Report for Rule 4566, Composting Green Waste, dated 1/10/2008
3. SJVUAPCD, Final Draft Staff Report for Rule 4566, Organic Waste Operations, dated 12/18/2008
4. The Policy Committee for the Central California Ozone Study, and SJVUAPCD, Request for Proposal for the Organic Waste Composting Study, dated 12/16/2008

5. South Coast Air Quality Management District, Final 2007 Air Quality Management Plan, Control Measure CM # 2007MCS-04, dated 6/1/2007
6. SCAQMD Technology Assessment for Proposed Rule 1133.

FSM 16 - Vanishing oils and rust inhibitors

Brief Summary:
Research VOC reductions from vanishing oils and rust inhibitors.

Purpose:
Reduce VOC emissions.

Source Category:
Stationary Source

Further Study Measure Description:
The South Coast AQMD adopted a rule in 2009 to reduce emissions from vanishing oils and rust inhibitors. Vanishing oils are lubricants metal working fluid (such as cutting oil) or other oil used manufacturing. Rust inhibitors are fluids used to inhibit, protect or prevent corrosion on metal surfaces. The South Coast rule, 1144, does not apply to oils and inhibitors that have a flash point of less than 200^{o}F. It sets an interim VOC limit for rust inhibitor at 300 grams VOC per liter of material, and a final limit for both inhibitor and oil at 50 grams VOC per liter of material. The staff report projects emissions reductions of 2.7 tons per day from a 3.2 ton per day inventory. The businesses likely to be affected include machine shops (job shops), aerospace facilities, steel mills, auto part rebuilders, screw machine shops, steel tube (pipe) manufacturers, steel spring manufacturers and captive machine shops located inside of others type of businesses.

Sources:
1. South Coast AQMD Rule 1144, Staff Report, SCAQMD, March 6, 2009

FSM 17 - Ferry System Expansion

Brief Summary:
MTC, the Air District, and the Water Emergency Transportation Authority (WETA) will collaborate to ensure that expansion of the regional ferry network will provide the greatest possible air quality benefit.

Purpose:
To reduce emissions of criteria pollutants and greenhouse gases.

Travel Market Affected:
This measure would affect all intraregional travel, including commute travel; shopping, personal business, social and recreational travel, including tourism. In particular, expansion of ferry service will affect peak period commute travel, when congestion on bridges is greatest.

Further Study Measure Description:
Because expansion of the ferry system does not show a clear-cut benefit for air quality based on current analytical methodologies, as explained below, TCM 7 (Improve Ferry Service) in the 2005 Ozone Strategy has been reclassified as a Further Study Measure for purposes of the 2010 Clean Air Plan.

Ferry service in the Bay Area is provided by the Golden Gate Bridge, Highway, and Transportation District (GGBHTD) and the Water Emergency Transportation Authority (WETA). GGBHTD provides ferry service from Larkspur and Sausalito to San Francisco. WETA was created by Senate Bill 976, resulting in the consolidation of Alameda, Oakland, and Vallejo ferry services under one authority. WETA issued a final transition plan for consolidation of services in June 2009. This plan also includes expansion projects envisioned over the next five years including new ferry routes from South San Francisco, Berkeley, Treasure Island, and Alameda Point, as well as pre-construction planning for longer term expansion of ferry service to Hercules, Redwood City, Richmond, Martinez, and Antioch. MTC's Resolution 3434 Regional Transit Expansion Program includes new or expanded ferry service to: Berkeley, Alameda/Oakland/Harbor Bay, Hercules, Richmond, and South San Francisco.

All ferry vessels purchased after January 1, 2009 must meet the emission limits set forth in Section 93118.5(e)(5), Title 17, California Code of Regulations, and WETA expansion vessels must comply with the mitigation measures adopted by the Water Transit Authority (now WETA) as part of the Implementation and Operations Plan (IOP) adopted by the California State Legislature in 2003. These measures effectively require that all new ferry vessels reduce emissions of NOx and PM by 85% below EPA Tier 2 emissions standards.

The use of engines that meet the emission standards described above will reduce overall emissions produced by ferry vessels, even as service is expanded. However, analysis of the ferry expansion plan indicates that emissions produced by the ferry vessels will likely outweigh the benefit of reduced emissions from decreased motor vehicle trips by new ferry riders. This is because, on average, ferry vessels require more horsepower per passenger-mile than bus, rail, or private vehicles and motor vehicle emission technology advances for these other transportation modes will continue to reduce emission rates for on-road vehicles in future years.

Ferry service provides a variety of benefits to the region including increased transbay transportation capacity, enhanced mobility, improved connectivity, tourism and recreation, back-up to the regional transportation system in the event of natural or man-made disruptions to the region's transit systems and road and bridge infrastructure, and emergency evacuation.

MTC, the Air District, and WETA will work together to maximize potential air quality benefits of ferry system expansion. Potential measures to improve the air quality outcome include maximizing ridership, promoting non-motorized modes of access to and from ferry terminals, prioritizing routes that would provide the greatest air quality benefit, and exploring how to further reduce emissions from ferry engines by means of operational efficiencies and/or advanced technologies such as hybrid designs. In particular, WETA will evaluate the option of consolidating future projected ridership onto fewer routes. Service consolidation will likely increase ridership demand for individual routes, resulting in a greater number of passengers per vessel trip and an improvement in net emissions reductions.

The three agencies will also work together to thoroughly analyze all assumptions regarding the new routes that will be created, the schedule as to when new routes will be brought into service, ridership projections, assumptions regarding prior mode of ferry riders and transportation mode that ferry patrons will use to access the ferry terminals, and actual emission rates for new ferry vessels. Additionally, WETA will evaluate scenarios on new routes where ridership can be maximized at reduced levels of service during peak and/or off-peak periods. Such scenarios would require fewer ferry operating hours and trips, resulting in a reduction of gross ferry emissions.

Expansion of the ferry network may be included as a transportation control measure in future air quality plans if MTC, the Air District, and WETA agree that expansion of the network would provide a clear air quality benefit.

Sources:

1. MTC's Transportation 2035 Plan: http://www.mtc.ca.gov/planning/2035_plan/
2. Water Emergency Transportation Authority: http://www.watertransit.org

3. Water Transit Authority (now WETA) Ridership Model Sensitivity Analysis: http://www.watertransit.org/files/pubs/techPubPresentations/CS_Sensitivity_analysis.pdf

FSM 18 – Greenhouse Gas Fee

Brief Summary:
The District will explore as a further study measure the viability of assessing a fee on greenhouse gas (GHG) emissions from stationary sources. The purpose of the GHG fee (sometimes referred to as a "carbon fee") would be to 1) provide these sources with an incentive to reduce their GHG emissions, and 2) generate revenues that could be used to fund replacement of higher-emitting sources with lower-emitting sources, or otherwise reduce GHG emissions.

Purpose:
The purpose of this measure would be to reduce emissions of greenhouse gases and accelerate replacement of sources with more energy-efficient sources. By decreasing combustion of fossil fuels, this measure would also provide co-benefits in reducing emissions of criteria pollutants and air toxics.

Source Category:
Stationary source emissions.

Further Study Measure Description:

As described in CAP Chapter 1, climate change poses a wide range of risks and negative impacts for the Bay Area, including the prospect of degraded air quality. In November of 2010, California voters will decide whether to suspend implementation of AB 32, California's ground-breaking climate protection law, by voting on Proposition 23. Prop 23 would suspend implementation of AB 32 until the state's economy experiences an unemployment rate of 5.5% or less for four consecutive quarters. At the federal level, negotiations in the Senate on comprehensive climate protection legislation, including a national GHG cap-and-trade program, have reached an impasse unlikely to be resolved in the near future. Should climate protection efforts falter at the state and federal levels, it will be important to take significant action to reduce GHG emissions at the regional and local levels.

Public opinion seems to favor strategies to reduce GHG emissions from polluting industries. A recent opinion survey by the Public Policy Institute of California [1] indicates strong public support for government policies to require industry to reduce greenhouse gas emissions from their processes and activities. A recent national survey conducted at Stanford University [2] found that more than 50% of Americans surveyed would vote for a law to reduce national greenhouse gas emissions by 85 percent by 2050 even if it resulted in a net cost to households.

The District currently collects fees for greenhouse gas emissions under Regulation 3, Schedule T. For fiscal year 2010-11 the fees are set at $0.048 per metric ton of CO2-equivalent. These fees, which are limited by State law to an amount necessary to fund

District programs related to greenhouse gas emissions at stationary sources, are too modest to motivate any major change in GHG emission rates.

Fee programs, or economic incentive programs, as they are referred to by EPA, are market-based programs to encourage people or industries to reduce emissions in an efficient manner. Examples of such programs include emissions fees, subsidies for purchases of zero-emitting vehicles, and transportation pricing. The success of fee programs is based upon establishing the fee at a level that is reasonable, but significant enough to motivate behavioral changes or investment in cleaner technology; clearly defining how fee revenues would be used; and providing flexibility to adjust the financial mechanism, should it prove either too costly or ineffective.

Many economists have argued that a greenhouse gas fee assessed on greenhouse gas emitters would be the fairest, simplest and most effective way to reduce greenhouse gas emissions. Unlike a cap-and-trade program, a greenhouse gas fee is less complex, can be implemented sooner, is transparent, and can more easily address emissions from a variety of economic sectors.

The District will evaluate the feasibility of developing a greenhouse gas fee for stationary sources. The District will consider structuring such a fee to be revenue-neutral, meaning that money collected would be used to fund development and installation of lower-emitting (more energy-efficient) sources. A range of energy efficiencies for certain types of equipment could be evaluated so as to set a fee that incentivizes and provides funds for replacement of less energy-efficient, higher GHG -emitting equipment with more energy-efficient, lower GHG -emitting equipment. New equipment would emit fewer criteria pollutants and toxic air contaminants, as well. The District will consult with other air districts and with ARB and other state agencies in this evaluation.

The District already collects fees on permitted stationary sources, including emissions fees on major stationary sources under Regulation 3, Schedule M. The District will evaluate whether sufficient legal authority exists to promulgate a GHG fee program. Should ample authority not be determined to exist, the District may seek legislation to gain such authority.

Sources:

1. Baldassare, Bonner, Petek and Willcoxon; Californians and the Environment; Public Policy Institute of California,; July 2010; http://www.ppic.org/content/pubs/survey/S_710MBS.pdf
2. Abt SRB;, Global Warming Poll; July, 2010; http://woods.stanford.edu/docs/surveys/July2010-Stanford-Survey.pdf
3. Improving Air Quality with Economic Incentive Programs; January, 2001; EPA-452/R-01-001

5.5. MITIGATING LOCAL COMMUNITY RISK AND HAZARD IMPACTS

For stationary sources, please refer to BAAQMD's permit handbook and BACT/T-BACT workbook. For land use projects, BAAQMD is developing community development guidelines to assist lead agencies in identifying mitigation measures to reduce risk and hazard impacts associated with proposed projects. The community development guidelines will contain risk reduction measures with estimated quantified reductions, as well as an analysis worksheet for lead agencies to review as they perform an environmental analysis. The mitigation measures will be helpful in protecting public health for proposed infill and transit-oriented development projects located near TAC sources.

The list below outlines potential mitigation measures for reducing TAC emissions and exposure to sensitive receptors:

1. Increase project distance from freeways and/or major roadways.

2. Redesign the site layout to locate sensitive receptors as far as possible from any freeways, major roadways, or other non-permitted TAC sources (e.g., loading docks, parking lots).

3. Large projects may consider phased development where commercial/retail portions of the project are developed first. This would allow time for CARB's diesel regulations to take effect in reducing diesel emissions along major highways and arterial roadways. Ultimately, lower concentrations would be anticipated along the roads in the near future such that residential development would be impacted by less risk in later phases of development.

4. Projects that propose sensitive receptors adjacent to sources of diesel PM (e.g., freeways, major roadways, rail lines, and rail yards) should consider tiered plantings of trees such as redwood, deodar cedar, live oak and oleander to reduce TAC and PM exposure. This recommendation is based on a laboratory study that measured the removal rates of PM passing through leaves and needles of vegetation. Particles were generated in a wind tunnel and a static chamber and passed through vegetative layers at low wind velocities. Redwood, deodar cedar, live oak, and oleander were tested. The results indicate that all forms of vegetation were able to remove 65–85 percent of very fine particles at wind velocities below 1.5 meters per second, with redwood and deodar cedar being the most effective.

5. Install and maintain air filtration systems of fresh air supply either on an individual unit-by-unit basis, with individual air intake and exhaust ducts ventilating each unit separately, or through a centralized building ventilation system. The ventilation system should be certified to achieve a performance effectiveness, for example, to remove at least 85% of ambient $PM_{2.5}$ concentrations from indoor areas. Air intakes should be located away from emission sources areas, such as major roadways. Users may factor in the amount of time that receptors spend indoors verses out-of-doors to account for air filtration systems in modeling, provided that all assumptions are justified with scientific documentation.

6. Where appropriate, install passive (drop-in) electrostatic filtering systems, especially those with low air velocities (i.e., 1 mph).

7. Require rerouting of nearby heavy-duty truck routes.

8. Enforce illegal parking and/or idling of heavy-duty trucks in vicinity.

APPENDIX B

Biological Resources

- List of Potential or Known Occurring Special Status Species in the Project Area
  - U.S. Fish and Wildlife Service, Endangered and Threatened Species List

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Plants					
Alopecurus aequalis var. sonomensis	Sonoma alopecurus	FE RPR 1B.1	Freshwater wetlands and wetland riparian.	Absent	Not likely. Appropriate habitat is not present on site. Two CNDDB records of this species have been documented within 5 miles of the project area.
Astragalus claranus	Clara Hunt's milkvetch	FE RPR 1B.1	Open grassy areas and thin clay soil with an affinity for serpentine soils.	Absent	Not likely. Appropriate habitat is not present on site. This species is known from only five occurrences between Sonoma and Napa Counties.
Balsamorhiza macrolepis	big-scale balsamroot	RPR 1B.2	Valley grassland, foothill woodland	Absent	Not likely. Appropriate habitat is not present on site. Two CNDDB records of this species have been documented within 5 miles of the project area.
Blennosperma bakeri	Baker's stickyseed / Sonoma sunshine	FE, CE RPR 1B.1	Vernal pools within valley grassland, freshwater wetlands, and wetland-riparian habitats.	Absent	Not likely. Appropriate habitat is not present on site. Seven CNDDB records of this species have been documented within 5 miles of the project area.
Carex albida	white sedge	FE, CE RPR 1B.1	Freshwater-marsh and bogs.	Absent	Not likely. Appropriate habitat is not present on site. This species is known from only one occurrence at Pitkin Marsh.
Centromadia parryi ssp. parryi	pappose tarplant	RPR 1B.2	Grassland, coastal salt marshes, alkaline springs, seeps	Absent	Not likely. Appropriate habitat is not present on site. One CNDDB record of this species has been documented within 5 miles of the project area.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Chorizanthe valida	Sonoma spineflower	FE RPR 1B.1	Coastal prairie on deep sandy soils	Absent	Not likely. Appropriate habitat is not present on site. This species is known from only one remaining natural population at Point Reyes National Seashore.
Clarkia imbricata	Vine Hill clarkia	FE, CE RPR 1B.1	Chaparral and valley grassland.	Absent	Not likely. Appropriate habitat is not present on site. This species is known from only one remaining natural occurrence near Vine Hill.
Cordylanthus mollis ssp. mollis	soft bird's beak	FE RPR 1B.2	Coastal salt marsh, wetland-riparian of the Sacramento-San Joaquin River Delta.	Absent	Not likely. Appropriate habitat is not present on site. No CNDDB occurences of this species have been recorded within 5 miles of the project area.
Delphinium bakeri	Baker's larkspur	FE, CE RPR 1B.1	Northern coastal scrub	Absent	Not likely. Appropriate habitat is not present on site. This species is known from only one remaining occurrence near Salmon Creek in Sonoma County
Delphinium luteum	yellow larkspur	FE RPR 1B.1	Coastal Prairie, chaparral, and northern coastal scrub. This species is endemic to the rocky, foggy hillsides of coastal Sonoma County, California.	Absent	Not likely. Appropriate habitat is not present on site. No CNDDB occurrences of this species have been re
Downingia pusilla	dwarf downingia	RPR 2.2	Freshwater wetland, vernal pools, and roadside ditches.	Marginally suitable habitat is present in the form of roadside ditches.	Not likely. This species may inhabit roadside ditches; therefore, marginally suitable habitat is present on site. Two CNDDB records of this species have been documented within 5 miles of the project area.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Fritillaria liliacea	fragrant fritillary	RPR 1B.2	Coastal Prairie, Valley Grassland, Northern Coastal Scrub, wetland-riparian	Absent	Not likely. Appropriate habitat is not present on site. One CNDDB record of this species has been documented within 5 miles of the project area and two additional records were recorded before 1975.
Hesperolinon congestum	Marin dwarfflax	FT, CT 1B.1	Chaparral and valley grassland on serpentine soils.	Absent	Not likely. Appropriate habitat is not present on site.
Lasthenia burkei	Burke's goldfields	FE, CE RPR 1B.1	Vernal pools in foothill woodland, freshwater wetlands, and wetland-riparian.	Absent	Not likely. Appropriate habitat is not present on site. Three CNDDB records of this species have been documented within 5 miles of the project area.
Lilium pardalinum ssp. pitkinense	Pitkin Marsh lily	RPR 1B.2	Wet meadows and freshwater marshes in western Sonoma County.	Absent	Not likely. Appropriate habitat is not present on site. Three CNDDB records of this species have been documented within 5 miles of the project area.
Limnanthes vinculans	Sebastopol meadowfoam	FE, CE RPR 1B.1	Vernal pools in foothill woodland, freshwater wetlands, and wetland-riparian.	Absent	Not likely. Appropriate habitat is not present on site. 18 CNDDB records of this species have been documented within 5 miles of the project area; however, all of these records are located on the west side of Highway 101.
Pleuropogon hooverianus	North Coast semaphore grass	RPR 1B.1	Mixed Evergreen Forest, North Coastal Coniferous Forest, Freshwater Wetlands, wetland-riparian	Absent	Not likely. Appropriate habitat is not present on site. One CNDDB record of this species has been documented within 5 miles of the project area.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Potentilla hickmanii	Hickman's potentilla	FE, CE RPR 1B.1	Northern coastal scrub, closed-cone pine forest, freshwater wetlands, and wetland-riparian.	Absent	Not likely. Appropriate habitat is not present on site.
Potentilla uliginosa	Cunningham Marsh cinquefoil	RPR 1A	Low-nutrient wetlands.	Absent	Not likely. This species is presumed extinct, and only one CNDDB occurrences has been recorded within 5 miles of the project area in 1990.
Sidalcea oregana ssp. valida	Kenwood Marsh checkermallow	FE, CE RPR 1B.1	Freshwater marsh.	Absent	Not likely. Appropriate habitat is not present on site. This species is known from only two locations in Sonoma County, California.
Trifolium amoenum	showy Indian clover	FE RPR 1B.1	Valley grassland and wetland-riparian.	Absent	Not likely. Appropriate habitat is not present on site.
Trifolium hydrophilum	Saline clover	RPR 1B.2	Valley and foothill grassland and vernal pools with an affinity to mesic/alkaline soils.	Absent	Not likely. Appropriate habitat is not present on site and only two CNDDB records are present within 5 miles of the project area. One CNDDB occurrence was mapped as occurring within or in the immediate vicinity of the project area. However, the record indicates that the location of the observation is “unknown”, and recorded as “near Rohnert Park.”

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Invertebrates					
Incisalia mossii bayensis	San Bruno elfin butterfly	FE	Lives only on north facing slopes of the coastal mountains in San Mateo County. Lays eggs on the larval food plant stonecrop (Sedum spathulifolium). The adults have a flight period of late February through mid-April.	Absent	Not likely. No CNDDB documented occurrences are within 5 miles of the action area. Suitable habitat is not present in the action area. The action area is outside the species' documented range.
Speyeria zerene myrtleae	Myrtle's silverspot butterfly	FE	Inhabits coastal terrace prairie, coastal bluff scrub, and associated non-native grassland habitats in western Marin and southwestern Sonoma Counties.	Absent	Not likely. Myrtle's silverspot is now only known from four populations in northwestern Marin County and southwestern Sonoma County, including two at Point Reyes National Seashore
Syncaris pacifica	California freshwater shrimp	FE CE	The California freshwater shrimp prefers streams that have water flowing year round with predominately low gradient flows. perennial freshwater streams or intermittent streams with perennial pools where banks are structurally diverse with undercut banks, exposed roots, overhanging woody debris, or overhanging vegetation.	Absent	Unlikely. One CNDDB occurrence of this species is located within 5 miles of the project area. Perennial streams in the project area are connected to Laguna de Santa Rosa, which is known to provide habitat for this species. However, perennial streams in the project area are manmade and are not structurally diverse, with no perennial pools, undercut banks, and little to no overhanging vegetation.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Fish					
Eucyclogobius newberryi	tidewater goby	FE, SSC	Inhabits estuarine habitats along the California coast, ranging upstream slightly into fresh water and downstream in water of up to approximately 75 percent sea water. Prefers to spawn in calm lagoon conditions afforded by sandbar closure.	Absent	Not Likely. Water of appropriate salinity is not located in the project area. No CNDDB occurrences of this species are located within 5 miles of the project area.
Hypomesus transpacificus	delta smelt	FT, CE	Migrates upstream from the brackish-water habitat associated with the mixing zone and disperses widely into river channels and tidally influenced backwater sloughs. Generally spawns in tidally influenced backwater sloughs and channel edgewaters.	Absent	Not Likely. No CNDDB documented occurrences are within 5 miles of the action area. Suitable saline aquatic habitat is not present in the action area.
Oncorhynchus kisutch	Coho salmon	FE	Spawn in streams at riffles with small-to-medium gravel substrates.	Present	Possible. Perennial streams in the project area are connected to Laguna de Santa Rosa, which is known to provide habitat for this species. Although the perennial streams in the project area do not provide suitable spawning habitat for this species, individuals may disperse into these streams.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Oncorhynchus mykiss	Central California Coast steelhead	FT	Spawn in streams at riffles with small-to-medium gravel substrates.	Present	Possible. Perennial streams in the project area are connected to Laguna de Santa Rosa, which is known to provide habitat for this species. Although the perennial streams in the project area do not provide suitable spawning habitat for this species, individuals may disperse into these streams.
Oncorhynchus mykiss	Central Valley steelhead	FT	Spawn in streams at riffles with small-to-medium gravel substrates.	Absent	Not Likely. The project area is outside of the known range of this species.
Oncorhynchus tshawytscha	California coastal chinook salmon	FT	Spawn in streams at riffles with small-to-medium gravel substrates.	Absent	Not Likely. The project area is outside of the known range of this species. Specifically, the project area lies on the southern edge of historic range, and outside of extant range.
Oncorhynchus tshawytscha	Central Valley spring-run chinook salmon	FT, CT	Spawn in streams at riffles with small-to-medium gravel substrates.	Absent	Not Likely. The project area is outside of the known range of this species.
Oncorhynchus tshawytscha	Winter-run chinook salmon, Sacramento River	FT, CE	Spawn in streams at riffles with small-to-medium gravel substrates.	Absent	Not Likely. The project area is outside of the known range of this species.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Amphibians					
Ambystoma californiense	California tiger salamander	FT, CT	Annual grasslands and grassy understory of valley foothill hardwood habitats with underground refuges and within dispersal distance of vernal pools, stock ponds, or other seasonal water sources for breeding.	Absent	Possible. 71 CNDDB occurrences of this species have been recorded within 5 miles of the project area, 21 of which were recorded within 1.5 miles of the project area. No suitable breeding habitat, upland habitat, or refugia were observed in the project area. However, California tiger salamander individuals may use perennial stream features (tributaries to Laguna de Santa Rosa) as aquatic dispersal habitat and as a corridor under Highway 101 to access the project area. In addition, the project area is located in close proximity to California tiger salamander critical habitat. Therefore; although the project area does not provide suitable aquatic or upland habitat for this species, California tiger salamander individuals may traverse the project area.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Rana boylii	Foothill yellow-legged frog	SSC	Found in partially shaded, shallow streams with rocky substrates in woodland, chaparral, and forest . Needs some cobblesized rocks as a substrate for egg laying. Requires water for 15 weeks for larval transformation.	Marginally suitable habitat present	Possible. 5 CNDDB occurrences of this species have been recorded within 5 miles of the project area. No suitable breeding habitat for this species is located in the project area. One of the CNDDB records is located approximately 1.3 miles east of the project area, along a perennial stream that traverses the project area. Therefore, although the project area does not provide suitable breeding habitat for this species, perennial streams in the project area may provide marginally suitable aquatic dispersal habitat for this species.
Rana draytonii	California red-legged frog	FT, SSC	Dense, shrubby riparian vegetation (*Salix lasiolepis*; also *Typha* and *Scirpus* spp.) associated with deep (2.3 feet), still or slow moving water.	Absent	Not Likely. Eight CNDDB occurrences are documented within 5 miles of the project area. Streams within the project area could provide suitable aquatic dispersal habitat for this species; however, a lack of nearby records and breeding habitat makes it unlikely that this species would occur in the project area.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Reptiles					
Emys marmorata	Western pond turtle	SSC	Permanent or nearly permanent bodies of water and low gradient, slow moving streams below 6,000 feet elevation; presence of haul-out sites important.	Present	Possible. 12 CNDDB occurrences of this species are located within 5 miles of the project area, 4 of which are located within 1.5 miles of the project area. Aquatic corridors connected to Laguna de Santa Rosa may provide suitable aquatic dispersal habitat for this species.
Birds					
Agelaius tricolor	Tricolor blackbird	CE	The tricolored blackbird is found primarily in the Central Valley, but is also found in the lowlands west of the Cascade-Sierra axis. Inhabits agricultural grain fields, dairies and feedlots with low-growing vegetation, grasslands, and marshes. Nesting habitat is found in marshes within cattails (Typhus spp.), often with willow (Salix spp.) canopy. The breeding season is from mid-March through early August, and autumnal breeding in the Central Valley occurs from September through November.	Absent	Not likely to nest in the project area. One CNDDB occurrence of this species is located within 5 miles of the project area. Suitable marsh habitat for this species is not located in the project area.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Athene cunicularia	Burrowing owl	SSC	Occurs in dry, open habitats such as grasslands and prairies, with low-growing or no vegetation where it occupies underground burrows, typically those of the California ground squirrel (Spermophilus beecheyi). Can also occur in open areas of farmland, levee banks and other disturbed or managed habitats where burrows or burrow-like features are present.	Absent	Not likely. One CNDDB occurrence of this species is located within 5 miles of the project area. No habitat for this species is present in the project area.
Brachyramphus marmoratus	marbled murrelet	FT, CE	Occurs near coastal areas, generally within 1.2 miles of saltwater. Nests in old-growth forest.	Absent	Not likely. No CNDDB occurrences for this species are located within 5 miles of the action area and no habitat for this species is present in the action area.
Coccyzus americanus occidentalis	western yellow-billed cuckoo	FT, CE	Occurs in open woodlands with clearings and dense scrubby vegetation, often along water.	Absent	Not likely. Two CNDDB occurrences of this species were recorded within 5 miles of the project area, both before 1975, and one of which is considered possibly extirpated. No suitable habitat for this species is located in the project area.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Elanus leucurus	White-tailed kite	CFP	This species builds nests in the tops of dense medium- to large-sized trees located near open areas that are used for foraging. Breeding generally occurs from February through October. White-tailed kite lays three to five eggs, which it incubates for 30 to 32 days, after which fledging occurs at 5 to 6 weeks of age.	Absent	Not likely to nest in the project area. One CNDDB occurrence of this species was recorded within 5 miles of the project area. Marginally suitable foraging habitat for this species may occur in ruderal patches in the project area.
Charadrius alexandrinus nivosus	Western snowy plover	FT, SSC	Breeding habitat found on barren to sparsely vegetated flats and along the shores of alkaline and saline lakes, reservoirs, ponds, braided river channels, agricultural waste water ponds, and salt evaporation ponds. Adults and broods typically forage near shallow water and on dry flats.	Absent	Not likely. No CNDDB occurrences for this species are located within 5 miles of the action area. In addition, the San Francisco Bay and associated salt marsh habitat is not located within the vicinity of the project.
Diomedea albatrus	Short-tailed albatross	FE	Require remote islands for breeding habitat and forage in the continental shelf-break areas.	Absent	Not likely. No CNDDB occurrences for this species are located within 5 miles of the action area. No habitat is present in the project area.
Rallus longirostris obsoletus	California clapper rail	FE, CE	Occurs along the ecotone between mudflat and higher vegetated zones, and in tidal sloughs.	Absent	Not likely. No CNDDB occurrences for this species are located within 5 miles of the action area. In addition, the San Francisco Bay and associated salt marsh habitat is not located within the vicinity of the project.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Sternula antillarum	California least tern	FE, CE	Nests in colonies on relatively open beaches where vegetation is limited by natural scouring from tidal action.	Absent	Not likely. No CNDDB occurrences for this species are located within 5 miles of the action area. In addition, the San Francisco Bay and associated salt marsh habitat is not located within the vicinity of the project.
Strix occidentalis caurina	Northern spotted owl	FT, CT	The species' breeding and roosting habitats are found in forests and woodlands with large old trees and snags, dense canopies, multiple canopy layers, and downed woody debris; foraging habitat includes more open stands. Breeding season is from mid-February to mid-September or early October.	Absent	Not likely. No forest is located within the project area. No CNDDB records of this species are located within 5 miles of the project area.
Mammals					
Reithrodontomys raviventris	salt marsh harvest mouse	FE, CFP	Marshes of the San Pablo, Suisun, Corte Madera, Richmond and South San Francisco bays. Critically dependent on dense cover. Preferred habitat is pickleweed (*Salicornia virginica*).	Absent	Not likely. Two CNDDB occurrences for this species are located within 5 miles of the action area. However; the San Francisco Bay and associated mudflat habitat is not located within the vicinity of the project.

Special-Status Species Potentially Occurring or Known to Occur in the Project Area

Scientific Name	Common Name	Status[1]	General Habitat Description	General Habitat Present/ Absent	Potential to Occur on the Project Site
Taxidea taxus	American badger	SSC		Absent	Not likely. Five CNDDB occurrences for this species are located within 5 miles of the project area. Existing development makes it unlikely that this species would occur in the project area.

[1] – **Listing Status Definitions:**

FE federal endangered
FT federal threatened
SE state endangered
ST state threatened
1A plant species that are presumed extinct in California (CNPS)
1B plant species that are rare, threatened, or endangered in California and elsewhere (CNPS)
SSC state species of concern
CFP California Fully Protected

Sources: data obtained from USFWS Species List Database, CNPS Rare Plant Database (USGS quadrangles searched include 501C Cotati, 501A Kenwood, 501D Glen Ellen, 501B Santa Rosa, 502A Sebastopol, 502D Two Rock, 485A Point Reyes NE, 484B Petaluma, and 484A Petaluma River), and CNDDB. CNDDB occurrences over 30 years old were not used to develop this species list.

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 150311030607

Current as of: March 11, 2015

Quad Lists

Listed Species

Invertebrates

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Speyeria zerene myrtleae
Myrtle's silverspot butterfly (E)

Syncaris pacifica
California freshwater shrimp (E)

Fish

Eucyclogobius newberryi
tidewater goby (E)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)
Critical habitat, coho salmon - central CA coast (X) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)

Oncorhynchus tshawytscha
California coastal chinook salmon (T) (NMFS)
Central Valley spring-run chinook salmon (T) (NMFS)
Critical habitat, California coastal chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, Sonoma Co. pop (E)

Rana draytonii
California red-legged frog (T)
Critical habitat, California red-legged frog (X)

Birds

Brachyramphus marmoratus
Critical habitat, marbled murrelet (X)
marbled murrelet (T)

Charadrius alexandrinus nivosus
western snowy plover (T)

Coccyzus americanus occidentalis
Western yellow-billed cuckoo (T)

Diomedea albatrus

short-tailed albatross (E)

Rallus longirostris obsoletus

California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni

California least tern (E)

Strix occidentalis caurina

northern spotted owl (T)

Mammals

Reithrodontomys raviventris

salt marsh harvest mouse (E)

Plants

Alopecurus aequalis var. sonomensis

Sonoma alopecurus (E)

Astragalus clarianus

Clara Hunt's milk-vetch (E)

Blennosperma bakeri

Baker's stickyseed [=Sonoma Sunshine] (E)

Carex albida

white sedge (E)

Chorizanthe valida

Sonoma spineflower (E)

Clarkia imbricata

Vine Hill clarkia (E)

Cordylanthus mollis ssp. mollis

soft bird's-beak (E)

Delphinium bakeri

Baker's larkspur (E)

Critical habitat, Baker's larkspur (X)

Delphinium luteum

yellow larkspur (E)

Hesperolinon congestum

Marin dwarf-flax (=western flax) (T)

Lasthenia burkei

Burke's goldfields (E)

Lasthenia conjugens

Contra Costa goldfields (E)

Lilium pardalinum ssp. pitkinense

Pitkin Marsh lily (E)

Limnanthes vinculans

Sebastopol meadowfoam (E)

Potentilla hickmanii

Hickman's potentilla (=cinquefoil) (E)

Sidalcea oregana ssp. valida

Kenwood Marsh checkermallow (=checkerbloom) (E)

Trifolium amoenum

showy Indian clover (E)

Quads Containing Listed, Proposed or Candidate Species:

PETALUMA RIVER (484A)

PETALUMA (484B)

POINT REYES NE (485A)

KENWOOD (501A)

SANTA ROSA (501B)
COTATI (501C)
GLEN ELLEN (501D)
SEBASTOPOL (502A)
TWO ROCK (502D)

County Lists

Sonoma County

Listed Species

Invertebrates

Branchinecta conservatio
Conservancy fairy shrimp (E)

Branchinecta lynchi
Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Haliotes cracherodii
black abalone (E) (NMFS)

Haliotes sorenseni
white abalone (E) (NMFS)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Speyeria callippe callippe
callippe silverspot butterfly (E)

Speyeria zerene behrensii
Behren's silverspot butterfly (E)

Speyeria zerene myrtleae
Myrtle's silverspot butterfly (E)

Syncaris pacifica
California freshwater shrimp (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
critical habitat, tidewater goby (X)
tidewater goby (E)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus (=Salmo) clarki henshawi

Lahontan cutthroat trout (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)
Critical habitat, coho salmon - central CA coast (X) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)
Critical habitat, Northern California steelhead (X) (NMFS)
Northern California steelhead (T) (NMFS)

Oncorhynchus tshawytscha
California coastal chinook salmon (T) (NMFS)
Central Valley spring-run chinook salmon (T) (NMFS)
Critical habitat, California coastal chinook salmon (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, Sonoma Co. pop (E)

Rana draytonii
California red-legged frog (T)
Critical habitat, California red-legged frog (X)

Reptiles

Caretta caretta
loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)
green turtle (T) (NMFS)

Dermochelys coriacea
leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)

Masticophis lateralis euryxanthus
Alameda whipsnake [=striped racer] (T)

Birds

Brachyramphus marmoratus
Critical habitat, marbled murrelet (X)
marbled murrelet (T)

Charadrius alexandrinus nivosus
Critical habitat, western snowy plover (X)

western snowy plover (T)

Coccyzus americanus occidentalis
Western yellow-billed cuckoo (T)

Diomedea albatrus
short-tailed albatross (E)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Strix occidentalis caurina
northern spotted owl (T)

Mammals

Aplodontia rufa nigra
Point Arena mountain beaver (E)

Arctocephalus townsendi
Guadalupe fur seal (T) (NMFS)

Balaenoptera borealis
sei whale (E) (NMFS)

Balaenoptera musculus
blue whale (E) (NMFS)

Balaenoptera physalus
finback (=fin) whale (E) (NMFS)

Eubalaena (=Balaena) glacialis
right whale (E) (NMFS)

Eumetopias jubatus
Steller (=northern) sea-lion (T) (NMFS)

Physeter catodon (=macrocephalus)
sperm whale (E) (NMFS)

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Alopecurus aequalis var. sonomensis

Sonoma alopecurus (E)

Astragalus clarianus
Clara Hunt's milk-vetch (E)

Blennosperma bakeri
Baker's stickyseed [=Sonoma Sunshine] (E)

Carex albida
white sedge (E)

Chorizanthe valida
Sonoma spineflower (E)

Clarkia imbricata
Vine Hill clarkia (E)

Cordylanthus mollis ssp. mollis
soft bird's-beak (E)

Cordylanthus tenuis ssp. capillaris
Pennell's bird's-beak (E)

Delphinium bakeri
Baker's larkspur (E)
Critical habitat, Baker's larkspur (X)

Delphinium luteum
Critical habitat, yellow larkspur (X)
yellow larkspur (E)

Eryngium constancei
Loch Lomond coyote-thistle (=button-celery) (E)

Hesperolinon congestum
Marin dwarf-flax (=western flax) (T)

Lasthenia burkei
Burke's goldfields (E)

Lasthenia conjugens
Contra Costa goldfields (E)
Critical habitat, Contra Costa goldfields (X)

Lilium pardalinum ssp. pitkinense
Pitkin Marsh lily (E)

Limnanthes vinculans
Sebastopol meadowfoam (E)

Lupinus tidestromii

clover lupine [Tidestrom's lupine] (E)

Navarretia leucocephala ssp. pauciflora
few-flowered navarretia (E)

Navarretia leucocephala ssp. plieantha
many-flowered navarretia (E)

Orcuttia tenuis
Critical habitat, slender Orcutt grass (X)
slender Orcutt grass (T)

Parvisedum leiocarpum
Lake County stonecrop (E)

Plagiobothrys strictus
Calistoga allocarya (popcorn-flower) (E)

Poa napensis
Napa bluegrass (E)

Potentilla hickmanii
Hickman's potentilla (=cinquefoil) (E)

Sidalcea oregana ssp. valida
Kenwood Marsh checkermallow (=checkerbloom) (E)

Trifolium amoenum
showy Indian clover (E)

Proposed Species

Plants

Cordylanthus mollis ssp. mollis
Critical habitat, soft bird's-beak (PX)

Key:

(E) *Endangered* - Listed as being in danger of extinction.
(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
(C) *Candidate* - Candidate to become a proposed species.
(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.
- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be June 09, 2015.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

March 11, 2015

Document Number: 150311030607

Peter Boice
AECOM
300 California Street Suite 400
San Francisco, CA 94014

Subject: Species List for Rohnert Park Priority Development Area Plan

Dear: Mr. Peter Boice

We are sending this official species list in response to your March 11, 2015 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be June 09, 2015.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found http://www.fws.gov/sacramento/es/Branch-Contacts/es_branch-contacts.htm.

Endangered Species Division

APPENDIX C

Cultural Resources Correspondence

July 29, 2015

Native American Heritage Commission
1550 Harbor Blvd Suite 100
West Sacramento, CA 95691

RE: Request for Native American Sacred Lands File research and Native American contacts list for the Central Rohnert Park Priority Development Area Plan

Dear NAHC Staff,

On behalf of the City of Rohnert Park and in accordance with the California Environmental Quality Act (CEQA) guidelines, AECOM is conducting an initial study of the proposed Central Rohnert Park Priority Development Area Plan project to determine whether an environmental impact report (EIR), a mitigated negative declaration (MND), or a negative declaration (ND) is required for the proposed plan.

AECOM is requesting a search of the Sacred Lands files for any places of concern that may be located within this area and a Native American contact list in order to further facilitate tribal interest in this project. Please find attached the completed NAHC form for this request.

If you have any questions, please feel free to contact me by email at Jenifer.Rogers@aecom.com or telephone (916) 414-5849. We appreciate your contribution to this project and look forward to hearing from you soon.

Thank you,
Jenifer Rogers
Archaeologist
AECOM Environment
2020 L Street Suite 400
Sacramento CA 95811
Desk: 916-414-5849
Fax: 916-414-5850
Jenifer.Rogers@aecom.com

Sacred Lands File & Native American Contacts List Request

Native American Heritage Commission

1550 Harbor Blvd, Suite 100
West Sacramento, CA 95691
916-373-3710
916-373-5471 – Fax
nahc@nahc.ca.gov

Information Below is Required for a Sacred Lands File Search

Project: **Central Rohnert Park Priority Development Area Plan**

County: **Sonoma**

USGS Quadrangle Name: Cotati, CA 7.5'

Township: **6N** **Range:** **8W** **Section(s):** **Unsectioned**

Company/Firm/Agency: **AECOM**

Street Address: **2020 L Street Suite 400**

City: **Sacramento** **Zip:** **95811**

Phone: **(916) 414-5849**

Fax: **(916) 414-5850**

Email: **Jenifer.Rogers@aecom.com**

Project Description:

The City of Rohnert Park is proposing a Priority Development Area (PDA) Plan, centered on Rohnert Park Expressway (RPX) and State Farm Drive, next to the planned Sonoma Marin Area Rail Transit (SMART) commuter rail station and City Center. The PDA is entirely within the City of Rohnert Park's city limits, in central Sonoma County, east of U.S. Highway 101. The PDA Plan is intended to support transit-oriented development and infill growth in existing communities, adjacent to transit. New roadways, transit, bicycle, and pedestrian improvements and corresponding circulation connections are proposed to improve non-vehicular access within the PDA, connect to and complete regional trails, and support the development of existing and new a mixed-use areas of the community, with a particular focus on providing community access to the SMART station and regional multi-use path (MUP).

From: Rogers, Jenifer
To: nahc@nahc.ca.gov
Subject: Request for Native American Sacred Lands File research and Native American contacts list for the Central Rohnert Park Priority Development Area Plan
Date: Wednesday, August 12, 2015 2:09:00 PM
Attachments: NAHC request form.docx

Dear NAHC Staff,

I am seeking a response to a request that I submitted to your office July 27, 2015. Following is a restatement of my request in case it is necessary.

On behalf of the City of Rohnert Park and in accordance with the California Environmental Quality Act (CEQA) guidelines, AECOM is conducting an initial study of the proposed Central Rohnert Park Priority Development Area Plan project to determine whether an environmental impact report (EIR), a mitigated negative declaration (MND), or a negative declaration (ND) is required for the proposed plan.

AECOM is requesting a search of the Sacred Lands files for any places of concern that may be located within this area and a Native American contact list in order to further facilitate tribal interest in this project. Please find attached the completed NAHC form for this request.

If you have any questions, please feel free to contact me by email at Jenifer.Rogers@aecom.com or telephone (916) 414-5849. We appreciate your contribution to this project and look forward to hearing from you soon.

Sincerely,
Jenifer Rogers
Archaeologist
AECOM Environment
2020 L Street Suite 400
Sacramento CA 95811
Desk: 916-414-5849
Fax: 916-414-5850
Jenifer.Rogers@aecom.com

STATE OF CALIFORNIA Edmund G. Brown, Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., ROOM 100
West SACRAMENTO, CA 95691
(916) 373-3710
Fax (916) 373-5471

August 17, 2015

Jenifer Rogers
AECOM
2020 L Street, Suite 400
Sacramento, CA 95811

Email to: Jenifer.Rogers@aecom.com

Re: Central Rohnert Park Priority Development Area Plan, Sonoma County.

Dear Ms. Rogers,

A record search of the sacred land file has failed to indicate the presence of Native American cultural resources in the immediate project area. The absence of specific site information in the sacred lands file does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Enclosed is a list of Native Americans individuals/organizations who may have knowledge of cultural resources in the project area. The Commission makes no recommendation or preference of a single individual, or group over another. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated, if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe or group. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact me at (916) 373-3712.

Sincerely,

Katy Sanchez

Katy Sanchez
Associate Government Program Analyst

Native American Contact List
Sonoma County
August 17, 2015

The Federated Indians of Graton Rancheria
Greg Sarris, Chairperson
6400 Redwood Drive, Ste
Rohnert Park, CA 94928
coastmiwok@aol.com
(707) 566-2288 Office

(707) 566-2291 Fax

Coast Miwok
Southern Pomo

Suki Waters
P.O. Box 53
Jenner , CA 95450
watertreks@gmail.com
(707) 865-2249

Coast Miwok
Pomo

The Federated Indians of Graton Rancheria
Gene Buvelot
6400 Redwood Drive, Ste 300
Rohnert Park, CA 94928
coastmiwok@aol.com
(415) 279-4844 Cell
(707) 566-2288 ext 103

Coast Miwok
Southern Pomo

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed Central Rohnert Park Priority Development Area Plan, Sonoma County.

AECOM
2020 L Street, Suite 400
Sacramento, CA 95811
www.aecom.com

916.414.5800 tel
916.414.5850 fax

August 25, 2015

Gene Buvelot
The Federated Indians of Graton Rancheria
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928

Subject: City of Rohnert Park Priority Development Area (PDA) Plan

Dear Mr. Buvelot,

On behalf of the City of Rohnert Park and in accordance with the California Environmental Quality Act (CEQA) guidelines, AECOM is conducting an initial study of the proposed Central Rohnert Park Priority Development Area Plan project to determine whether an environmental impact report (EIR), a mitigated negative declaration (MND), or a negative declaration (ND) is required for the proposed plan. The project is located on the USGS Cotati, CA 7.5' Quadrangle, Township 6N, Range 8W, unsectioned.

The City of Rohnert Park is proposing its Priority Development Area (PDA) Plan, centered on Rohnert Park Expressway (RPX) and State Farm Drive, next to the planned Sonoma Marin Area Rail Transit (SMART) commuter rail station and City Center. The Central Rohnert Park PDA Plan is an existing mixed-use area. The proposed project generally consists of various development types, including multi-family residential units, retail/service commercial uses, public institutional uses, office uses, light industrial uses, public park facilities, and open space. New roadways, transit, bicycle, and pedestrian improvements and corresponding circulation connections are proposed to improve non-vehicular access within the PDA, connect to and complete regional trails, and support the development of existing and new a mixed-use areas of the community, with a particular focus on providing community access to the SMART station and regional multi-use path.

The Native American Heritage Commission (NAHC) has identified you as a member of a California Native American tribe that is traditionally and culturally affiliated with the geographic area. If you or your tribe has concerns regarding tribal cultural resources in the project footprint you are invited to consult with the City of Rohnert Park. Please respond in writing via letter within 30 days of receipt of this notification. If you do not respond within 30 days the City of Rohnert Park will consider consultation with you and your tribe complete, pursuant to Public Resources Code Section 21082.3(d)(3).

AECOM
2020 L Street, Suite 400
Sacramento, CA 95811
www.aecom.com

916.414.5800 tel
916.414.5850 fax

Please send written notification to:
Jenifer Rogers
Archaeologist
AECOM
2020 L Street, Suite 400, Sacramento, CA 95811 USA

Sincerely,

Jenifer Rogers
Archaeologist
AECOM Environment
(916) 414-5849
Jenifer.Rogers@aecom.com

AECOM
2020 L Street, Suite 400, Sacramento, CA 95811 USA
T +1 916.414.5849 F +1 916.414.5850
www.aecom.com

Enclosure

AECOM
2020 L Street, Suite 400
Sacramento, CA 95811
www.aecom.com

916.414.5800 tel
916.414.5850 fax

August 25, 2015

Greg Sarris, Chairperson
The Federated Indians of Graton Rancheria
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928

Subject: City of Rohnert Park Priority Development Area (PDA) Plan

Dear Chairperson Sarris,

On behalf of the City of Rohnert Park and in accordance with the California Environmental Quality Act (CEQA) guidelines, AECOM is conducting an initial study of the proposed Central Rohnert Park Priority Development Area Plan project to determine whether an environmental impact report (EIR), a mitigated negative declaration (MND), or a negative declaration (ND) is required for the proposed plan. The project is located on the USGS Cotati, CA 7.5' Quadrangle, Township 6N, Range 8W, unsectioned.

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Sacramento, CA 95811
www.aecom.com

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Please send written notification to:
Jenifer Rogers
Archaeologist
AECOM
2020 L Street, Suite 400, Sacramento, CA 95811 USA

Sincerely,

Jenifer Rogers
Archaeologist
AECOM Environment
(916) 414-5849
Jenifer.Rogers@aecom.com

AECOM
2020 L Street, Suite 400, Sacramento, CA 95811 USA
T +1 916.414.5849 F +1 916.414.5850
www.aecom.com

Enclosure

AECOM
2020 L Street, Suite 400
Sacramento, CA 95811
www.aecom.com

916.414.5800 tel
916.414.5850 fax

August 25, 2015

Suki Waters
P.O. Box 53
Jenner, CA 95450

Subject: City of Rohnert Park Priority Development Area (PDA) Plan

Dear Suki Waters,

On behalf of the City of Rohnert Park and in accordance with the California Environmental Quality Act (CEQA) guidelines, AECOM is conducting an initial study of the proposed Central Rohnert Park Priority Development Area Plan project to determine whether an environmental impact report (EIR), a mitigated negative declaration (MND), or a negative declaration (ND) is required for the proposed plan. The project is located on the USGS Cotati, CA 7.5' Quadrangle, Township 6N, Range 8W, unsectioned.

The City of Rohnert Park is proposing its Priority Development Area (PDA) Plan, centered on Rohnert Park Expressway (RPX) and State Farm Drive, next to the planned Sonoma Marin Area Rail Transit (SMART) commuter rail station and City Center. The Central Rohnert Park PDA Plan is an existing mixed-use area. The proposed project generally consists of various development types, including multi-family residential units, retail/service commercial uses, public institutional uses, office uses, light industrial uses, public park facilities, and open space. New roadways, transit, bicycle, and pedestrian improvements and corresponding circulation connections are proposed to improve non-vehicular access within the PDA, connect to and complete regional trails, and support the development of existing and new a mixed-use areas of the community, with a particular focus on providing community access to the SMART station and regional multi-use path.

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Sacramento, CA 95811
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916.414.5800 tel
916.414.5850 fax

Please send written notification to:
Jenifer Rogers
Archaeologist
AECOM
2020 L Street, Suite 400, Sacramento, CA 95811 USA

Sincerely,

Jenifer Rogers
Archaeologist
AECOM Environment
(916) 414-5849
Jenifer.Rogers@aecom.com

AECOM
2020 L Street, Suite 400, Sacramento, CA 95811 USA
T +1 916.414.5849 F +1 916.414.5850
www.aecom.com

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DATE & TIME	STATUS OF ITEM	LOCATION
August 27, 2015 , 11:59 am	**Delivered**	**ROHNERT PARK, CA 94928**
Your item was delivered at 11:59 am on August 27, 2015 in ROHNERT PARK, CA 94928.		
August 27, 2015 , 8:23 am	Out for Delivery	ROHNERT PARK, CA 94928
August 27, 2015 , 8:13 am	Sorting Complete	ROHNERT PARK, CA 94928
August 27, 2015 , 6:52 am	Arrived at Unit	ROHNERT PARK, CA 94928
August 26, 2015 , 8:30 pm	Departed USPS Facility	PETALUMA, CA 94999
August 26, 2015 , 6:30 pm	Arrived at USPS Destination Facility	PETALUMA, CA 94999
August 26, 2015 , 3:17 am	Arrived at USPS Facility	SAN FRANCISCO, CA 94188
August 25, 2015 , 10:46 pm	Departed USPS Facility	WEST SACRAMENTO, CA 95799
August 25, 2015 , 7:22 pm	Arrived at USPS Origin Facility	WEST SACRAMENTO, CA 95799
August 25, 2015 , 2:31 pm	Acceptance	SACRAMENTO, CA 95816

Available Actions

Text Updates

Email Updates

Tracking Number: 70150640000013829844

On Time
Expected Delivery Day: Thursday, August 27, 2015

Available Actions

Product & Tracking Information

Text Updates

Email Updates

Postal Product: First-Class Mail®

Features: Certified Mail™

DATE & TIME	STATUS OF ITEM	LOCATION
August 27, 2015 , 11:59 am	**Delivered**	**ROHNERT PARK, CA 94928**
Your item was delivered at 11:59 am on August 27, 2015 in ROHNERT PARK, CA 94928.		
August 27, 2015 , 8:23 am	Out for Delivery	ROHNERT PARK, CA 94928
August 27, 2015 , 8:13 am	Sorting Complete	ROHNERT PARK, CA 94928
August 27, 2015 , 6:52 am	Arrived at Unit	ROHNERT PARK, CA 94928
August 26, 2015 , 8:30 pm	Departed USPS Facility	PETALUMA, CA 94999
August 26, 2015 , 6:30 pm	Arrived at USPS Destination Facility	PETALUMA, CA 94999
August 26, 2015 , 3:17 am	Arrived at USPS Facility	SAN FRANCISCO, CA 94188
August 25, 2015 , 10:46 pm	Departed USPS Facility	WEST SACRAMENTO, CA 95799
August 25, 2015 , 7:22 pm	Arrived at USPS Origin Facility	WEST SACRAMENTO, CA 95799
August 25, 2015 , 2:31 pm	Acceptance	SACRAMENTO, CA 95816

Tracking Number: **70041350000537763335**

On Time
Expected Delivery Day: **Thursday, August 27, 2015**

Product & Tracking Information

Postal Product: First-Class Mail®

Features: Certified Mail™

DATE & TIME	STATUS OF ITEM	LOCATION
August 27, 2015 , 8:53 am	**Available for Pickup**	**JENNER, CA 95450**
Your item arrived at the JENNER, CA 95450 post office at 8:53 am on August 27, 2015 and is ready for pickup.		
August 27, 2015 , 8:53 am	Arrived at Unit	JENNER, CA 95450
August 26, 2015 , 8:50 pm	Departed USPS Destination Facility	PETALUMA, CA 94999
August 26, 2015 , 6:40 pm	Arrived at USPS Destination Facility	PETALUMA, CA 94999
August 26, 2015 , 3:17 am	Arrived at USPS Facility	SAN FRANCISCO, CA 94188
August 25, 2015 , 10:46 pm	Departed USPS Facility	WEST SACRAMENTO, CA 95799

Available Actions

Text Updates

Email Updates

DATE & TIME	STATUS OF ITEM	LOCATION
August 25, 2015 , 7:22 pm	Arrived at USPS Origin Facility	WEST SACRAMENTO, CA 95799
August 25, 2015 , 2:31 pm	Acceptance	SACRAMENTO, CA 95816

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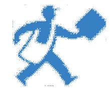

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APPENDIX D

Noise Worksheets

- Ambient Noise Measurements
- Construction Noise Calculations
- Operation Noise Calculations

Rohnert Park PDA - Noise Measurement Locations:

R1 - Off-site sensitive use to the northeast
R2 - Off-site sensitive use to the east
R3 - On-site future residential use, also representing existing residential use to the east
R4 - On-site existing residential use, also representing future residential use
R5 - On-site existing residential use
R6 - On-site exisiting commercial use
R7 - Off-site sensitive use to the west
R8 - Off-site sensitive use (school and residential) to the south

Property of AES

Quest Technologies
2900 Integrating/Logging Sound Level Meter

Unit Version Number: 02.4 Serial Number:
Name:

Work Area:

Comments:

Meter Calibration: 114.0dB, 3/31/2015 @ 10:29:47 PM

Calibrator Serial Number:

Calibration Date:

Study 1

Measuring Parameters

Range: 40 - 100 dB	Weighting: A	Time Constant: Slow
Threshold: Off	Exchange Rate: 3dB	Peak Weighting: C

Study Started: 4/1/2015 @ 10:17:39 AM
Study Stopped: 4/1/2015 @ 10:32:39 AM
Run Time: 0:15:00
Peak Level: 93.6dB, 4/1/2015 @ 10:21:23 AM
Max Level: 70.9dB, 4/1/2015 @ 10:23:11 AM
Min Level: 47.6dB, 4/1/2015 @ 10:31:55 AM
Overload: 0.00%

LEQ: 55.5dB	SEL(3):85.1dB	TWA: 40.5dB	TAKM3: 56.7dB
LDN: 55.5dB	CNEL: 55.5dB	Pa2Sec: 0.1	
L1: 63.1dB	L10: 57.7dB	L50: 54.0dB	L90: 51.1dB

Study 1

Logging (1 Minute)	**LEQ**	**LMAX**	**Ovl**
10:18:39 AM	54.4dB	63.8dB	
10:19:39 AM	55.1dB	60.1dB	
10:20:39 AM	56.3dB	58.9dB	
10:21:39 AM	56.6dB	61.1dB	
10:22:39 AM	57.3dB	59.5dB	
10:23:39 AM	61.0dB	70.9dB	
10:24:39 AM	55.5dB	57.3dB	
10:25:39 AM	52.5dB	55.2dB	
10:26:39 AM	52.2dB	56.4dB	
10:27:39 AM	53.9dB	56.4dB	
10:28:39 AM	54.8dB	58.6dB	
10:29:39 AM	54.0dB	56.4dB	
10:30:39 AM	52.0dB	54.6dB	
10:31:39 AM	54.0dB	58.8dB	
10:32:39 AM	51.5dB	53.9dB	

Study 2

Measuring Parameters

Range: 40 - 100 dB	Weighting: A	Time Constant: Slow
Threshold: Off	Exchange Rate: 3dB	Peak Weighting: C

Study Started: 4/1/2015 @ 10:55:07 AM
Study Stopped: 4/1/2015 @ 11:10:07 AM
Run Time: 0:15:00
Peak Level: 92.0dB, 4/1/2015 @ 11:07:36 AM
Max Level: 54.5dB, 4/1/2015 @ 11:03:15 AM
Min Level: 40.7dB, 4/1/2015 @ 11:08:38 AM
Overload: 0.00%

LEQ: 44.6dB	SEL(3):74.1dB	TWA: 29.5dB	TAKM3: 45.6dB
LDN: 44.6dB	CNEL: 44.6dB	Pa2Sec: 0.0	
L1: 50.3dB	L10: 46.1dB	L50: 44.0dB	L90: 42.3dB

Study 2

Logging (1 Minute)	LEQ	LMAX	Ovl
10:56:07 AM	43.6dB	45.5dB	
10:57:07 AM	44.8dB	46.8dB	
10:58:07 AM	45.2dB	47.3dB	
10:59:07 AM	44.1dB	46.7dB	
11:00:07 AM	44.8dB	48.6dB	
11:01:07 AM	44.6dB	46.8dB	
11:02:07 AM	43.1dB	45.5dB	
11:03:07 AM	45.6dB	47.7dB	
11:04:07 AM	46.4dB	54.5dB	
11:05:07 AM	43.3dB	47.5dB	
11:06:07 AM	45.5dB	52.0dB	
11:07:07 AM	44.5dB	51.7dB	
11:08:07 AM	45.2dB	48.5dB	
11:09:07 AM	42.6dB	44.6dB	
11:10:07 AM	43.1dB	50.9dB	

Study 3

Measuring Parameters

Range: 40 - 100 dB	Weighting: A	Time Constant: Slow
Threshold: Off	Exchange Rate: 3dB	Peak Weighting: C

Study Started: 4/1/2015 @ 11:25:27 AM
Study Stopped: 4/1/2015 @ 11:40:27 AM
Run Time: 0:15:00
Peak Level: 98.8dB, 4/1/2015 @ 11:36:45 AM
Max Level: 68.0dB, 4/1/2015 @ 11:36:48 AM
Min Level: 42.3dB, 4/1/2015 @ 11:27:55 AM
Overload: 0.03%

LEQ: 49.3dB	SEL(3):78.9dB	TWA: 34.3dB	TAKM3: 51.3dB
LDN: 49.3dB	CNEL: 49.3dB	Pa2Sec: 0.0	
L1: 61.1dB	L10: 51.0dB	L50: 45.9dB	L90: 43.8dB

Study 3

Logging (1 Minute)	LEQ	LMAX	Ovl
11:26:27 AM	45.0dB	50.4dB	
11:27:27 AM	44.4dB	46.3dB	
11:28:27 AM	43.4dB	44.8dB	
11:29:27 AM	45.5dB	48.5dB	
11:30:27 AM	47.5dB	52.1dB	
11:31:27 AM	50.4dB	56.2dB	
11:32:27 AM	45.3dB	48.4dB	
11:33:27 AM	45.9dB	48.1dB	
11:34:27 AM	47.0dB	51.7dB	*
11:35:27 AM	48.6dB	53.7dB	*
11:36:27 AM	46.1dB	47.4dB	
11:37:27 AM	57.2dB	68.0dB	
11:38:27 AM	48.6dB	55.4dB	
11:39:27 AM	45.1dB	46.5dB	
11:40:27 AM	51.4dB	59.7dB	

Study 4

Measuring Parameters

Range: 50 - 110 dB	Weighting: A	Time Constant: Slow
Threshold: Off	Exchange Rate: 3dB	Peak Weighting: C

Study Started: 4/1/2015 @ 11:44:27 AM
Study Stopped: 4/1/2015 @ 11:59:27 AM
Run Time: 0:15:00
Peak Level: 95.1dB, 4/1/2015 @ 11:58:04 AM
Max Level: 76.7dB, 4/1/2015 @ 11:53:41 AM
Min Level: 46.9dB, 4/1/2015 @ 11:48:10 AM
Overload: 0.00%

LEQ: 63.8dB	SEL(3):93.3dB	TWA: 48.7dB	TAKM3: 66.0dB
LDN: 63.8dB	CNEL: 63.8dB	Pa2Sec: 0.9	
L1: 71.2dB	L10: 67.7dB	L50: 61.1dB	L90: 51.1dB

Study 4

Logging (1 Minute)	**LEQ**	**LMAX**	**Ovl**
11:45:27 AM	64.5dB	71.2dB	
11:46:27 AM	64.0dB	74.7dB	
11:47:27 AM	63.3dB	69.1dB	
11:48:27 AM	60.7dB	68.5dB	
11:49:27 AM	63.6dB	71.0dB	
11:50:27 AM	63.3dB	72.7dB	
11:51:27 AM	63.7dB	71.0dB	
11:52:27 AM	63.4dB	70.5dB	
11:53:27 AM	63.7dB	70.6dB	
11:54:27 AM	66.2dB	76.7dB	
11:55:27 AM	63.2dB	69.1dB	
11:56:27 AM	60.9dB	68.6dB	
11:57:27 AM	64.8dB	70.9dB	
11:58:27 AM	65.3dB	71.4dB	
11:59:27 AM	62.5dB	69.8dB	

Study 5

Measuring Parameters

Range: 50 - 110 dB	Weighting: A	Time Constant: Slow
Threshold: Off	Exchange Rate: 3dB	Peak Weighting: C

Study Started: 4/1/2015 @ 12:25:16 PM
Study Stopped: 4/1/2015 @ 12:40:16 PM
Run Time: 0:15:00
Peak Level: 92.8dB, 4/1/2015 @ 12:26:36 PM
Max Level: 68.9dB, 4/1/2015 @ 12:26:36 PM
Min Level: 41.6dB, 4/1/2015 @ 12:29:21 PM
Overload: 0.00%

LEQ: 52.7dB	SEL(3):82.3dB	TWA: 37.7dB	TAKM3: 55.3dB
LDN: 52.7dB	CNEL: 52.7dB	Pa2Sec: 0.1	
L1: 64.3dB	L10: 56.8dB	L50: 44.3dB	L90: 41.6dB

Study 5

Logging (1 Minute)	**LEQ**	**LMAX**	**Ovl**
12:26:16 PM	50.4dB	61.8dB	
12:27:16 PM	58.0dB	68.9dB	
12:28:16 PM	53.2dB	66.2dB	
12:29:16 PM	53.2dB	61.3dB	
12:30:16 PM	42.0dB	44.5dB	
12:31:16 PM	52.8dB	62.7dB	
12:32:16 PM	52.5dB	63.2dB	
12:33:16 PM	43.0dB	46.4dB	
12:34:16 PM	55.0dB	65.5dB	
12:35:16 PM	55.1dB	65.9dB	
12:36:16 PM	53.0dB	63.9dB	
12:37:16 PM	48.9dB	57.0dB	
12:38:16 PM	53.5dB	65.7dB	
12:39:16 PM	45.1dB	56.5dB	
12:40:16 PM	49.3dB	59.5dB	

Study 6

Measuring Parameters

Range: 50 - 110 dB
Weighting: A
Time Constant: Slow
Threshold: Off
Exchange Rate: 3dB
Peak Weighting: C

Study Started: 4/1/2015 @ 1:07:10 PM
Study Stopped: 4/1/2015 @ 1:22:10 PM
Run Time: 0:15:00
Peak Level: 103.4dB, 4/1/2015 @ 1:07:36 PM
Max Level: 77.6dB, 4/1/2015 @ 1:11:52 PM
Min Level: 44.8dB, 4/1/2015 @ 1:18:26 PM
Overload: 0.00%

LEQ: 66.6dB	SEL(3):96.1dB	TWA: 51.5dB	TAKM3: 69.0dB
LDN: 66.6dB	CNEL: 66.6dB	Pa2Sec: 1.6	
L1: 75.2dB	L10: 71.0dB	L50: 62.6dB	L90: 50.5dB

Study 6

Logging (1 Minute)	LEQ	LMAX	Ovl
1:08:10 PM	68.2dB	76.1dB	
1:09:10 PM	67.2dB	76.5dB	
1:10:10 PM	66.0dB	73.5dB	
1:11:10 PM	63.0dB	72.7dB	
1:12:10 PM	67.1dB	77.6dB	
1:13:10 PM	67.0dB	73.5dB	
1:14:10 PM	65.6dB	75.5dB	
1:15:10 PM	66.9dB	74.6dB	
1:16:10 PM	67.4dB	76.9dB	
1:17:10 PM	60.4dB	69.4dB	
1:18:10 PM	65.8dB	73.8dB	
1:19:10 PM	66.2dB	75.5dB	
1:20:10 PM	69.4dB	76.0dB	
1:21:10 PM	66.8dB	75.3dB	
1:22:10 PM	64.9dB	73.2dB	

Study 7

Measuring Parameters

Range: 50 - 110 dB
Weighting: A
Time Constant: Slow
Threshold: Off
Exchange Rate: 3dB
Peak Weighting: C

Study Started: 4/1/2015 @ 1:29:53 PM
Study Stopped: 4/1/2015 @ 1:44:53 PM
Run Time: 0:15:00
Peak Level: 98.9dB, 4/1/2015 @ 1:44:14 PM
Max Level: 75.1dB, 4/1/2015 @ 1:44:14 PM
Min Level: 60.6dB, 4/1/2015 @ 1:42:35 PM
Overload: 0.00%

LEQ: 65.6dB	SEL(3):95.1dB	TWA: 50.5dB	TAKM3: 66.5dB
LDN: 65.6dB	CNEL: 65.6dB	Pa2Sec: 1.3	
L1: 70.9dB	L10: 67.6dB	L50: 64.8dB	L90: 62.9dB

Study 7

Logging (1 Minute)	LEQ	LMAX	Ovl
1:30:53 PM	65.1dB	68.1dB	
1:31:53 PM	64.4dB	66.5dB	
1:32:53 PM	66.8dB	70.3dB	
1:33:53 PM	65.3dB	68.1dB	
1:34:53 PM	65.4dB	68.1dB	
1:35:53 PM	66.3dB	70.7dB	
1:36:53 PM	66.7dB	72.4dB	
1:37:53 PM	65.4dB	69.1dB	
1:38:53 PM	67.7dB	72.8dB	
1:39:53 PM	65.1dB	68.5dB	
1:40:53 PM	65.5dB	68.6dB	
1:41:53 PM	64.2dB	67.8dB	
1:42:53 PM	64.1dB	67.8dB	
1:43:53 PM	64.2dB	67.1dB	
1:44:53 PM	65.5dB	75.1dB	

Study 8

Measuring Parameters

Range: 50 - 110 dB	Weighting: A	Time Constant: Slow
Threshold: Off	Exchange Rate: 3dB	Peak Weighting: C

Study Started: 4/1/2015 @ 1:54:46 PM
Study Stopped: 4/1/2015 @ 2:09:46 PM
Run Time: 0:15:00
Peak Level: 96.7dB, 4/1/2015 @ 2:03:51 PM
Max Level: 70.3dB, 4/1/2015 @ 2:03:51 PM
Min Level: 54.0dB, 4/1/2015 @ 2:03:13 PM
Overload: 0.00%

LEQ: 62.2dB	SEL(3):91.7dB	TWA: 47.1dB	TAKM3: 63.4dB
LDN: 62.2dB	CNEL: 62.2dB	Pa2Sec: 0.6	
L1: 68.3dB	L10: 64.9dB	L50: 61.0dB	L90: 57.7dB

Study 8

Logging (1 Minute)	LEQ	LMAX	Ovl
1:55:46 PM	61.4dB	65.8dB	
1:56:46 PM	61.2dB	64.3dB	
1:57:46 PM	60.7dB	65.6dB	
1:58:46 PM	63.5dB	68.5dB	
1:59:46 PM	61.1dB	64.3dB	
2:00:46 PM	62.7dB	66.2dB	
2:01:46 PM	61.5dB	66.2dB	
2:02:46 PM	60.3dB	66.5dB	
2:03:46 PM	61.3dB	65.4dB	
2:04:46 PM	64.4dB	70.3dB	
2:05:46 PM	63.6dB	69.7dB	
2:06:46 PM	62.3dB	66.4dB	
2:07:46 PM	61.4dB	66.6dB	
2:08:46 PM	62.0dB	70.3dB	
2:09:46 PM	62.7dB	65.6dB	

Project: Rohnert Park PDA

Construction Phase: ***Demolition***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Rubber Tired Loader	1	79	40%	50	0
Concrete/Industrial Saw	1	90	20%	50	0
Tractor/Loader/Backhoe	1	78	40%	50	0
Haul Truck	1	76	40%	50	0

Receptor: ***at 50 feet distance***

Results:

1-hour Leq: 84.4

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Grading***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Drill Rig	1	84	20%	50	0
Excavator	2	81	40%	50	0
Front end loader	2	79	40%	50	0
Compactor	1	83	20%	50	0
Crane	1	81	16%	50	0
Haul Truck	2	76	40%	50	0
					0

Receptor: ***at 50 feet distance***

Results:

1-hour Leq: 84.9

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Building Construction***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Crane	1	81	16%	50	0
Concrete Truck	1	79	40%	50	0
Concrete Pump	1	81	20%	50	0
Front end loader	1	79	40%	50	0
Fork Lift	1	75	20%	50	0
Aerial Lift (gradall)	1	83	40%	50	0
Generator	1	81	50%	50	0
Welder	1	74	40%	50	0

Receptor: ***at 50 feet distance***

Results:

1-hour Leq: 84.3

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Paving***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Pavers	1	77	50%	100	0
Cement and Mortar Mixers	1	79	40%	100	0
Rollers	1	80	20%	100	0
Tractor/Loader/Backhoe	1	78	40%	100	0

Receptor: ***at 50 feet distance***

Results:

1-hour Leq: 74.1

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Demolition***

Equipment

Description	**No. of Equip.**	**Reference Noise Level at 50ft, Lmax**	**Acoustical Usage Factor**	**Distance to Receptor, ft**	**Estimated Noise Shielding, dBA**
Rubber Tired Loader	1	79	40%	100	0
Concrete/Industrial Saw	1	90	20%	100	0
Tractor/Loader/Backhoe	1	78	40%	100	0
Haul Truck	1	76	40%	100	0

Receptor: ***at 100 feet distance***

Results:

1-hour Leq: 78.3

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Grading***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Drill Rig	1	84	20%	100	0
Excavator	2	81	40%	100	0
Front end loader	2	79	40%	100	0
Compactor	1	83	20%	100	0
Crane	1	81	16%	100	0
Haul Truck	2	76	40%	100	0
					0

Receptor: ***at 100 feet distance***

Results:

1-hour Leq: 78.8

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Building Construction***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Crane	1	81	16%	100	0
Concrete Truck	1	79	40%	100	0
Concrete Pump	1	81	20%	100	0
Front end loader	1	79	40%	100	0
Fork Lift	1	75	20%	100	0
Aerial Lift (gradall)	1	83	40%	100	0
Generator	1	81	50%	100	0
Welder	1	74	40%	100	0

Receptor: ***at 100 feet distance***

Results:

1-hour Leq: 78.3

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Paving***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Pavers	1	77	50%	100	0
Cement and Mortar Mixers	1	79	40%	100	0
Rollers	1	80	20%	100	0
Tractor/Loader/Backhoe	1	78	40%	100	0

Receptor: ***at 100 feet distance***

Results:

1-hour Leq: 74.1

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Demolition***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Rubber Tired Loader	1	79	40%	200	0
Concrete/Industrial Saw	1	90	20%	200	0
Tractor/Loader/Backhoe	1	78	40%	200	0
Haul Truck	1	76	40%	200	0

Receptor: ***at 200 feet distance***

Results:

1-hour Leq: 72.3

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Grading***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Drill Rig	1	84	20%	200	0
Excavator	2	81	40%	200	0
Front end loader	2	79	40%	200	0
Compactor	1	83	20%	200	0
Crane	1	81	16%	200	0
Haul Truck	2	76	40%	200	0
					0

Receptor: ***at 200 feet distance***

Results:

1-hour Leq: 72.8

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Building Construction***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Crane	1	81	16%	200	0
Concrete Truck	1	79	40%	200	0
Concrete Pump	1	81	20%	200	0
Front end loader	1	79	40%	200	0
Fork Lift	1	75	20%	200	0
Aerial Lift (gradall)	1	83	40%	200	0
Generator	1	81	50%	200	0
Welder	1	74	40%	200	0

Receptor: ***at 200 feet distance***

Results:

1-hour Leq: 72.2

Source for Ref. Noise Levels: FHWA RCNM, 2006

Project: Rohnert Park PDA

Construction Phase: ***Paving***

Equipment

Description	No. of Equip.	Reference Noise Level at 50ft, Lmax	Acoustical Usage Factor	Distance to Receptor, ft	Estimated Noise Shielding, dBA
Pavers	1	77	50%	200	0
Cement and Mortar Mixers	1	79	40%	200	0
Rollers	1	80	20%	200	0
Tractor/Loader/Backhoe	1	78	40%	200	0

Receptor: ***at 200 feet distance***

Results:

1-hour Leq: 68.0

Source for Ref. Noise Levels: FHWA RCNM, 2006

Appendix D
Traffic Noise Prediction Model, (FHWA RD-77-108)
Model Input Sheet

AECOM

Project Name : Central Rohnert Park PDA Plan
Project Number : 60299353
Modeling Condition : EXISTING
Ground Type : Hard **K Factor :** 10
Metric (L_{eq}, L_{dn}, **CNEL**) **:** Ldn **Traffic Desc. (Peak or ADT) :** Peak

Segment	Roadway	Segment From	Segment To	Traffic Vol.	Speed (Mph)	Distance to CL	% Autos	%MT	% HT	Day %	Eve %	Night %	Offset (dB)
1	Golf Course Drive	West of	US 101	1,705	35	100	98	1	1	80	0	20	0
2	Golf Course Drive	East of	US 101	1,348	35	100	98	1	1	80	0	20	0
3	Rohnert Park Exp	West of	US 101	2,678	40	100	98	1	1	80	0	20	0
4	Rohnert Park Exp	Commerce Blvd.	State Farm Dr.	2,001	35	100	98	1	1	80	0	20	0
5	Rohnert Park Exp	East of	State Farm Dr.	2,186	40	100	98	1	1	80	0	20	0
6	Enterprise Drive	Commerce Blvd.	Hunter Dr.	307	30	100	98	1	1	80	0	20	0
7	Enterprise Drive	Hunter Dr.	State Farm Dr.	564	30	100	98	1	1	80	0	20	0
8	Enterprise Drive	State Farm Dr.	Seed Farm Dr.	829	30	100	98	1	1	80	0	20	0
9	Commerce Boulevard	Golf Course Dr.	State Farm Dr.	1,154	35	100	98	1	1	80	0	20	0
10	Commerce Boulevard	State Farm Dr.	Professional Dr.	672	35	100	98	1	1	80	0	20	0
11	Commerce Boulevard	Professional Dr.	Rohnert Park Exp	841	35	100	98	1	1	80	0	20	0
12	Commerce Boulevard	Rohnert Park Exp	Enterprise Dr.	1,331	35	100	98	1	1	80	0	20	0
13	Commerce Boulevard	South of	Enterprise Dr.	1,456	35	100	98	1	1	80	0	20	0
14	State Farm Drive	Commerce Blvd.	Professional Dr.	540	30	100	98	1	1	80	0	20	0
15	State Farm Drive	Professional Dr.	Rohnert Park Exp	694	35	100	98	1	1	80	0	20	0
16	State Farm Drive	Rohnert Park Exp	Enterprise Dr.	847	30	100	98	1	1	80	0	20	0
17	Professional Center Drive	Commerce Blvd.	State Farm Dr.	151	30	100	98	1	1	80	0	20	0
18	Padre Parkway	Commerce Blvd.	State Farm Dr.	278	30	100	98	1	1	80	0	20	0
19	City Center Drive	East of	State Farm Dr.	167	30	100	98	1	1	80	0	20	0
20	Seed Farm Drive	South of	Enterprise Dr.	811	30	100	98	1	1	80	0	20	0

Appendix D
Traffic Noise Prediction Model, (FHWA RD-77-108)
Predicted Noise Levels

Project Name : Central Rohnert Park PDA Plan
Project Number : 60299353
Modeling Condition : EXISTING
Metric (Leq, Ldn, CNEL) : Ldn

		Segment		Noise Levels, dB Ldn				Distance to Traffic Noise Contours, Feet				
Segment	Roadway	From	To	Auto	MT	HT	Total	70 dB	65 dB	60 dB	55 dB	50 dB
1	Golf Course Drive	West of	US 101	64.2	54.0	59.2	65.7	37	117	369	1167	3689
2	Golf Course Drive	East of	US 101	63.2	52.9	58.1	64.6	29	92	292	922	2917
3	Rohnert Park Exp	West of	US 101	67.8	56.8	61.6	69.0	80	252	798	2524	7982
4	Rohnert Park Exp	Commerce Blvd.	State Farm Dr.	64.9	54.7	59.8	66.4	43	137	433	1369	4330
5	Rohnert Park Exp	East of	State Farm Dr.	66.9	55.9	60.8	68.1	65	206	652	2060	6516
6	Enterprise Drive	Commerce Blvd.	Hunter Dr.	54.8	45.5	52.6	57.1	5	16	52	164	518
7	Enterprise Drive	Hunter Dr.	State Farm Dr.	57.4	48.1	55.2	59.8	10	30	95	301	953
8	Enterprise Drive	State Farm Dr.	Seed Farm Dr.	59.1	49.8	56.9	61.5	14	44	140	443	1401
9	Commerce Boulevard	Golf Course Dr.	State Farm Dr.	62.5	52.3	57.5	64.0	25	79	250	789	2496
10	Commerce Boulevard	State Farm Dr.	Professional Dr.	60.1	49.9	55.1	61.6	15	46	145	460	1454
11	Commerce Boulevard	Professional Dr.	Rohnert Park Exp	61.1	50.9	56.1	62.6	18	58	182	575	1820
12	Commerce Boulevard	Rohnert Park Exp	Enterprise Dr.	63.1	52.9	58.1	64.6	29	91	288	911	2880
13	Commerce Boulevard	South of	Enterprise Dr.	63.5	53.3	58.5	65.0	32	100	315	996	3150
14	State Farm Drive	Commerce Blvd.	Professional Dr.	57.3	47.9	55.0	59.6	9	29	91	289	912
15	State Farm Drive	Professional Dr.	Rohnert Park Exp	60.3	50.1	55.2	61.8	15	47	150	475	1501
16	State Farm Drive	Rohnert Park Exp	Enterprise Dr.	59.2	49.9	57.0	61.6	14	45	143	453	1432
17	Professional Center Drive	Commerce Blvd.	State Farm Dr.	51.7	42.4	49.5	54.1	3	8	26	81	255
18	Padre Parkway	Commerce Blvd.	State Farm Dr.	54.4	45.0	52.2	56.7	5	15	47	148	469
19	City Center Drive	East of	State Farm Dr.	52.2	42.8	49.9	54.5	3	9	28	89	282
20	Seed Farm Drive	South of	Enterprise Dr.	59.0	49.7	56.8	61.4	14	43	137	434	1372

Appendix D

Traffic Noise Prediction Model, (FHWA RD-77-108)

Model Input Sheet

Project Name : Central Rohnert Park PDA Plan
Project Number : 60299353
Modeling Condition : EXISTING + PROJECT
Ground Type : Hard **K Factor :** 10
Metric (L_{eq}, L_{dn}, CNEL) : Ldn **Traffic Desc. (Peak or ADT) :** Peak

Segment	Roadway	Segment From	Segment To	Traffic Vol.	Speed (Mph)	Distance to CL	% Autos	%MT	% HT	Day %	Eve %	Night %	Offset (dB)
1	Golf Course Drive	West of	US 101	1,755	35	100	98	1	1	80	0	20	0
2	Golf Course Drive	East of	US 101	1,461	35	100	98	1	1	80	0	20	0
3	Rohnert Park Exp	West of	US 101	2,982	40	100	98	1	1	80	0	20	0
4	Rohnert Park Exp	Commerce Blvd.	State Farm Dr.	2,704	35	100	98	1	1	80	0	20	0
5	Rohnert Park Exp	East of	State Farm Dr.	2,430	40	100	98	1	1	80	0	20	0
6	Enterprise Drive	Commerce Blvd.	Hunter Dr.	367	30	100	98	1	1	80	0	20	0
7	Enterprise Drive	Hunter Dr.	State Farm Dr.	697	30	100	98	1	1	80	0	20	0
8	Enterprise Drive	State Farm Dr.	Seed Farm Dr.	996	30	100	98	1	1	80	0	20	0
9	Commerce Boulevard	Golf Course Dr.	State Farm Dr.	1,444	35	100	98	1	1	80	0	20	0
10	Commerce Boulevard	State Farm Dr.	Professional Dr.	771	35	100	98	1	1	80	0	20	0
11	Commerce Boulevard	Professional Dr.	Rohnert Park Exp	1,192	35	100	98	1	1	80	0	20	0
12	Commerce Boulevard	Rohnert Park Exp	Enterprise Dr.	1,391	35	100	98	1	1	80	0	20	0
13	Commerce Boulevard	South of	Enterprise Dr.	1,556	35	100	98	1	1	80	0	20	0
14	State Farm Drive	Commerce Blvd.	Professional Dr.	656	30	100	98	1	1	80	0	20	0
15	State Farm Drive	Professional Dr.	Rohnert Park Exp	916	35	100	98	1	1	80	0	20	0
16	State Farm Drive	Rohnert Park Exp	Enterprise Dr.	1,314	30	100	98	1	1	80	0	20	0
17	Professional Center Drive	Commerce Blvd.	State Farm Dr.	273	30	100	98	1	1	80	0	20	0
18	Padre Parkway	Commerce Blvd.	State Farm Dr.	357	30	100	98	1	1	80	0	20	0
19	City Center Drive	East of	State Farm Dr.	296	30	100	98	1	1	80	0	20	0
20	Seed Farm Drive	South of	Enterprise Dr.	1,087	30	100	98	1	1	80	0	20	0

Appendix D
Traffic Noise Prediction Model, (FHWA RD-77-108)
Predicted Noise Levels

AECOM

Project Name : Central Rohnert Park PDA Plan
Project Number : 60299353
Modeling Condition : EXISTING + PROJECT
Metric (Leq, Ldn, CNEL) : Ldn

		Segment		Noise Levels, dB Ldn				Distance to Traffic Noise Contours, Feet				
Segment	Roadway	From	To	Auto	MT	HT	Total	70 dB	65 dB	60 dB	55 dB	50 dB
1	Golf Course Drive	West of	US 101	64.3	54.1	59.3	65.8	38	120	380	1201	3797
2	Golf Course Drive	East of	US 101	63.5	53.3	58.5	65.0	32	100	316	1000	3161
3	Rohnert Park Exp	West of	US 101	68.3	57.3	62.1	69.5	89	281	889	2811	8888
4	Rohnert Park Exp	Commerce Blvd.	State Farm Dr.	66.2	56.0	61.2	67.7	58	185	585	1850	5850
5	Rohnert Park Exp	East of	State Farm Dr.	67.4	56.4	61.2	68.6	72	229	724	2290	7243
6	Enterprise Drive	Commerce Blvd.	Hunter Dr.	55.6	46.2	53.4	57.9	6	20	62	196	621
7	Enterprise Drive	Hunter Dr.	State Farm Dr.	58.4	49.0	56.2	60.7	12	37	118	373	1179
8	Enterprise Drive	State Farm Dr.	Seed Farm Dr.	59.9	50.6	57.7	62.3	17	53	168	532	1684
9	Commerce Boulevard	Golf Course Dr.	State Farm Dr.	63.5	53.2	58.4	64.9	31	99	312	988	3124
10	Commerce Boulevard	State Farm Dr.	Professional Dr.	60.7	50.5	55.7	62.2	17	53	167	528	1668
11	Commerce Boulevard	Professional Dr.	Rohnert Park Exp	62.6	52.4	57.6	64.1	26	82	258	815	2578
12	Commerce Boulevard	Rohnert Park Exp	Enterprise Dr.	63.3	53.1	58.3	64.8	30	95	301	952	3010
13	Commerce Boulevard	South of	Enterprise Dr.	63.8	53.6	58.8	65.3	34	106	337	1065	3367
14	State Farm Drive	Commerce Blvd.	Professional Dr.	58.1	48.8	55.9	60.4	11	35	111	351	1109
15	State Farm Drive	Professional Dr.	Rohnert Park Exp	61.5	51.3	56.5	63.0	20	63	198	627	1982
16	State Farm Drive	Rohnert Park Exp	Enterprise Dr.	61.1	51.8	58.9	63.5	22	70	222	702	2221
17	Professional Center Drive	Commerce Blvd.	State Farm Dr.	54.3	45.0	52.1	56.6	5	15	46	146	462
18	Padre Parkway	Commerce Blvd.	State Farm Dr.	55.5	46.1	53.2	57.8	6	19	60	191	604
19	City Center Drive	East of	State Farm Dr.	54.6	45.3	52.4	57.0	5	16	50	158	501
20	Seed Farm Drive	South of	Enterprise Dr.	60.3	51.0	58.1	62.6	18	58	184	581	1838

Appendix D

Traffic Noise Prediction Model, (FHWA RD-77-108)

Model Input Sheet

Project Name : Central Rohnert Park PDA Plan
Project Number : 60299353
Modeling Condition : FUTURE NO PROJECT
Ground Type : Hard
K Factor : 10
Metric (L_{eq}, L_{dn}, CNEL) : Ldn
Traffic Desc. (Peak or ADT) : Peak

Segment	Roadway	Segment From	Segment To	Traffic Vol.	Speed (Mph)	Distance to CL	% Autos	%MT	% HT	Day %	Eve %	Night %	Offset (dB)
1	Golf Course Drive	West of	US 101	4,441	35	100	98	1	1	80	0	20	0
2	Golf Course Drive	East of	US 101	2,967	35	100	98	1	1	80	0	20	0
3	Rohnert Park Exp	West of	US 101	3,929	40	100	98	1	1	80	0	20	0
4	Rohnert Park Exp	Commerce Blvd.	State Farm Dr.	2,743	35	100	98	1	1	80	0	20	0
5	Rohnert Park Exp	East of	State Farm Dr.	2,944	40	100	98	1	1	80	0	20	0
6	Enterprise Drive	Commerce Blvd.	Hunter Dr.	378	30	100	98	1	1	80	0	20	0
7	Enterprise Drive	Hunter Dr.	State Farm Dr.	656	30	100	98	1	1	80	0	20	0
8	Enterprise Drive	State Farm Dr.	Seed Farm Dr.	593	30	100	98	1	1	80	0	20	0
9	Commerce Boulevard	Golf Course Dr.	State Farm Dr.	1,873	35	100	98	1	1	80	0	20	0
10	Commerce Boulevard	State Farm Dr.	Professional Dr.	841	35	100	98	1	1	80	0	20	0
11	Commerce Boulevard	Professional Dr.	Rohnert Park Exp	1,051	35	100	98	1	1	80	0	20	0
12	Commerce Boulevard	Rohnert Park Exp	Enterprise Dr.	1,538	35	100	98	1	1	80	0	20	0
13	Commerce Boulevard	South of	Enterprise Dr.	1,660	35	100	98	1	1	80	0	20	0
14	State Farm Drive	Commerce Blvd.	Professional Dr.	841	30	100	98	1	1	80	0	20	0
15	State Farm Drive	Professional Dr.	Rohnert Park Exp	1,022	35	100	98	1	1	80	0	20	0
16	State Farm Drive	Rohnert Park Exp	Enterprise Dr.	1,090	30	100	98	1	1	80	0	20	0
17	Professional Center Drive	Commerce Blvd.	State Farm Dr.	173	30	100	98	1	1	80	0	20	0
18	Padre Parkway	Commerce Blvd.	State Farm Dr.	387	30	100	98	1	1	80	0	20	0
19	City Center Drive	East of	State Farm Dr.	285	30	100	98	1	1	80	0	20	0
20	Seed Farm Drive	South of	Enterprise Dr.	1,163	30	100	98	1	1	80	0	20	0

Appendix D
Traffic Noise Prediction Model, (FHWA RD-77-108)
Predicted Noise Levels

Project Name : Central Rohnert Park PDA Plan
Project Number : 60299353
Modeling Condition : FUTURE NO PROJECT
Metric (Leq, Ldn, CNEL) : Ldn

		Segment		Noise Levels, dB Ldn				Distance to Traffic Noise Contours, Feet				
Segment	Roadway	From	To	Auto	MT	HT	Total	70 dB	65 dB	60 dB	55 dB	50 dB
1	Golf Course Drive	West of	US 101	68.3	58.1	63.3	69.8	96	304	961	3039	9609
2	Golf Course Drive	East of	US 101	66.6	56.4	61.6	68.1	64	203	642	2030	6420
3	Rohnert Park Exp	West of	US 101	69.5	58.5	63.3	70.7	117	370	1171	3703	11711
4	Rohnert Park Exp	Commerce Blvd.	State Farm Dr.	66.2	56.0	61.2	67.7	59	188	593	1877	5934
5	Rohnert Park Exp	East of	State Farm Dr.	68.2	57.2	62.1	69.4	88	277	878	2775	8775
6	Enterprise Drive	Commerce Blvd.	Hunter Dr.	55.7	46.4	53.5	58.1	6	20	64	202	639
7	Enterprise Drive	Hunter Dr.	State Farm Dr.	58.1	48.8	55.9	60.4	11	35	111	351	1109
8	Enterprise Drive	State Farm Dr.	Seed Farm Dr.	57.7	48.3	55.5	60.0	10	32	100	317	1003
9	Commerce Boulevard	Golf Course Dr.	State Farm Dr.	64.6	54.4	59.6	66.1	41	128	405	1281	4052
10	Commerce Boulevard	State Farm Dr.	Professional Dr.	61.1	50.9	56.1	62.6	18	58	182	575	1819
11	Commerce Boulevard	Professional Dr.	Rohnert Park Exp	62.1	51.9	57.1	63.6	23	72	227	719	2274
12	Commerce Boulevard	Rohnert Park Exp	Enterprise Dr.	63.7	53.5	58.7	65.2	33	105	333	1052	3328
13	Commerce Boulevard	South of	Enterprise Dr.	64.1	53.8	59.0	65.6	36	114	359	1136	3592
14	State Farm Drive	Commerce Blvd.	Professional Dr.	59.2	49.8	57.0	61.5	14	45	142	450	1422
15	State Farm Drive	Professional Dr.	Rohnert Park Exp	62.0	51.7	56.9	63.4	22	70	221	699	2210
16	State Farm Drive	Rohnert Park Exp	Enterprise Dr.	60.3	51.0	58.1	62.7	18	58	184	583	1842
17	Professional Center Drive	Commerce Blvd.	State Farm Dr.	52.3	43.0	50.1	54.7	3	9	29	93	293
18	Padre Parkway	Commerce Blvd.	State Farm Dr.	55.8	46.5	53.6	58.2	7	21	65	207	654
19	City Center Drive	East of	State Farm Dr.	54.5	45.1	52.3	56.8	5	15	48	152	482
20	Seed Farm Drive	South of	Enterprise Dr.	60.6	51.3	58.4	62.9	20	62	197	622	1967

Appendix D

Traffic Noise Prediction Model, (FHWA RD-77-108)

Model Input Sheet

Project Name : Central Rohnert Park PDA Plan
Project Number : 60299353
Modeling Condition : FUTURE + PROJECT
Ground Type : Hard **K Factor :** 10
Metric (L_{eq}, L_{dn}, CNEL) : Ldn **Traffic Desc. (Peak or ADT) :** Peak

Segment	Roadway	Segment From	Segment To	Traffic Vol.	Speed (Mph)	Distance to CL	% Autos	%MT	% HT	Day %	Eve %	Night %	Offset (dB)
1	Golf Course Drive	West of	US 101	4,491	35	100	98	1	1	80	0	20	0
2	Golf Course Drive	East of	US 101	3,080	35	100	98	1	1	80	0	20	0
3	Rohnert Park Exp	West of	US 101	4,233	40	100	98	1	1	80	0	20	0
4	Rohnert Park Exp	Commerce Blvd.	State Farm Dr.	3,445	35	100	98	1	1	80	0	20	0
5	Rohnert Park Exp	East of	State Farm Dr.	3,188	40	100	98	1	1	80	0	20	0
6	Enterprise Drive	Commerce Blvd.	Hunter Dr.	439	30	100	98	1	1	80	0	20	0
7	Enterprise Drive	Hunter Dr.	State Farm Dr.	789	30	100	98	1	1	80	0	20	0
8	Enterprise Drive	State Farm Dr.	Seed Farm Dr.	760	30	100	98	1	1	80	0	20	0
9	Commerce Boulevard	Golf Course Dr.	State Farm Dr.	2,163	35	100	98	1	1	80	0	20	0
10	Commerce Boulevard	State Farm Dr.	Professional Dr.	940	35	100	98	1	1	80	0	20	0
11	Commerce Boulevard	Professional Dr.	Rohnert Park Exp	1,402	35	100	98	1	1	80	0	20	0
12	Commerce Boulevard	Rohnert Park Exp	Enterprise Dr.	1,598	35	100	98	1	1	80	0	20	0
13	Commerce Boulevard	South of	Enterprise Dr.	1,760	35	100	98	1	1	80	0	20	0
14	State Farm Drive	Commerce Blvd.	Professional Dr.	957	30	100	98	1	1	80	0	20	0
15	State Farm Drive	Professional Dr.	Rohnert Park Exp	1,244	35	100	98	1	1	80	0	20	0
16	State Farm Drive	Rohnert Park Exp	Enterprise Dr.	1,556	30	100	98	1	1	80	0	20	0
17	Professional Center Drive	Commerce Blvd.	State Farm Dr.	295	30	100	98	1	1	80	0	20	0
18	Padre Parkway	Commerce Blvd.	State Farm Dr.	467	30	100	98	1	1	80	0	20	0
19	City Center Drive	East of	State Farm Dr.	414	30	100	98	1	1	80	0	20	0
20	Seed Farm Drive	South of	Enterprise Dr.	1,439	30	100	98	1	1	80	0	20	0

Appendix D
Traffic Noise Prediction Model, (FHWA RD-77-108)
Predicted Noise Levels

AECOM

Project Name : Central Rohnert Park PDA Plan
Project Number : 60299353
Modeling Condition : FUTURE + PROJECT
Metric (Leq, Ldn, CNEL) : Ldn

		Segment		Noise Levels, dB Ldn				Distance to Traffic Noise Contours, Feet				
Segment	Roadway	From	To	Auto	MT	HT	Total	70 dB	65 dB	60 dB	55 dB	50 dB
1	Golf Course Drive	West of	US 101	68.4	58.2	63.4	69.9	97	307	972	3073	9717
2	Golf Course Drive	East of	US 101	66.7	56.5	61.7	68.2	67	211	666	2107	6664
3	Rohnert Park Exp	West of	US 101	69.8	58.8	63.6	71.0	126	399	1262	3990	12617
4	Rohnert Park Exp	Commerce Blvd.	State Farm Dr.	67.2	57.0	62.2	68.7	75	236	745	2357	7454
5	Rohnert Park Exp	East of	State Farm Dr.	68.6	57.6	62.4	69.8	95	300	950	3005	9502
6	Enterprise Drive	Commerce Blvd.	Hunter Dr.	56.4	47.0	54.1	58.7	7	23	74	235	742
7	Enterprise Drive	Hunter Dr.	State Farm Dr.	58.9	49.6	56.7	61.3	13	42	133	422	1334
8	Enterprise Drive	State Farm Dr.	Seed Farm Dr.	58.7	49.4	56.5	61.1	13	41	129	406	1285
9	Commerce Boulevard	Golf Course Dr.	State Farm Dr.	65.2	55.0	60.2	66.7	47	148	468	1480	4680
10	Commerce Boulevard	State Farm Dr.	Professional Dr.	61.6	51.4	56.6	63.1	20	64	203	643	2033
11	Commerce Boulevard	Professional Dr.	Rohnert Park Exp	63.3	53.1	58.3	64.8	30	96	303	959	3033
12	Commerce Boulevard	Rohnert Park Exp	Enterprise Dr.	63.9	53.7	58.9	65.4	35	109	346	1093	3458
13	Commerce Boulevard	South of	Enterprise Dr.	64.3	54.1	59.3	65.8	38	120	381	1204	3808
14	State Farm Drive	Commerce Blvd.	Professional Dr.	59.7	50.4	57.5	62.1	16	51	162	512	1618
15	State Farm Drive	Professional Dr.	Rohnert Park Exp	62.8	52.6	57.8	64.3	27	85	269	851	2692
16	State Farm Drive	Rohnert Park Exp	Enterprise Dr.	61.9	52.5	59.6	64.2	26	83	263	832	2631
17	Professional Center Drive	Commerce Blvd.	State Farm Dr.	54.6	45.3	52.4	57.0	5	16	50	158	499
18	Padre Parkway	Commerce Blvd.	State Farm Dr.	56.6	47.3	54.4	59.0	8	25	79	249	789
19	City Center Drive	East of	State Farm Dr.	56.1	46.8	53.9	58.5	7	22	70	221	700
20	Seed Farm Drive	South of	Enterprise Dr.	61.5	52.2	59.3	63.9	24	77	243	770	2434

APPENDIX E

Traffic Impact Study

- Traffic Impact Study Report
- Existing Intersection Level of Service Calculations
- Future Intersection Level of Service Calculations
- Existing Plus Project Intersection Level of Service Calculations
- Future Plus Project Intersection Level of Service Calculations
- Freeway Level of Service Calculations
- NCHRP Internal Capture Calculation Worksheets

Whitlock & Weinberger Transportation, Inc.

490 Mendocino Avenue
Suite 201
Santa Rosa, CA 95401
voice (707) 542-9500
fax (707) 542-9590

475 14th Street
Suite 290
Oakland, CA 94612
voice (510) 444-2600

website www.w-trans.com

Traffic Impact Study for the Central Rohnert Park PDA Plan

Draft Report

April 24, 2015

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Introduction

This report presents an analysis of the potential traffic and circulation impacts that would be associated with implementation of the Central Rohnert Park Priority Development Area (PDA) Plan. This assessment considers the Draft PDA Plan prepared by AECOM which was released in May 2015. The Draft PDA Plan is the result of extensive community outreach, as well as collaboration with City staff and Rohnert Park decision makers. W-Trans assisted the AECOM team with circulation-related expertise during development of the Plan. This study was completed in accordance with the criteria established by the City of Rohnert Park, and is consistent with standard traffic engineering techniques.

Prelude

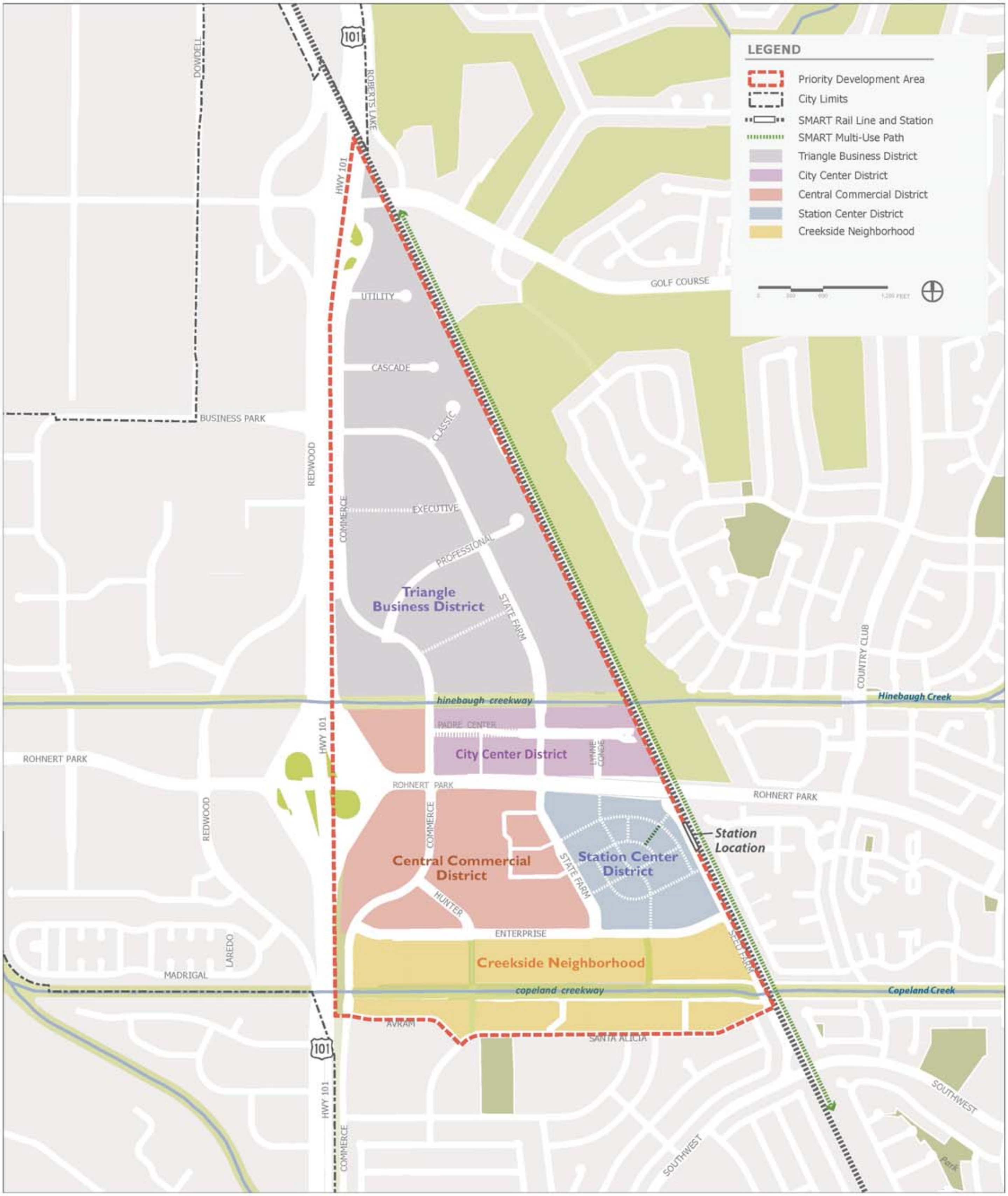
The purpose of a traffic impact study is to provide City staff and policy makers with data that they can use to make an informed decision regarding the potential circulation impacts of a proposed project or plan, and any associated improvements that would be required in order to mitigate these impacts to a level of insignificance as defined by the City's General Plan or other policies. Vehicular traffic impacts are typically evaluated by determining the number of new trips that the proposed use would be expected to generate, distributing these trips to the surrounding street system based on existing travel patterns or anticipated travel patterns specific to the proposed project, then analyzing the impact the new traffic would be expected to have on critical intersections. Impacts relative to access for pedestrians, bicyclists, and to transit are also addressed.

Project Profile

The boundaries of the Central Rohnert Park Priority Development Area (PDA) roughly form a triangle bounded by US 101 on the west, the Sonoma-Marin Area Rail Transit (SMART) rail corridor on the east, and Avram Avenue-Santa Alicia Avenue on the south. The SMART commuter rail station is located just south of Rohnert Park Expressway, and passenger rail service is planned to begin in late 2016. From a circulation perspective, one of the goals of the PDA plan is to increase the amount of housing and employment that is proximate to existing and planned transit services, thereby reducing reliance on the private automobile and trips made using single-occupant vehicles. In order to further support transit and reduce automobile reliance, a strong emphasis on pedestrian and bicycle circulation is a key component of the plan.

The PDA plan identifies numerous multimodal improvements to the circulation network ranging from the creation of new pedestrian-bicycle linkages, to establishment of effective bus-rail transfers, to identification of intersection improvements needed to support future traffic growth. The plan would allow for construction of approximately 835 new residential units and approximately 823,000 square feet of additional non-residential uses including commercial, office, and light industrial among five "districts".

A map showing the PDA plan area and the boundaries of its five districts is shown in Figure 1.



Source: AECOM

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Central Rohnert Park PDA Plan

Figure 1 – Plan Area and Districts

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Regulatory Framework

Following are the state and local laws and policies that are relevant to the CEQA review process for transportation and circulation.

Caltrans

The California Department of Transportation (Caltrans) is the primary State agency responsible for transportation issues. One of its duties is the construction and maintenance of the State highway system. Caltrans approves the planning, design, and construction of improvements for all State-controlled facilities including US 101 and the associated interchanges for these facilities located in the Plan Area. Caltrans has established standards for roadway traffic flow and developed procedures to determine if State-controlled facilities require improvements.

The following Caltrans procedures and directives are relevant to the transportation analysis conducted for the Rohnert Park PDA Plan:

- Level of Service Target: Caltrans has established a level of service (LOS) target of LOS E[1] on mainline US 101 through Rohnert Park, and LOS D for freeway ramp intersections. Where a facility is operating at less than these thresholds without the project, the existing measure of effectiveness should be maintained.

- Caltrans Director's Policy 22: This policy establishes support for balancing transportation needs with community goals. Caltrans seeks to involve and integrate community goals in the planning, design, construction, and maintenance and operations processes, including accommodating the needs of bicyclists and pedestrians.

Sonoma County Transportation Authority

In November 1990, the Sonoma County Transportation Authority (SCTA) was designated as the Congestion Management Agency (CMA) for Sonoma County. In 1997, the SCTA relinquished its position as the CMA under new state legislation that made this function optional. The SCTA now serves as the coordinating and advocacy agency for transportation funding for Sonoma County.

The 2009 *Comprehensive Transportation Plan for Sonoma* County (2009 CTP) is the latest county-wide planning document approved by the SCTA. The 2009 CTP includes goals, objectives, and policies for improving mobility on Sonoma County's streets, highways, and transit system and bicycle/pedestrian facilities, and outlines the regional improvements needed to reduce transportation related impacts over the next 25 years. SCTA also oversees Measure M, the Traffic Relief Act for Sonoma County, which is a sales tax measure that was passed by Sonoma County voters in November 2004. Completion of the Golf Course Drive interchange at US 101 and widening of US 101 with HOV and auxiliary lanes are recent Measure M projects overseen by SCTA that have improved circulation in Rohnert Park.

City of Rohnert Park General Plan

The City of Rohnert Park's 2020 General Plan outlines a vision of long-range physical and economic development and resource conservation that reflect the aspirations of the community. The

[1] Caltrans LOS thresholds for Rohnert Park obtained from Graton Rancheria Casino and Hotel Project – Draft Environmental Impact Statement (DEIS) Scoping comments written by the California Department of Transportation (Caltrans), April 2004.

Transportation Element contains goals and policies to encourage the conservation and proper management of the community's resources. Following is a list of the City's General Plan policies related to transportation and traffic that are applicable to the PDA Plan and future development that would be allowed under the Plan.

- Policy TR-1: Establish LOS C as the minimum standard for all arterial and collector roadway segments ("segments") and intersections, except for (1) those specified segments and intersections for which allowable LOS standards are otherwise established *[these are referenced in Table 4.1-2 of the General Plan and include the intersections at Golf Course Drive/US 101 South Ramps, Commerce Boulevard/Golf Course Drive, and Commerce Boulevard/US 101 Northbound Ramps]* and (2) segments and intersections that are operating at LOS D or lower at the time an application for a development project or a specified plan is submitted if no feasible improvements exist to improve the LOS. The then-existing LOS may be permitted to be the standard for those segments and intersections in category (2), provided that the LOS not be permitted to deteriorate further due to the proposed development project or specific plan.

- Policy TR-2: Require mitigation measures, as needed, for new development that increases traffic such that LOS levels fall below the established minimum standard. Ensure that mitigation measures are coordinated with roadway improvements programmed for funding through transportation-related impact fees.

- Goal TR-J: Reduce peak-hour traffic congestion and associated impacts, including air pollution, energy consumption, and noise.

- Goal TR-K: Reduce the need for roadway improvements by making more efficient use of existing roads, bikeways, transit service, and other transportation facilities and services.

- Policy TR-21A: Work with Sonoma County, the City of Santa Rosa, the City of Cotati, and the City of Petaluma ("Contributing Jurisdictions") and the Sonoma County Transportation Authority (SCTA) to plan and implement selected improvements necessary to mitigate impacts of increased traffic congestion on major roads and intersections in Penngrove ("Regional Mitigation Plan"). The Regional Mitigation Plan shall include those roadway and other improvements necessary to mitigate the impacts of increased traffic congestion on major roads and intersections in Penngrove ("Regional Mitigation Projects"), and a financing plan that explains how those improvements will be funded and that determines each Contributing Jurisdiction's proportional share. The City shall contribute its proportional share of the total cost of the Regional Mitigation Plan provided that the City's participation is roughly proportional to the traffic impacts from new development in Rohnert Park.

  The City's payment or other contribution of its proportional share shall be provided when all of the following occur: (1) A Regional Mitigation Project is approved by the Sonoma County Board of Supervisors, and each of the Contributing Jurisdictions; (2) a financing plan for the Regional Mitigation Project has been approved by the Sonoma County Board of Supervisors, and each of the Contributing Jurisdictions; (3) new development that contributes to the traffic impacts to be mitigated by the project receives final approval by the City; and (4) each of the Contributing Jurisdictions has appropriated its proportional share to the Regional Mitigation Project. In the event that other jurisdictions do not contribute their proportional share to the Regional Mitigation Project, and funding for their proportional share is provided by some other means to ensure implementation of the Regional Mitigation Project, the City will contribute and be limited to its proportional share.

- Policy TR-22: In cooperation with the Chamber of Commerce, adopt a non-mandatory employer based transportation demand management (TDM) program for Rohnert Park businesses.

- Policy TR-23: Allow reductions in transportation impact fees on new non-residential development commensurate with provision of transportation demand management (TDM) measures, and develop reduction parameters.

- Goal TR-L: Promote local and regional public transit serving Rohnert Park and facilitate transfers between transit routes and operators.

- Policy TR-27: Work with Sonoma County Transit and Golden Gate Transit to develop an expanded bus route system, in order to serve areas of new development in Rohnert Park.

- Policy TR-30: In consultation with Golden Gate Transit and Sonoma County Transit, determine appropriate locations of new bus stops, in conjunction with increased service and expanded routes.

- Policy TR-31: Require project proponents to provide bus stops and shelters in conjunction with new development.

- Policy TR-32: Work with Sonoma County Transit, Golden Gate Transit, and private developers to ensure that bus stops and shelters adhere to the following standards:
    - Bus pull-outs shall be required at bus stop locations, in order to prevent stopping buses from interfering with traffic flow;
    - Bus stop locations shall allow direct, convenient pedestrian access to adjacent development;
    - Pedestrian access to bus stops shall be safe and comfortable;
    - Bus shelters shall provide adequate protection from sun, wind, and rain;
    - Bus stops and shelters shall display schedules and routes; and
    - Bus shelters shall be adequately designed and sized to accommodate waiting passengers during inclement weather.

Circulation Network Setting

Roadway Network

The PDA Plan area is comprised of commercial development throughout the area and is generally fully developed, with few undeveloped parcels in the area. The local circulation system serving the project site is shown in Figure 2. Following is a description of the key roadways within and surrounding the Specific Plan area.

US 101 is the primary route connecting the City of Rohnert Park to the San Francisco Bay Area to the south and Santa Rosa to the north. Within Rohnert Park, US 101 is a six-lane freeway with interchanges at Rohnert Park Expressway and Golf Course Drive.

Golf Course Drive/Golf Course Drive West is an east-west secondary arterial that connects the northeastern portions of Rohnert Park to US 101. The corridor includes four lanes, on-street bicycle lanes, and sidewalks on both sides of the street except along the golf course, where the street has two lanes and on-street bicycle lanes. The posted speed limit is 35 mph.

Commerce Boulevard is identified as a major arterial in the Rohnert Park General Plan, and extends from SR 116 in Cotati to just north of Golf Course Drive, where it turns west and crosses under US 101 and connects to Redwood Drive. Commerce Boulevard has a posted speed limit of 35 mph.

State Farm Drive is identified as a major collector in the Rohnert Park General Plan, and provides internal circulation through the Specific Plan area between Commerce Boulevard and Enterprise Drive. The corridor generally includes four lanes, left-turn lanes into side streets and driveways, and sidewalks on both sides of the street, except for the northernmost one-third mile segment between Professional Center Drive and Commerce Boulevard where the road includes one lane in each direction. On-street bicycle lanes are provided south of Rohnert Park Expressway. The posted speed limit is 30 mph, except between Professional Center Drive and City Center Drive where the posted speed limit is 35 mph.

Rohnert Park Expressway serves as the major east-west arterial for the City of Rohnert Park, connecting residences to the east to the commercial development in the west, as well as to US 101. The corridor generally includes four lanes, on-street bicycle lanes, and sidewalks on both sides of the street. The posted speed limit for Rohnert Park Expressway is 35 mph between Redwood Drive and State Farm Drive, and 40 mph west of Redwood Drive and east of State Farm Drive.

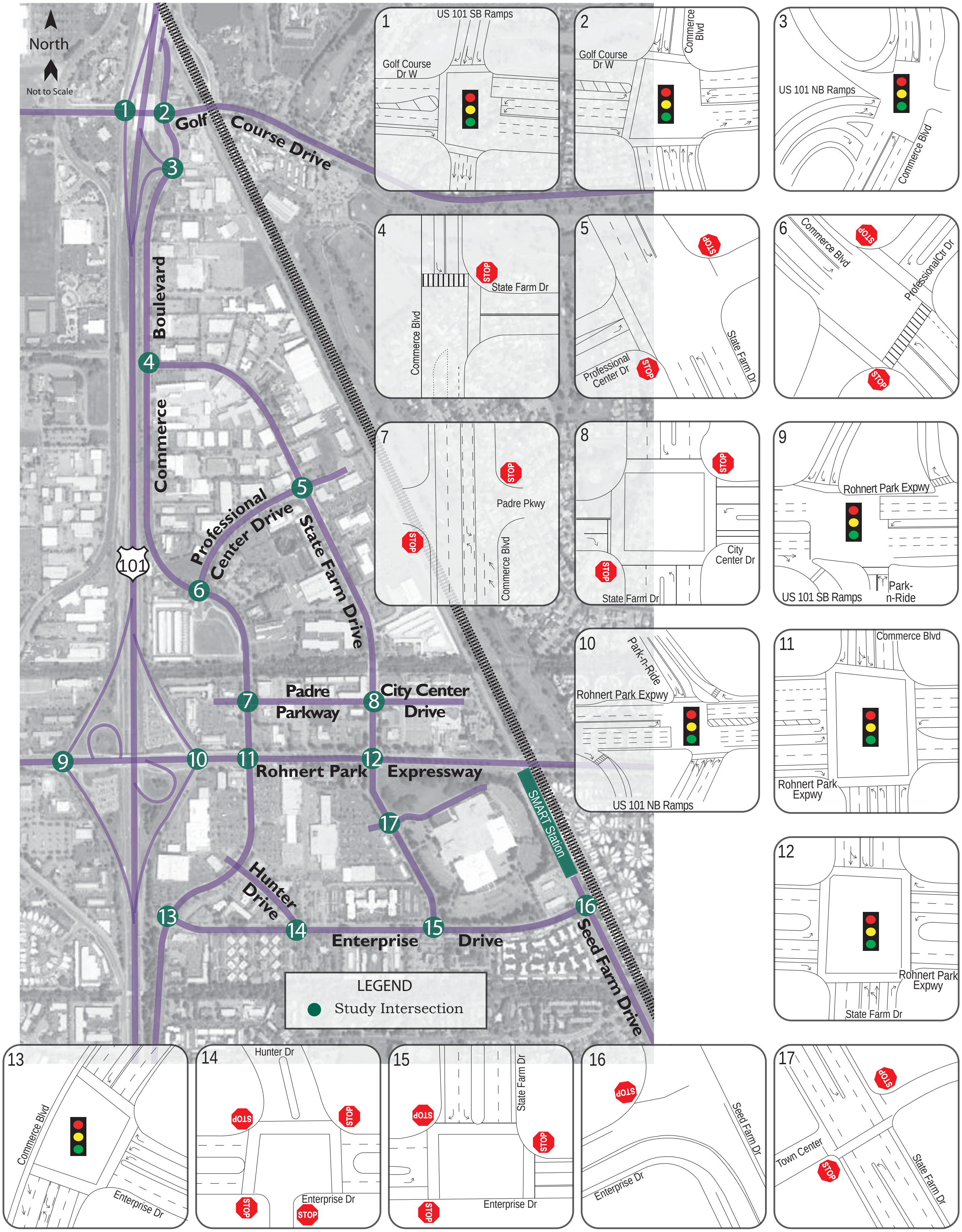
Enterprise Drive is a collector providing internal circulation along the southern part of the Specific Plan area. The corridor is identified as a major collector in the Rohnert Park General Plan west of State Farm Drive, and as a minor collector east of State Farm Drive. Enterprise Drive west of State Farm Drive generally includes four lanes, left-turn pockets for minor-street approaches and driveways, and sidewalks on both sides of the street. East of State Farm Drive, Enterprise Drive includes two travel lanes, a two-way left-turn lane, on-street bicycle lanes, and sidewalks on both sides of the street. Enterprise Drive has a posted speed limit of 30 mph.

Study Intersections and Periods

Study Intersections

The following seventeen study intersections within and adjacent to the PDA were selected for analysis:

1. Golf Course Drive West/US 101 South Ramps
2. Golf Course Drive/Commerce Boulevard



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Central Rohnert Park PDA Plan

Figure 2 – Study Area and Lane Configurations

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3. Commerce Boulevard/US 101 North Ramps
4. Commerce Boulevard/State Farm Drive
5. State Farm Drive/Professional Center Drive
6. Commerce Boulevard/Professional Center Drive
7. Commerce Boulevard/Padre Parkway
8. State Farm Drive/City Center Drive
9. Rohnert Park Expressway/US 101 South Ramps
10. Rohnert Park Expressway/US 101 North Ramps
11. Rohnert Park Expressway/Commerce Boulevard
12. Rohnert Park Expressway/State Farm Drive
13. Commerce Boulevard/Enterprise Drive
14. Enterprise Drive/Hunter Drive
15. Enterprise Drive/State Farm Drive
16. Enterprise Drive/Seed Farm Drive
17. State Farm Drive/Town Center

Study Periods

Operating conditions during the a.m. and p.m. peak periods were evaluated to capture the highest potential impacts for the proposed project as well as the highest volumes on the local transportation network. The morning peak hour occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while the p.m. peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion during the homeward bound commute.

The locations of the study intersections and the existing lane configurations and controls are shown in Figure 2.

Traffic Counts

Traffic counts were obtained at the study intersections in September 2013 and March 2014[2]. All counts were obtained while area schools, including Sonoma State University, were in session. Traffic volumes on mainline US 101 were obtained from raw 2013 data supplied by Caltrans, updated to reflect conditions after opening of the casino portion of the Graton Rancheria Resort and Casino.

Pedestrian Facilities

Pedestrian facilities include sidewalks, paths, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. Continuous sidewalks are provided on the east side of Commerce Boulevard north of Utility Court, and on both sides of the street elsewhere except along the frontage of two undeveloped parcels, one on Commerce Boulevard west of Professional Center Drive, and one on State Farm Drive north of Professional Center Drive. Marked crosswalks crossing the major street are generally provided at unsignalized intersections, with the exception of State Farm Drive/Professional Center Drive where the State Farm Drive crossings are unmarked. All of the signalized study intersections include marked crosswalks and pedestrian signal heads.

[2] Counts obtained at intersections 1-3 and 9-12 in March 2014, and at intersections 4-8 and 13-17 in September 2013

Bicycle Circulation

The *Highway Design Manual*, California Department of Transportation (Caltrans), 2012, classifies bikeways into three categories:

- *Class I Multi-Use Path*: a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.

- *Class II Bike Lane*: a striped and signed lane for one-way bike travel on a street or highway.

- *Class III Bike Route*: signing only for shared use with motor vehicles within the same travel lane on a street or highway.

Class II on-street bicycle lanes are provided along Golf Course Drive, Commerce Boulevard south of Utility Court, Rohnert Park Expressway, State Farm Drive south of Rohnert Park Expressway, Enterprise Drive east of State Farm Drive, and Seed Farm Drive. In addition, Class I multi-use paths exist along the west side of Commerce Boulevard between Cascade Court and Professional Center Drive, along Hinebaugh Creek east of Commerce Boulevard, along Copeland Creek east of Commerce Boulevard, and south of Enterprise Drive/Hunter Drive connecting the intersection to the Copeland Creek Class I multi-use path.

Rohnert Park Bicycle and Pedestrian Master Plan

The *Rohnert Park Bicycle and Pedestrian Master Plan* was developed as a component of the *SCTA Countywide Bicycle and Pedestrian Master Plan*. The Plan includes the following objectives and policies which are relevant to the Central Rohnert Park PDA Plan.

- Objective 4.0: Comprehensive Support Facilities – Encourage the development of comprehensive support facilities for walking and bicycling.

- Policy 4.1: Require adequate short-term bicycle parking for retail, office, commercial and industrial uses.

- Policy 4.3: Require new development to construct/install bicycle facilities for project users in proportion to demand generated by the project. Such support facilities may include, but are not limited to, secure indoor and/or covered bicycle parking for project users, and adequate shower and locker facilities for employees.

- Policy 4.5: Install high-visibility crossing treatments, pedestrian scale lighting, street furniture, drinking fountains, and other pedestrian amenities in pedestrian–oriented activity centers, pedestrian corridors, and on Class I trails.

The Plan also identifies several physical projects to be completed in the future in and near the PDA Area:

Future Off-Street Paths

- SMART corridor multi-use path
- Extension of the Hinebaugh Creek Path east of SMART corridor
- Extension of the Hinebaugh Creek Path between Commerce Boulevard and Redwood Drive (including overpass at US 101)

Future Bicycle Lanes

- Commerce Boulevard between the US 101 northbound ramps and Golf Course Drive
- State Farm Drive between Rohnert Park Expressway and Commerce Boulevard
- Hunter Drive between Commerce Boulevard and Enterprise Drive
- Enterprise Drive between Commerce Boulevard and State Farm Drive

Future Pedestrian Crossing Enhancements

- Hinebaugh Creek Path at US 101, Commerce Boulevard, State Farm Drive, and SMART Rail corridor

The SCTA exhibit showing existing and planned pedestrian and bicycle facilities is shown in Figure 3.

Transit Facilities

<u>Sonoma County Transit</u>

Sonoma County Transit (SCT) is the principal transit service within Rohnert Park, providing daily local and intercity service. SCT local Routes 10, 12, and 14 operate together to provide transit access to destinations on both the east and west sides of US 101. Each local route operates with approximately 90- to 120-minute headways between 6:00 a.m. and 6:00 p.m. on weekdays, and 9:30 a.m. and 3:00 p.m. on Saturdays; no local service is provided on Sundays.

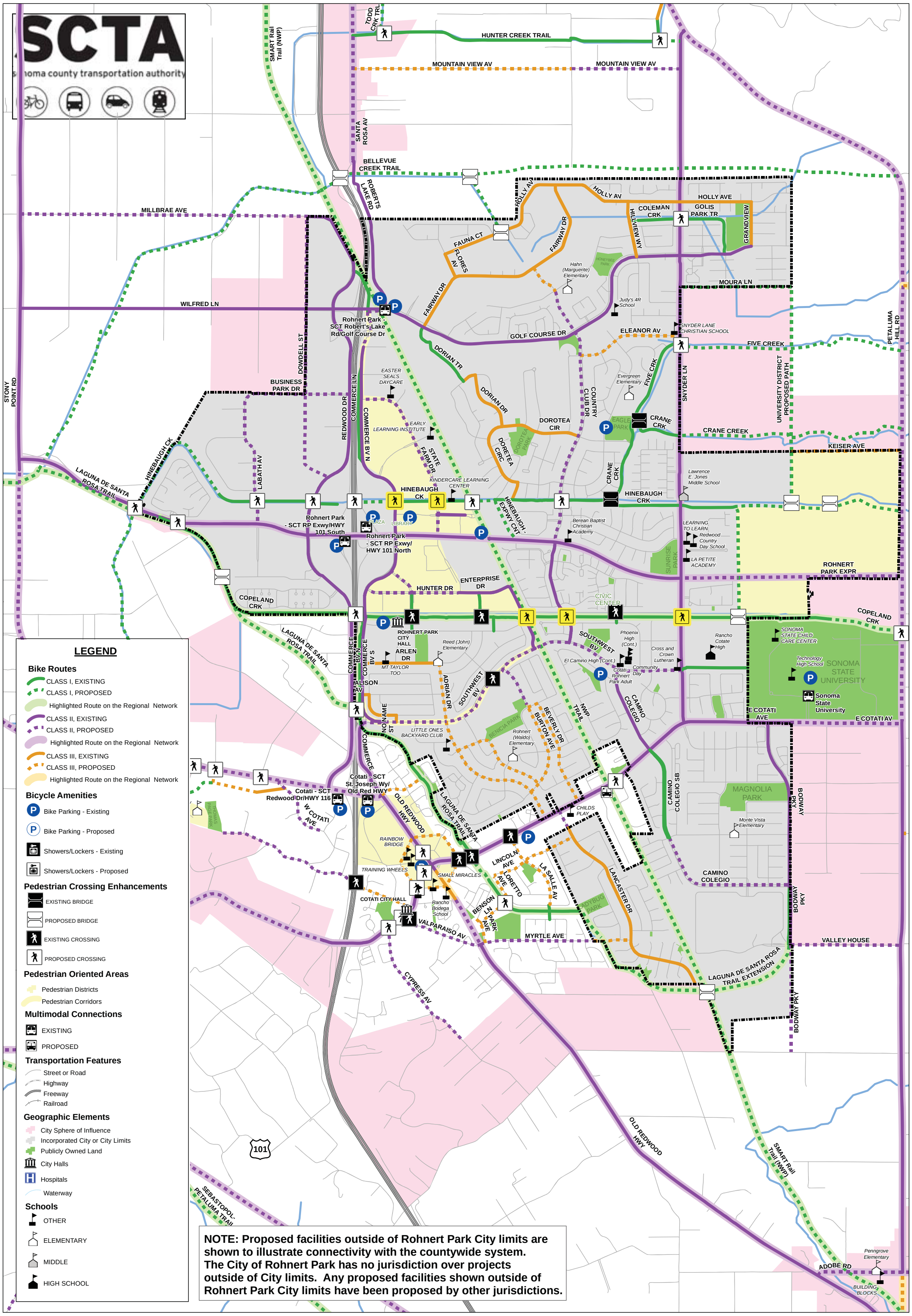
SCT Routes 26, 44, and 48 provide intercity service to Rohnert Park. Route 26 provides service between Rohnert Park and Santa Rosa. Routes 44 and 48 provide service between Petaluma and Santa Rosa. Route 26 operates between approximately 6:30 a.m. and 5:30 p.m., with two runs one hour apart for the morning and evening commutes and one run during the middle of the day. Routes 44 and 48 operate with approximately 40- to 120-minute headways between 6:30 a.m. and 8:30 p.m. on weekdays, with a combined headway of 30 to 60 minutes. On weekends, SCT Routes 44 and 48 operate with approximately two- to four-hour headways between 7:00 a.m. and 8:00 p.m. and a combined headway of one to two hours.

The nearest SCT bus stops serving the Plan area are located at Rohnert Park Expressway and Commerce Boulevard, Raley's Town Center on State Farm Drive between Rohnert Park Expressway and Enterprise Drive, the Senior Center on Hunter Drive, and Chase Bank on Rohnert Park Expressway between Commerce Boulevard and State Farm. On weekdays, the Plan area is served by SCT Routes 10, 12/14, 26, 44/48. On weekends, the Plan area is served by SCT Routes 10/12 and 44/48.

All SCT buses are wheelchair lift-equipped and can transport two wheelchair passengers at a time. SCT allows bikes on all of its buses. Buses are equipped with a front-loading bike rack that accommodates either two or three bicycles. When the front-loading rack is full, bus drivers may allow up to two bikes inside the bus.

<u>Golden Gate Transit</u>

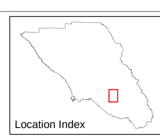
Golden Gate Transit (GGT) provides daily interregional service along the US 101 corridor between Santa Rosa and San Francisco. Route 72 provides weekday commuter service between Santa Rosa and San Francisco, with a southbound stop at Rohnert Park Expressway and one northbound at US 101 and Rohnert Park Expressway. Route 72 operates with 20- to 30-minute headways on weekdays only, with southbound service into San Francisco between 4:00 a.m. and 7:00 a.m. and northbound service out of San Francisco between 3:30 p.m. and 7:30 p.m. GGT Route 101 operates daily along the US 101



CITY OF ROHNERT PARK AND VICINITY

PROPOSED AND EXISTING BICYCLE AND PEDESTRIAN FACITLITIES
SONOMA COUNTY, CALIFORNIA

Kilometers: 0 0.125 0.25 0.5 0.75 1
Miles: 0 0.125 0.25 0.5 0.75 1



Author: Sonoma County Transportation Authority
Date: April 20, 2006
Revised: December 27, 2013
Projection & Coordinate System: CA State Plane, Zone 11, NAD 83, US Survey Feet, Lambert Conformal Conic Projection.
Source: S:\SCTA\SCTA Modeling Program\PROJECTS\bikeplan\2014_Update\rp_2014.mxd
Sources: SCTA Countywide Bicycle and Pedestrian Advisory Committee, Sonoma County GIS, City of Rohnert Park

This map is for illustrative purposes only, and though care has been taken to ensure that data is accurate, maps and represented data are provided without warranty of any kind.

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Figure 3 – Pedestrian and Bicycle Facilities

corridor between Santa Rosa and San Francisco, with a stop on Commerce Boulevard at Rohnert Park Expressway. Southbound Route 101 service in Rohnert Park begins around 4:00 a.m. with approximately one-hour headways until 10 p.m. In the northbound direction Route 101 operates at approximately one-hour headways between 7:30 a.m. and 2:00 a.m. All GGT buses are handicap accessible and equipped with a front-loading bike rack that accommodates either two or three bicycles. On express buses, storage space for bicycles is provided under the coach.

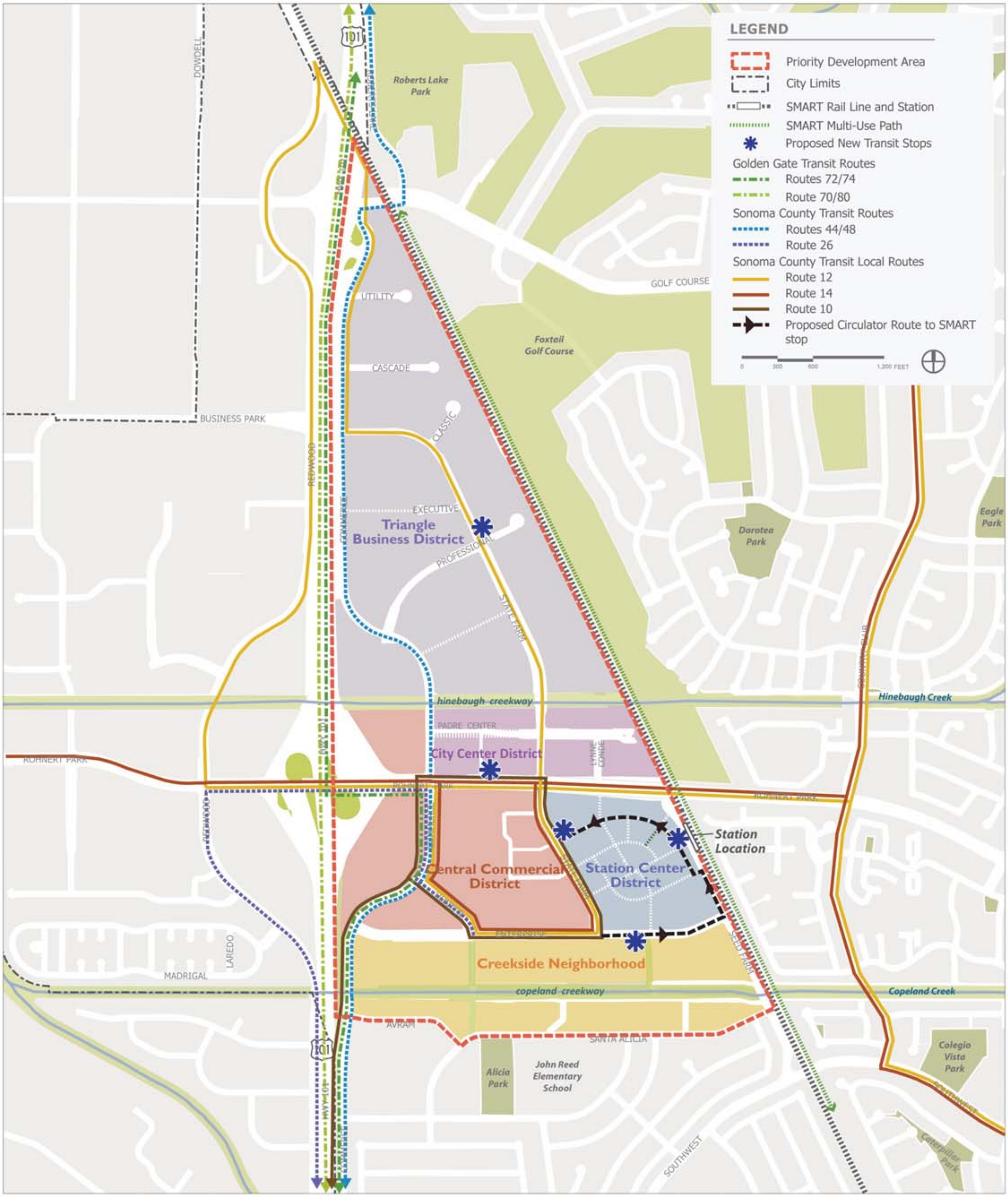
SMART Rail

The SMART commuter rail system is a 70-mile rail line that is planned to run from Cloverdale, at the north end of Sonoma County, to Larkspur, where the Golden Gate Ferry connects Marin County with San Francisco. Along the way, SMART will have stations at the major population and job centers of the North Bay including the downtown Rohnert Park station, which is located just south of Rohnert Park Expressway in the core of the Plan area. Train service will be provided by an estimated 14 round-trip trains on weekdays and four round-trip trains on weekends. Headways during the morning and evening commute periods will be 30 minutes, with longer headways during midday, evening, and weekend periods. SMART plans to initiate rail service between Airport Boulevard in northern Santa Rosa and downtown San Rafael in 2016.

Dial-a-Ride

Dial-a-Ride, also known as paratransit or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. Sonoma County Paratransit is designed to serve the needs of individuals with disabilities within Sonoma County. Service days are Monday through Friday from 5:00 a.m. to 11:00 p.m., and Saturday and Sunday from 7:00 a.m. to 9:00 p.m.

A map of transit routes serving the plan area is shown in Figure 4.



Source: AECOM

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Central Rohnert Park PDA Plan

Figure 4 – Transit Routes

w-trans

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation.

Intersection Operation

The study intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2000. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

The Levels of Service for the intersections with side-street stop controls, or those which are unsignalized and have one or two approaches stop controlled, were analyzed using the "Two-Way Stop-Controlled" intersection capacity method from the HCM. This methodology determines a level of service for each minor turning movement by estimating the level of average delay in seconds per vehicle. Results are presented for individual movements together with the weighted overall average delay for the intersection.

The study intersections with stop signs on all approaches were analyzed using the "All-Way Stop-Controlled" Intersection methodology from the HCM. This methodology evaluates delay for each approach based on turning movements, opposing and conflicting traffic volumes, and the number of lanes. Average vehicle delay is computed for the intersection as a whole, and is then related to a Level of Service.

The study intersections that are currently controlled by a traffic signal, or may be in the future, were evaluated using the signalized methodology from the HCM. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether or not the signals are coordinated, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology.

The ranges of delay associated with the various levels of service are indicated in Table 1.

Table 1
Intersection Level of Service Criteria

LOS	Two-Way Stop-Controlled	All-Way Stop-Controlled	Signalized
A	Delay of 0 to 10 seconds. Gaps in traffic are readily available for drivers exiting the minor street.	Delay of 0 to 10 seconds. Upon stopping, drivers are immediately able to proceed.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
B	Delay of 10 to 15 seconds. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street.	Delay of 10 to 15 seconds. Drivers may wait for one or two vehicles to clear the intersection before proceeding from a stop.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 15 to 25 seconds. Acceptable gaps in traffic are less frequent, and drivers may approach while another vehicle is already waiting to exit the side street.	Delay of 15 to 25 seconds. Drivers will enter a queue of one or two vehicles on the same approach, and wait for vehicle to clear from one or more approaches prior to entering the intersection.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 25 to 35 seconds. There are fewer acceptable gaps in traffic, and drivers may enter a queue of one or two vehicles on the side street.	Delay of 25 to 35 seconds. Queues of more than two vehicles are encountered on one or more approaches.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 35 to 50 seconds. Few acceptable gaps in traffic are available, and longer queues may form on the side street.	Delay of 35 to 50 seconds. Longer queues are encountered on more than one approach to the intersection.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 50 seconds. Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues.	Delay of more than 50 seconds. Drivers enter long queues on all approaches.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Reference: *Highway Capacity Manual,* Transportation Research Board, 2000

<u>Freeway Operation</u>

The freeway analysis methodology contained in Chapter 10 of the HCM, "Freeway Facilities," was used to determine levels of service on US 101. The method analyzes extended lengths of freeway composed of continuously connected basic freeway, weaving, merge, and diverge segments, which are collectively referred to as a freeway facility. For each individual segment, the analysis methodologies from the relevant chapters of the HCM, including Chapter 11 "Basic Freeway Segments," Chapter 12 "Freeway Weaving Segments," and Chapter 13 "Freeway Merge and Diverge Segments," were used. The method uses variables such as traffic volumes, geometric configuration of the freeway (i.e. number of lanes, presence of auxiliary lanes, distance between merges and diverges, widths of lanes and shoulders), topography, the percentage of heavy vehicles, and free-flow speeds. These data are used to determine the density of the segment, which is the criteria used for determining freeway LOS. Density is indicative of the travel speed service flow rates and travel demand on a freeway facility, and is measured in the number of passenger cars per mile per lane. The ranges of vehicle density associated with the various Levels of Service are presented in Table 2.

Table 2
Freeway Level of Service Criteria

Level of Service (LOS)	Basic Freeway Segment Density (pc/mi/ln)	Weaving, Merge, and Diverge Segment Density (pc/mi/ln)
A	≤ 11	≤ 10
B	> 11 – 18	> 10 – 20
C	> 18 – 26	> 20 – 28
D	> 26 – 35	> 28 – 35
E	> 35 – 45	> 35
F	> 45 or any component with V/C ratio > 1.00	Demand exceeds capacity

Notes: pc/mi/ln = passenger cars per mile per lane; V/C = volume to capacity

Traffic Operation Standards

The applied thresholds of significance for intersection impacts are based on those included in Policy TR-1 of the Rohnert Park 2020 General Plan. The Project would create a significant circulation impact if it would:

- Fail to maintain LOS C as the minimum standard for signalized intersections in Rohnert Park, except for the following three intersections where LOS D operation is allowed: Golf Course Drive West/ US 101 Southbound Ramps, Golf Course Drive/Commerce Boulevard, and Commerce Boulevard/ US 101 Northbound Ramps.

- Add traffic to an unsignalized intersection where individual movements are projected to operate at LOS F and the peak hour signal warrant criteria in the *California Manual on Uniform Traffic Control Devices*, 2012, would be met.

The applied threshold of significance for the US 101 freeway is based on the Caltrans *Guide for the Preparation of Traffic Impact Studies*, 2002. A project would create a significant impact to freeway facilities if it would:

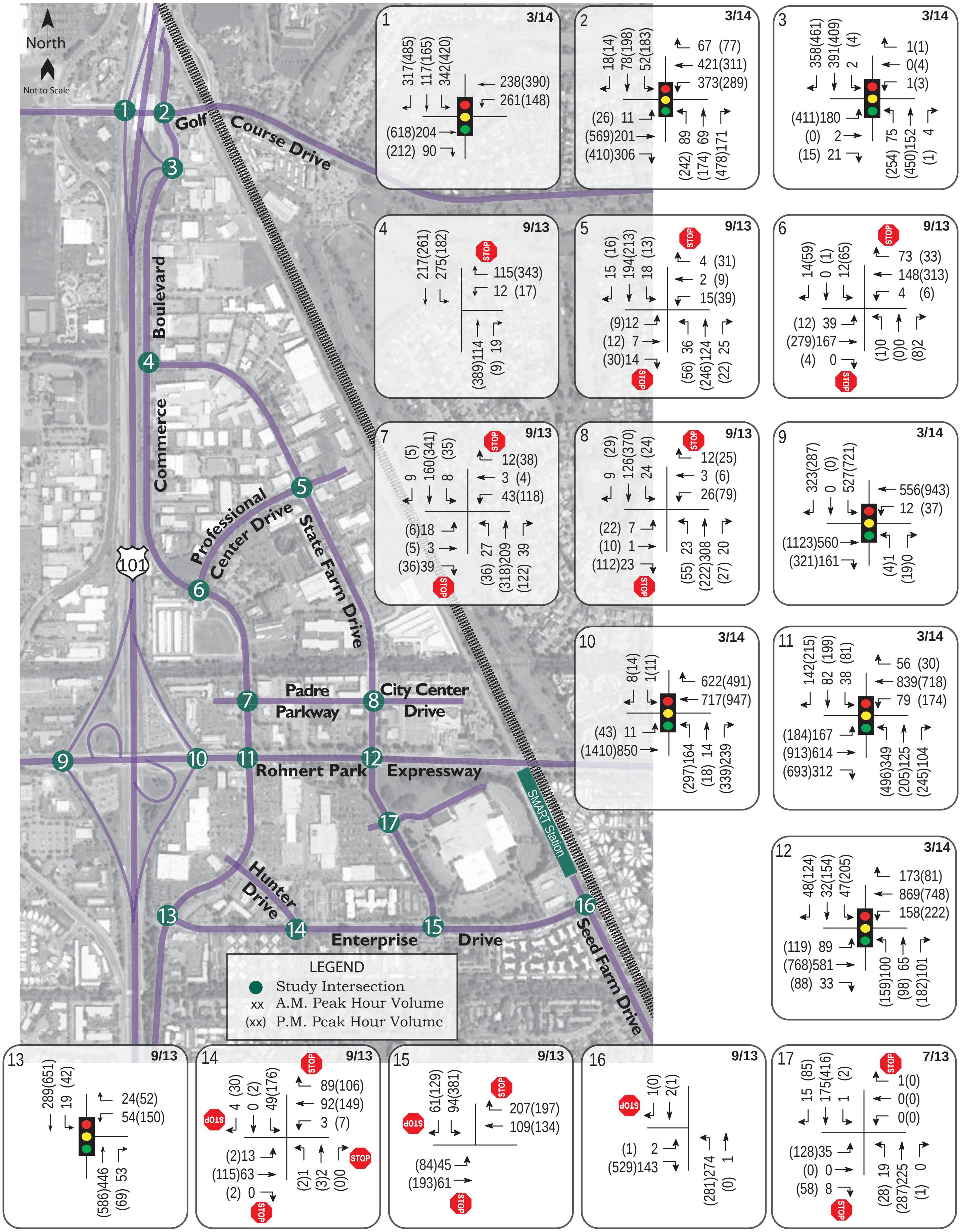
- Fail to maintain operation on US 101 at or above the LOS E threshold, or in cases where the freeway is already projected to operate deficiently at LOS F without the project, failure to maintain the existing measures of effectiveness (MOE). For such instances where the freeway is anticipated to operate at LOS F, the freeway volume-to-capacity (v/c) ratio is calculated and used as the MOE. A Project-attributable increase in the v/c ratio of 0.01 or greater is considered to be a cumulatively significant impact.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the a.m. and p.m. peak periods. This condition does not include the potential growth in traffic volumes associated with development of the Central Rohnert Park PDA.

Existing Intersection Operation

Under existing conditions, 15 of the 17 study intersections are operating acceptably within the LOS criteria established by the City. The intersections at Rohnert Park Expressway/Commerce Boulevard and Rohnert Park Expressway/State Farm Drive are currently operating at LOS D during the p.m. peak hour, which is considered unacceptable since the City's standard at these locations is LOS C. A summary of the intersection level of service calculations is contained in Table 3. The existing traffic volumes are shown in Figure 5 and copies of the Level of Service calculations are provided in Appendix A.



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Central Rohnert Park PDA Plan

Figure 5 – Existing Traffic Volumes

Table 3
Existing Peak Hour Intersection Levels of Service

Study Intersection *Approach*	**AM Peak**		**PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**
1. Golf Course Drive West/US 101 South Ramps	29.8	C	22.1	C
2. Golf Course Drive/Commerce Boulevard	20.1	C	24.7	C
3. Commerce Boulevard/US 101 North Ramps	7.7	A	12.5	B
4. Commerce Boulevard/State Farm Drive	5.0	A	9.9	A
Westbound Approach	*11.9*	*B*	*28.5*	*D*
5. State Farm Drive/Professional Center Drive	2.2	A	3.6	A
Eastbound Approach	*11.3*	*B*	*12.7*	*B*
Westbound Approach	*11.9*	*B*	*16.4*	*C*
6. Commerce Boulevard/Professional Center Drive	1.4	A	2.3	A
Southbound (Professional Center) Approach	*10.2*	*B*	*12.5*	*B*
7. Commerce Boulevard/Padre Parkway	2.7	A	3.6	A
Eastbound Approach	*10.1*	*B*	*10.9*	*B*
Westbound Approach	*11.7*	*B*	*17.3*	*C*
8. State Farm Drive/City Center Drive	2.1	A	5.4	A
Eastbound Approach	*9.9*	*A*	*12.8*	*B*
Westbound Approach	*13.0*	*B*	*25.8*	*D*
9. Rohnert Park Expressway/US 101 South Ramps	20.1	C	27.3	C
10. Rohnert Park Expressway/US 101 North Ramps	24.0	C	23.2	C
11. Rohnert Park Expressway/Commerce Boulevard	32.5	C	41.7	**D**
12. Rohnert Park Expressway/State Farm Drive	33.4	C	41.0	**D**
13. Commerce Boulevard/Enterprise Drive	9.5	A	8.8	A
14. Enterprise Drive/Hunter Drive	7.2	A	8.8	A
15. Enterprise Drive/State Farm Drive	8.4	A	17.7	C
16. Enterprise Drive/Seed Farm Drive	0.1	A	0.0	A
Southbound Approach	*11.1*	*B*	*16.4*	*C*
17. State Farm Drive/Town Center	1.4	A	4.9	A
Eastbound Approach	*11.5*	*B*	*25.2*	*D*
Westbound Approach	*9.0*	*A*	*0.0*	*A*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* ** = delay greater than 120 seconds; **Bold** text = deficient operation

Existing Freeway Operation

Existing freeway facilities including mainline, merge-diverge, and weaving segments operations were evaluated between the SR 116 and Todd Road freeway interchanges. All of the freeway facilities are currently operating acceptably at LOS E or better. Summaries of freeway facility levels of service are shown for the a.m. and p.m. peak hours in Table 4 and Table 5, respectively, and calculation worksheets are provided in Appendix E.

Table 4
Existing AM Peak Hour Freeway Levels of Service

US 101 Freeway Segment ***Direction***	**Segment Type**	**V/C Ratio**	**Density**	**LOS**
Northbound				
SR 116 off-ramp to on-ramp	Basic Segment	0.47	16.0	B
SR 116 on-ramp to RPX off-ramp	Weaving	0.49	17.8	B
RPX off-ramp to RPX EB on-ramp	Basic Segment	0.56	19.1	C
RPX EB on-ramp	On Ramp	0.60	23.8	C
RPX EB on-ramp to RPX WB on-ramp	Basic Segment	0.60	21.3	C
RPX WB on-ramp to Golf Course Dr. off-ramp	Weaving	0.55	20.1	C
Golf Course Dr. off-ramp to on-ramp	Basic Segment	0.70	24.8	C
Golf Course Dr. on ramp to Santa Rosa Ave. off-ramp	Weaving	0.55	21.2	C
Santa Rosa Ave. off-ramp to Todd Rd. off-ramp	Basic Segment	0.74	26.7	D
Southbound				
Todd Rd. on-ramp to Golf Course Dr. off-ramp	Basic Segment	0.79	29.2	D
Golf Course Dr. off-ramp	Off Ramp	0.79	30.5	D
Golf Course Dr. off-ramp to on-ramp	Basic Segment	0.65	22.6	C
Golf Course Dr. on-ramp to RPX off-ramp	Weaving	0.55	21.1	C
RPX off-ramp to RPX WB on-ramp	Basic Segment	0.57	19.5	C
RPX WB on-ramp	On Ramp	0.63	25.7	C
RPX EB on-ramp to SR 116 off-ramp	Weaving	0.52	18.4	B
SR 116 off-ramp to SR 116 on-ramp	Basic Segment	0.57	19.5	C

Notes: V/C ratio = volume to capacity ratio; Density is measured in passenger cars per mile per lane (pc/mi/ln)
LOS = Level of Service; RPX=Rohnert Park Expressway; EB=Eastbound; WB=Westbound

Table 5
Existing PM Peak Hour Freeway Levels of Service

US 101 Freeway Segment *Direction*	**Segment Type**	**V/C Ratio**	**Density**	**LOS**
Northbound				
SR 116 off-ramp to on-ramp	Basic Segment	0.79	29.5	D
SR 116 on-ramp to RPX off-ramp	Weaving	0.67	27.0	C
RPX off-ramp to RPX EB on-ramp	Basic Segment	0.75	27.4	D
RPX EB on-ramp	On Ramp	0.83	34.8	D
RPX EB on-ramp to RPX WB on-ramp	Basic Segment	0.83	31.6	D
RPX WB on-ramp to Golf Course Dr. off-ramp	Weaving	0.70	27.1	C
Golf Course Dr. off-ramp to on-ramp	Basic Segment	0.81	30.5	D
Golf Course Dr. on ramp to Santa Rosa Ave. off-ramp	Weaving	0.72	29.2	D
Santa Rosa Ave. off-ramp to Todd Rd. off-ramp	Basic Segment	0.94	393	E
Southbound				
Todd Rd. on-ramp to Golf Course Dr. off-ramp	Basic Segment	0.79	29.3	D
Golf Course Dr. off-ramp	Off Ramp	0.79	30.7	D
Golf Course Dr. off-ramp to on-ramp	Basic Segment	0.63	21.8	C
Golf Course Dr. on-ramp to RPX off-ramp	Weaving	0.68	22.2	C
RPX off-ramp to RPX WB on-ramp	Basic Segment	0.55	18.9	C
RPX WB on-ramp	On Ramp	0.59	23.9	C
RPX EB on-ramp to SR 116 off-ramp	Weaving	0.57	21.1	C
SR 116 off-ramp to SR 116 on-ramp	Basic Segment	0.53	18.2	C

Notes: V/C ratio = volume to capacity ratio; Density is measured in passenger cars per mile per lane (pc/mi/ln)
LOS = Level of Service; RPX=Rohnert Park Expressway; EB=Eastbound; WB=Westbound

Future Conditions

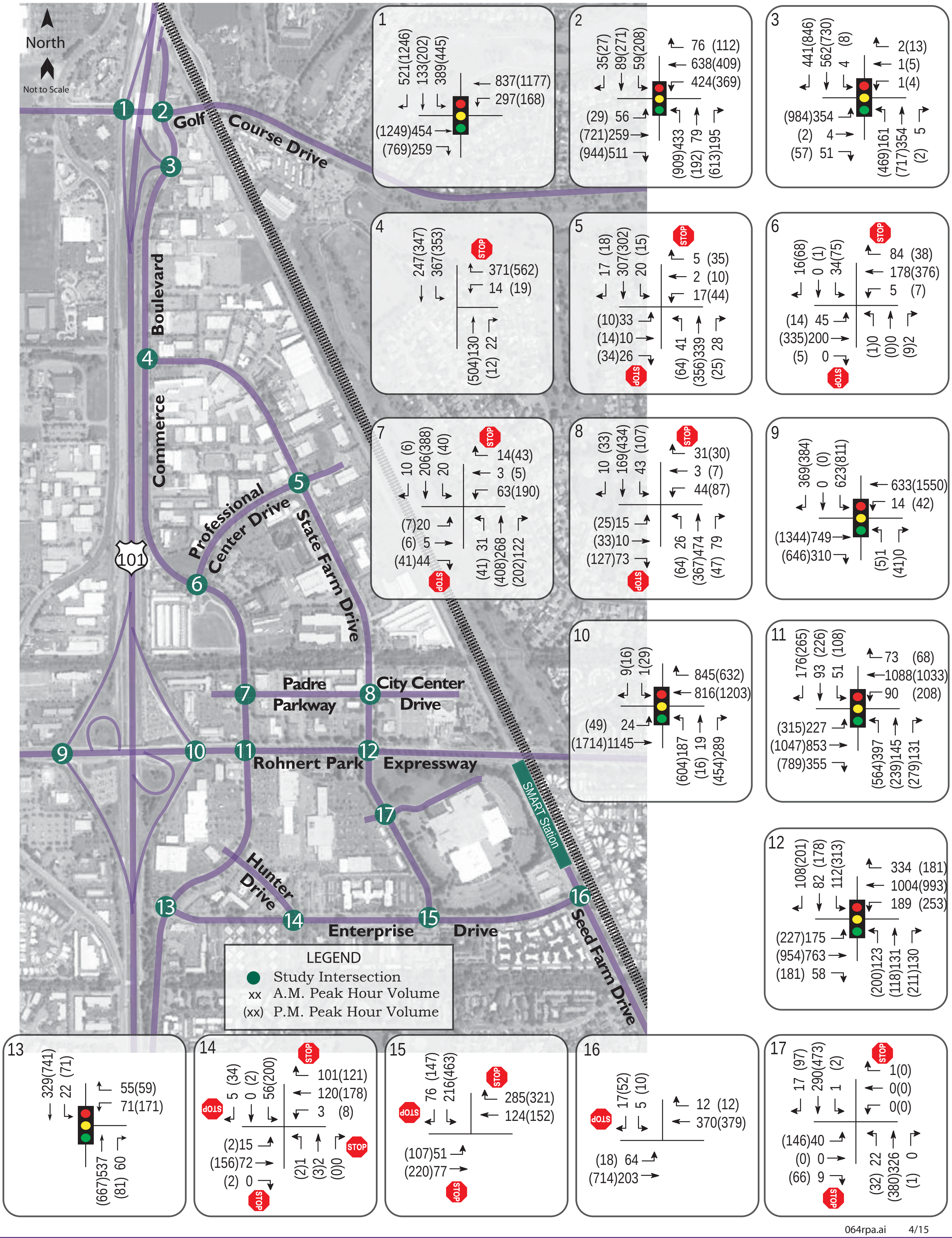
Future traffic volume projections were obtained from the Sonoma County Travel Model (SCTM/10), which is maintained by the SCTA. The SCTA provided the most recently available modeling data as of December 2014. The SCTM/10 model includes traffic projections anticipated to occur upon buildout of all development expected to take place by the year 2040 throughout Sonoma County and the Bay Area. Within Rohnert Park, the future development assumptions contained in the model include (but are not limited to) full buildout of the Graton Rancheria Resort and Casino, Wilfred-Dowdell Specific Plan, Stadium Area Master Plan, Northeast Area Specific Plan, University District Specific Plan, Southeast Area Specific Plan, Sonoma Mountain Village development, and Northwest Area Specific Plan.

In addition to a year 2040 future scenario, the SCTM/10 model also includes a baseline scenario that represents all traffic generated by existing development throughout the County. W-Trans developed year 2040 intersection turning movements using the Furness procedure, which adds the incremental traffic increase between the traffic model's baseline and future scenarios to existing turning movement counts. For any intersections not included in the SCTA model, growth factors based on adjacent links and intersections were applied. For the "no project" scenario, the former State Farm campus in the core of the PDA was assumed to remain vacant. Traffic associated with pick-up, drop-off, and park-and-ride activity at the SMART station is included in the projections. After applying these various procedures and adjustments, the resulting "first draft" set of traffic projections were then reviewed by individual turning movement, and increased where necessary to reflect a minimum growth of 13.8 percent, which translates to 0.5 percent per year.

The SCTM/10 travel model assumes a financially-constrained set of infrastructure improvements identified in the 2009 Comprehensive Transportation Plan (CTP) to be in place by the year 2040. In other words, the model only includes roadway and alternative transportation improvements that SCTA has deemed to be financially-feasible by the year 2040, including the widening of US 101 through the Marin-Sonoma narrows and implementation of Sonoma-Marin Area Rail Transit (SMART) commuter rail service.

Future Intersection Operation

Under the anticipated Future volumes, 13 of the 17 study intersections are expected to operate acceptably within the LOS parameters set by the City. The intersection at Commerce Boulevard/State Farm Drive is projected to operate unacceptably at LOS F during the p.m. peak hour. The Rohnert Park Expressway/Commerce Boulevard intersection is projected to operate at LOS D during the p.m. peak hour, which is considered unacceptable per the City's LOS standards. The intersection at Rohnert Park Expressway/State Farm Drive is projected to operate unacceptably at LOS D during the a.m. peak hour and LOS E during the p.m. peak hour. Finally, the intersection at Enterprise Drive/State Farm Drive is projected to operate unacceptably at LOS D during the p.m. peak hour. Operating conditions are summarized in Table 6 and future volumes are shown in Figure 6. The intersection LOS calculations are included in Appendix B.



Central Rohnert Park PDA Plan

Figure 6 – Future (no project) Traffic Volumes

w-trans

Table 6
Future Peak Hour Intersection Levels of Service

Study Intersection *Approach*	**AM Peak**		**PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**
1. Golf Course Drive West/US 101 South Ramps	24.8	C	36.9	D
2. Golf Course Drive/Commerce Boulevard	25.5	C	38.2	D
3. Commerce Boulevard/US 101 North Ramps	11.3	B	33.8	C
4. Commerce Boulevard/State Farm Drive	7.9	A	56.8	**F**
Westbound Approach	*15.4*	*C*	*169.4*	*F*
5. State Farm Drive/Professional Center Drive	2.3	A	3.3	A
Eastbound Approach	*14.7*	*B*	*13.5*	*B*
Westbound Approach	*16.8*	*C*	*18.0*	*C*
6. Commerce Boulevard/Professional Center Drive	1.7	A	2.2	A
Southbound (Professional Center) Approach	*10.9*	B	*12.5*	B
7. Commerce Boulevard/Padre Parkway	2.7	A	5.4	A
Eastbound Approach	*10.4*	*B*	*11.2*	*B*
Westbound Approach	*12.9*	*B*	*25.9*	*D*
8. State Farm Drive/City Center Drive	3.4	A	13.2	C
Eastbound Approach	*11.7*	*B*	*19.8*	*C*
Westbound Approach	*20.5*	*C*	*103.3*	*F*
9. Rohnert Park Expressway/US 101 South Ramps	21.5	C	21.6	C
10. Rohnert Park Expressway/US 101 North Ramps	32.9	C	32.9	C
11. Rohnert Park Expressway/Commerce Boulevard	34.6	C	44.1	**D**
12. Rohnert Park Expressway/State Farm Drive	44.6	**D**	60.8	**E**
13. Commerce Boulevard/Enterprise Drive	13.6	B	7.8	A
14. Enterprise Drive/Hunter Drive	7.4	A	9.3	A
15. Enterprise Drive/State Farm Drive	10.7	B	31.1	**D**
16. Enterprise Drive/Seed Farm Drive	1.4	A	1.0	A
Southbound Approach	*12.0*	*B*	*13.4*	*B*
17. State Farm Drive/Town Center	1.2	A	6.2	A
Eastbound Approach	*13.7*	*B*	*33.6*	*D*
Westbound Approach	*9.3*	*A*	*14.3*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* ** = delay greater than 120 seconds; **Bold** text = deficient operation

Future Freeway Operation

Under Future conditions, several freeway facility components are projected to operate below the LOS E threshold established by Caltrans. The freeway segment between Todd Road and Golf Course Drive is projected to operate at LOS F in the southbound direction during the a.m. peak hour, and in both directions during the p.m. peak hour. Related to these LOS F segment operations, the Golf Course Drive southbound off-ramp is also projected to operate at LOS F during both peak hours, as is the northbound weaving segment between Golf Course Drive and Santa Rosa Avenue during the p.m. peak hour.

Freeway facility levels of service under future conditions are summarized for the a.m. and p.m. peak hours in Table 7 and Table 8, respectively, and calculation worksheets are provided in Appendix E.

Table 7
Future AM Peak Hour Freeway Levels of Service

US 101 Freeway Segment *Direction*	**Segment Type**	**V/C Ratio**	**Density**	**LOS**
Northbound				
SR 116 off-ramp to on-ramp	Basic Segment	0.51	17.6	B
SR 116 on-ramp to RPX off-ramp	Weaving	0.63	21.6	C
RPX off-ramp to RPX EB on-ramp	Basic Segment	0.65	22.9	C
RPX EB on-ramp	On Ramp	0.71	28.7	D
RPX EB on-ramp to RPX WB on-ramp	Basic Segment	0.71	25.5	C
RPX WB on-ramp to Golf Course Dr. off-ramp	Weaving	0.68	26.0	C
Golf Course Dr. off-ramp to on-ramp	Basic Segment	0.81	30.7	D
Golf Course Dr. on ramp to Santa Rosa Ave. off-ramp	Weaving	0.66	26.6	C
Santa Rosa Ave. off-ramp to Todd Rd. off-ramp	Basic Segment	0.84	32.6	D
Southbound				
Todd Rd. on-ramp to Golf Course Dr. off-ramp	Basic Segment	1.08	44.7	**F**
Golf Course Dr. off-ramp	Off Ramp	1.08	41.6	**F**
Golf Course Dr. off-ramp to on-ramp	Basic Segment	0.89	31.1	D
Golf Course Dr. on-ramp to RPX off-ramp	Weaving	0.76	35.2	E
RPX off-ramp to RPX WB on-ramp	Basic Segment	0.83	28.3	D
RPX WB on-ramp	On Ramp	0.90	36.7	E
RPX EB on-ramp to SR 116 off-ramp	Weaving	0.75	24.5	C
SR 116 off-ramp to SR 116 on-ramp	Basic Segment	0.84	29.6	D

Notes: V/C ratio = volume to capacity ratio; Density is measured in passenger cars per mile per lane (pc/mi/ln)
LOS = Level of Service; RPX=Rohnert Park Expressway; EB=Eastbound; WB=Westbound
Bold values indicate operation below acceptable threshold

Table 8
Future PM Peak Hour Freeway Levels of Service

US 101 Freeway Segment *Direction*	**Segment Type**	**V/C Ratio**	**Density**	**LOS**
Northbound				
SR 116 off-ramp to on-ramp	Basic Segment	0.56	19.3	C
SR 116 on-ramp to RPX off-ramp	Weaving	0.71	29.6	D
RPX off-ramp to RPX EB on-ramp	Basic Segment	0.84	31.9	D
RPX EB on-ramp	On Ramp	0.93	42.0	E
RPX EB on-ramp to RPX WB on-ramp	Basic Segment	0.93	39.0	E
RPX WB on-ramp to Golf Course Dr. off-ramp	Weaving	0.77	31.8	D
Golf Course Dr. off-ramp to on-ramp	Basic Segment	0.93	44.6	E
Golf Course Dr. on ramp to Santa Rosa Ave. off-ramp	Weaving	0.86	69.2	**F**
Santa Rosa Ave. off-ramp to Todd Rd. off-ramp	Basic Segment	1.10	44.5	**F**
Southbound				
Todd Rd. on-ramp to Golf Course Dr. off-ramp	Basic Segment	1.05	44.7	**F**
Golf Course Dr. off-ramp	Off Ramp	1.05	41.7	**F**
Golf Course Dr. off-ramp to on-ramp	Basic Segment	0.84	30.4	D
Golf Course Dr. on-ramp to RPX off-ramp	Weaving	0.72	36.0	E
RPX off-ramp to RPX WB on-ramp	Basic Segment	0.79	27.7	D
RPX WB on-ramp	On Ramp	0.83	34.4	D
RPX EB on-ramp to SR 116 off-ramp	Weaving	0.65	21.9	C
SR 116 off-ramp to SR 116 on-ramp	Basic Segment	0.74	25.8	C

Notes: V/C ratio = volume to capacity ratio; Density is measured in passenger cars per mile per lane (pc/mi/ln)
LOS = Level of Service; RPX=Rohnert Park Expressway; EB=Eastbound; WB=Westbound
Bold values indicate operation below acceptable threshold

Plus Project Capacity Analysis

Project Description

Future development permitted under the PDA Plan would entail changes to allowed land uses and densities within the area. Nearly all of the area contained within the PDA boundaries has been developed, though some parcels are currently vacant and/or underutilized. Implementation of the plan would increase the amount of allowable retail, office, and light industrial square footage as well as the number of allowable residential units. For planning purposes the PDA plan area has been subdivided into the following five districts.

- Triangle Business District – This is the largest and most northern district bounded by US 101, the SMART rail corridor, and Hinebaugh Creek. The area is currently characterized by office and light industrial uses along with some retail uses.
- City Center District – This district includes civic uses, some newer mixed-use development, and some traditional suburban-oriented retail uses, and is bounded by Hinebaugh Creek, Rohnert Park Expressway, the SMART rail corridor, and Commerce Boulevard.
- Central Commercial District – This district is largely comprised of existing shopping centers including grocery and drug stores, along with quick-serve restaurants and some office uses. The district includes a northern area bounded by Hinebaugh Creek, Rohnert Park Expressway, US 101, and Commerce Boulevard, as well as a larger southern area bounded by Rohnert Park Expressway, Enterprise Drive, US 101, and State Farm Drive.
- Station Center District – The former State Farm office complex, which is currently vacant, forms the boundaries of this District. The district also includes the downtown SMART station and City corporation yard. Rohnert Park Expressway, Enterprise Drive, State Farm Drive, and the SMART rail corridor form the district boundaries.
- Creekside Neighborhood District – This district is mostly residential in nature, with some retail and office uses including City Hall. The district's boundaries are Enterprise Drive, Avram Avenue, Santa Alicia Drive, Commerce Boulevard, and the SMART rail corridor.

<u>Land Use</u>

AECOM determined the additional development potential that the PDA plan would allow in each of the five districts. The land use summary is shown in Table 9.

Table 9
Additional Development Potential by District

District	Residential	Retail/ Service	Office	Public/ Institutional	Industrial
Triangle Business	0 units	120.88 ksf	91.42 ksf	0 ksf	129.32 ksf
City Center	115 units	56.85 ksf	32.56 ksf	50.36 ksf	0 ksf
Central Commercial	0 units	74.26 ksf	0 ksf	12.45 ksf	0 ksf
Station Center	565 units	171.63 ksf	65.34 ksf	0 ksf	0 ksf
Creekside Neighborhood	155 units	17.53 ksf	0 ksf	0 ksf	0 ksf
TOTAL	**835 units**	**441.15 ksf**	**189.32 ksf**	**62.81 ksf**	**129.32 ksf**

Notes: Values represent the additional development that the PDA plan would allow beyond that existing in 2015
ksf=1,000 square feet

It should be noted that the plan would also permit for the construction of up to 500 additional hotel rooms. The square footage of any such hotel(s) are accounted for in the land use quantities shown above.

Circulation

Traffic analyses evaluating the plan's potential impacts to the surrounding circulation network were completed during development of the PDA Plan. This was done to test alternative roadway and intersection configurations, and ultimately to determine the circulation improvements that should be included within the plan itself in order to "self-mitigate" potential impacts to the degree possible. A list of the intersection-related improvements that the Plan includes is shown in Table 10.

Table 10
Intersection Improvements Included in PDA Plan

Intersection	Improvements
Commerce Blvd/State Farm Dr	Signalize with SB left-turn protected phasing and WB right-turn overlap; add WB right-turn pocket
State Farm Dr/Professional Center Dr	Modify NB and SB from L-T-TR to L-TR
Commerce Boulevard/Padre Parkway	Signalize with protected phasing NB/SB and permitted phasing EB/WB; modify NB from L-T-TR to L-T-R and SB from L-T-TR to L-TR
State Farm Dr/City Center Dr	Signalize with protected phasing NB/SB and permitted phasing EB/WB; modify NB from L-T-TR to L-T-R and SB from L-T-TR to L-TR
RPX/Commerce Blvd	Convert Commerce to protected phasing and add NB right-turn overlap; modify SB from L-LT-T-R to L-T-T-R; add bulbout NW corner; extend EB left lanes to 350' and WB left lane to 225'
RPX/State Farm Dr	Convert State Farm to protected phasing; add right-turn overlaps all approaches; modify SB from L-LT-R to L-L-T-R and NB from L-LT-T-R to L-L-T-R
Enterprise Dr/Hunter Dr	Convert EB from LT-TR to L-TR and WB from LT-TR to LT-R
Enterprise Dr/State Farm Dr	Signalize with two-phase operation; modify WB from T-TR to T-R
State Farm Dr/Town Center	Signalize with protected phasing NB/SB and permitted phasing EB/WB; modify NB and SB from L-T-TR to L-T-R; modify EB/WB from LTR to LT-R
RPX/Lynne Conde Way	Add protected pedestrian crossing on RPX (pedestrian signal or HAWK signal); continue to restrict side street movements to right turns on/off of RPX
RPX/SMART multi-use path	Add protected pedestrian crossing on RPX (pedestrian signal or HAWK signal)

Note: NB=Northbound; SB=Southbound; EB=Eastbound; WB=Westbound; L=left-turn lane; T=through lane; R=right-turn lane; lanes shown as grouped (example: L-T-TR is a 3-lane approach with one left-turn lane, one through lane, and a shared through-right turn lane); RPX=Rohnert Park Expressway

Trip Generation

Trip Generation Rate Sources

When determining the potential amount of vehicle traffic generated by future development, transportation planners and engineers typically refer to the publication *Trip Generation Manual*, 9th Edition, 2012, by the Institute of Transportation Engineers (ITE). This publication is a standard reference used by jurisdictions throughout the country, and is based on actual trip generation studies performed at numerous locations in areas of various populations. The following trip generation land use categories were used in the analysis.

- Residential – “Apartment” ITE Land Use #220
- Retail/Service – “Specialty Retail Center” ITE Land Use #826
- Office – “General Office Building” ITE Land Use #710
- Public/Institutional – “Recreational Community Center” ITE Land Use #495

- Industrial – “Light Industrial” ITE Land Use #110

While the PDA plan would allow for up to 500 new hotel rooms, it was determined that on a square footage basis retail uses generate more trips than hotels. For this reason, the analysis conservatively uses retail trip generation rates for all retail/service and hotel uses.

<u>Internal Capture Trips</u>

There are several shortcomings with using unadjusted trip generation rates in mixed-use and/or transit-oriented environments such as those envisioned in portions of the PDA. Because much of the data used to develop trip generation rates has historically been collected in auto-oriented suburban locations where individual land uses are segregated, direct application of these rates could significantly overstate traffic levels. The effects of higher residential densities, diverse land uses, proximity of jobs to housing, transit accessibility, and an interconnected pedestrian and roadway network would not be reflected in these standard rates. It was determined that additional trip estimation resources would be appropriate for the City Center and Station Center districts, which are envisioned to include a diverse mix of pedestrian-oriented uses and are located within one-half mile of the SMART station and several local and regional bus transit stops.

Internal trip reduction rates were determined using NCHRP Report 684, *Enhancing Internal Capture Estimation for Mixed-Use Developments*, Transportation Research Board, 2011. The trip reduction calculations, which are applied to standard ITE rates, are based upon the total quantity of various land uses and their proximity to each other. Based on the anticipated mix of uses in the City Center and Station Center districts, the resulting internal trips deductions are 5 percent during the a.m. peak hour and 24 percent during the p.m. peak hour. Copies of the spreadsheets indicating the derivation of the internal capture rates are provided in Appendix F. While the NCHRP research does not include specific trip reduction guidance for daily trip generation, the anticipated land use mix is likely to have daily internal capture rates that are approximately the average of the two peak hours, or 14 percent.

<u>Total Project Trip Generation</u>

Future development permitted under the proposed land uses contained within the PDA would be expected to result in a total of 27,777 added trips per day, including 1,352 during the AM peak hour and 1,973 during the PM peak hour. A summary of the trip generation estimates by PDA district is shown in Table 11.

Table 11
Trip Generation Summary

District Land Use	**Units**	**Daily**		**AM Peak Hour**		**PM Peak Hour**	
		Rate	**Trips**	**Rate**	**Trips**	**Rate**	**Trips**
Triangle Business							
Retail/Service (ITE #826)	120.88 ksf	44.32	5,357	0.96	116	2.71	328
Office (ITE #710)	91.42 ksf	11.03	1,008	1.56	143	1.49	136
Industrial (ITE #110)	129.32	6.97	901	0.92	119	0.97	125
District Total			7,266		378		589
City Center							
Residential (ITE #220)	115 du	6.65	765	0.51	59	0.62	71
Retail/Service (ITE #826)	56.85 ksf	44.32	2,520	0.96	55	2.71	154
Office (ITE #710)	32.56 ksf	11.03	359	1.56	51	1.49	49
Public/Institutional (ITE #495)	50.36 ksf	33.82	1,703	2.05	103	2.74	138
Internal Trip Deduction		*-14%*	*-749*	*-5%*	*-13*	*-24%*	*-100*
District Total			4,598		255		312
Station Center							
Residential (ITE #220)	565 du	6.65	3,757	0.51	288	0.62	350
Retail/Service (ITE #826)	171.63 ksf	44.32	7,607	0.96	165	2.71	465
Office (ITE #710)	65.34 ksf	11.03	721	1.56	102	1.49	97
Internal Trip Deduction		*-14%*	*-1,692*	*-5%*	*-29*	*-24%*	*-219*
District Total			10,393		526		693
Central Commercial							
Retail/Service (ITE #826)	74.26 ksf	44.32	3,291	0.96	71	2.71	201
Public/Institutional (ITE #495)	12.45 ksf	33.82	421	2.05	26	2.74	34
District Total			3,712		97		235
City Center							
Residential (ITE #220)	155 du	6.65	1,031	0.51	79	0.62	96
Retail/Service (ITE #826)	17.53 ksf	44.32	777	0.96	17	2.71	48
District Total			1,808		96		144
TOTAL NEW TRIPS			**27,777**		**1,352**		**1,973**

Note: du = dwelling unit; ksf = 1,000 square feet

Trip Distribution

The pattern used to allocate trips to and from uses within the PDA to the surrounding local and regional street network was based on two "select zone" model runs conducted within the SCTM/10 travel demand model, one of which is based on residential uses and the other of which assumes a mix of employment-based non-residential uses. The resulting trip distribution estimates were then further refined to reflect local street and travel patterns. The trip distribution estimates are shown in Table 12.

Table 12
Trip Distribution Assumptions

Route	Non-Residential Uses	Residential Uses
US 101 North	24%	18%
US 101 South	14%	14%
RPX – west of US 101	16%	14%
RPX – east of SMART	14%	13%
Seed Farm Drive – south of Enterprise	14%	18%
Commerce Blvd – north of Golf Course	2%	1%
Commerce Blvd – south of Enterprise	5%	7%
Golf Course Drive – east of Commerce	4%	3%
Golf Course Drive – west of US 101	3%	4%
Northern PDA area	2%	4%
Southern PDA area	2%	4%
TOTAL	**100%**	**100%**

Note: RPX = Rohnert Park Expressway

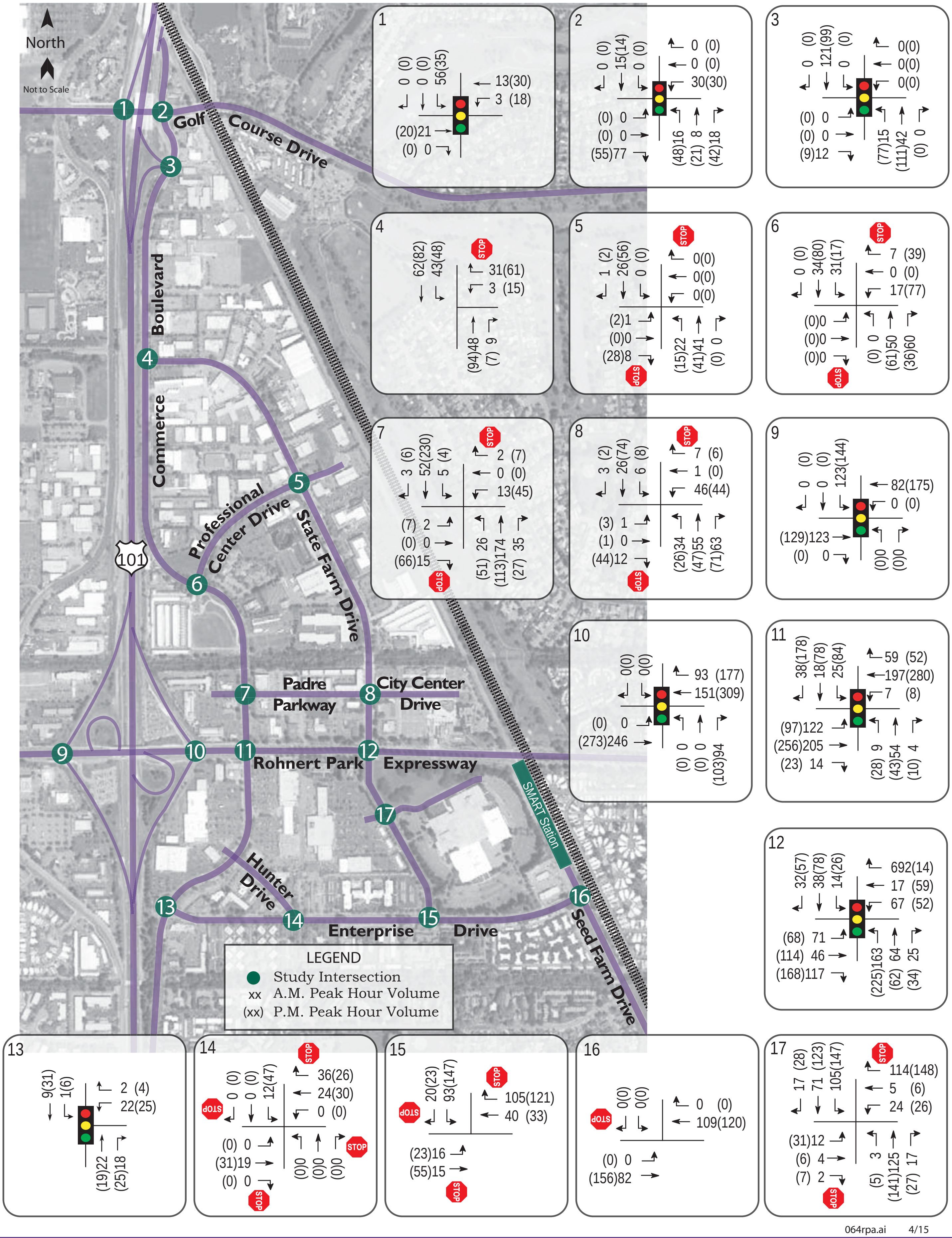
Existing plus Project Operation

Existing plus Project Intersection Operation

Upon the addition of project-related traffic to existing volumes and without any of the intersection improvements proposed by the Plan, 12 of the 17 study intersections are expected to continue operating acceptably. The five intersections projected to operate unacceptably include Commerce Boulevard/State Farm Drive, Rohnert Park Expressway/Commerce Boulevard, Rohnert Park Expressway/State Farm Drive, Enterprise Drive/State Farm Drive, and State Farm Drive/Town Center.

With incorporation of the intersection improvements included in the PDA Plan and shown in Table 10, the intersections at Rohnert Park Expressway/Commerce Boulevard and Rohnert Park Expressway/ State Farm Drive would continue to operate at LOS D during the p.m. peak hour. Because these two intersections already operate at LOS D during the existing (no project) p.m. peak hour, and because the PDA plan and its associated intersection improvements would not further degrade the intersections below their current LOS D level, Policy TR-1 of the General Plan considers this LOS D operation to be acceptable. As a result, all 17 study intersections are projected to operate acceptably under Existing plus Project conditions with the proposed improvements.

Existing plus Project level of service results are summarized in Table 13. Project traffic volumes are shown in Figure 7, and copies of the LOS calculations are provided in Appendix C.



Central Rohnert Park PDA Plan

Figure 7 – Project Traffic Volumes

Table 13
Existing and Existing plus Project Intersection Levels of Service

Study Intersection *Approach*	**Existing**		**Existing plus Project**	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
1. Golf Course Drive West/US 101 South Ramps	29.8/C	22.1/C	29.6/C	22.3/C
2. Golf Course Drive/Commerce Boulevard	20.1/C	24.7/C	21.9/C	26.0/C
3. Commerce Boulevard/US 101 North Ramps	7.7/A	12.5/B	8.8/A	14.6/B
4. Commerce Boulevard/State Farm Drive	5.0/A	9.9/A	5.4/A	**44.3/E**
Westbound Approach	*11.9/B*	*28.5/D*	*14.6/B*	***/F*
With PDA Plan Improvements	-	-	9.3/A	14.7/B
5. State Farm Drive/Professional Center Drive	2.2/A	3.6/A	2.4/A	4.1/A
Eastbound Approach	*11.3/B*	*12.7/B*	*11.7/B*	*13.2/B*
Westbound Approach	*11.9/B*	*16.4/C*	*13.5/B*	*21.3/C*
With PDA Plan Improvements	-	-	2.5/A	4.6/A
Eastbound Approach	-	-	*12.3/B*	*14.4/B*
Westbound Approach	-	-	*14.5/B*	*25.5/B*
6. Commerce Boulevard/Professional Center Drive	1.4/A	2.3/A	4.4/A	6.3/A
Southbound (Professional Center) Approach	*10.2/B*	*12.5/B*	*12.6/B*	*19.6/C*
7. Commerce Boulevard/Padre Parkway	2.7/A	3.6/A	2.9/A	11.2/B
Eastbound Approach	*10.1/B*	*10.9/B*	*11.0/B*	*13.7/B*
Westbound Approach	*11.7/B*	*17.3/C*	*16.2/C*	*72.2/F*
With PDA Plan Improvements	-	-	13.2/B	21.7/C
8. State Farm Drive/City Center Drive	2.1/A	5.4/A	3.6/A	20.4/C
Eastbound Approach	*9.9/A*	*12.8/B*	*10.3/B*	*15.2/C*
Westbound Approach	*13.0/B*	*25.8/D*	*19.9/C*	***/F*
With PDA Plan Improvements	-	-	13.9/B	16.8/B
9. Rohnert Park Expressway/US 101 South Ramps	20.1/C	27.3/C	21.6/C	29.4/C
10. Rohnert Park Expressway/US 101 North Ramps	24.0/C	23.2/C	37.3/D	28.1/C
11. Rohnert Park Expressway/Commerce Boulevard	32.5/C	**41.7/D**	**39.5/D**	**62.5/E**
With PDA Plan Improvements	-	-	25.5/C	38.5/D[1]
12. Rohnert Park Expressway/State Farm Drive	33.4/C	**41.0/D**	**44.4/D**	**71.7/E**
With PDA Plan Improvements	-	-	32.7/C	41.8/D[1]
13. Commerce Boulevard/Enterprise Drive	9.5/A	8.8/A	11.1/B	10.8/B
14. Enterprise Drive/Hunter Drive	7.2/A	8.8/A	7.5/A	9.8/A
With PDA Plan Improvements	-	-	7.4/A	9.9/A
15. Enterprise Drive/State Farm Drive	8.4/A	17.7/C	11.6/B	**58.1/F**
With PDA Plan Improvements	-	-	6.2/A	9.7/A

Table 13
Existing and Existing plus Project Intersection Levels of Service

Study Intersection *Approach*	**Existing**		**Existing plus Project**	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
16. Enterprise Drive/Seed Farm Drive	0.1/A	0.0/A	0.1/A	0.0/A
Southbound Approach	*11.1/B*	*16.4/C*	*12.9/B*	*22.3/C*
17. State Farm Drive/Town Center	1.4/A	4.9/A	5.0/A	****/F**
Eastbound Approach	*11.5/B*	*25.2D*	*29.5/D*	***/F*
Westbound Approach	*9.0/A*	*0.0/A*	*14.3/B*	*30.1/D*
With PDA Plan Improvements	-	-	18.2/B	15.9/B

Notes: Results shown as Delay/LOS; Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* ** = delay greater than 120 seconds; **Bold** text = deficient operation
[1] LOS D operation considered to be acceptable since the project includes improvements that prevent the existing LOS from further deteriorating

Finding: Upon the addition of project traffic to existing volumes and completion of the intersection improvements identified in the plan, all 17 study intersections are projected to continue operating acceptably under Existing plus Project conditions.

Existing plus Project Freeway Operation

Under existing plus project conditions, all of the freeway facilities are projected to continue operating acceptably at LOS E or better. A summary of freeway facility levels of service is shown for the a.m. and p.m. peak hours is shown in Table 14 and 15, respectively, and calculation worksheets are provided in Appendix E.

Table 14
Existing and Existing plus Project AM Peak Hour Freeway Levels of Service

US 101 Freeway Segment *Direction*	**Existing**			**Existing plus Project**			**Δ**
	V/C	**Density**	**LOS**	**V/C**	**Density**	**LOS**	**V/C**
Northbound							
SR 116 off-ramp to on-ramp	0.47	16.0	B	0.49	16.8	B	0.02
SR 116 on-ramp to RPX off-ramp	0.49	17.8	B	0.53	18.6	C	0.04
RPX off-ramp to RPX EB on-ramp	0.56	19.1	C	0.56	19.2	C	0.00
RPX EB on-ramp	0.60	23.8	C	0.61	23.9	C	0.01
RPX EB on-ramp to RPX WB on-ramp	0.60	21.3	C	0.61	21.4	C	0.01
RPX WB on-ramp to Golf Course Dr. off-ramp	0.55	20.1	C	0.57	21.0	C	0.02
Golf Course Dr. off-ramp to on-ramp	0.70	24.8	C	0.72	25.7	C	0.02
Golf Course Dr. on to Santa Rosa Ave. off-ramp	0.55	21.2	C	0.56	21.9	C	0.01
Santa Rosa Ave. off-ramp to Todd Rd. off-ramp	0.74	26.7	D	0.76	27.9	D	0.02
Southbound							
Todd Rd. on-ramp to Golf Course Dr. off-ramp	0.79	29.2	D	0.82	31.4	D	0.03
Golf Course Dr. off-ramp	0.79	30.5	D	0.82	32.1	D	0.03
Golf Course Dr. off-ramp to on-ramp	0.65	22.6	C	0.67	23.8	C	0.02
Golf Course Dr. on-ramp to RPX off-ramp	0.55	21.1	C	0.59	22.1	C	0.04
RPX off-ramp to RPX WB on-ramp	0.57	19.5	C	0.57	19.5	C	0.00
RPX WB on-ramp	0.63	25.7	C	0.65	26.4	C	0.02
RPX EB on-ramp to SR 116 off-ramp	0.52	18.4	B	0.53	18.9	B	0.00
SR 116 off-ramp to SR 116 on-ramp	0.57	19.5	C	0.58	20.1	C	0.01

Notes: V/C = volume to capacity ratio; Density is measured in passenger cars per mile per lane (pc/mi/ln)
LOS = Level of Service; RPX=Rohnert Park Expressway; EB=Eastbound; WB=Westbound;
Δ V/C = increase in v/c ratio that is attributable to the project

Table 15
Existing and Existing plus Project PM Peak Hour Freeway Levels of Service

US 101 Freeway Segment *Direction*	**Existing15**			**Existing plus Project**			**Δ**
	V/C	**Density**	**LOS**	**V/C**	**Density**	**LOS**	**V/C**
Northbound							
SR 116 off-ramp to on-ramp	0.79	29.5	D	0.81	30.8	D	0.02
SR 116 on-ramp to RPX off-ramp	0.67	27.0	C	0.70	28.0	D	0.03
RPX off-ramp to RPX EB on-ramp	0.75	27.4	D	0.75	27.5	D	0.00
RPX EB on-ramp	0.83	34.8	D	0.83	35.0	D	0.00
RPX EB on-ramp to RPX WB on-ramp	0.83	31.6	D	0.83	31.7	D	0.00
RPX WB on-ramp to Golf Course Dr. off-ramp	0.70	27.1	C	0.73	28.8	D	0.03
Golf Course Dr. off-ramp to on-ramp	0.81	30.5	D	0.85	32.8	D	0.04
Golf Course Dr. on to Santa Rosa Ave. off-ramp	0.72	29.2	D	0.75	31.2	D	0.03
Santa Rosa Ave. off-ramp to Todd Rd. off-ramp	0.94	393	E	0.99	44.1	E	0.05
Southbound							
Todd Rd. on-ramp to Golf Course Dr. off-ramp	0.79	29.3	D	0.83	31.5	D	0.04
Golf Course Dr. off-ramp	0.79	30.7	D	0.83	32.3	D	0.04
Golf Course Dr. off-ramp to on-ramp	0.63	21.8	C	0.66	23.1	C	0.03
Golf Course Dr. on-ramp to RPX off-ramp	0.68	22.2	C	0.75	23.6	C	0.07
RPX off-ramp to RPX WB on-ramp	0.55	18.9	C	0.55	19.0	C	0.00
RPX WB on-ramp	0.59	23.9	C	0.63	25.4	C	0.04
RPX EB on-ramp to SR 116 off-ramp	0.57	21.1	C	0.59	22.1	C	0.02
SR 116 off-ramp to SR 116 on-ramp	0.53	18.2	C	0.56	19.4	C	0.03

Notes: V/C = volume to capacity ratio; Density is measured in passenger cars per mile per lane (pc/mi/ln)
LOS = Level of Service; RPX=Rohnert Park Expressway; EB=Eastbound; WB=Westbound

Finding: US 101 freeway facilities are projected to operate at acceptable levels of service upon the addition of project-generated trips to existing traffic levels.

Future plus Project Operation

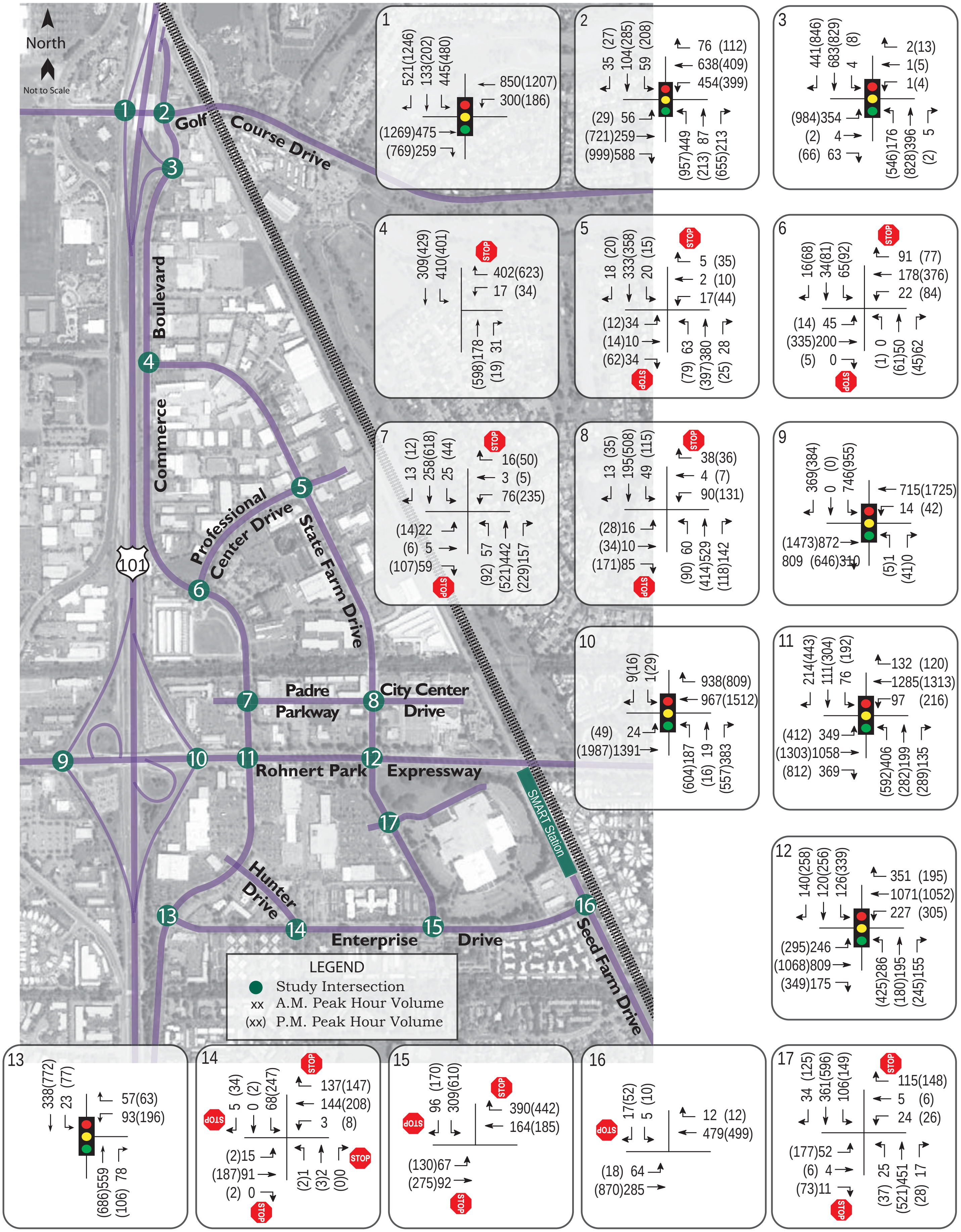
<u>Future plus Project Intersection Operation</u>

Upon the addition of project-related traffic to future volumes and without any of the intersection improvements proposed by the Plan, 10 of the 17 study intersections would be expected to continue operating acceptably. The seven intersections projected to operate unacceptably include Commerce Boulevard/State Farm Drive, Commerce Boulevard/Padre Parkway, State Farm Drive/City Center Drive, Rohnert Park Expressway/Commerce Boulevard, Rohnert Park Expressway/State Farm Drive, Enterprise Drive/State Farm Drive, and State Farm Drive/Town Center.

With incorporation of the intersection improvements included in the PDA Plan and shown in Table 10, five of the seven intersections projected to operate unacceptably would improve to LOS C or better overall. The intersections at Rohnert Park Expressway/Commerce Boulevard and Rohnert Park

Expressway/State Farm Drive are projected to operate at LOS D. As in the Existing plus Project scenario, however, these intersections would operate at LOS D (or worse) without the project, and buildout of the PDA Plan and its associated improvements would not cause operation to further degrade. In fact, p.m. peak hour operation at Rohnert Park Expressway/State Farm Drive is projected to be LOS E without the project, but would improve to LOS D with the project (as a result of intersection improvements included in the Plan).

Future plus Project level of service results are summarized in Table 16, and copies of the LOS calculations are provided in Appendix D. Peak hour Future plus Project traffic volumes at the study intersections are shown in Figure 8.



Central Rohnert Park PDA Plan

Figure 8 – Future plus Project Traffic Volumes

Table 16
Future and Future plus Project Intersection Levels of Service

Study Intersection *Approach*	**Future**		**Future plus Project**	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
1. Golf Course Drive West/US 101 South Ramps	24.8/C	41.8/D	25.7/C	40.8/D
2. Golf Course Drive/Commerce Boulevard	25.5/C	38.3/D	26.2/C	45.4/D
3. Commerce Boulevard/US 101 North Ramps	11.3/B	34.1/C	12.3/B	40.5/D
4. Commerce Boulevard/State Farm Drive	7.9/A	**56.8/F**	9.6/A	****/F**
Westbound Approach	*15.4/C*	*169.4/F*	*22.1/C*	***/F*
With PDA Plan Improvements	-	-	9.8/A	21.1/C
5. State Farm Drive/Professional Center Drive	2.3/A	3.3/A	2.5/A	3.8/A
Eastbound Approach	*14.7/B*	*13.5/B*	*15.9/C*	*13.8/B*
Westbound Approach	*16.8/C*	*18.0/C*	*19.7/C*	*22.7/C*
With PDA Plan Improvements	-	-	2.8/A	4.3/A
Eastbound Approach	-	-	*17.9/C*	*15.4/C*
Westbound Approach	-	-	*22.2/C*	*28.1/D*
6. Commerce Boulevard/Professional Center Drive	1.7/A	2.2/A	4.4/A	5.4/A
Southbound (Professional Center) Approach	*10.9/B*	*12.5/B*	*13.3/B*	*17.7/C*
7. Commerce Boulevard/Padre Parkway	2.7/A	5.4/A	2.9/A	**25.7/D**
Eastbound Approach	*10.4/B*	*11.2/B*	*11.3/B*	*13.8/B*
Westbound Approach	*12.9/B*	*25.9/D*	*17.7/C*	***/F*
With PDA Plan Improvements	-	-	15.7/B	24.5/C
8. State Farm Drive/City Center Drive	3.4/A	13.2/C	7.9/A	**75.2/F**
Eastbound Approach	*11.7/B*	*19.8/C*	*13.0/B*	*27.5/D*
Westbound Approach	*20.5/C*	*103.3/F*	*55.5.F*	***/F*
With PDA Plan Improvements	-	-	19.8/B	22.3/C
9. Rohnert Park Expressway/US 101 South Ramps	21.5/C	21.6/C	19.9/B	22.9/C
10. Rohnert Park Expressway/US 101 North Ramps	32.9/C	32.9/C	29.7/C	24.5/C
11. Rohnert Park Expressway/Commerce Boulevard	34.6/C	**44.1/D**	**52.5/D**	**97.2/F**
With PDA Plan Improvements	-	-	28.5/C	50.9/D
12. Rohnert Park Expressway/State Farm Drive	**44.6/D**	**60.8/E**	**74.1/E**	**93.8/F**
With PDA Plan Improvements	-	-	37.8/D	46.6/D
13. Commerce Boulevard/Enterprise Drive	13.6/B	7.8/A	14.1/B	8.2/A
14. Enterprise Drive/Hunter Drive	7.4/A	9.3/A	7.7/A	10.4/B
With PDA Plan Improvements	-	-	7.6/A	10.7/B
15. Enterprise Drive/State Farm Drive	10.7/B	**31.1/D**	17.0/C	**90.7/F**
With PDA Plan Improvements	-	-	6.9/A	10.6/B

Table 16
Future and Future plus Project Intersection Levels of Service

Study Intersection *Approach*	**Future**		**Future plus Project**	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
16. Enterprise Drive/Seed Farm Drive	1.4/A	1.0/A	1.2/A	1.0/A
Southbound Approach	*12.0/B*	*13.4/B*	*13.6/B*	*16.3/C*
17. State Farm Drive/Town Center	1.2/A	6.2/A	5.3/A	****/F**
Eastbound Approach	*13.7/B*	*33.6/D*	*43.5/E*	***/F*
Westbound Approach	*9.3/A*	*14.3/B*	*16.6/C*	*33.6/D*
With PDA Plan Improvements	-	-	17.3/B	18.0/B

Notes: Results shown as Delay/LOS; Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* ** = delay greater than 120 seconds; **Bold** text = deficient operation

Finding: With buildout of the PDA plan and its improvements, and in consideration of policy TR-1 of the City's General Plan, all 17 study intersections are projected to operate acceptably under Future plus Project conditions.

<u>Future plus Project Freeway Operation</u>

Under future plus project conditions, the addition of traffic associated with buildout of the PDA would lead to further degradation of two freeway segments already projected to operate unacceptably at LOS F without the project. On the segment of northbound US 101 between Golf Course Drive and Santa Rosa Avenue, the project would be responsible for an increase in the volume-to-capacity ratio of 0.04 during the p.m. peak hour, which is considered to be cumulatively significant. On the segment of southbound US 101 between Todd Road and Golf Course Drive, the project would be responsible for volume-to-capacity ratio increases of 0.04 during the a.m. peak hour and 0.03 during the p.m. peak hour, both of which are also considered to be cumulatively significant. On the remaining freeway segments the project would not be expected to cause operation to fall below LOS E during either peak hour.

A summary of freeway facility levels of service is shown for the a.m. and p.m. peak hours in Table 17 and Table 18, respectively, and calculation worksheets are provided in Appendix E.

Table 17
Future and Future plus Project AM Peak Hour Freeway Levels of Service

US 101 Freeway Segment	**Future**			**Future plus Project**			**Δ**
Direction	**V/C**	**Density**	**LOS**	**V/C**	**Density**	**LOS**	**V/C**
Northbound							
SR 116 off-ramp to on-ramp	0.51	17.6	B	0.54	18.4	C	0.03
SR 116 on-ramp to RPX off-ramp	0.63	21.6	C	0.66	22.5	C	0.03
RPX off-ramp to RPX EB on-ramp	0.65	22.9	C	0.66	23.0	C	0.01
RPX EB on-ramp	0.71	28.7	D	0.71	28.8	D	0.00
RPX EB on-ramp to RPX WB on-ramp	0.71	25.5	C	0.71	25.6	C	0.00
RPX WB on-ramp to Golf Course Dr. off-ramp	0.68	26.0	C	0.70	27.0	C	0.02
Golf Course Dr. off-ramp to on-ramp	0.81	30.7	D	0.83	31.9	D	0.02
Golf Course Dr. on to Santa Rosa Ave. off-ramp	0.66	26.6	C	0.68	27.4	C	0.02
Santa Rosa Ave. off-ramp to Todd Rd. off-ramp	0.84	32.6	D	0.87	34.0	D	0.03
Southbound							
Todd Rd. on-ramp to Golf Course Dr. off-ramp	1.08	44.7	**F**	1.12	44.7	**F**	**0.04**
Golf Course Dr. off-ramp	1.08	41.6	**F**	1.12	41.7	**F**	**0.04**
Golf Course Dr. off-ramp to on-ramp	0.89	31.1	D	0.92	31.1	D	0.03
Golf Course Dr. on-ramp to RPX off-ramp	0.76	35.2	E	0.79	35.6	E	0.03
RPX off-ramp to RPX WB on-ramp	0.83	28.3	D	0.83	27.7	D	0.00
RPX WB on-ramp	0.90	36.7	E	0.92	36.7	E	0.02
RPX EB on-ramp to SR 116 off-ramp	0.75	24.5	C	0.76	24.1	C	0.01
SR 116 off-ramp to SR 116 on-ramp	0.84	29.6	D	0.86	29.7	D	0.02

Notes: V/C = volume to capacity ratio; Density is measured in passenger cars per mile per lane (pc/mi/ln)
LOS = Level of Service; RPX=Rohnert Park Expressway; EB=Eastbound; WB=Westbound;
Δ V/C = increase in v/c ratio that is attributable to the project

Table 18
Future and Future plus Project PM Peak Hour Freeway Levels of Service

US 101 Freeway Segment *Direction*	**Future**			**Future plus Project**			**Δ**
	V/C	**Density**	**LOS**	**V/C**	**Density**	**LOS**	**V/C**
Northbound							
SR 116 off-ramp to on-ramp	0.56	19.3	C	0.58	20.0	C	0.02
SR 116 on-ramp to RPX off-ramp	0.71	29.6	D	0.73	33.5	D	0.02
RPX off-ramp to RPX EB on-ramp	0.84	31.9	D	0.84	32.7	D	0.00
RPX EB on-ramp	0.93	42.0	E	0.93	42.0	E	0.00
RPX EB on-ramp to RPX WB on-ramp	0.93	39.0	E	0.93	39.0	E	0.00
RPX WB on-ramp to Golf Course Dr. off-ramp	0.77	31.8	D	0.81	44.9	D	0.04
Golf Course Dr. off-ramp to on-ramp	0.93	44.6	E	0.96	53.0	E	0.03
Golf Course Dr. on to Santa Rosa Ave. off-ramp	0.86	69.2	**F**	0.90	76.0	**F**	**0.04**
Santa Rosa Ave. off-ramp to Todd Rd. off-ramp	1.10	44.5	**F**	1.16	44.5	**F**	**0.04**
Southbound							
Todd Rd. on-ramp to Golf Course Dr. off-ramp	1.05	44.7	**F**	1.08	44.7	**F**	**0.03**
Golf Course Dr. off-ramp	1.05	41.7	**F**	1.08	41.7	**F**	**0.03**
Golf Course Dr. off-ramp to on-ramp	0.84	30.4	D	0.88	30.4	D	0.04
Golf Course Dr. on-ramp to RPX off-ramp	0.75	36.0	E	0.79	36.7	E	0.04
RPX off-ramp to RPX WB on-ramp	0.79	27.7	D	0.79	27.1	D	0.00
RPX WB on-ramp	0.83	34.4	D	0.87	34.4	D	0.04
RPX EB on-ramp to SR 116 off-ramp	0.65	21.9	C	0.67	22.8	C	0.02
SR 116 off-ramp to SR 116 on-ramp	0.74	25.8	C	0.77	26.4	D	0.03

Notes: V/C = volume to capacity ratio; Density is measured in passenger cars per mile per lane (pc/mi/ln)
LOS = Level of Service; RPX=Rohnert Park Expressway; EB=Eastbound; WB=Westbound

The projected unacceptable operation on US 101 could be mitigated by widening the freeway to include additional through lanes in each direction. Further widening of US 101 is not included in the SCTA's Comprehensive Transportation Plan, nor do any financing mechanisms currently exist to fund such a widening project. Widening the freeway would require major reconstruction of multiple freeway structures, right-of-way acquisition including many homes and businesses, potential relocation of city streets paralleling the freeway corridor (including Redwood Boulevard and Commerce Boulevard), and the likely creation of additional secondary environmental impacts. The environmental, social, and financial impacts render such a widening project infeasible.

The MTC, County of Sonoma, City of Rohnert Park, and SCTA recognize that US 101 will experience congestion into the foreseeable future, and that there will be no further major capacity enhancements such as expansions or new freeways. All four agencies concur in various planning and policy documents that long-range solutions to regional mobility must focus on better land use planning that supports transit and alternative transportation modes; stronger jobs-housing balances; and increased support of transportation demand measures. The creation of designated PDA areas by MTC and ABAG, including the Central Rohnert Park PDA that is the subject of this analysis, is intended to further these goals and minimize impacts created by regional traffic demands.

Finding: Future development permitted under the PDA Plan would contribute to LOS F operation on mainline US 101 to the north of Golf Course Drive in both the northbound and southbound directions, increasing these segments' volume-to-capacity ratio by greater than 0.01, which is considered to be cumulatively significant.

Analysis of Non-Automobile Modes

Pedestrian and Bicycle Facilities

A major goal of the PDA plan is to enhance pedestrian and bicycle circulation, expanding and improving current networks to make walking and bicycling a preferred mode of travel for residents, employees, and visitors to central Rohnert Park. The pedestrian and bicycle enhancements identified in the Plan have also been crafted to create convenient connections to the SMART rail station and SMART corridor regional multi-use path.

Improvements Included in Plan

Following is a brief summary of future improvements included in the plan.

New and Enhanced Off-Street Linkages

- Create new east-west pedestrian connections in the Triangle Business District linking Commerce Boulevard to State Farm Drive
- Create a north-south pedestrian and bicycle "paseo" through the Triangle Business District linking Professional Drive to Cascade Court
- Fill gaps in the trail network along Hinebaugh Creek
- Extend the Commerce Boulevard bike path/trail northward from Enterprise Drive to Rohnert Park Expressway
- Make improvements and add connections to Rohnert Park Expressway bike paths/trails

On-Street Bicycle Facility Enhancements

- Fill bicycle lane gaps on Commerce Boulevard
- Improve bicycle facilities along Professional Center Drive, creating a strong bike connection between Commerce Boulevard and the SMART corridor multi-use pathway
- Implement bicycle facility enhancements on State Farm Drive
- Implement bicycle boulevards on streets within the Station Center District that enhance bicycle connectivity to the SMART station
- Add bicycle lanes on Hunter Drive and Enterprise Drive

Pedestrian Walkways

- Add new sidewalks and paths in the City Center district, including new links between Rohnert Park Expressway and Hinebaugh Creek
- Establish a robust network of pedestrian walkway improvements within the Central Commercial District including new and/or enhanced north-south and east-west connections

Pedestrian and Bicycle Crossings

- Implement pedestrian crossing improvements at intersections throughout the Plan area
- Establish two new signalized pedestrian crossings on Rohnert Park Expressway, one serving the SMART multi-use path and the other creating a pedestrian linkage between the City Center and Station Center Districts at Lynne Conde Way
- Plan for a future bicycle/pedestrian bridge over Rohnert Park Expressway to the east of the SMART rail corridor, linking the Station Center District to the City Center District

- Establish a pedestrian crossing on Enterprise Drive between the Station Center District and the existing trail linkage leading to the Copeland Creek trails, potentially at a mid-block location and/or with a pedestrian signal such as a HAWK if appropriate

<u>Assessment of Planned Pedestrian and Bicycle Improvements</u>

The new and enhanced on- and off-street pedestrian and bicycle improvements identified in the Plan build upon (and are consistent with) facilities identified in the *Rohnert Park Bicycle and Pedestrian Master Plan*. The creation of new pedestrian and bicycle connections reduces the effective block sizes within the PDA area, minimizing the distances pedestrians and cyclists must traverse when traveling from one point to another, including the SMART rail station. The need to make such trips by automobile is thereby reduced both at the local level and at the regional level by making pedestrian and bicycle connections to transit more convenient.

An integral component to improving pedestrian and bicycle connectivity is creating public street crossings that are both comfortable to use and carefully designed to accommodate all users in a safe manner. At the intersections identified in the Plan as having intersection crossing enhancements, improvements could include those that increase driver awareness of crossing areas (high-visibility markings and pedestrian/bicyclist-activated warning lights), reduce pedestrian crossing distances (bulb-outs and median refuges), or increase the feeling of safety (pedestrian-scale lighting). These types of improvements can significantly enhance pedestrian and bicyclist safety while causing minimal impacts to motor vehicle modes.

New Crossings on Rohnert Park Expressway

The new pedestrian crossings identified on Rohnert Park Expressway would need to be carefully designed to achieve the desired results of improved pedestrian connectivity, minimized disruption to through traffic, and user safety. Both locations would be designed primarily for pedestrians, with no provisions for passenger vehicle left-turns from Rohnert Park Expressway onto side streets and vice versa. Given the traffic levels on Rohnert Park Expressway, it is necessary for these crossings to be signalized, using either conventional traffic signals or a newer type of device called a pedestrian hybrid beacon, also referred to as a "HAWK" signal. Both types of devices can be integrated into the coordinated signal timing that exists on Rohnert Park Expressway, effectively minimizing disruption to through traffic by activating pedestrian crossings to occur in between the "platoons" of through traffic created by signal coordination. A conventional traffic signal would be active at all times, whereas a HAWK signal would only activate when a pedestrian or bicyclist wishes to cross the corridor. Both devices can also be designed to communicate with railroad crossing signaling systems to ensure that any queues downstream of the rail crossing are cleared prior to arrival of a train, and both can also be programmed to accommodate emergency vehicle preemption. Both of these parameters are particularly important at these locations on Rohnert Park Expressway given the proximity of the SMART rail corridor and existing fire station emergency signal.

With respect to traffic flow on Rohnert Park Expressway, implementation of the two potential pedestrian signals was tested assuming full coordination with adjacent signals, with resulting operation at each signal found to be in the LOS A-B range under buildout conditions during both the a.m. and p.m. peak hours.

The choice of signalization option (conventional versus HAWK) as well as a more detailed evaluation of appropriate signal timing and preemption schemes for these two signals will need to be completed prior to installation, and preferably once detailed development details for future development in the Station Center District are known.

New Crossing on Enterprise Drive

The new pedestrian crossing on Enterprise Drive identified in the Plan would be located adjacent to an existing pathway that links the south side of the street to pathways on Copeland Creek. How this new crossing should be accommodated is dependent on how the property on the north side of the street (the Station Center District) ultimately develops. If the Station Center District development includes a public street at this location, the crossing would not be considered "mid-block" and could effectively accommodate pedestrians and cyclists using components such as bulbouts, median refuge areas, high-visibility pavement parking, and if warranted, pedestrian warning lights or signals. If the crossing ends up occurring at a mid-block location, similar techniques may be used, though the potential need to include warning lights or a signal becomes more likely. In either case it will be necessary to evaluate the types of crossing amenities that are warranted at such time as a development proposal moves forward and the surrounding circulation context is known.

Finding: The pedestrian and bicycle facilities identified in the PDA plan will encourage travel by non-auto modes and help to support future growth in Central Rohnert Park.

Finding: The new pedestrian and bicycle crossings identified in the Plan can be designed to enhance pedestrian and bicycle circulation in a manner that does not adversely affect traffic flow or safety at the SMART rail crossing.

Transit Facilities

The PDA is served by several Sonoma County Transit bus routes that provide local service as well as service to adjacent Sonoma County communities. Regional bus service connecting communities from Santa Rosa to San Francisco is also provided by Golden Gate Transit. All transit routes serve the Central Commercial District with stops on Commerce Boulevard and/or Enterprise Drive, and several Sonoma County Transit routes also operate on Rohnert Park Expressway and State Farm Drive. The plan identifies several locations where new transit stops would be beneficial, and identifies a potential new bus circulator route serving the SMART station via new streets in the Station Center District. The circulator route could be utilized by diverting existing routes once the SMART station and development in the Station Center District are complete. The street network depicted for the Station Center District allows considerable flexibility for transit operators in determining routing, including the ability to continue serving existing stops in the vicinity.

In addition to concentrating future development around the SMART rail station, the PDA plan would also focus development in an area that has an existing concentration of local and regional bus routes with timed stops on Commerce Boulevard and Hunter Drive.

Finding: The PDA plan would support and encourage use of transit through concentrating development around existing bus facilities and the planned SMART rail station, and by accommodating new or diverted bus routes that directly interface with the SMART station.

Conclusions

- The PDA plan identifies multimodal improvements to the circulation network including new pedestrian-bicycle linkages and identification of intersection improvements needed to support future growth.
- The plan would allow for construction of approximately 835 new residential units and approximately 823,000 square feet of additional non-residential uses including commercial, office, and light industrial among five "districts".
- Future development permitted under the proposed land uses contained within the PDA could result in a total of 27,777 added trips per day, including 1,352 during the AM peak hour and 1,973 during the PM peak hour.
- The PDA plan includes roadway and intersection improvements that are intended to "self-mitigate" potential traffic impacts.
- The intersections at Rohnert Park Expressway/Commerce Boulevard and Rohnert Park Expressway/ State Farm Drive are currently operating at LOS D during the p.m. peak hour, which is considered unacceptable since the City's standard for these locations is LOS C.
- Upon the addition of project-related traffic to existing volumes and with incorporation of the intersection improvements included in the plan, the intersections at Rohnert Park Expressway/ Commerce Boulevard and Rohnert Park Expressway/State Farm Drive are expected to operate at LOS D. Because these two intersections already operate at LOS D without the project, and the project would not further degrade LOS, this is considered to be acceptable per General Plan Policy TR-1.
- Under year 2040 buildout conditions without the project, the intersections at Commerce Boulevard/State Farm Drive, Rohnert Park Expressway/Commerce Boulevard, and Enterprise Drive/ State Farm Drive are projected to operate at unacceptable levels of service.
- Upon the addition of project-related traffic to future volumes and with incorporation of the intersection improvements included in the PDA Plan, the intersections at Rohnert Park Expressway/ Commerce Boulevard and Rohnert Park Expressway/State Farm Drive are projected to operate at LOS D. Buildout of the PDA Plan and its associated improvements would not cause LOS to further degrade.
- With buildout of the PDA plan and its improvements, and in consideration of policy TR-1 of the City's General Plan, all 17 study intersections are projected to operate acceptably under Existing plus Project and Future plus Project conditions.
- US 101 freeway facilities between the State Route 116 and Todd Road freeway interchanges are currently operating acceptably at LOS E or better.
- US 101 is projected to continue operating acceptably under Existing plus Project conditions.
- Under year 2040 buildout conditions without the project, the US 101 freeway segment between Todd Road and Golf Course Drive is projected to operate unacceptably at LOS F.
- Under future plus project conditions, buildout of the PDA would add traffic to two freeway segments already projected to operate unacceptably at LOS F without the project (northbound

between Golf Course Drive and Santa Rosa Avenue and southbound between Todd Road and Golf Course Drive). Increases in the freeway volume-to-capacity ratios on affected segments would range from 0.03 to 0.04, which is considered to be cumulatively significant.

- Future LOS F operation on US 101 could be mitigated by widening the freeway, though the environmental, social, and financial impacts render such a widening project infeasible. The creation of designated PDA areas by MTC and ABAG, including the Central Rohnert Park PDA, is intended to manage regional growth in an efficient manner that supports non-auto modes and minimizes vehicular impacts.

- The pedestrian and bicycle improvements identified in the Plan expand upon those identified in the *Rohnert Park Bicycle and Pedestrian Master Plan*, emphasizing the use of non-auto modes in Central Rohnert Park and enhancing connectivity to transit including the SMART rail station.

- The new pedestrian and bicycle crossings identified in the Plan can be designed to enhance pedestrian and bicycle circulation in a manner that does not adversely affect traffic flow or safety at the SMART rail crossing.

- The PDA plan would support and encourage use of transit through concentrating development around existing bus facilities and the planned SMART rail station, and by accommodating new or diverted bus routes that directly interface with SMART.

Study Participants and References

Study Participants

Principal in Charge:	Zachary Matley, AICP
Transportation Engineer:	Sam Lam, PE
Assistant Engineer:	Lauren Davini, EIT
Technician/Graphics:	Deborah J. Mizell
Editing/Formatting:	Angela McCoy
Report Review:	Dalene J. Whitlock, PE, PTOE

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RPA064

Appendix A

Existing Intersection LOS Calculations

HCM Signalized Intersection Capacity Analysis
1: US 101 South Ramps & Golf Course Drive West/Golf Course Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	204	90	261	238	0	0	0	0	342	117	317
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (prot)		3539	1583	3433	3539					1681	1727	1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (perm)		3539	1583	3433	3539					1681	1727	1583
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	232	102	297	270	0	0	0	0	389	133	360
RTOR Reduction (vph)	0	0	45	0	0	0	0	0	0	0	0	276
Lane Group Flow (vph)	0	232	57	297	270	0	0	0	0	257	265	84
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		6		5	2					8	8	
Permitted Phases			6									8
Actuated Green, G (s)		61.3	61.3	13.0	77.3					25.7	25.7	25.7
Effective Green, g (s)		61.3	61.3	13.0	77.3					25.7	25.7	25.7
Actuated g/C Ratio		0.56	0.56	0.12	0.70					0.23	0.23	0.23
Clearance Time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Vehicle Extension (s)		1.5	1.5	1.0	1.5					1.5	1.5	1.5
Lane Grp Cap (vph)		1972	882	405	2486					392	403	369
v/s Ratio Prot		c0.07		c0.09	0.08					0.15	c0.15	
v/s Ratio Perm			0.04									0.05
v/c Ratio		0.12	0.06	0.73	0.11					0.66	0.66	0.23
Uniform Delay, d1		11.5	11.2	46.8	5.3					38.1	38.2	34.1
Progression Factor		0.49	0.74	1.00	1.00					1.00	1.00	1.00
Incremental Delay, d2		0.1	0.1	5.8	0.1					3.0	2.9	0.1
Delay (s)		5.8	8.4	52.7	5.4					41.1	41.1	34.2
Level of Service		A	A	D	A					D	D	C
Approach Delay (s)		6.6			30.1			0.0			38.3	
Approach LOS		A			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Commerce Blvd & Golf Course Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	201	306	373	421	67	89	69	171	52	78	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	13	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.95		0.97	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	3453		3433	1863	1636	1770	1806	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	3453		3433	1863	1636	1770	1806	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	12	221	336	410	463	74	98	76	188	57	86	20
RTOR Reduction (vph)	0	0	198	0	9	0	0	0	123	0	7	0
Lane Group Flow (vph)	12	221	138	410	528	0	98	76	65	57	99	0
Confl. Peds. (#/hr)						5						1
Confl. Bikes (#/hr)						1						
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	1	6	4	5	2		4	4	5	3	3	
Permitted Phases			6						4			
Actuated Green, G (s)	0.7	17.8	29.1	13.4	30.5		11.3	11.3	24.7	12.5	12.5	
Effective Green, g (s)	0.7	17.8	29.1	13.4	30.5		11.3	11.3	24.7	12.5	12.5	
Actuated g/C Ratio	0.01	0.25	0.41	0.19	0.43		0.16	0.16	0.35	0.18	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	1.0	1.5	1.5	1.0	1.5		1.5	1.5	1.0	1.5	1.5	
Lane Grp Cap (vph)	17	1274	648	647	1483		546	296	661	311	317	
v/s Ratio Prot	0.01	0.04	0.03	c0.12	c0.15		0.03	c0.04	0.02	0.03	c0.05	
v/s Ratio Perm			0.05						0.02			
v/c Ratio	0.71	0.17	0.21	0.63	0.36		0.18	0.26	0.10	0.18	0.31	
Uniform Delay, d1	35.0	20.8	13.5	26.5	13.6		25.8	26.2	15.6	24.9	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	72.3	0.0	0.1	1.5	0.1		0.1	0.2	0.0	0.1	0.2	
Delay (s)	107.4	20.9	13.6	28.0	13.7		25.9	26.3	15.7	25.0	25.7	
Level of Service	F	C	B	C	B		C	C	B	C	C	
Approach Delay (s)		18.4			19.9			20.7			25.5	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	20.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	71.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Commerce Blvd & US 101 North Ramps

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	2	21	1	0	1	75	152	4	2	391	358
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.93		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1793	1687	1794		1695		1770	3524		1770	3539	1583
Flt Permitted	0.95	0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1793	1687	1794		1695		1770	3524		1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	186	2	22	1	0	1	77	157	4	2	403	369
RTOR Reduction (vph)	0	0	17	0	2	0	0	1	0	0	0	0
Lane Group Flow (vph)	95	93	5	0	0	0	77	160	0	2	403	369
Confl. Peds. (#/hr)									2			
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA		Prot	NA	Free
Protected Phases	8	8	1	7	7		1	6		5	2	
Permitted Phases			8									Free
Actuated Green, G (s)	6.0	6.0	9.9		0.7		3.9	23.3		0.6	20.0	44.6
Effective Green, g (s)	6.0	6.0	9.9		0.7		3.9	23.3		0.6	20.0	44.6
Actuated g/C Ratio	0.13	0.13	0.22		0.02		0.09	0.52		0.01	0.45	1.00
Clearance Time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0		4.0		2.0	2.0		2.0	4.0	
Lane Grp Cap (vph)	241	226	398		26		154	1841		23	1586	1583
v/s Ratio Prot	0.05	c0.06	0.00		0.00		c0.04	0.05		0.00	0.11	
v/s Ratio Perm			0.00									c0.23
v/c Ratio	0.39	0.41	0.01		0.00		0.50	0.09		0.09	0.25	0.23
Uniform Delay, d1	17.6	17.7	13.5		21.6		19.4	5.3		21.7	7.7	0.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.4	0.4	0.0		0.0		0.9	0.0		0.6	0.1	0.3
Delay (s)	18.0	18.1	13.5		21.6		20.4	5.3		22.3	7.8	0.3
Level of Service	B	B	B		C		C	A		C	A	A
Approach Delay (s)		17.6			21.6			10.2			4.3	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	7.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	44.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr

3/31/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	12	115	114	19	275	217
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	14	132	131	22	316	249
Pedestrians	5		5			5
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	0		0			0
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1034	152			158	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1034	152			158	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	85			78	
cM capacity (veh/h)	198	887			1416	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	146	153	316	249
Volume Left	14	0	316	0
Volume Right	132	22	0	0
cSH	668	1700	1416	1700
Volume to Capacity	0.22	0.09	0.22	0.15
Queue Length 95th (ft)	21	0	21	0
Control Delay (s)	11.9	0.0	8.3	0.0
Lane LOS	B		A	
Approach Delay (s)	11.9	0.0	4.6	
Approach LOS	B			

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	7	14	15	2	4	36	124	25	18	194	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	13	8	15	16	2	4	39	133	27	19	209	16
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	415	503	122	396	498	90	230			165		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	415	503	122	396	498	90	230			165		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	98	98	97	100	100	97			99		
cM capacity (veh/h)	493	446	898	498	449	942	1330			1405		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	13	23	23	39	89	71	19	139	86
Volume Left	13	0	16	39	0	0	19	0	0
Volume Right	0	15	4	0	0	27	0	0	16
cSH	493	671	541	1330	1700	1700	1405	1700	1700
Volume to Capacity	0.03	0.03	0.04	0.03	0.05	0.04	0.01	0.08	0.05
Queue Length 95th (ft)	2	3	3	2	0	0	1	0	0
Control Delay (s)	12.5	10.6	11.9	7.8	0.0	0.0	7.6	0.0	0.0
Lane LOS	B	B	B	A			A		
Approach Delay (s)	11.3		11.9	1.5			0.6		
Approach LOS	B		B						

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	29.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Commerce Blvd & Professional Center Dr

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	39	167	0	4	148	73	0	0	2	12	0	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	44	190	0	5	168	83	0	0	2	14	0	16
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			TWLTL							
Median storage veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	256			195			482	549	200	509	507	220
vC1, stage 1 conf vol							283	283		224	224	
vC2, stage 2 conf vol							198	265		286	283	
vCu, unblocked vol	256			195			482	549	200	509	507	220
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			100			100	100	100	98	100	98
cM capacity (veh/h)	1303			1373			616	558	834	617	584	813

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	44	190	5	251	2	14	16
Volume Left	44	0	5	0	0	14	0
Volume Right	0	0	0	83	2	0	16
cSH	1303	1700	1373	1700	834	617	813
Volume to Capacity	0.03	0.11	0.00	0.15	0.00	0.02	0.02
Queue Length 95th (ft)	3	0	0	0	0	2	1
Control Delay (s)	7.9	0.0	7.6	0.0	9.3	11.0	9.5
Lane LOS	A		A		A	B	A
Approach Delay (s)	1.5		0.1		9.3	10.2	
Approach LOS					A	B	

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	34.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	18	3	39	43	3	12	27	209	39	8	160	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	22	4	47	52	4	14	33	252	47	10	193	11
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								480				
pX, platoon unblocked												
vC, conflicting volume	435	591	112	515	573	159	209			304		
vC1, stage 1 conf vol	222	222		345	345							
vC2, stage 2 conf vol	212	369		169	228							
vCu, unblocked vol	435	591	112	515	573	159	209			304		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	99	95	91	99	98	98			99		
cM capacity (veh/h)	633	543	912	563	550	850	1354			1249		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	72	70	33	168	131	10	129	75
Volume Left	22	52	33	0	0	10	0	0
Volume Right	47	14	0	0	47	0	0	11
cSH	782	605	1354	1700	1700	1249	1700	1700
Volume to Capacity	0.09	0.12	0.02	0.10	0.08	0.01	0.08	0.04
Queue Length 95th (ft)	8	10	2	0	0	1	0	0
Control Delay (s)	10.1	11.7	7.7	0.0	0.0	7.9	0.0	0.0
Lane LOS	B	B	A			A		
Approach Delay (s)	10.1	11.7	0.8			0.4		
Approach LOS	B	B						

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	29.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	1	23	26	3	12	23	308	20	24	126	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	7	1	24	27	3	12	24	321	21	25	131	9
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								456				
pX, platoon unblocked												
vC, conflicting volume	418	586	80	529	580	181	146			347		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	418	586	80	529	580	181	146			347		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	97	93	99	98	98			98		
cM capacity (veh/h)	486	402	956	403	405	824	1428			1204		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	8	24	27	16	24	214	128	25	88	53
Volume Left	7	0	27	0	24	0	0	25	0	0
Volume Right	0	24	0	12	0	0	21	0	0	9
cSH	480	928	403	683	1428	1700	1700	1204	1700	1700
Volume to Capacity	0.02	0.03	0.07	0.02	0.02	0.13	0.08	0.02	0.05	0.03
Queue Length 95th (ft)	1	2	5	2	1	0	0	2	0	0
Control Delay (s)	12.6	9.0	14.6	10.4	7.6	0.0	0.0	8.1	0.0	0.0
Lane LOS	B	A	B	B	A			A		
Approach Delay (s)	9.9		13.0		0.5			1.2		
Approach LOS	A		B							

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	32.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	560	161	12	556	0	1	0	0	527	0	323
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.5	4.5	3.5	4.5		4.0			4.0		4.0
Lane Util. Factor		0.91	1.00	1.00	0.91		1.00			0.97		1.00
Frpb, ped/bikes		1.00	0.98	1.00	1.00		1.00			1.00		1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00			1.00		1.00
Frt		1.00	0.85	1.00	1.00		1.00			1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95			0.95		1.00
Satd. Flow (prot)		5085	1495	1770	5085		1770			3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.95			0.95		1.00
Satd. Flow (perm)		5085	1495	1770	5085		1770			3433		1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	583	168	12	579	0	1	0	0	549	0	336
RTOR Reduction (vph)	0	0	96	0	0	0	0	0	0	0	0	177
Lane Group Flow (vph)	0	583	72	12	579	0	1	0	0	549	0	159
Confl. Peds. (#/hr)			4			4						
Turn Type		NA	Perm	Prot	NA		Prot		Prot	Prot		Perm
Protected Phases		2		1	6		3		3	4		
Permitted Phases			2									4
Actuated Green, G (s)		64.6	64.6	2.7	70.8		1.2			65.5		65.5
Effective Green, g (s)		64.6	64.6	2.7	70.8		1.2			65.5		65.5
Actuated g/C Ratio		0.43	0.43	0.02	0.47		0.01			0.44		0.44
Clearance Time (s)		4.5	4.5	3.5	4.5		4.0			4.0		4.0
Vehicle Extension (s)		4.0	4.0	2.0	4.0		3.0			2.0		2.0
Lane Grp Cap (vph)		2189	643	31	2400		14			1499		691
v/s Ratio Prot		c0.11		c0.01	0.11		c0.00			c0.16		
v/s Ratio Perm			0.05									0.10
v/c Ratio		0.27	0.11	0.39	0.24		0.07			0.37		0.23
Uniform Delay, d1		27.5	25.5	72.8	23.6		73.8			28.3		26.5
Progression Factor		0.36	0.24	1.09	0.89		1.00			1.00		1.00
Incremental Delay, d2		0.3	0.3	2.9	0.2		2.2			0.1		0.1
Delay (s)		10.2	6.6	82.2	21.2		76.0			28.4		26.5
Level of Service		B	A	F	C		E			C		C
Approach Delay (s)		9.4			22.4			76.0			27.7	
Approach LOS		A			C			E			C	

Intersection Summary			
HCM 2000 Control Delay	20.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	850	0	0	717	622	164	14	239	1	0	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.86			0.91	1.00	0.95	0.95	0.88	1.00		1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	1.00	1.00	1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (prot)	1770	6408			5085	1550	1681	1698	2787	1770		1583
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (perm)	1770	6408			5085	1550	1681	1698	2787	1770		1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	12	904	0	0	763	662	174	15	254	1	0	9
RTOR Reduction (vph)	0	0	0	0	0	172	0	0	230	0	0	9
Lane Group Flow (vph)	12	904	0	0	763	490	94	95	24	1	0	0
Confl. Peds. (#/hr)			4			4						
Turn Type	Prot	NA			NA	Perm	Split	NA	Perm	Prot		Perm
Protected Phases	5	2			6		3	3		4		
Permitted Phases						6			3			4
Actuated Green, G (s)	2.9	118.0			111.1	111.1	14.2	14.2	14.2	2.8		2.8
Effective Green, g (s)	2.9	118.0			111.1	111.1	14.2	14.2	14.2	2.8		2.8
Actuated g/C Ratio	0.02	0.79			0.74	0.74	0.09	0.09	0.09	0.02		0.02
Clearance Time (s)	4.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Vehicle Extension (s)	2.0	4.0			2.0	2.0	2.0	2.0	2.0	4.0		4.0
Lane Grp Cap (vph)	34	5040			3766	1148	159	160	263	33		29
v/s Ratio Prot	c0.01	0.14			0.15		0.06	c0.06		c0.00		
v/s Ratio Perm						c0.32			0.01			0.00
v/c Ratio	0.35	0.18			0.20	0.43	0.59	0.59	0.09	0.03		0.01
Uniform Delay, d1	72.6	4.0			5.9	7.4	65.1	65.1	62.0	72.3		72.2
Progression Factor	1.11	0.44			0.72	6.29	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.2	0.1			0.1	1.1	3.9	3.9	0.1	0.5		0.1
Delay (s)	82.6	1.8			4.4	47.5	69.0	69.0	62.1	72.8		72.3
Level of Service	F	A			A	D	E	E	E	E		E
Approach Delay (s)		2.9			24.4			65.0			72.4	
Approach LOS		A			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	167	614	312	79	839	56	349	125	104	38	82	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1559	1770	5030		3433	1863	1552	1610	3383	1557
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1559	1770	5030		3433	1863	1552	1610	3383	1557
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	178	653	332	84	893	60	371	133	111	40	87	151
RTOR Reduction (vph)	0	0	106	0	3	0	0	0	93	0	0	79
Lane Group Flow (vph)	178	653	226	84	950	0	371	133	18	36	91	72
Confl. Peds. (#/hr)			7			6			7			13
Confl. Bikes (#/hr)						3						3
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	Perm	Split	NA	pm+ov
Protected Phases	5	2	3	1	6		3	3		4	4	5
Permitted Phases			2						3			4
Actuated Green, G (s)	11.6	78.3	102.0	11.2	77.9		23.7	23.7	23.7	16.8	16.8	28.4
Effective Green, g (s)	11.6	78.3	102.0	11.2	77.9		23.7	23.7	23.7	16.8	16.8	28.4
Actuated g/C Ratio	0.08	0.52	0.68	0.07	0.52		0.16	0.16	0.16	0.11	0.11	0.19
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	1.5	1.5	1.0	1.0	1.0
Lane Grp Cap (vph)	265	1847	1112	132	2612		542	294	245	180	378	294
v/s Ratio Prot	c0.05	0.18	0.03	c0.05	c0.19		c0.11	0.07		0.02	0.03	c0.02
v/s Ratio Perm			0.11						0.01			0.03
v/c Ratio	0.67	0.35	0.20	0.64	0.36		0.68	0.45	0.07	0.20	0.24	0.25
Uniform Delay, d1	67.3	21.0	8.9	67.4	21.4		59.6	57.3	53.8	60.5	60.8	51.7
Progression Factor	0.95	0.97	2.32	0.82	0.48		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.5	0.0	6.7	0.4		2.9	0.4	0.0	0.2	0.1	0.2
Delay (s)	69.2	20.9	20.7	61.8	10.7		62.5	57.7	53.8	60.7	60.9	51.9
Level of Service	E	C	C	E	B		E	E	D	E	E	D
Approach Delay (s)		28.2			14.8			59.9			56.0	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: State Farm Dr & Rohnert Park Expressway

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	89	581	33	158	869	173	100	65	101	47	32	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1548	1770	3539	1560	1610	3321	1553	1610	3065	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1548	1770	3539	1560	1610	3321	1553	1610	3065	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	94	612	35	166	915	182	105	68	106	49	34	51
RTOR Reduction (vph)	0	0	18	0	0	55	0	0	94	0	45	0
Lane Group Flow (vph)	94	612	17	166	915	127	57	116	12	44	45	0
Confl. Peds. (#/hr)			8			2			5			2
Confl. Bikes (#/hr)									1			1
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			6			3			
Actuated Green, G (s)	11.8	74.8	74.8	21.0	84.0	84.0	17.2	17.2	17.2	17.0	17.0	
Effective Green, g (s)	11.8	74.8	74.8	21.0	84.0	84.0	17.2	17.2	17.2	17.0	17.0	
Actuated g/C Ratio	0.08	0.50	0.50	0.14	0.56	0.56	0.11	0.11	0.11	0.11	0.11	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)	139	1764	771	247	1981	873	184	380	178	182	347	
v/s Ratio Prot	0.05	0.17		c0.09	c0.26		c0.04	0.03		c0.03	0.01	
v/s Ratio Perm			0.01			0.08			0.01			
v/c Ratio	0.68	0.35	0.02	0.67	0.46	0.15	0.31	0.31	0.07	0.24	0.13	
Uniform Delay, d1	67.2	22.8	19.1	61.2	19.6	15.8	61.0	60.9	59.3	60.6	59.8	
Progression Factor	0.87	1.11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.05	
Incremental Delay, d2	9.4	0.5	0.1	5.6	0.8	0.4	0.4	0.2	0.1	0.3	0.1	
Delay (s)	68.0	25.9	19.1	66.8	20.4	16.2	61.3	61.1	59.3	62.4	62.6	
Level of Service	E	C	B	E	C	B	E	E	E	E	E	
Approach Delay (s)		30.9			25.9			60.5			62.6	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Commerce Blvd & Enterprise Dr

3/31/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	54	24	446	53	19	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	0.98	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3433	1547	3477		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3433	1547	3477		1770	3539
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	56	25	465	55	20	301
RTOR Reduction (vph)	0	22	13	0	0	0
Lane Group Flow (vph)	56	3	507	0	20	301
Confl. Peds. (#/hr)		5		5		
Confl. Bikes (#/hr)		5		5		
Turn Type	Prot	Perm	NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	3.1	3.1	10.8		0.3	15.1
Effective Green, g (s)	3.1	3.1	10.8		0.3	15.1
Actuated g/C Ratio	0.12	0.12	0.41		0.01	0.58
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	406	183	1433		20	2039
v/s Ratio Prot	c0.02		c0.15		c0.01	0.09
v/s Ratio Perm		0.00				
v/c Ratio	0.14	0.02	0.35		1.00	0.15
Uniform Delay, d1	10.4	10.2	5.3		12.9	2.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.0	0.2		201.2	0.0
Delay (s)	10.5	10.2	5.5		214.2	2.6
Level of Service	B	B	A		F	A
Approach Delay (s)	10.4		5.5			15.8
Approach LOS	B		A			B

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	26.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	28.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	13	63	0	3	92	89	1	2	0	49	0	4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	14	69	0	3	101	98	1	2	0	54	0	4

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	49	35	54	148	3	58
Volume Left (vph)	14	0	3	0	1	54
Volume Right (vph)	0	0	0	98	0	4
Hadj (s)	0.18	0.03	0.06	-0.43	0.10	0.17
Departure Headway (s)	5.0	4.8	4.8	4.3	4.7	4.7
Degree Utilization, x	0.07	0.05	0.07	0.18	0.00	0.08
Capacity (veh/h)	708	723	740	818	717	718
Control Delay (s)	7.1	6.9	7.0	7.0	7.7	8.1
Approach Delay (s)	7.0		7.0		7.7	8.1
Approach LOS	A		A		A	A

Intersection Summary			
Delay	7.2		
Level of Service	A		
Intersection Capacity Utilization	25.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Enterprise Dr & State Farm Dr

3/31/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	45	61	109	207	94	61
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	51	69	122	233	106	69

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	51	69	82	273	106	69
Volume Left (vph)	51	0	0	0	106	0
Volume Right (vph)	0	0	0	233	0	69
Hadj (s)	0.53	0.03	0.03	-0.56	0.53	-0.67
Departure Headway (s)	5.9	5.4	5.2	4.6	6.1	4.9
Degree Utilization, x	0.08	0.10	0.12	0.35	0.18	0.09
Capacity (veh/h)	582	640	668	763	556	681
Control Delay (s)	8.2	7.8	7.7	8.8	9.2	7.2
Approach Delay (s)	8.0		8.5		8.4	
Approach LOS	A		A		A	

Intersection Summary					
Delay		8.4			
Level of Service		A			
Intersection Capacity Utilization		30.3%	ICU Level of Service		A
Analysis Period (min)		15			

HCM Unsignalized Intersection Capacity Analysis
16: Enterprise Dr/Seed Farm Dr

3/31/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	2	143	274	1	2	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	159	304	1	2	1
Pedestrians		5	5		5	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	311				478	315
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	311				478	315
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1245				540	719

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	161	306	3
Volume Left	2	0	2
Volume Right	0	1	1
cSH	1245	1700	589
Volume to Capacity	0.00	0.18	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.1	0.0	11.1
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.1
Approach LOS			B

Intersection Summary					
Average Delay		0.1			
Intersection Capacity Utilization		26.0%	ICU Level of Service		A
Analysis Period (min)		15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	35	0	8	0	0	1	19	225	0	1	175	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	0	9	0	0	1	21	245	0	1	190	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											561	
pX, platoon unblocked												
vC, conflicting volume	365	486	103	392	495	122	207			245		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	365	486	103	392	495	122	207			245		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	100	99	100	100	100	98			100		
cM capacity (veh/h)	558	472	932	530	467	906	1362			1319		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	47	1	21	163	82	1	127	80
Volume Left	38	0	21	0	0	1	0	0
Volume Right	9	1	0	0	0	0	0	16
cSH	603	906	1362	1700	1700	1319	1700	1700
Volume to Capacity	0.08	0.00	0.02	0.10	0.05	0.00	0.07	0.05
Queue Length 95th (ft)	6	0	1	0	0	0	0	0
Control Delay (s)	11.5	9.0	7.7	0.0	0.0	7.7	0.0	0.0
Lane LOS	B	A	A			A		
Approach Delay (s)	11.5	9.0	0.6			0.0		
Approach LOS	B	A						

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	28.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis

1: US 101 South Ramps & Golf Course Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰↰	↑↑					↰	↰↑	↱
Volume (vph)	0	618	212	148	390	0	0	0	0	420	165	485
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00					1.00	1.00	0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (prot)		3539	1532	3433	3539					1681	1731	1540
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (perm)		3539	1532	3433	3539					1681	1731	1540
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	637	219	153	402	0	0	0	0	433	170	500
RTOR Reduction (vph)	0	0	102	0	0	0	0	0	0	0	0	252
Lane Group Flow (vph)	0	637	117	153	402	0	0	0	0	299	304	248
Confl. Peds. (#/hr)			10									10
Confl. Bikes (#/hr)			10									10
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		6		5	2					8	8	
Permitted Phases			6									8
Actuated Green, G (s)		58.9	58.9	9.3	71.2					31.8	31.8	31.8
Effective Green, g (s)		58.9	58.9	9.3	71.2					31.8	31.8	31.8
Actuated g/C Ratio		0.54	0.54	0.08	0.65					0.29	0.29	0.29
Clearance Time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Vehicle Extension (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Grp Cap (vph)		1894	820	290	2290					485	500	445
v/s Ratio Prot		c0.18		c0.04	0.11					c0.18	0.18	
v/s Ratio Perm			0.08									0.16
v/c Ratio		0.34	0.14	0.53	0.18					0.62	0.61	0.56
Uniform Delay, d1		14.5	12.9	48.2	7.7					33.8	33.7	33.1
Progression Factor		0.54	0.47	1.00	1.00					1.00	1.00	1.00
Incremental Delay, d2		0.4	0.3	0.8	0.2					1.6	1.4	0.9
Delay (s)		8.3	6.3	49.0	7.9					35.5	35.2	34.0
Level of Service		A	A	D	A					D	D	C
Approach Delay (s)		7.8			19.2			0.0			34.7	
Approach LOS		A			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	22.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

2: Commerce Blvd & Golf Course Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↱	↰↰	↑↱		↰↰	↑	↱	↰	↱	
Volume (vph)	26	569	410	289	311	77	242	174	478	183	198	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	13	12	12	12
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.0	4.5	4.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.95		0.97	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	0.99		1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1562	3433	3403		3433	1863	1619	1770	1840	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1562	3433	3403		3433	1863	1619	1770	1840	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	27	593	427	301	324	80	252	181	498	191	206	15
RTOR Reduction (vph)	0	0	215	0	16	0	0	0	214	0	2	0
Lane Group Flow (vph)	27	593	212	301	388	0	252	181	284	191	219	0
Confl. Peds. (#/hr)			10			10						10
Confl. Bikes (#/hr)			10			10			10			10
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	1	6	4	5	2		4	4	5	3	3	
Permitted Phases			6						4			
Actuated Green, G (s)	2.5	19.8	33.8	11.9	29.2		14.0	14.0	25.9	16.6	16.6	
Effective Green, g (s)	2.5	19.8	33.8	11.9	29.2		14.0	14.0	25.9	16.6	16.6	
Actuated g/C Ratio	0.03	0.25	0.42	0.15	0.37		0.18	0.18	0.32	0.21	0.21	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.0	4.5	4.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	55	1261	661	511	1245		602	326	525	368	382	
v/s Ratio Prot	0.02	c0.12	0.06	c0.09	0.11		0.07	c0.10	0.08	0.11	c0.12	
v/s Ratio Perm			0.08						0.09			
v/c Ratio	0.49	0.47	0.32	0.59	0.31		0.42	0.56	0.54	0.52	0.57	
Uniform Delay, d1	38.0	25.5	15.3	31.7	18.1		29.3	30.1	22.1	28.1	28.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	0.1	0.1	1.1	0.1		0.2	1.2	0.6	0.5	1.3	
Delay (s)	40.5	25.6	15.4	32.8	18.2		29.5	31.2	22.7	28.6	29.7	
Level of Service	D	C	B	C	B		C	C	C	C	C	
Approach Delay (s)		21.9			24.4			26.2			29.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	24.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	79.8	Sum of lost time (s)	17.5
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

3: Commerce Blvd & US 101 North Ramps

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	411	0	15	3	4	1	254	450	1	4	409	461
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		0.98		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.98		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1793	1681	1794		1759		1770	3538		1770	3539	1546
Flt Permitted	0.95	0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1793	1681	1794		1759		1770	3538		1770	3539	1546
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	433	0	16	3	4	1	267	474	1	4	431	485
RTOR Reduction (vph)	0	0	9	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	216	217	7	0	7	0	267	475	0	4	431	485
Confl. Peds. (#/hr)						10			10			
Confl. Bikes (#/hr)									10			10
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA		Prot	NA	Free
Protected Phases	8	8	1	7	7		1	6		5	2	
Permitted Phases			8									Free
Actuated Green, G (s)	11.5	11.5	23.3		0.6		11.8	27.6		0.6	16.4	54.3
Effective Green, g (s)	11.5	11.5	23.3		0.6		11.8	27.6		0.6	16.4	54.3
Actuated g/C Ratio	0.21	0.21	0.43		0.01		0.22	0.51		0.01	0.30	1.00
Clearance Time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0		2.0		2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	379	356	769		19		384	1798		19	1068	1546
v/s Ratio Prot	0.12	c0.13	0.00		0.00		c0.15	0.13		0.00	c0.12	
v/s Ratio Perm			0.00									c0.31
v/c Ratio	0.57	0.61	0.01		0.37		0.70	0.26		0.21	0.40	0.31
Uniform Delay, d1	19.2	19.4	8.9		26.7		19.6	7.6		26.6	15.1	0.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.2	2.0	0.0		4.4		4.4	0.1		2.0	0.3	0.5
Delay (s)	20.4	21.4	8.9		31.0		24.0	7.7		28.6	15.4	0.5
Level of Service	C	C	A		C		C	A		C	B	A
Approach Delay (s)		20.5			31.0			13.5			7.6	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	54.3	Sum of lost time (s)	14.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

4: Commerce Blvd & State Farm Dr

3/31/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	17	343	389	9	182	261
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	19	390	442	10	207	297
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1157	447			452	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1157	447			452	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	36			81	
cM capacity (veh/h)	176	611			1108	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	409	452	207	297
Volume Left	19	0	207	0
Volume Right	390	10	0	0
cSH	548	1700	1108	1700
Volume to Capacity	0.75	0.27	0.19	0.17
Queue Length 95th (ft)	161	0	17	0
Control Delay (s)	28.5	0.0	9.0	0.0
Lane LOS	D		A	
Approach Delay (s)	28.5	0.0	3.7	
Approach LOS	D			

Intersection Summary			
Average Delay	9.9		
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

5: State Farm Dr & Professional Center Dr

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	9	12	30	39	9	31	56	246	22	13	213	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	11	15	37	48	11	38	68	300	27	16	260	20
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	631	765	140	655	761	163	279			327		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	631	765	140	655	761	163	279			327		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	95	96	85	96	96	95			99		
cM capacity (veh/h)	323	310	883	308	312	852	1280			1230		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	11	51	96	68	200	127	16	173	106
Volume Left	11	0	48	68	0	0	16	0	0
Volume Right	0	37	38	0	0	27	0	0	20
cSH	323	578	412	1280	1700	1700	1230	1700	1700
Volume to Capacity	0.03	0.09	0.23	0.05	0.12	0.07	0.01	0.10	0.06
Queue Length 95th (ft)	3	7	22	4	0	0	1	0	0
Control Delay (s)	16.5	11.8	16.4	8.0	0.0	0.0	8.0	0.0	0.0
Lane LOS	C	B	C	A			A		
Approach Delay (s)	12.7		16.4	1.4			0.4		
Approach LOS	B		C						

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	32.0%	ICU Level of Service	A
Analysis Period (min)	15		

6: Commerce Blvd & Professional Center Dr

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	279	4	6	313	33	1	0	8	65	1	59
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	15	340	5	7	382	40	1	0	10	79	1	72
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			TWLTL							
Median storage veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	422			345			841	809	343	796	791	402
vC1, stage 1 conf vol							372	372		416	416	
vC2, stage 2 conf vol							469	437		379	374	
vCu, unblocked vol	422			345			841	809	343	796	791	402
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	100	99	84	100	89
cM capacity (veh/h)	1137			1214			435	480	700	496	490	648

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	15	345	7	422	11	79	73
Volume Left	15	0	7	0	1	79	0
Volume Right	0	5	0	40	10	0	72
cSH	1137	1700	1214	1700	656	496	645
Volume to Capacity	0.01	0.20	0.01	0.25	0.02	0.16	0.11
Queue Length 95th (ft)	1	0	0	0	1	14	10
Control Delay (s)	8.2	0.0	8.0	0.0	10.6	13.6	11.3
Lane LOS	A		A		B	B	B
Approach Delay (s)	0.3		0.1		10.6	12.5	
Approach LOS					B	B	

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	35.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Commerce Blvd & Padre Pkwy

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	5	36	118	4	38	36	318	122	35	341	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	7	6	40	133	4	43	40	357	137	39	383	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								480				
pX, platoon unblocked												
vC, conflicting volume	769	1040	194	820	974	247	389			494		
vC1, stage 1 conf vol	465	465		507	507							
vC2, stage 2 conf vol	304	575		313	467							
vCu, unblocked vol	769	1040	194	820	974	247	389			494		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	99	95	68	99	94	97			96		
cM capacity (veh/h)	440	383	814	421	407	753	1166			1066		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	53	180	40	238	256	39	255	133
Volume Left	7	133	40	0	0	39	0	0
Volume Right	40	43	0	0	137	0	0	6
cSH	663	470	1166	1700	1700	1066	1700	1700
Volume to Capacity	0.08	0.38	0.03	0.14	0.15	0.04	0.15	0.08
Queue Length 95th (ft)	6	44	3	0	0	3	0	0
Control Delay (s)	10.9	17.3	8.2	0.0	0.0	8.5	0.0	0.0
Lane LOS	B	C	A			A		
Approach Delay (s)	10.9	17.3	0.6			0.8		
Approach LOS	B	C						

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	22	10	112	79	6	25	55	222	27	24	370	29
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	24	11	124	88	7	28	61	247	30	27	411	32
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								456				
pX, platoon unblocked												
vC, conflicting volume	757	879	222	773	881	138	443			277		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	757	879	222	773	881	138	443			277		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	96	84	60	97	97	95			98		
cM capacity (veh/h)	266	263	782	222	263	885	1113			1283		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	30	130	88	34	61	164	112	27	274	169
Volume Left	24	0	88	0	61	0	0	27	0	0
Volume Right	0	124	0	28	0	0	30	0	0	32
cSH	265	721	222	607	1113	1700	1700	1283	1700	1700
Volume to Capacity	0.11	0.18	0.40	0.06	0.05	0.10	0.07	0.02	0.16	0.10
Queue Length 95th (ft)	9	16	44	5	4	0	0	2	0	0
Control Delay (s)	20.3	11.1	31.5	11.3	8.4	0.0	0.0	7.9	0.0	0.0
Lane LOS	C	B	D	B	A			A		
Approach Delay (s)	12.8		25.8		1.5			0.4		
Approach LOS	B		D							

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: US 101 SB Ramps & Rohnert Park Expressway

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1123	321	37	943	0	4	0	19	721	0	287
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.5	4.5	3.5	4.5		4.0		4.0	4.0		4.0
Lane Util. Factor		0.91	1.00	1.00	0.91		1.00		1.00	0.97		1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)		5085	1531	1770	5085		1770		1583	3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (perm)		5085	1531	1770	5085		1770		1583	3433		1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	1170	334	39	982	0	4	0	20	751	0	299
RTOR Reduction (vph)	0	0	95	0	0	0	0	0	19	0	0	119
Lane Group Flow (vph)	0	1170	239	39	982	0	4	0	1	751	0	180
Turn Type		NA	Perm	Prot	NA		Prot		Prot	Prot		Perm
Protected Phases		2		1	6		3		3	4		
Permitted Phases			2									4
Actuated Green, G (s)		79.3	79.3	6.8	89.6		3.8		3.8	44.1		44.1
Effective Green, g (s)		79.3	79.3	6.8	89.6		3.8		3.8	44.1		44.1
Actuated g/C Ratio		0.53	0.53	0.05	0.60		0.03		0.03	0.29		0.29
Clearance Time (s)		4.5	4.5	3.5	4.5		4.0		4.0	4.0		4.0
Vehicle Extension (s)		4.0	4.0	2.0	4.0		3.0		3.0	2.0		2.0
Lane Grp Cap (vph)		2688	809	80	3037		44		40	1009		465
v/s Ratio Prot		c0.23		c0.02	0.19		c0.00		0.00	c0.22		
v/s Ratio Perm			0.16									0.11
v/c Ratio		0.44	0.30	0.49	0.32		0.09		0.01	0.74		0.39
Uniform Delay, d1		21.6	19.7	69.9	15.1		71.4		71.3	47.9		42.2
Progression Factor		1.00	1.00	1.07	0.66		1.00		1.00	1.00		1.00
Incremental Delay, d2		0.5	0.9	1.6	0.3		0.9		0.1	2.6		0.2
Delay (s)		22.2	20.7	76.4	10.2		72.3		71.4	50.5		42.4
Level of Service		C	C	E	B		E		E	D		D
Approach Delay (s)		21.8			12.7			71.6			48.2	
Approach LOS		C			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: US 101 NB Ramps & Rohnert Park Expressway

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	43	1410	0	0	947	491	297	18	339	11	0	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0			6.0	6.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.86			0.91	1.00	0.95	0.95	0.88	1.00		1.00
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (prot)	1770	6408			5085	1583	1681	1695	2787	1770		1583
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (perm)	1770	6408			5085	1583	1681	1695	2787	1770		1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	45	1469	0	0	986	511	309	19	353	11	0	15
RTOR Reduction (vph)	0	0	0	0	0	183	0	0	138	0	0	15
Lane Group Flow (vph)	45	1469	0	0	986	328	164	164	215	11	0	0
Turn Type	Prot	NA			NA	Perm	Split	NA	Perm	Prot		Perm
Protected Phases	5	2			6		3	3		4		
Permitted Phases						6			3			4
Actuated Green, G (s)	7.3	108.7			96.4	96.4	21.8	21.8	21.8	3.5		3.5
Effective Green, g (s)	7.3	108.7			96.4	96.4	21.8	21.8	21.8	3.5		3.5
Actuated g/C Ratio	0.05	0.72			0.64	0.64	0.15	0.15	0.15	0.02		0.02
Clearance Time (s)	5.0	6.0			6.0	6.0	5.0	5.0	5.0	5.0		5.0
Vehicle Extension (s)	2.0	4.0			4.0	4.0	2.0	2.0	2.0	2.0		2.0
Lane Grp Cap (vph)	86	4643			3267	1017	244	246	405	41		36
v/s Ratio Prot	c0.03	c0.23			0.19		c0.10	0.10		c0.01		
v/s Ratio Perm						0.21			0.08			0.00
v/c Ratio	0.52	0.32			0.30	0.32	0.67	0.67	0.53	0.27		0.01
Uniform Delay, d1	69.7	7.4			11.9	12.1	60.7	60.7	59.4	72.0		71.6
Progression Factor	1.15	1.37			0.66	2.33	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.3	0.2			0.2	0.8	5.6	5.2	0.6	1.3		0.0
Delay (s)	82.1	10.2			8.0	28.9	66.3	65.9	59.9	73.3		71.6
Level of Service	F	B			A	C	E	E	E	E		E
Approach Delay (s)		12.4			15.1			62.9			72.3	
Approach LOS		B			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	23.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	184	913	693	174	718	30	496	205	245	81	199	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1556	1770	5050		3433	1863	1547	1610	3384	1562
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1556	1770	5050		3433	1863	1547	1610	3384	1562
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	192	951	722	181	748	31	517	214	255	84	207	224
RTOR Reduction (vph)	0	0	139	0	2	0	0	0	203	0	0	70
Lane Group Flow (vph)	192	951	583	181	777	0	517	214	52	76	215	154
Confl. Peds. (#/hr)			13			10			5			7
Confl. Bikes (#/hr)						2			5			2
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	Perm	Split	NA	pm+ov
Protected Phases	5	2	3	1	6		3	3		4	4	5
Permitted Phases			2						3			4
Actuated Green, G (s)	11.0	57.4	87.8	23.6	70.0		30.4	30.4	30.4	18.6	18.6	29.6
Effective Green, g (s)	11.0	57.4	87.8	23.6	70.0		30.4	30.4	30.4	18.6	18.6	29.6
Actuated g/C Ratio	0.07	0.38	0.59	0.16	0.47		0.20	0.20	0.20	0.12	0.12	0.20
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	1.5	1.5	1.0	1.0	1.0
Lane Grp Cap (vph)	251	1354	962	278	2356		695	377	313	199	419	308
v/s Ratio Prot	0.06	c0.27	c0.12	c0.10	0.15		c0.15	0.11		0.05	c0.06	0.04
v/s Ratio Perm			0.25						0.03			0.06
v/c Ratio	0.76	0.70	0.61	0.65	0.33		0.74	0.57	0.17	0.38	0.51	0.50
Uniform Delay, d1	68.2	39.1	20.0	59.3	25.2		56.1	53.9	49.3	60.4	61.5	53.6
Progression Factor	0.79	0.65	1.13	1.12	1.29		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.3	2.9	0.7	3.7	0.3		3.8	1.2	0.1	0.4	0.4	0.5
Delay (s)	65.5	28.5	23.3	70.2	32.9		59.9	55.1	49.4	60.9	61.9	54.1
Level of Service	E	C	C	E	C		E	E	D	E	E	D
Approach Delay (s)		30.3			39.9			56.2			58.3	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	41.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: State Farm Dr & Rohnert Park Expressway

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	119	768	88	222	748	81	159	98	182	205	157	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.99	
Satd. Flow (prot)	1770	3539	1539	1770	3539	1553	1610	3318	1548	1610	3152	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.99	
Satd. Flow (perm)	1770	3539	1539	1770	3539	1553	1610	3318	1548	1610	3152	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	135	873	100	252	850	92	181	111	207	233	178	141
RTOR Reduction (vph)	0	0	67	0	0	47	0	0	182	0	64	0
Lane Group Flow (vph)	135	873	33	252	850	45	96	196	25	186	302	0
Confl. Peds. (#/hr)			12			5			10			4
Confl. Bikes (#/hr)			1			1						1
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			6			3			
Actuated Green, G (s)	16.4	48.9	48.9	36.2	68.7	68.7	18.2	18.2	18.2	26.7	26.7	
Effective Green, g (s)	16.4	48.9	48.9	36.2	68.7	68.7	18.2	18.2	18.2	26.7	26.7	
Actuated g/C Ratio	0.11	0.33	0.33	0.24	0.46	0.46	0.12	0.12	0.12	0.18	0.18	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)	193	1153	501	427	1620	711	195	402	187	286	561	
v/s Ratio Prot	c0.08	c0.25		c0.14	0.24		c0.06	0.06		c0.12	0.10	
v/s Ratio Perm			0.02			0.03			0.02			
v/c Ratio	0.70	0.76	0.07	0.59	0.52	0.06	0.49	0.49	0.13	0.65	0.54	
Uniform Delay, d1	64.4	45.2	34.8	50.3	29.0	22.7	61.6	61.5	58.9	57.3	56.0	
Progression Factor	1.44	0.43	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.9	3.7	0.2	1.5	1.2	0.2	0.7	0.3	0.1	4.0	0.5	
Delay (s)	99.7	23.3	3.5	51.8	30.2	22.9	62.3	61.9	59.0	61.3	56.5	
Level of Service	F	C	A	D	C	C	E	E	E	E	E	
Approach Delay (s)		30.9			34.2			60.8			58.1	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	41.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Commerce Blvd & Enterprise Dr 3/31/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	150	52	586	69	42	651
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3433	1583	3484		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3433	1583	3484		1770	3539
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	160	55	623	73	45	693
RTOR Reduction (vph)	0	44	12	0	0	0
Lane Group Flow (vph)	160	11	684	0	45	693
Turn Type	Prot	Perm	NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	7.4	7.4	15.8		1.1	20.9
Effective Green, g (s)	7.4	7.4	15.8		1.1	20.9
Actuated g/C Ratio	0.20	0.20	0.44		0.03	0.58
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	699	322	1516		53	2037
v/s Ratio Prot	c0.05		c0.20		c0.03	0.20
v/s Ratio Perm		0.01				
v/c Ratio	0.23	0.03	0.45		0.85	0.34
Uniform Delay, d1	12.1	11.6	7.2		17.5	4.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.0	0.2		70.0	0.1
Delay (s)	12.2	11.6	7.4		87.5	4.2
Level of Service	B	B	A		F	A
Approach Delay (s)	12.1		7.4			9.2
Approach LOS	B		A			A

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	36.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	36.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr 3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	115	2	7	149	106	2	3	0	176	2	30
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	121	2	7	157	112	2	3	0	185	2	32

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	63	63	86	190	5	219
Volume Left (vph)	2	0	7	0	2	185
Volume Right (vph)	0	2	0	112	0	32
Hadj (s)	0.05	0.01	0.08	-0.38	0.11	0.12
Departure Headway (s)	5.4	5.4	5.3	4.9	5.3	4.9
Degree Utilization, x	0.09	0.09	0.13	0.26	0.01	0.30
Capacity (veh/h)	622	631	645	709	620	685
Control Delay (s)	7.8	7.8	7.9	8.3	8.3	10.1
Approach Delay (s)	7.8		8.2		8.3	10.1
Approach LOS	A		A		A	B

Intersection Summary			
Delay	8.8		
Level of Service	A		
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Enterprise Dr & State Farm Dr

3/31/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	84	193	134	197	381	129
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	90	208	144	212	410	139

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	90	208	96	260	410	139
Volume Left (vph)	90	0	0	0	410	0
Volume Right (vph)	0	0	0	212	0	139
Hadj (s)	0.53	0.03	0.03	-0.54	0.53	-0.67
Departure Headway (s)	7.4	6.9	6.8	6.3	6.9	5.7
Degree Utilization, x	0.19	0.40	0.18	0.45	0.78	0.22
Capacity (veh/h)	460	498	497	550	512	609
Control Delay (s)	10.9	13.1	10.2	13.1	29.1	9.1
Approach Delay (s)	12.4		12.3		24.0	
Approach LOS	B		B		C	

Intersection Summary			
Delay	17.7		
Level of Service	C		
Intersection Capacity Utilization	45.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
16: Enterprise Dr/Seed Farm Dr

3/31/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	1	529	281	0	1	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	575	305	0	1	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	305				883	305
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	305				883	305
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1255				316	734

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	576	305	1
Volume Left	1	0	1
Volume Right	0	0	0
cSH	1255	1700	316
Volume to Capacity	0.00	0.18	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	16.4
Lane LOS	A		C
Approach Delay (s)	0.0	0.0	16.4
Approach LOS			C

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	128	0	58	0	0	0	28	287	1	2	416	85
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	139	0	63	0	0	0	30	312	1	2	452	92
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											575	
pX, platoon unblocked												
vC, conflicting volume	720	877	272	667	922	157	545			313		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	720	877	272	667	922	157	545			313		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	55	100	91	100	100	100	97			100		
cM capacity (veh/h)	308	277	725	307	260	861	1021			1244		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	202	0	30	208	105	2	301	243
Volume Left	139	0	30	0	0	2	0	0
Volume Right	63	0	0	0	1	0	0	92
cSH	375	1700	1021	1700	1700	1244	1700	1700
Volume to Capacity	0.54	0.00	0.03	0.12	0.06	0.00	0.18	0.14
Queue Length 95th (ft)	77	0	2	0	0	0	0	0
Control Delay (s)	25.2	0.0	8.6	0.0	0.0	7.9	0.0	0.0
Lane LOS	D	A	A			A		
Approach Delay (s)	25.2	0.0	0.8			0.0		
Approach LOS	D	A						

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix B

Future Intersection LOS Calculations

HCM Signalized Intersection Capacity Analysis
1: US 101 South Ramps & Golf Course Drive West/Golf Course Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	454	259	297	837	0	0	0	0	389	133	521
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	0.97	0.95					1.00	0.95	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.91	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3539	1583	3433	3539					1770	1609	1504
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3539	1583	3433	3539					1770	1609	1504
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	478	273	313	881	0	0	0	0	409	140	548
RTOR Reduction (vph)	0	0	145	0	0	0	0	0	0	0	61	66
Lane Group Flow (vph)	0	478	128	313	881	0	0	0	0	409	293	268
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		6		5	2					8	8	
Permitted Phases			6									8
Actuated Green, G (s)		52.6	52.6	13.6	69.2					35.8	35.8	35.8
Effective Green, g (s)		52.6	52.6	13.6	69.2					35.8	35.8	35.8
Actuated g/C Ratio		0.47	0.47	0.12	0.62					0.32	0.32	0.32
Clearance Time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Vehicle Extension (s)		1.5	1.5	1.0	1.5					1.5	1.5	1.5
Lane Grp Cap (vph)		1662	743	416	2186					565	514	480
v/s Ratio Prot		0.14		c0.09	c0.25					c0.23	0.18	
v/s Ratio Perm			0.08									0.18
v/c Ratio		0.29	0.17	0.75	0.40					0.72	0.57	0.56
Uniform Delay, d1		18.2	17.1	47.6	10.9					33.7	31.7	31.6
Progression Factor		0.66	0.99	1.00	1.00					1.00	1.00	1.00
Incremental Delay, d2		0.4	0.5	6.7	0.6					3.9	0.9	0.8
Delay (s)		12.5	17.4	54.3	11.4					37.6	32.6	32.4
Level of Service		B	B	D	B					D	C	C
Approach Delay (s)		14.2			22.7			0.0			34.4	
Approach LOS		B			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	24.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	112.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Commerce Blvd & Golf Course Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	56	259	511	424	638	76	433	79	195	59	89	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	13	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.95		0.97	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	3472		3433	1863	1636	1770	1777	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	3472		3433	1863	1636	1770	1777	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	59	273	538	446	672	80	456	83	205	62	94	37
RTOR Reduction (vph)	0	0	311	0	7	0	0	0	121	0	13	0
Lane Group Flow (vph)	59	273	227	446	745	0	456	83	84	62	118	0
Confl. Peds. (#/hr)						5						1
Confl. Bikes (#/hr)						1						
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	1	6	4	5	2		4	4	5	3	3	
Permitted Phases			6						4			
Actuated Green, G (s)	6.0	17.0	35.0	16.0	27.0		18.0	18.0	34.0	15.8	15.8	
Effective Green, g (s)	6.0	17.0	35.0	16.0	27.0		18.0	18.0	34.0	15.8	15.8	
Actuated g/C Ratio	0.07	0.21	0.42	0.19	0.33		0.22	0.22	0.41	0.19	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	1.0	1.5	1.5	1.0	1.5		1.5	1.5	1.0	1.5	1.5	
Lane Grp Cap (vph)	128	1044	669	663	1132		746	405	750	337	339	
v/s Ratio Prot	0.03	0.05	0.07	c0.13	c0.21		c0.13	0.04	0.02	0.04	c0.07	
v/s Ratio Perm			0.07						0.03			
v/c Ratio	0.46	0.26	0.34	0.67	0.66		0.61	0.20	0.11	0.18	0.35	
Uniform Delay, d1	36.8	27.6	16.1	31.0	23.9		29.2	26.5	15.1	28.1	29.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.0	0.1	2.1	1.1		1.0	0.1	0.0	0.1	0.2	
Delay (s)	37.8	27.7	16.2	33.1	25.0		30.3	26.6	15.1	28.2	29.3	
Level of Service	D	C	B	C	C		C	C	B	C	C	
Approach Delay (s)		21.3			28.0			25.7			28.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	82.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Commerce Blvd & US 101 North Ramps
3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	354	4	51	1	1	2	161	354	5	4	562	441
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.93		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1793	1687	1794		1716		1770	3531		1770	3539	1583
Flt Permitted	0.95	0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1793	1687	1794		1716		1770	3531		1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	373	4	54	1	1	2	169	373	5	4	592	464
RTOR Reduction (vph)	0	0	37	0	2	0	0	1	0	0	0	0
Lane Group Flow (vph)	190	187	17	0	2	0	169	377	0	4	592	464
Confl. Peds. (#/hr)									2			
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA		Prot	NA	Free
Protected Phases	8	8	1	7	7		1	6		5	2	
Permitted Phases			8									Free
Actuated Green, G (s)	8.1	8.1	15.2		0.6		7.1	26.0		0.6	19.5	49.3
Effective Green, g (s)	8.1	8.1	15.2		0.6		7.1	26.0		0.6	19.5	49.3
Actuated g/C Ratio	0.16	0.16	0.31		0.01		0.14	0.53		0.01	0.40	1.00
Clearance Time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0		4.0		2.0	2.0		2.0	4.0	
Lane Grp Cap (vph)	294	277	553		20		254	1862		21	1399	1583
v/s Ratio Prot	0.11	c0.11	0.00		0.00		c0.10	0.11		0.00	c0.17	
v/s Ratio Perm			0.00									c0.29
v/c Ratio	0.65	0.68	0.03		0.10		0.67	0.20		0.19	0.42	0.29
Uniform Delay, d1	19.3	19.4	11.9		24.1		20.0	6.2		24.1	10.8	0.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.6	5.0	0.0		3.0		5.0	0.0		1.6	0.3	0.5
Delay (s)	22.9	24.4	11.9		27.1		25.0	6.2		25.7	11.1	0.5
Level of Service	C	C	B		C		C	A		C	B	A
Approach Delay (s)		22.2			27.1			12.0			6.5	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	14.0
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr
3/31/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	14	371	130	22	367	247
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	15	391	137	23	386	260
Pedestrians	5		5			5
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	0		0			0
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1191	158			165	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1191	158			165	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	56			73	
cM capacity (veh/h)	149	880			1407	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	405	160	386	260
Volume Left	15	0	386	0
Volume Right	391	23	0	0
cSH	746	1700	1407	1700
Volume to Capacity	0.54	0.09	0.27	0.15
Queue Length 95th (ft)	83	0	28	0
Control Delay (s)	15.4	0.0	8.5	0.0
Lane LOS	C		A	
Approach Delay (s)	15.4	0.0	5.1	
Approach LOS	C			

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	33	10	26	17	2	5	41	339	28	20	307	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	35	11	27	18	2	5	43	357	29	21	323	18
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	655	857	181	704	851	203	346			391		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	655	857	181	704	851	203	346			391		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	96	97	94	99	99	96			98		
cM capacity (veh/h)	328	275	824	287	278	797	1205			1159		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	35	38	25	43	238	148	21	215	126
Volume Left	35	0	18	43	0	0	21	0	0
Volume Right	0	27	5	0	0	29	0	0	18
cSH	328	531	330	1205	1700	1700	1159	1700	1700
Volume to Capacity	0.11	0.07	0.08	0.04	0.14	0.09	0.02	0.13	0.07
Queue Length 95th (ft)	9	6	6	3	0	0	1	0	0
Control Delay (s)	17.3	12.3	16.8	8.1	0.0	0.0	8.2	0.0	0.0
Lane LOS	C	B	C	A			A		
Approach Delay (s)	14.7		16.8	0.8			0.5		
Approach LOS	B		C						

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	33.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Commerce Blvd & Professional Center Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	45	200	0	5	178	84	0	0	2	34	0	16
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	47	211	0	5	187	88	0	0	2	36	0	17
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			TWLTL							
Median storage veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	281			216			530	602	221	559	557	242
vC1, stage 1 conf vol							310	310		247	247	
vC2, stage 2 conf vol							220	291		312	310	
vCu, unblocked vol	281			216			530	602	221	559	557	242
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			100	100	100	94	100	98
cM capacity (veh/h)	1276			1349			589	535	812	590	562	791

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	47	211	5	276	2	36	17
Volume Left	47	0	5	0	0	36	0
Volume Right	0	0	0	88	2	0	17
cSH	1276	1700	1349	1700	812	590	791
Volume to Capacity	0.04	0.12	0.00	0.16	0.00	0.06	0.02
Queue Length 95th (ft)	3	0	0	0	0	5	2
Control Delay (s)	7.9	0.0	7.7	0.0	9.4	11.5	9.7
Lane LOS	A		A		A	B	A
Approach Delay (s)	1.5		0.1		9.4	10.9	
Approach LOS					A	B	

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	37.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Commerce Blvd & Padre Pkwy

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	5	44	63	3	14	31	268	122	20	206	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	5	46	66	3	15	33	282	128	21	217	11
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								480				
pX, platoon unblocked												
vC, conflicting volume	497	750	124	621	691	215	232			416		
vC1, stage 1 conf vol	269	269		417	417							
vC2, stage 2 conf vol	228	481		204	274							
vCu, unblocked vol	497	750	124	621	691	215	232			416		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	99	95	87	99	98	98			98		
cM capacity (veh/h)	591	472	896	506	503	783	1327			1135		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	73	84	33	188	222	21	145	83
Volume Left	21	66	33	0	0	21	0	0
Volume Right	46	15	0	0	128	0	0	11
cSH	738	539	1327	1700	1700	1135	1700	1700
Volume to Capacity	0.10	0.16	0.02	0.11	0.13	0.02	0.09	0.05
Queue Length 95th (ft)	8	14	2	0	0	1	0	0
Control Delay (s)	10.4	12.9	7.8	0.0	0.0	8.2	0.0	0.0
Lane LOS	B	B	A			A		
Approach Delay (s)	10.4	12.9	0.6			0.7		
Approach LOS	B	B						

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	10	73	44	3	31	26	474	79	43	169	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	16	11	77	46	3	33	27	499	83	45	178	11
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								456				
pX, platoon unblocked	1.00	1.00		1.00	1.00	1.00				1.00		
vC, conflicting volume	622	921	104	867	884	301	193			587		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	622	920	104	867	884	301	193			587		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	96	92	77	99	95	98			95		
cM capacity (veh/h)	328	250	923	205	262	689	1371			980		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	21	82	46	36	27	333	249	45	119	70
Volume Left	16	0	46	0	27	0	0	45	0	0
Volume Right	0	77	0	33	0	0	83	0	0	11
cSH	304	787	205	603	1371	1700	1700	980	1700	1700
Volume to Capacity	0.07	0.10	0.23	0.06	0.02	0.20	0.15	0.05	0.07	0.04
Queue Length 95th (ft)	6	9	21	5	2	0	0	4	0	0
Control Delay (s)	17.7	10.1	27.6	11.3	7.7	0.0	0.0	8.9	0.0	0.0
Lane LOS	C	B	D	B	A			A		
Approach Delay (s)	11.7		20.5		0.3			1.7		
Approach LOS	B		C							

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: US 101 SB Ramps & Rohnert Park Expressway

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	749	310	14	633	0	1	0	0	623	0	369
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.5	4.5	3.5	4.5		4.0			4.0		4.0
Lane Util. Factor		0.91	*0.75	1.00	0.91		1.00			0.97		1.00
Frpb, ped/bikes		1.00	0.92	1.00	1.00		1.00			1.00		1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00			1.00		1.00
Frt		1.00	0.85	1.00	1.00		1.00			1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95			0.95		1.00
Satd. Flow (prot)		5085	1061	1770	5085		1770			3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.95			0.95		1.00
Satd. Flow (perm)		5085	1061	1770	5085		1770			3433		1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	788	326	15	666	0	1	0	0	656	0	388
RTOR Reduction (vph)	0	0	171	0	0	0	0	0	0	0	0	169
Lane Group Flow (vph)	0	788	155	15	666	0	1	0	0	656	0	219
Confl. Peds. (#/hr)			20			20						
Confl. Bikes (#/hr)			20			20						
Turn Type		NA	Perm	Prot	NA		Prot		Prot	Prot		Perm
Protected Phases		2		1	6		3		3	4		
Permitted Phases			2									4
Actuated Green, G (s)		69.2	69.2	4.6	77.3		1.2			59.0		59.0
Effective Green, g (s)		69.2	69.2	4.6	77.3		1.2			59.0		59.0
Actuated g/C Ratio		0.46	0.46	0.03	0.52		0.01			0.39		0.39
Clearance Time (s)		4.5	4.5	3.5	4.5		4.0			4.0		4.0
Vehicle Extension (s)		4.0	4.0	2.0	4.0		3.0			2.0		2.0
Lane Grp Cap (vph)		2345	489	54	2620		14			1350		622
v/s Ratio Prot		c0.15		0.01	c0.13		c0.00			c0.19		
v/s Ratio Perm			0.15									0.14
v/c Ratio		0.34	0.32	0.28	0.25		0.07			0.49		0.35
Uniform Delay, d1		25.8	25.5	71.1	20.3		73.8			34.1		32.0
Progression Factor		0.24	1.26	0.81	0.66		1.00			1.00		1.00
Incremental Delay, d2		0.4	1.6	1.0	0.2		2.2			0.1		0.1
Delay (s)		6.6	33.7	58.4	13.5		76.0			34.2		32.2
Level of Service		A	C	E	B		E			C		C
Approach Delay (s)		14.6			14.5			76.0			33.5	
Approach LOS		B			B			E			C	

Intersection Summary			
HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: US 101 NB Ramps & Rohnert Park Expressway

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	1145	0	0	816	845	187	19	289	1	0	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.86			0.91	1.00	0.95	0.95	0.88	1.00		1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	1.00	1.00	1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (prot)	1770	6408			5085	1550	1681	1700	2787	1770		1583
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (perm)	1770	6408			5085	1550	1681	1700	2787	1770		1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	25	1205	0	0	859	889	197	20	304	1	0	9
RTOR Reduction (vph)	0	0	0	0	0	226	0	0	241	0	0	9
Lane Group Flow (vph)	25	1205	0	0	859	663	108	109	63	1	0	0
Confl. Peds. (#/hr)			4			4						
Turn Type	Prot	NA			NA	Perm	Split	NA	Perm	Prot		Perm
Protected Phases	5	2			6		3	3		4		
Permitted Phases						6			3			4
Actuated Green, G (s)	4.8	118.9			110.1	110.1	14.9	14.9	14.9	1.2		1.2
Effective Green, g (s)	4.8	118.9			110.1	110.1	14.9	14.9	14.9	1.2		1.2
Actuated g/C Ratio	0.03	0.79			0.73	0.73	0.10	0.10	0.10	0.01		0.01
Clearance Time (s)	4.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Vehicle Extension (s)	2.0	4.0			2.0	2.0	2.0	2.0	2.0	4.0		4.0
Lane Grp Cap (vph)	56	5079			3732	1137	166	168	276	14		12
v/s Ratio Prot	c0.01	0.19			0.17		c0.06	0.06		c0.00		
v/s Ratio Perm						c0.43			0.02			0.00
v/c Ratio	0.45	0.24			0.23	0.58	0.65	0.65	0.23	0.07		0.01
Uniform Delay, d1	71.3	4.0			6.4	9.3	65.0	65.0	62.2	73.8		73.8
Progression Factor	1.27	1.86			0.65	7.68	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	1.9	0.1			0.1	1.9	6.8	6.3	0.2	2.9		0.3
Delay (s)	92.6	7.5			4.2	73.2	71.8	71.4	62.4	76.8		74.1
Level of Service	F	A			A	E	E	E	E	E		E
Approach Delay (s)		9.2			39.3			66.2			74.4	
Approach LOS		A			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway
3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	853	355	90	1088	73	397	145	131	51	93	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00	0.95	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1538	1770	5023		3433	1863	1508	1610	3382	1546
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1538	1770	5023		3433	1863	1508	1610	3382	1546
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	239	898	374	95	1145	77	418	153	138	54	98	185
RTOR Reduction (vph)	0	0	121	0	3	0	0	0	115	0	0	69
Lane Group Flow (vph)	239	898	253	95	1219	0	418	153	23	49	103	116
Confl. Peds. (#/hr)			20			20			20			20
Confl. Bikes (#/hr)			10			10			10			10
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	Perm	Split	NA	pm+ov
Protected Phases	5	2	3	1	6		3	3		4	4	5
Permitted Phases			2						3			4
Actuated Green, G (s)	13.6	76.3	101.5	11.7	74.4		25.2	25.2	25.2	16.8	16.8	30.4
Effective Green, g (s)	13.6	76.3	101.5	11.7	74.4		25.2	25.2	25.2	16.8	16.8	30.4
Actuated g/C Ratio	0.09	0.51	0.68	0.08	0.50		0.17	0.17	0.17	0.11	0.11	0.20
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	1.5	1.5	1.0	1.0	1.0
Lane Grp Cap (vph)	311	1800	1091	138	2491		576	312	253	180	378	313
v/s Ratio Prot	c0.07	c0.25	0.04	c0.05	0.24		c0.12	0.08		0.03	0.03	c0.03
v/s Ratio Perm			0.13						0.02			0.04
v/c Ratio	0.77	0.50	0.23	0.69	0.49		0.73	0.49	0.09	0.27	0.27	0.37
Uniform Delay, d1	66.7	24.3	9.3	67.4	25.2		59.1	56.6	52.7	61.0	61.0	51.5
Progression Factor	0.68	0.41	2.35	1.11	1.07		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.6	1.0	0.0	9.7	0.6		3.8	0.4	0.1	0.3	0.1	0.3
Delay (s)	54.7	10.9	21.9	84.4	27.6		63.0	57.0	52.8	61.3	61.1	51.8
Level of Service	D	B	C	F	C		E	E	D	E	E	D
Approach Delay (s)		20.5			31.7			59.7			56.0	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	34.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: State Farm Dr & Rohnert Park Expressway
3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	763	58	189	1004	334	123	131	130	112	82	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1548	1770	3539	1560	1610	3350	1553	1610	3081	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1548	1770	3539	1560	1610	3350	1553	1610	3081	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	184	803	61	199	1057	352	129	138	137	118	86	114
RTOR Reduction (vph)	0	0	32	0	0	93	0	0	121	0	100	0
Lane Group Flow (vph)	184	803	29	199	1057	259	86	181	16	106	112	0
Confl. Peds. (#/hr)			8			2			5			2
Confl. Bikes (#/hr)									1			1
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			6			3			
Actuated Green, G (s)	11.0	71.5	71.5	22.1	82.6	82.6	17.9	17.9	17.9	18.5	18.5	
Effective Green, g (s)	11.0	71.5	71.5	22.1	82.6	82.6	17.9	17.9	17.9	18.5	18.5	
Actuated g/C Ratio	0.07	0.48	0.48	0.15	0.55	0.55	0.12	0.12	0.12	0.12	0.12	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)	129	1686	737	260	1948	859	192	399	185	198	379	
v/s Ratio Prot	c0.10	0.23		c0.11	c0.30		0.05	c0.05		c0.07	0.04	
v/s Ratio Perm			0.02			0.17			0.01			
v/c Ratio	1.43	0.48	0.04	0.77	0.54	0.30	0.45	0.45	0.09	0.54	0.30	
Uniform Delay, d1	69.5	26.6	20.9	61.5	21.6	18.2	61.5	61.5	58.8	61.7	59.8	
Progression Factor	0.96	0.30	0.13	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	
Incremental Delay, d2	227.6	0.9	0.1	11.4	1.1	0.9	0.6	0.3	0.1	1.4	0.2	
Delay (s)	294.5	8.8	2.8	72.9	22.7	19.1	62.1	61.8	58.9	63.5	60.2	
Level of Service	F	A	A	E	C	B	E	E	E	E	E	
Approach Delay (s)		58.6			28.1			60.9			61.3	
Approach LOS		E			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	44.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Commerce Blvd & Enterprise Dr

3/31/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	71	55	537	60	22	329
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	0.98	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3433	1550	3480		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3433	1550	3480		1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	75	58	565	63	23	346
RTOR Reduction (vph)	0	49	11	0	0	0
Lane Group Flow (vph)	75	9	617	0	23	346
Confl. Peds. (#/hr)		5		5		
Confl. Bikes (#/hr)		5		5		
Turn Type	Prot	Perm	NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	4.9	4.9	15.4		0.3	19.7
Effective Green, g (s)	4.9	4.9	15.4		0.3	19.7
Actuated g/C Ratio	0.15	0.15	0.47		0.01	0.60
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	516	232	1643		16	2138
v/s Ratio Prot	c0.02		c0.18		c0.01	0.10
v/s Ratio Perm		0.01				
v/c Ratio	0.15	0.04	0.38		1.44	0.16
Uniform Delay, d1	12.0	11.8	5.5		16.2	2.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.1	0.1		385.6	0.0
Delay (s)	12.2	11.9	5.7		401.8	2.9
Level of Service	B	B	A		F	A
Approach Delay (s)	12.0		5.7			27.7
Approach LOS	B		A			C

Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	32.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	31.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr

3/31/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	15	72	0	3	120	101	1	2	0	56	0	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	16	76	0	3	126	106	1	2	0	59	0	5

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	54	38	66	169	3	64
Volume Left (vph)	16	0	3	0	1	59
Volume Right (vph)	0	0	0	106	0	5
Hadj (s)	0.18	0.03	0.06	-0.41	0.10	0.17
Departure Headway (s)	5.0	4.9	4.8	4.3	4.8	4.8
Degree Utilization, x	0.08	0.05	0.09	0.20	0.00	0.09
Capacity (veh/h)	700	715	727	809	699	703
Control Delay (s)	7.2	6.9	7.1	7.3	7.8	8.2
Approach Delay (s)	7.1		7.2		7.8	8.2
Approach LOS	A		A		A	A

Intersection Summary			
Delay	7.4		
Level of Service	A		
Intersection Capacity Utilization	28.2%	ICU Level of Service	A
Analysis Period (min)	15		

15: Enterprise Dr & State Farm Dr

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	51	77	124	285	216	76
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	54	81	131	300	227	80

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	54	81	87	344	227	80
Volume Left (vph)	54	0	0	0	227	0
Volume Right (vph)	0	0	0	300	0	80
Hadj (s)	0.53	0.03	0.03	-0.58	0.53	-0.67
Departure Headway (s)	6.5	6.0	5.7	5.1	6.4	5.2
Degree Utilization, x	0.10	0.14	0.14	0.48	0.40	0.12
Capacity (veh/h)	520	566	604	688	527	646
Control Delay (s)	9.0	8.7	8.4	11.5	12.5	7.7
Approach Delay (s)	8.8		10.9		11.3	
Approach LOS	A		B		B	

Intersection Summary			
Delay	10.7		
Level of Service	B		
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		

16: Enterprise Dr/Seed Farm Dr

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	64	203	370	12	5	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	67	214	389	13	5	18
Pedestrians		5	5		5	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	407				754	406
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	407				754	406
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				99	97
cM capacity (veh/h)	1147				352	640

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	281	402	23
Volume Left	67	0	5
Volume Right	0	13	18
cSH	1147	1700	539
Volume to Capacity	0.06	0.24	0.04
Queue Length 95th (ft)	5	0	3
Control Delay (s)	2.4	0.0	12.0
Lane LOS	A		B
Approach Delay (s)	2.4	0.0	12.0
Approach LOS			B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	0	9	0	0	1	22	326	0	1	290	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	42	0	9	0	0	1	23	343	0	1	305	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											561	
pX, platoon unblocked												
vC, conflicting volume	535	706	162	554	715	172	323			343		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	535	706	162	554	715	172	323			343		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	99	100	100	100	98			100		
cM capacity (veh/h)	421	352	855	405	348	842	1233			1213		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	52	1	23	229	114	1	204	120
Volume Left	42	0	23	0	0	1	0	0
Volume Right	9	1	0	0	0	0	0	18
cSH	464	842	1233	1700	1700	1213	1700	1700
Volume to Capacity	0.11	0.00	0.02	0.13	0.07	0.00	0.12	0.07
Queue Length 95th (ft)	9	0	1	0	0	0	0	0
Control Delay (s)	13.7	9.3	8.0	0.0	0.0	8.0	0.0	0.0
Lane LOS	B	A	A			A		
Approach Delay (s)	13.7	9.3	0.5			0.0		
Approach LOS	B	A						

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
1: US 101 South Ramps & Golf Course Dr

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1249	769	168	1177	0	0	0	0	445	202	1246
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lane Util. Factor		0.95	1.00	0.97	0.95					1.00	0.95	0.95
Frpb, ped/bikes		1.00	0.96	1.00	1.00					1.00	0.98	0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	0.89	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3539	1526	3433	3539					1770	1543	1460
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3539	1526	3433	3539					1770	1543	1460
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1274	785	171	1201	0	0	0	0	454	206	1271
RTOR Reduction (vph)	0	0	332	0	0	0	0	0	0	0	17	34
Lane Group Flow (vph)	0	1274	453	171	1201	0	0	0	0	454	736	690
Confl. Peds. (#/hr)			10									10
Confl. Bikes (#/hr)			10									10
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		6		5	2					8	8	
Permitted Phases			6									8
Actuated Green, G (s)		39.1	39.1	4.9	48.5					48.5	48.5	48.5
Effective Green, g (s)		39.1	39.1	4.9	48.5					48.5	48.5	48.5
Actuated g/C Ratio		0.37	0.37	0.05	0.46					0.46	0.46	0.46
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Vehicle Extension (s)		1.5	1.5	1.0	1.5					1.5	1.5	1.5
Lane Grp Cap (vph)		1305	562	158	1619					809	705	668
v/s Ratio Prot		c0.36		0.05	c0.34					0.26	c0.48	
v/s Ratio Perm			0.30									0.47
v/c Ratio		0.98	0.81	1.08	0.74					0.56	1.04	1.03
Uniform Delay, d1		33.0	30.0	50.5	23.6					21.0	28.8	28.8
Progression Factor		0.60	0.27	0.94	0.84					1.00	1.00	1.00
Incremental Delay, d2		14.6	7.5	86.1	2.4					0.5	46.0	43.7
Delay (s)		34.4	15.7	133.5	22.2					21.5	74.7	72.5
Level of Service		C	B	F	C					C	E	E
Approach Delay (s)		27.3			36.0			0.0			61.4	
Approach LOS		C			D			A			E	

Intersection Summary			
HCM 2000 Control Delay	41.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	101.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Commerce Blvd & Golf Course Dr

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	721	944	369	409	112	909	192	613	208	271	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	13	12	12	12
Total Lost time (s)	3.5	4.1	4.1	4.1	4.1		4.1	4.1	4.1	4.1	4.1	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.95		0.97	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	0.99		1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1572	3433	3381		3433	1863	1616	1770	1831	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1572	3433	3381		3433	1863	1616	1770	1831	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	30	736	963	377	417	114	928	196	626	212	277	28
RTOR Reduction (vph)	0	0	24	0	23	0	0	0	42	0	3	0
Lane Group Flow (vph)	30	736	939	377	508	0	928	196	584	212	302	0
Confl. Peds. (#/hr)			10			10						10
Confl. Bikes (#/hr)			10			10			10			10
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	1	6	4	5	2		4	4	5	3	3	
Permitted Phases			6						4			
Actuated Green, G (s)	4.3	15.6	59.5	14.0	25.9		43.9	43.9	57.9	16.1	16.1	
Effective Green, g (s)	4.3	15.6	59.5	14.0	25.9		43.9	43.9	57.9	16.1	16.1	
Actuated g/C Ratio	0.04	0.15	0.56	0.13	0.24		0.41	0.41	0.55	0.15	0.15	
Clearance Time (s)	3.5	4.1	4.1	4.1	4.1		4.1	4.1	4.1	4.1	4.1	
Vehicle Extension (s)	1.0	1.5	1.5	1.0	1.5		1.5	1.5	1.0	1.5	1.5	
Lane Grp Cap (vph)	71	748	943	453	826		1421	771	882	268	278	
v/s Ratio Prot	0.02	0.14	c0.41	c0.11	0.15		0.27	0.11	0.09	0.12	c0.16	
v/s Ratio Perm			0.19						0.27			
v/c Ratio	0.42	0.98	1.00	0.83	0.62		0.65	0.25	0.66	0.79	1.08	
Uniform Delay, d1	49.6	45.1	23.1	44.9	35.6		24.9	20.3	17.1	43.3	44.9	
Progression Factor	0.66	0.87	0.66	0.76	0.67		0.80	0.85	0.63	1.00	1.00	
Incremental Delay, d2	0.7	19.1	19.0	11.1	3.2		0.6	0.0	1.1	13.8	78.5	
Delay (s)	33.6	58.1	34.3	45.2	27.0		20.5	17.2	11.8	57.1	123.4	
Level of Service	C	E	C	D	C		C	B	B	E	F	
Approach Delay (s)		44.4			34.5			17.0			96.2	
Approach LOS		D			C			B			F	

Intersection Summary			
HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Commerce Blvd & US 101 North Ramps 4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	984	2	57	4	5	13	469	717	2	8	730	846
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	3.5		3.5		3.5	4.0		3.5	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.92		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1793	1686	1794		1699		1770	3538		1770	3539	1546
Flt Permitted	0.95	0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1793	1686	1794		1699		1770	3538		1770	3539	1546
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	1004	2	58	4	5	13	479	732	2	8	745	863
RTOR Reduction (vph)	0	0	23	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	502	504	35	0	9	0	479	734	0	8	745	863
Confl. Bikes (#/hr)												10
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA		Prot	NA	Free
Protected Phases	8	8	1	7	7		1	6		5	2	
Permitted Phases			8									Free
Actuated Green, G (s)	33.4	33.4	63.2		1.6		29.8	55.2		0.8	26.2	106.0
Effective Green, g (s)	33.4	33.4	63.2		1.6		29.8	55.2		0.8	26.2	106.0
Actuated g/C Ratio	0.32	0.32	0.60		0.02		0.28	0.52		0.01	0.25	1.00
Clearance Time (s)	4.0	4.0	3.5		3.5		3.5	4.0		3.5	4.0	
Vehicle Extension (s)	1.5	1.5	1.0		1.0		1.0	1.5		1.0	1.5	
Lane Grp Cap (vph)	564	531	1069		25		497	1842		13	874	1546
v/s Ratio Prot	0.28	c0.30	0.01		0.01		c0.27	0.21		0.00	c0.21	
v/s Ratio Perm			0.01									c0.56
v/c Ratio	0.89	0.95	0.03		0.37		0.96	0.40		0.62	0.85	0.56
Uniform Delay, d1	34.6	35.5	8.8		51.7		37.6	15.4		52.4	38.1	0.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.01	0.98	1.00
Incremental Delay, d2	18.7	28.3	0.0		3.3		30.9	0.1		5.4	0.8	0.1
Delay (s)	53.3	63.8	8.8		55.0		68.5	15.4		58.1	37.9	0.1
Level of Service	D	E	A		E		E	B		E	D	A
Approach Delay (s)		55.8			55.0			36.4			17.8	
Approach LOS		E			E			D			B	

Intersection Summary			
HCM 2000 Control Delay	34.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr 4/6/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	19	562	504	12	353	347
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	19	573	514	12	360	354
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1595	520			527	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1595	520			527	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	75	0			65	
cM capacity (veh/h)	77	556			1040	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	593	527	360	354
Volume Left	19	0	360	0
Volume Right	573	12	0	0
cSH	462	1700	1040	1700
Volume to Capacity	1.28	0.31	0.35	0.21
Queue Length 95th (ft)	630	0	39	0
Control Delay (s)	169.4	0.0	10.3	0.0
Lane LOS	F		B	
Approach Delay (s)	169.4	0.0	5.2	
Approach LOS	F			

Intersection Summary			
Average Delay	56.8		
Intersection Capacity Utilization	92.6%	ICU Level of Service	F
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	14	34	44	10	35	64	356	25	15	302	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	10	14	35	45	10	36	65	363	26	15	308	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	701	867	163	733	864	194	327			389		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	701	867	163	733	864	194	327			389		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	95	96	83	96	96	95			99		
cM capacity (veh/h)	287	270	853	270	272	814	1230			1166		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	10	49	91	65	242	147	15	205	121
Volume Left	10	0	45	65	0	0	15	0	0
Volume Right	0	35	36	0	0	26	0	0	18
cSH	287	524	367	1230	1700	1700	1166	1700	1700
Volume to Capacity	0.04	0.09	0.25	0.05	0.14	0.09	0.01	0.12	0.07
Queue Length 95th (ft)	3	8	24	4	0	0	1	0	0
Control Delay (s)	18.0	12.6	18.0	8.1	0.0	0.0	8.1	0.0	0.0
Lane LOS	C	B	C	A			A		
Approach Delay (s)	13.5		18.0	1.2			0.4		
Approach LOS	B		C						

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	35.7%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
6: Commerce Blvd & Professional Center Dr

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	14	335	5	7	376	38	1	0	9	75	1	68
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	14	342	5	7	384	39	1	0	9	77	1	69
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			TWLTL							
Median storage veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	422			347			841	810	344	797	793	403
vC1, stage 1 conf vol							373	373		417	417	
vC2, stage 2 conf vol							468	437		380	376	
vCu, unblocked vol	422			347			841	810	344	797	793	403
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	100	99	85	100	89
cM capacity (veh/h)	1137			1212			437	480	698	496	489	647

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	14	347	7	422	10	77	70
Volume Left	14	0	7	0	1	77	0
Volume Right	0	5	0	39	9	0	69
cSH	1137	1700	1212	1700	659	496	644
Volume to Capacity	0.01	0.20	0.01	0.25	0.02	0.15	0.11
Queue Length 95th (ft)	1	0	0	0	1	14	9
Control Delay (s)	8.2	0.0	8.0	0.0	10.5	13.6	11.3
Lane LOS	A		A		B	B	B
Approach Delay (s)	0.3		0.1		10.5	12.5	
Approach LOS					B	B	

Intersection Summary				
Average Delay	2.2			
Intersection Capacity Utilization	39.6%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
7: Commerce Blvd & Padre Pkwy

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	6	41	190	5	43	41	408	202	40	388	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	7	6	42	194	5	44	42	416	206	41	396	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								480				
pX, platoon unblocked												
vC, conflicting volume	819	1187	201	928	1087	311	402			622		
vC1, stage 1 conf vol	481	481		603	603							
vC2, stage 2 conf vol	338	706		324	484							
vCu, unblocked vol	819	1187	201	928	1087	311	402			622		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	98	95	48	99	94	96			96		
cM capacity (veh/h)	417	335	806	376	375	685	1153			954		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	55	243	42	278	345	41	264	138
Volume Left	7	194	42	0	0	41	0	0
Volume Right	42	44	0	0	206	0	0	6
cSH	631	409	1153	1700	1700	954	1700	1700
Volume to Capacity	0.09	0.59	0.04	0.16	0.20	0.04	0.16	0.08
Queue Length 95th (ft)	7	93	3	0	0	3	0	0
Control Delay (s)	11.2	25.9	8.2	0.0	0.0	8.9	0.0	0.0
Lane LOS	B	D	A			A		
Approach Delay (s)	11.2	25.9	0.5			0.8		
Approach LOS	B	D						

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	33	127	87	7	30	64	367	47	107	434	33
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	26	34	130	89	7	31	65	374	48	109	443	34
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								456				
pX, platoon unblocked												
vC, conflicting volume	1030	1231	238	1115	1224	211	477			422		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1030	1231	238	1115	1224	211	477			422		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	83	77	83	10	95	96	94			90		
cM capacity (veh/h)	154	149	763	99	151	794	1082			1133		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	42	146	89	38	65	250	173	109	295	181
Volume Left	26	0	89	0	65	0	0	109	0	0
Volume Right	0	130	0	31	0	0	48	0	0	34
cSH	152	518	99	440	1082	1700	1700	1133	1700	1700
Volume to Capacity	0.28	0.28	0.90	0.09	0.06	0.15	0.10	0.10	0.17	0.11
Queue Length 95th (ft)	27	29	129	7	5	0	0	8	0	0
Control Delay (s)	37.6	14.7	141.3	14.0	8.5	0.0	0.0	8.5	0.0	0.0
Lane LOS	E	B	F	B	A			A		
Approach Delay (s)	19.8		103.3		1.1			1.6		
Approach LOS	C		F							

Intersection Summary			
Average Delay	13.2		
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: US 101 SB Ramps & Rohnert Park Expressway

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1344	646	42	1550	0	5	0	41	811	0	384
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.5	4.5	3.5	4.5		4.0		4.0	4.0		4.0
Lane Util. Factor		0.91	1.00	1.00	0.91		1.00		1.00	0.97		1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)		5085	1531	1770	5085		1770		1583	3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (perm)		5085	1531	1770	5085		1770		1583	3433		1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1371	659	43	1582	0	5	0	42	828	0	392
RTOR Reduction (vph)	0	0	181	0	0	0	0	0	41	0	0	58
Lane Group Flow (vph)	0	1371	478	43	1582	0	5	0	1	828	0	334
Turn Type		NA	Perm	Prot	NA		Prot		Prot	Prot		Perm
Protected Phases		2		1	6		3		3	4		
Permitted Phases			2									4
Actuated Green, G (s)		81.6	81.6	7.6	92.7		4.7		4.7	48.1		48.1
Effective Green, g (s)		81.6	81.6	7.6	92.7		4.7		4.7	48.1		48.1
Actuated g/C Ratio		0.52	0.52	0.05	0.59		0.03		0.03	0.30		0.30
Clearance Time (s)		4.5	4.5	3.5	4.5		4.0		4.0	4.0		4.0
Vehicle Extension (s)		4.0	4.0	2.0	4.0		3.0		3.0	2.0		2.0
Lane Grp Cap (vph)		2626	790	85	2983		52		47	1045		481
v/s Ratio Prot		0.27		0.02	c0.31		c0.00		0.00	c0.24		
v/s Ratio Perm			c0.31									0.21
v/c Ratio		0.52	0.61	0.51	0.53		0.10		0.03	0.79		0.69
Uniform Delay, d1		25.3	26.9	73.4	19.6		74.6		74.4	50.4		48.5
Progression Factor		0.36	0.36	0.83	0.42		1.00		1.00	1.00		1.00
Incremental Delay, d2		0.5	2.2	1.5	0.6		0.8		0.2	3.9		3.5
Delay (s)		9.6	11.9	62.4	8.8		75.4		74.7	54.3		52.0
Level of Service		A	B	E	A		E		E	D		D
Approach Delay (s)		10.3			10.2			74.7			53.5	
Approach LOS		B			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	158.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: US 101 NB Ramps & Rohnert Park Expressway

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	49	1714	0	0	1203	632	604	16	454	29	0	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0			6.0	6.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.86			0.91	1.00	0.95	0.95	0.88	1.00		1.00
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.95	1.00	0.95		1.00
Satd. Flow (prot)	1770	6408			5085	1583	1681	1689	2787	1770		1583
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.95	1.00	0.95		1.00
Satd. Flow (perm)	1770	6408			5085	1583	1681	1689	2787	1770		1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	50	1749	0	0	1228	645	616	16	463	30	0	16
RTOR Reduction (vph)	0	0	0	0	0	305	0	0	72	0	0	15
Lane Group Flow (vph)	50	1749	0	0	1228	340	314	318	391	30	0	1
Turn Type	Prot	NA			NA	Perm	Split	NA	Perm	Prot		Perm
Protected Phases	5	2			6		3	3		4		
Permitted Phases						6			3			4
Actuated Green, G (s)	8.0	96.4			83.4	83.4	40.2	40.2	40.2	5.4		5.4
Effective Green, g (s)	8.0	96.4			83.4	83.4	40.2	40.2	40.2	5.4		5.4
Actuated g/C Ratio	0.05	0.61			0.53	0.53	0.25	0.25	0.25	0.03		0.03
Clearance Time (s)	5.0	6.0			6.0	6.0	5.0	5.0	5.0	5.0		5.0
Vehicle Extension (s)	2.0	4.0			4.0	4.0	2.0	2.0	2.0	2.0		2.0
Lane Grp Cap (vph)	89	3909			2684	835	427	429	709	60		54
v/s Ratio Prot	c0.03	c0.27			0.24		0.19	c0.19		c0.02		
v/s Ratio Perm						0.22			0.14			0.00
v/c Ratio	0.56	0.45			0.46	0.41	0.74	0.74	0.55	0.50		0.01
Uniform Delay, d1	73.3	16.5			23.2	22.4	54.0	54.1	51.1	75.0		73.7
Progression Factor	0.89	0.48			0.81	3.51	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	3.9	0.3			0.5	1.2	5.6	5.9	0.5	2.4		0.0
Delay (s)	69.3	8.2			19.3	79.9	59.6	60.1	51.6	77.3		73.7
Level of Service	E	A			B	E	E	E	D	E		E
Approach Delay (s)		9.9			40.2			56.4			76.1	
Approach LOS		A			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	158.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	315	1047	789	208	1033	68	564	239	279	108	226	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1556	1770	5030		3433	1863	1547	1610	3383	1565
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1556	1770	5030		3433	1863	1547	1610	3383	1565
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	321	1068	805	212	1054	69	576	244	285	110	231	270
RTOR Reduction (vph)	0	0	117	0	3	0	0	0	223	0	0	64
Lane Group Flow (vph)	321	1068	688	212	1120	0	576	244	62	99	242	206
Confl. Peds. (#/hr)			13			10			5			7
Confl. Bikes (#/hr)						2			5			2
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	Perm	Split	NA	pm+ov
Protected Phases	5	2	3	1	6		3	3		4	4	5
Permitted Phases			2						3			4
Actuated Green, G (s)	16.0	55.9	90.3	27.9	67.8		34.4	34.4	34.4	19.8	19.8	35.8
Effective Green, g (s)	16.0	55.9	90.3	27.9	67.8		34.4	34.4	34.4	19.8	19.8	35.8
Actuated g/C Ratio	0.10	0.35	0.57	0.18	0.43		0.22	0.22	0.22	0.13	0.13	0.23
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	1.5	1.5	1.0	1.0	1.0
Lane Grp Cap (vph)	347	1252	889	312	2158		747	405	336	201	423	404
v/s Ratio Prot	0.09	c0.30	c0.17	c0.12	0.22		0.17	0.13		0.06	0.07	c0.05
v/s Ratio Perm			0.27						0.04			0.08
v/c Ratio	0.93	0.85	0.77	0.68	0.52		0.77	0.60	0.18	0.49	0.57	0.51
Uniform Delay, d1	70.4	47.2	26.0	60.9	33.1		58.1	55.6	50.4	64.4	65.1	53.4
Progression Factor	0.71	0.58	1.52	0.71	0.62		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	27.4	6.9	3.5	3.4	0.7		4.5	1.7	0.1	0.7	1.2	0.4
Delay (s)	77.6	34.3	43.0	46.3	21.2		62.6	57.4	50.5	65.1	66.3	53.8
Level of Service	E	C	D	D	C		E	E	D	E	E	D
Approach Delay (s)		43.8			25.2			58.3			60.6	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	44.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	158.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: State Farm Dr & Rohnert Park Expressway

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	954	181	253	993	181	200	118	211	313	178	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.99	
Satd. Flow (prot)	1770	3539	1538	1770	3539	1552	1610	3316	1547	1610	3116	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	0.99	
Satd. Flow (perm)	1770	3539	1538	1770	3539	1552	1610	3316	1547	1610	3116	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	232	973	185	258	1013	185	204	120	215	319	182	205
RTOR Reduction (vph)	0	0	99	0	0	70	0	0	189	0	98	0
Lane Group Flow (vph)	232	973	86	258	1013	115	106	218	26	239	369	0
Confl. Peds. (#/hr)			12			5			10			4
Confl. Bikes (#/hr)			1			1						1
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			6			3			
Actuated Green, G (s)	31.7	72.9	72.9	16.0	57.2	57.2	19.1	19.1	19.1	30.0	30.0	
Effective Green, g (s)	31.7	72.9	72.9	16.0	57.2	57.2	19.1	19.1	19.1	30.0	30.0	
Actuated g/C Ratio	0.20	0.46	0.46	0.10	0.36	0.36	0.12	0.12	0.12	0.19	0.19	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)	355	1632	709	179	1281	561	194	400	187	305	591	
v/s Ratio Prot	c0.13	0.27		c0.15	c0.29		c0.07	0.07		c0.15	0.12	
v/s Ratio Perm			0.06			0.07			0.02			
v/c Ratio	0.65	0.60	0.12	1.44	0.79	0.20	0.55	0.55	0.14	0.78	0.62	
Uniform Delay, d1	58.1	31.6	24.3	71.0	45.1	34.7	65.4	65.4	62.1	60.9	58.8	
Progression Factor	0.54	0.63	1.30	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.2	1.1	0.2	227.3	5.0	0.8	1.7	0.8	0.1	11.5	1.5	
Delay (s)	33.6	21.2	31.7	298.3	50.1	35.6	67.1	66.2	62.2	72.4	60.3	
Level of Service	C	C	C	F	D	D	E	E	E	E	E	
Approach Delay (s)		24.6			92.2			64.8			64.4	
Approach LOS		C			F			E			E	

Intersection Summary			
HCM 2000 Control Delay	60.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	158.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	92.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Commerce Blvd & Enterprise Dr

4/6/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	171	59	667	81	71	741
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3433	1583	3482		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3433	1583	3482		1770	3539
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	174	60	681	83	72	756
RTOR Reduction (vph)	0	49	13	0	0	0
Lane Group Flow (vph)	174	11	751	0	72	756
Turn Type	Prot	Perm	NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	7.4	7.4	16.9		2.9	23.8
Effective Green, g (s)	7.4	7.4	16.9		2.9	23.8
Actuated g/C Ratio	0.19	0.19	0.43		0.07	0.61
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	648	298	1501		130	2148
v/s Ratio Prot	c0.05		c0.22		c0.04	0.21
v/s Ratio Perm		0.01				
v/c Ratio	0.27	0.04	0.50		0.55	0.35
Uniform Delay, d1	13.6	13.0	8.1		17.5	3.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.1	0.3		5.0	0.1
Delay (s)	13.8	13.0	8.4		22.6	3.9
Level of Service	B	B	A		C	A
Approach Delay (s)	13.6		8.4			5.6
Approach LOS	B		A			A

Intersection Summary			
HCM 2000 Control Delay	7.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	39.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr

4/6/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	156	2	8	178	121	2	3	0	200	2	34
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	2	159	2	8	182	123	2	3	0	204	2	35

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	82	82	99	214	5	241
Volume Left (vph)	2	0	8	0	2	204
Volume Right (vph)	0	2	0	123	0	35
Hadj (s)	0.05	0.02	0.08	-0.37	0.11	0.12
Departure Headway (s)	5.6	5.5	5.5	5.0	5.5	5.1
Degree Utilization, x	0.13	0.13	0.15	0.30	0.01	0.34
Capacity (veh/h)	607	614	629	689	585	660
Control Delay (s)	8.2	8.1	8.2	8.9	8.6	10.8
Approach Delay (s)	8.2		8.7		8.6	10.8
Approach LOS	A		A		A	B

Intersection Summary			
Delay	9.3		
Level of Service	A		
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	107	220	152	321	463	147
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	109	224	155	328	472	150

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	109	224	103	379	472	150
Volume Left (vph)	109	0	0	0	472	0
Volume Right (vph)	0	0	0	328	0	150
Hadj (s)	0.53	0.03	0.03	-0.57	0.53	-0.67
Departure Headway (s)	8.1	7.5	7.3	6.7	7.4	6.2
Degree Utilization, x	0.24	0.47	0.21	0.71	0.97	0.26
Capacity (veh/h)	444	477	487	530	483	566
Control Delay (s)	12.5	15.9	11.1	23.2	60.0	10.1
Approach Delay (s)	14.8		20.6		48.0	
Approach LOS	B		C		E	

Intersection Summary			
Delay	31.1		
Level of Service	D		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	18	714	379	12	10	52
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	18	729	387	12	10	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	399				1158	393
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	399				1158	393
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				95	92
cM capacity (veh/h)	1160				213	656

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	747	399	63
Volume Left	18	0	10
Volume Right	0	12	53
cSH	1160	1700	491
Volume to Capacity	0.02	0.23	0.13
Queue Length 95th (ft)	1	0	11
Control Delay (s)	0.4	0.0	13.4
Lane LOS	A		B
Approach Delay (s)	0.4	0.0	13.4
Approach LOS			B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	146	0	66	1	0	1	32	380	1	2	473	97
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	149	0	67	1	0	1	33	388	1	2	483	99
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											575	
pX, platoon unblocked												
vC, conflicting volume	796	990	291	766	1039	194	582			389		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	796	990	291	766	1039	194	582			389		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	45	100	90	100	100	100	97			100		
cM capacity (veh/h)	270	236	706	257	221	814	989			1166		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	216	2	33	259	130	2	322	260
Volume Left	149	1	33	0	0	2	0	0
Volume Right	67	1	0	0	1	0	0	99
cSH	334	391	989	1700	1700	1166	1700	1700
Volume to Capacity	0.65	0.01	0.03	0.15	0.08	0.00	0.19	0.15
Queue Length 95th (ft)	107	0	3	0	0	0	0	0
Control Delay (s)	33.6	14.3	8.8	0.0	0.0	8.1	0.0	0.0
Lane LOS	D	B	A			A		
Approach Delay (s)	33.6	14.3	0.7			0.0		
Approach LOS	D	B						

Intersection Summary				
Average Delay	6.2			
Intersection Capacity Utilization	46.9%	ICU Level of Service		A
Analysis Period (min)	15			

Appendix C

Existing plus Project Intersection LOS Calculations

HCM Signalized Intersection Capacity Analysis
1: US 101 South Ramps & Golf Course Drive West/Golf Course Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	225	90	264	251	0	0	0	0	398	117	317
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.97	1.00
Satd. Flow (prot)		3539	1583	3433	3539					1681	1722	1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.97	1.00
Satd. Flow (perm)		3539	1583	3433	3539					1681	1722	1583
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	256	102	300	285	0	0	0	0	452	133	360
RTOR Reduction (vph)	0	0	47	0	0	0	0	0	0	0	0	270
Lane Group Flow (vph)	0	256	55	300	285	0	0	0	0	289	296	90
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		6		5	2					8	8	
Permitted Phases			6									8
Actuated Green, G (s)		59.3	59.3	13.1	75.4					27.6	27.6	27.6
Effective Green, g (s)		59.3	59.3	13.1	75.4					27.6	27.6	27.6
Actuated g/C Ratio		0.54	0.54	0.12	0.69					0.25	0.25	0.25
Clearance Time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Vehicle Extension (s)		1.5	1.5	1.0	1.5					1.5	1.5	1.5
Lane Grp Cap (vph)		1907	853	408	2425					421	432	397
v/s Ratio Prot		c0.07		c0.09	0.08					c0.17	0.17	
v/s Ratio Perm			0.03									0.06
v/c Ratio		0.13	0.06	0.74	0.12					0.69	0.69	0.23
Uniform Delay, d1		12.6	12.1	46.8	5.9					37.3	37.3	32.7
Progression Factor		0.52	0.81	1.00	1.00					1.00	1.00	1.00
Incremental Delay, d2		0.1	0.1	5.8	0.1					3.7	3.6	0.1
Delay (s)		6.6	10.0	52.6	6.0					41.0	40.8	32.8
Level of Service		A	B	D	A					D	D	C
Approach Delay (s)		7.6			29.9			0.0			37.8	
Approach LOS		A			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	29.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	37.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Commerce Blvd & Golf Course Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	201	383	403	421	67	105	77	189	52	93	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	13	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.95		0.97	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	3452		3433	1863	1636	1770	1813	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	3452		3433	1863	1636	1770	1813	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	12	221	421	443	463	74	115	85	208	57	102	20
RTOR Reduction (vph)	0	0	259	0	9	0	0	0	139	0	6	0
Lane Group Flow (vph)	12	221	162	443	528	0	115	85	69	57	116	0
Confl. Peds. (#/hr)						5						1
Confl. Bikes (#/hr)						1						
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	1	6	4	5	2		4	4	5	3	3	
Permitted Phases			6						4			
Actuated Green, G (s)	0.7	17.4	28.5	13.5	30.2		11.1	11.1	24.6	15.9	15.9	
Effective Green, g (s)	0.7	17.4	28.5	13.5	30.2		11.1	11.1	24.6	15.9	15.9	
Actuated g/C Ratio	0.01	0.24	0.39	0.18	0.41		0.15	0.15	0.33	0.22	0.22	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	1.0	1.5	1.5	1.0	1.5		1.5	1.5	1.0	1.5	1.5	
Lane Grp Cap (vph)	16	1197	610	627	1410		515	279	633	380	390	
v/s Ratio Prot	0.01	0.04	0.04	c0.13	c0.15		0.03	c0.05	0.02	0.03	c0.06	
v/s Ratio Perm			0.06						0.02			
v/c Ratio	0.75	0.18	0.27	0.71	0.37		0.22	0.30	0.11	0.15	0.30	
Uniform Delay, d1	36.5	22.6	15.5	28.3	15.3		27.6	28.0	17.1	23.5	24.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	97.6	0.0	0.1	3.0	0.1		0.1	0.2	0.0	0.1	0.2	
Delay (s)	134.1	22.6	15.6	31.3	15.3		27.7	28.2	17.1	23.6	24.5	
Level of Service	F	C	B	C	B		C	C	B	C	C	
Approach Delay (s)		20.2			22.5			22.4			24.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	73.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Commerce Blvd & US 101 North Ramps
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	2	33	1	0	1	90	194	4	2	512	358
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.93		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1793	1687	1794		1695		1770	3527		1770	3539	1583
Flt Permitted	0.95	0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1793	1687	1794		1695		1770	3527		1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	186	2	34	1	0	1	93	200	4	2	528	369
RTOR Reduction (vph)	0	0	25	0	2	0	0	1	0	0	0	0
Lane Group Flow (vph)	95	93	9	0	0	0	93	203	0	2	528	369
Confl. Peds. (#/hr)									2			
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA		Prot	NA	Free
Protected Phases	8	8	1	7	7		1	6		5	2	
Permitted Phases			8									Free
Actuated Green, G (s)	7.6	7.6	13.8		0.8		6.2	26.9		0.7	21.4	50.0
Effective Green, g (s)	7.6	7.6	13.8		0.8		6.2	26.9		0.7	21.4	50.0
Actuated g/C Ratio	0.15	0.15	0.28		0.02		0.12	0.54		0.01	0.43	1.00
Clearance Time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0		4.0		2.0	2.0		2.0	4.0	
Lane Grp Cap (vph)	272	256	495		27		219	1897		24	1514	1583
v/s Ratio Prot	0.05	c0.06	0.00		0.00		c0.05	0.06		0.00	c0.15	
v/s Ratio Perm			0.00									c0.23
v/c Ratio	0.35	0.36	0.02		0.00		0.42	0.11		0.08	0.35	0.23
Uniform Delay, d1	19.0	19.0	13.2		24.2		20.3	5.7		24.3	9.6	0.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.3	0.0		0.0		0.5	0.0		0.5	0.2	0.3
Delay (s)	19.3	19.3	13.2		24.2		20.7	5.7		24.9	9.8	0.3
Level of Service	B	B	B		C		C	A		C	A	A
Approach Delay (s)		18.4			24.2			10.4			6.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr
4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	146	162	28	318	279
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	17	168	186	32	366	321
Pedestrians	5		5			5
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	0		0			0
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1264	212			223	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1264	212			223	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	80			73	
cM capacity (veh/h)	135	821			1340	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	185	218	366	321
Volume Left	17	0	366	0
Volume Right	168	32	0	0
cSH	557	1700	1340	1700
Volume to Capacity	0.33	0.13	0.27	0.19
Queue Length 95th (ft)	36	0	28	0
Control Delay (s)	14.6	0.0	8.7	0.0
Lane LOS	B		A	
Approach Delay (s)	14.6	0.0	4.6	
Approach LOS	B			

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr

4/16/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	15	146	162	28	318	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.99	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1575	1817		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1575	1817		1770	1863
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	17	168	186	32	366	321
RTOR Reduction (vph)	0	96	10	0	0	0
Lane Group Flow (vph)	17	72	208	0	366	321
Confl. Peds. (#/hr)	5	5		5	5	
Confl. Bikes (#/hr)		5		5		
Turn Type	Prot	pm+ov	NA		Prot	NA
Protected Phases	8	1	2		1	6
Permitted Phases		8				
Actuated Green, G (s)	3.4	19.0	11.8		15.6	31.9
Effective Green, g (s)	3.4	19.0	11.8		15.6	31.9
Actuated g/C Ratio	0.08	0.43	0.27		0.35	0.72
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	135	835	483		623	1341
v/s Ratio Prot	0.01	c0.03	c0.11		c0.21	0.17
v/s Ratio Perm		0.02				
v/c Ratio	0.13	0.09	0.43		0.59	0.24
Uniform Delay, d1	19.1	7.5	13.5		11.7	2.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	0.0	0.6		1.4	0.1
Delay (s)	19.5	7.5	14.1		13.1	2.2
Level of Service	B	A	B		B	A
Approach Delay (s)	8.6		14.1			8.0
Approach LOS	A		B			A

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	44.3	Sum of lost time (s)	13.5
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	13	7	22	15	2	4	58	165	25	18	220	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	14	8	24	16	2	4	62	177	27	19	237	17
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	513	623	137	510	618	112	259			209		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	513	623	137	510	618	112	259			209		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	98	97	96	99	100	95			99		
cM capacity (veh/h)	413	373	879	402	375	912	1297			1353		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	14	31	23	62	118	86	19	158	96
Volume Left	14	0	16	62	0	0	19	0	0
Volume Right	0	24	4	0	0	27	0	0	17
cSH	413	662	446	1297	1700	1700	1353	1700	1700
Volume to Capacity	0.03	0.05	0.05	0.05	0.07	0.05	0.01	0.09	0.06
Queue Length 95th (ft)	3	4	4	4	0	0	1	0	0
Control Delay (s)	14.0	10.7	13.5	7.9	0.0	0.0	7.7	0.0	0.0
Lane LOS	B	B	B	A			A		
Approach Delay (s)	11.7		13.5	1.9			0.5		
Approach LOS	B		B						

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	29.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	13	7	22	15	2	4	58	165	25	18	220	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	14	8	24	16	2	4	62	177	27	19	237	17
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	601	623	255	628	618	201	259			209		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	601	623	255	628	618	201	259			209		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	97	95	99	99	95			99		
cM capacity (veh/h)	383	374	777	354	377	833	1300			1356		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	14	31	23	62	204	19	254
Volume Left	14	0	16	62	0	19	0
Volume Right	0	24	4	0	27	0	17
cSH	383	617	401	1300	1700	1356	1700
Volume to Capacity	0.04	0.05	0.06	0.05	0.12	0.01	0.15
Queue Length 95th (ft)	3	4	4	4	0	1	0
Control Delay (s)	14.8	11.1	14.5	7.9	0.0	7.7	0.0
Lane LOS	B	B	B	A		A	
Approach Delay (s)	12.3		14.5	1.8		0.5	
Approach LOS	B		B				

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	34.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Commerce Blvd & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	39	167	0	21	148	80	0	50	62	43	34	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	44	190	0	24	168	91	0	57	70	49	39	16
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			TWLTL							
Median storage veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	264			195			540	595	200	649	550	224
vC1, stage 1 conf vol							283	283		266	266	
vC2, stage 2 conf vol							256	312		382	283	
vCu, unblocked vol	264			195			540	595	200	649	550	224
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			98			100	89	92	89	93	98
cM capacity (veh/h)	1295			1373			559	532	834	457	557	809

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	44	190	24	259	127	49	55
Volume Left	44	0	24	0	0	49	0
Volume Right	0	0	0	91	70	0	16
cSH	1295	1700	1373	1700	666	457	613
Volume to Capacity	0.03	0.11	0.02	0.15	0.19	0.11	0.09
Queue Length 95th (ft)	3	0	1	0	18	9	7
Control Delay (s)	7.9	0.0	7.7	0.0	11.7	13.8	11.5
Lane LOS	A		A		B	B	B
Approach Delay (s)	1.5		0.6		11.7	12.6	
Approach LOS					B	B	

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	36.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Commerce Blvd & Padre Pkwy

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	3	54	56	3	14	53	383	74	13	212	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	24	4	65	67	4	17	64	461	89	16	255	14
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								480				
pX, platoon unblocked												
vC, conflicting volume	681	982	145	870	945	285	275			556		
vC1, stage 1 conf vol	299	299		639	639							
vC2, stage 2 conf vol	382	683		231	306							
vCu, unblocked vol	681	982	145	870	945	285	275			556		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	99	93	82	99	98	95			98		
cM capacity (veh/h)	484	379	869	372	397	706	1280			1007		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	93	88	64	308	243	16	170	100
Volume Left	24	67	64	0	0	16	0	0
Volume Right	65	17	0	0	89	0	0	14
cSH	691	410	1280	1700	1700	1007	1700	1700
Volume to Capacity	0.13	0.21	0.05	0.18	0.14	0.02	0.10	0.06
Queue Length 95th (ft)	12	20	4	0	0	1	0	0
Control Delay (s)	11.0	16.2	8.0	0.0	0.0	8.6	0.0	0.0
Lane LOS	B	C	A			A		
Approach Delay (s)	11.0	16.2	0.8			0.5		
Approach LOS	B	C						

Intersection Summary				
Average Delay	2.9			
Intersection Capacity Utilization	37.2%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
7: Commerce Blvd & Padre Pkwy

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	3	54	56	3	14	53	383	74	13	212	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.98			0.99		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.91			0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99			0.96		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1631			1731		1770	1863	1534	1763	1845	
Flt Permitted		0.90			0.81		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1483			1458		1770	1863	1534	1763	1845	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	24	4	65	67	4	17	64	461	89	16	255	14
RTOR Reduction (vph)	0	54	0	0	14	0	0	0	38	0	2	0
Lane Group Flow (vph)	0	39	0	0	74	0	64	461	51	16	267	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)			5			5			5			5
Turn Type	Perm	NA		Perm	NA		Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8					2			
Actuated Green, G (s)		8.7			8.7		3.4	30.9	30.9	0.6	28.1	
Effective Green, g (s)		8.7			8.7		3.4	30.9	30.9	0.6	28.1	
Actuated g/C Ratio		0.16			0.16		0.06	0.58	0.58	0.01	0.52	
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		240			236		112	1072	882	19	965	
v/s Ratio Prot							c0.04	c0.25		0.01	0.14	
v/s Ratio Perm		0.03			c0.05				0.03			
v/c Ratio		0.16			0.31		0.57	0.43	0.06	0.84	0.28	
Uniform Delay, d1		19.4			19.9		24.4	6.4	5.0	26.5	7.1	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			0.8		6.9	1.3	0.1	131.7	0.7	
Delay (s)		19.7			20.6		31.3	7.7	5.1	158.2	7.8	
Level of Service		B			C		C	A	A	F	A	
Approach Delay (s)		19.7			20.6			9.8			16.3	
Approach LOS		B			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	53.7	Sum of lost time (s)	13.5
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	8	1	35	72	4	19	57	363	83	30	152	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	8	1	36	75	4	20	59	378	86	31	158	12
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								456				
pX, platoon unblocked												
vC, conflicting volume	567	820	95	729	783	242	176			470		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	567	820	95	729	783	242	176			470		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	96	73	99	97	96			97		
cM capacity (veh/h)	365	284	935	278	298	752	1392			1084		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	9	37	75	24	59	252	212	31	106	65
Volume Left	8	0	75	0	59	0	0	31	0	0
Volume Right	0	36	0	20	0	0	86	0	0	12
cSH	359	905	278	595	1392	1700	1700	1084	1700	1700
Volume to Capacity	0.02	0.04	0.27	0.04	0.04	0.15	0.13	0.03	0.06	0.04
Queue Length 95th (ft)	2	3	27	3	3	0	0	2	0	0
Control Delay (s)	15.3	9.1	22.7	11.3	7.7	0.0	0.0	8.4	0.0	0.0
Lane LOS	C	A	C	B	A			A		
Approach Delay (s)	10.3		19.9		0.9			1.3		
Approach LOS	B		C							

Intersection Summary				
Average Delay	3.6			
Intersection Capacity Utilization	37.3%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	8	1	35	72	4	19	57	363	83	30	152	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	0.96	1.00	0.97		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes		0.99	1.00	0.99	1.00		1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85	1.00	0.88		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1773	1527	1757	1582		1770	1863	1535	1770	1839	
Flt Permitted		0.85	1.00	0.75	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1576	1527	1391	1582		1770	1863	1535	1770	1839	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	8	1	36	75	4	20	59	378	86	31	158	12
RTOR Reduction (vph)	0	0	28	0	16	0	0	0	40	0	3	0
Lane Group Flow (vph)	0	9	8	75	8	0	59	378	46	31	167	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)			5			5			5			5
Turn Type	Perm	NA	Perm	Perm	NA		Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8					2			
Actuated Green, G (s)		13.4	13.4	13.4	13.4		3.5	33.7	33.7	2.0	32.2	
Effective Green, g (s)		13.4	13.4	13.4	13.4		3.5	33.7	33.7	2.0	32.2	
Actuated g/C Ratio		0.21	0.21	0.21	0.21		0.06	0.54	0.54	0.03	0.51	
Clearance Time (s)		4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		337	326	297	338		98	1002	826	56	945	
v/s Ratio Prot					0.01		c0.03	c0.20		0.02	0.09	
v/s Ratio Perm		0.01	0.01	c0.05					0.03			
v/c Ratio		0.03	0.02	0.25	0.02		0.60	0.38	0.06	0.55	0.18	
Uniform Delay, d1		19.4	19.4	20.4	19.4		28.9	8.4	6.9	29.9	8.1	
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.0	0.0	0.4	0.0		10.0	1.1	0.1	11.3	0.4	
Delay (s)		19.5	19.5	20.9	19.5		38.9	9.5	7.0	41.2	8.5	
Level of Service		B	B	C	B		D	A	A	D	A	
Approach Delay (s)		19.5			20.5			12.4			13.6	
Approach LOS		B			C			B			B	

Intersection Summary				
HCM 2000 Control Delay	13.9	HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio	0.37			
Actuated Cycle Length (s)	62.6	Sum of lost time (s)		13.5
Intersection Capacity Utilization	45.5%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
9: US 101 SB Ramps & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	683	161	12	638	0	1	0	0	650	0	323
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.5	4.5	3.5	4.5		4.0			4.0		4.0
Lane Util. Factor		0.91	1.00	1.00	0.91		1.00			0.97		1.00
Frpb, ped/bikes		1.00	0.98	1.00	1.00		1.00			1.00		1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00			1.00		1.00
Frt		1.00	0.85	1.00	1.00		1.00			1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95			0.95		1.00
Satd. Flow (prot)		5085	1495	1770	5085		1770			3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.95			0.95		1.00
Satd. Flow (perm)		5085	1495	1770	5085		1770			3433		1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	711	168	12	665	0	1	0	0	677	0	336
RTOR Reduction (vph)	0	0	96	0	0	0	0	0	0	0	0	152
Lane Group Flow (vph)	0	711	72	12	665	0	1	0	0	677	0	184
Confl. Peds. (#/hr)			4			4						
Turn Type		NA	Perm	Prot	NA		Prot		Prot	Prot		Perm
Protected Phases		2		1	6		3		3	4		
Permitted Phases			2									4
Actuated Green, G (s)		64.1	64.1	2.7	70.3		1.2			66.0		66.0
Effective Green, g (s)		64.1	64.1	2.7	70.3		1.2			66.0		66.0
Actuated g/C Ratio		0.43	0.43	0.02	0.47		0.01			0.44		0.44
Clearance Time (s)		4.5	4.5	3.5	4.5		4.0			4.0		4.0
Vehicle Extension (s)		4.0	4.0	2.0	4.0		3.0			2.0		2.0
Lane Grp Cap (vph)		2172	638	31	2383		14			1510		696
v/s Ratio Prot		c0.14		0.01	c0.13		c0.00			c0.20		
v/s Ratio Perm			0.05									0.12
v/c Ratio		0.33	0.11	0.39	0.28		0.07			0.45		0.26
Uniform Delay, d1		28.6	25.8	72.8	24.4		73.8			29.3		26.6
Progression Factor		0.39	0.25	1.10	0.99		1.00			1.00		1.00
Incremental Delay, d2		0.4	0.3	2.9	0.3		2.2			0.1		0.1
Delay (s)		11.6	6.7	83.2	24.4		76.0			29.4		26.7
Level of Service		B	A	F	C		E			C		C
Approach Delay (s)		10.7			25.5			76.0			28.5	
Approach LOS		B			C			E			C	

Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: US 101 NB Ramps & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	1096	0	0	868	715	164	14	333	1	0	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.86			0.91	1.00	0.95	0.95	0.88	1.00		1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	1.00	1.00	1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (prot)	1770	6408			5085	1550	1681	1698	2787	1770		1583
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (perm)	1770	6408			5085	1550	1681	1698	2787	1770		1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	12	1166	0	0	923	761	174	15	354	1	0	9
RTOR Reduction (vph)	0	0	0	0	0	200	0	0	279	0	0	9
Lane Group Flow (vph)	12	1166	0	0	923	561	94	95	75	1	0	0
Confl. Peds. (#/hr)			4			4						
Turn Type	Prot	NA			NA	Perm	Split	NA	Perm	Prot		Perm
Protected Phases	5	2			6		3	3		4		
Permitted Phases						6			3			4
Actuated Green, G (s)	2.9	117.4			110.5	110.5	14.8	14.8	14.8	2.8		2.8
Effective Green, g (s)	2.9	117.4			110.5	110.5	14.8	14.8	14.8	2.8		2.8
Actuated g/C Ratio	0.02	0.78			0.74	0.74	0.10	0.10	0.10	0.02		0.02
Clearance Time (s)	4.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Vehicle Extension (s)	2.0	4.0			2.0	2.0	2.0	2.0	2.0	4.0		4.0
Lane Grp Cap (vph)	34	5015			3745	1141	165	167	274	33		29
v/s Ratio Prot	0.01	c0.18			0.18		0.06	c0.06		c0.00		
v/s Ratio Perm						c0.36			0.03			0.00
v/c Ratio	0.35	0.23			0.25	0.49	0.57	0.57	0.28	0.03		0.01
Uniform Delay, d1	72.6	4.3			6.4	8.2	64.6	64.6	62.6	72.3		72.2
Progression Factor	1.08	0.44			1.49	12.66	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.2	0.1			0.1	1.4	2.7	2.6	0.2	0.5		0.1
Delay (s)	80.3	2.0			9.6	104.6	67.2	67.2	62.8	72.8		72.3
Level of Service	F	A			A	F	E	E	E	E		E
Approach Delay (s)		2.8			52.5			64.4			72.4	
Approach LOS		A			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	37.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	289	819	326	86	1036	115	358	179	108	63	100	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1559	1770	4998		3433	1863	1552	1610	3374	1559
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1559	1770	4998		3433	1863	1552	1610	3374	1559
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	307	871	347	91	1102	122	381	190	115	67	106	191
RTOR Reduction (vph)	0	0	112	0	6	0	0	0	97	0	0	72
Lane Group Flow (vph)	307	871	235	91	1218	0	381	190	18	56	117	119
Confl. Peds. (#/hr)			7			6			7			13
Confl. Bikes (#/hr)						3						3
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	Perm	Split	NA	pm+ov
Protected Phases	5	2	3	1	6		3	3		4	4	5
Permitted Phases			2						3			4
Actuated Green, G (s)	13.7	77.6	101.6	11.5	75.4		24.0	24.0	24.0	16.9	16.9	30.6
Effective Green, g (s)	13.7	77.6	101.6	11.5	75.4		24.0	24.0	24.0	16.9	16.9	30.6
Actuated g/C Ratio	0.09	0.52	0.68	0.08	0.50		0.16	0.16	0.16	0.11	0.11	0.20
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	1.5	1.5	1.0	1.0	1.0
Lane Grp Cap (vph)	313	1830	1107	135	2512		549	298	248	181	380	318
v/s Ratio Prot	c0.09	0.25	0.03	c0.05	c0.24		c0.11	0.10		0.03	0.03	c0.03
v/s Ratio Perm			0.12						0.01			0.04
v/c Ratio	0.98	0.48	0.21	0.67	0.48		0.69	0.64	0.07	0.31	0.31	0.38
Uniform Delay, d1	68.0	23.2	9.1	67.4	24.5		59.5	58.9	53.6	61.2	61.2	51.5
Progression Factor	1.02	1.07	2.02	0.94	0.67		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	44.8	0.9	0.0	8.8	0.6		3.1	3.3	0.0	0.4	0.2	0.3
Delay (s)	114.2	25.7	18.5	72.0	17.0		62.6	62.2	53.6	61.5	61.3	51.7
Level of Service	F	C	B	E	B		E	E	D	E	E	D
Approach Delay (s)		41.9			20.8			61.0			56.3	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	39.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	289	819	326	86	1036	115	358	179	108	63	100	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	4.0	5.0	4.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1557	1770	4999		3433	1863	1550	1770	3539	1562
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1557	1770	4999		3433	1863	1550	1770	3539	1562
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	307	871	347	91	1102	122	381	190	115	67	106	191
RTOR Reduction (vph)	0	0	114	0	8	0	0	0	69	0	0	72
Lane Group Flow (vph)	307	871	233	91	1216	0	381	190	46	67	106	119
Confl. Peds. (#/hr)			7			6			7			13
Confl. Bikes (#/hr)						3						3
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	5	2	3	1	6		3	8	1	7	4	5
Permitted Phases			2						8			4
Actuated Green, G (s)	14.5	68.0	87.2	9.5	63.0		19.2	21.7	31.2	12.8	13.3	27.8
Effective Green, g (s)	14.5	68.0	87.2	9.5	63.0		19.2	21.7	31.2	12.8	13.3	27.8
Actuated g/C Ratio	0.11	0.52	0.67	0.07	0.48		0.15	0.17	0.24	0.10	0.10	0.21
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	4.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	3.0	1.0	3.0	1.0	1.0
Lane Grp Cap (vph)	382	1851	1104	129	2422		507	310	431	174	362	394
v/s Ratio Prot	c0.09	0.25	0.03	0.05	c0.24		c0.11	c0.10	0.01	0.04	0.03	0.03
v/s Ratio Perm			0.12						0.02			0.04
v/c Ratio	0.80	0.47	0.21	0.71	0.50		0.75	0.61	0.11	0.39	0.29	0.30
Uniform Delay, d1	56.4	19.6	8.2	58.9	22.8		53.1	50.3	38.5	54.9	54.0	42.9
Progression Factor	0.90	0.56	0.20	0.92	0.28		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.7	0.8	0.0	11.2	0.6		5.5	3.6	0.0	1.4	0.2	0.2
Delay (s)	61.2	11.9	1.6	65.5	7.1		58.6	53.8	38.6	56.3	54.2	43.1
Level of Service	E	B	A	E	A		E	D	D	E	D	D
Approach Delay (s)		19.5			11.1			53.9			48.8	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: State Farm Dr & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	627	150	196	936	190	263	129	126	61	70	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1548	1770	3539	1560	1610	3307	1553	1610	3098	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1548	1770	3539	1560	1610	3307	1553	1610	3098	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	660	158	206	985	200	277	136	133	64	74	84
RTOR Reduction (vph)	0	0	90	0	0	68	0	0	115	0	74	0
Lane Group Flow (vph)	168	660	68	206	985	132	138	275	18	58	90	0
Confl. Peds. (#/hr)			8			2			5			2
Confl. Bikes (#/hr)									1			1
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			6			3			
Actuated Green, G (s)	22.4	64.3	64.3	28.1	70.0	70.0	20.6	20.6	20.6	17.0	17.0	
Effective Green, g (s)	22.4	64.3	64.3	28.1	70.0	70.0	20.6	20.6	20.6	17.0	17.0	
Actuated g/C Ratio	0.15	0.43	0.43	0.19	0.47	0.47	0.14	0.14	0.14	0.11	0.11	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)	264	1517	663	331	1651	728	221	454	213	182	351	
v/s Ratio Prot	0.09	0.19		c0.12	c0.28		c0.09	0.08		c0.04	0.03	
v/s Ratio Perm			0.04			0.08			0.01			
v/c Ratio	0.64	0.44	0.10	0.62	0.60	0.18	0.62	0.61	0.09	0.32	0.26	
Uniform Delay, d1	60.0	30.1	25.6	56.1	29.6	23.3	61.0	60.9	56.5	61.2	60.7	
Progression Factor	0.83	1.14	3.11	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.02	
Incremental Delay, d2	3.4	0.8	0.3	2.6	1.6	0.5	3.9	1.6	0.1	0.4	0.1	
Delay (s)	53.0	35.2	79.8	58.7	31.2	23.9	65.0	62.4	56.5	62.3	62.1	
Level of Service	D	D	E	E	C	C	E	E	E	E	E	
Approach Delay (s)		45.4			34.2			61.6			62.1	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	44.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: State Farm Dr & Rohnert Park Expressway

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	627	150	196	936	190	263	129	126	61	70	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	11	11	11
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1539	1770	3539	1552	3433	1863	1569	3319	1801	1518
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1539	1770	3539	1552	3433	1863	1569	3319	1801	1518
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	660	158	206	985	200	277	136	133	64	74	84
RTOR Reduction (vph)	0	0	74	0	0	78	0	0	39	0	0	62
Lane Group Flow (vph)	168	660	84	206	985	122	277	136	94	64	74	22
Confl. Peds. (#/hr)			8			2			5			2
Confl. Bikes (#/hr)									1			1
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	14.6	53.7	68.8	22.6	61.7	74.8	15.1	22.6	45.2	13.1	19.6	34.2
Effective Green, g (s)	14.6	53.7	68.8	22.6	61.7	74.8	15.1	22.6	45.2	13.1	19.6	34.2
Actuated g/C Ratio	0.11	0.41	0.53	0.17	0.47	0.58	0.12	0.17	0.35	0.10	0.15	0.26
Clearance Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	3.0	1.0	1.0	3.0	3.0	3.0	1.0	3.0	1.0	1.0
Lane Grp Cap (vph)	198	1461	861	307	1679	940	398	323	605	334	271	457
v/s Ratio Prot	c0.09	0.19	0.01	c0.12	c0.28	0.01	c0.08	c0.07	0.03	0.02	0.04	0.01
v/s Ratio Perm			0.04			0.07			0.03			0.01
v/c Ratio	0.85	0.45	0.10	0.67	0.59	0.13	0.70	0.42	0.16	0.19	0.27	0.05
Uniform Delay, d1	56.6	27.5	15.2	50.2	24.9	12.7	55.2	47.9	29.2	53.6	48.9	35.8
Progression Factor	0.88	1.09	3.23	0.72	0.60	0.19	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.5	0.9	0.0	4.0	1.3	0.1	5.2	0.9	0.0	0.3	0.2	0.0
Delay (s)	74.1	30.9	49.1	40.2	16.3	2.5	60.5	48.8	29.3	53.9	49.1	35.8
Level of Service	E	C	D	D	B	A	E	D	C	D	D	D
Approach Delay (s)		41.2			17.8			50.0			45.4	
Approach LOS		D			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Commerce Blvd & Enterprise Dr

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	76	26	468	71	20	298
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	0.98	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3433	1552	3462		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3433	1552	3462		1770	3539
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	79	27	488	74	21	310
RTOR Reduction (vph)	0	22	18	0	0	0
Lane Group Flow (vph)	79	5	544	0	21	310
Confl. Peds. (#/hr)		5		5		
Confl. Bikes (#/hr)		5		5		
Turn Type	Prot	Perm	NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	4.8	4.8	10.7		0.3	15.0
Effective Green, g (s)	4.8	4.8	10.7		0.3	15.0
Actuated g/C Ratio	0.17	0.17	0.38		0.01	0.54
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	592	267	1332		19	1909
v/s Ratio Prot	c0.02		c0.16		c0.01	0.09
v/s Ratio Perm		0.00				
v/c Ratio	0.13	0.02	0.41		1.11	0.16
Uniform Delay, d1	9.7	9.5	6.2		13.8	3.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.0	0.2		242.0	0.0
Delay (s)	9.8	9.6	6.4		255.8	3.3
Level of Service	A	A	A		F	A
Approach Delay (s)	9.8		6.4			19.3
Approach LOS	A		A			B

Intersection Summary			
HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	27.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	29.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (veh/h)	13	82	0	3	116	125	1	2	0	61	0	4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	14	90	0	3	127	137	1	2	0	67	0	4

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	59	45	67	201	3	71
Volume Left (vph)	14	0	3	0	1	67
Volume Right (vph)	0	0	0	137	0	4
Hadj (s)	0.15	0.03	0.06	-0.44	0.10	0.18
Departure Headway (s)	5.1	4.9	4.8	4.3	4.9	4.9
Degree Utilization, x	0.08	0.06	0.09	0.24	0.00	0.10
Capacity (veh/h)	695	706	721	810	679	685
Control Delay (s)	7.3	7.1	7.1	7.5	7.9	8.4
Approach Delay (s)	7.2		7.4		7.9	8.4
Approach LOS	A		A		A	A

Intersection Summary			
Delay	7.5		
Level of Service	A		
Intersection Capacity Utilization	28.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	13	82	0	3	116	125	1	2	0	61	0	4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	14	90	0	3	127	137	1	2	0	67	0	4

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	14	90	131	137	3	71
Volume Left (vph)	14	0	3	0	1	67
Volume Right (vph)	0	0	0	137	0	4
Hadj (s)	0.53	0.03	0.05	-0.67	0.10	0.18
Departure Headway (s)	5.4	4.9	4.8	4.1	4.9	4.9
Degree Utilization, x	0.02	0.12	0.18	0.16	0.00	0.10
Capacity (veh/h)	646	707	724	852	681	686
Control Delay (s)	7.4	7.4	7.7	6.7	7.9	8.4
Approach Delay (s)	7.4		7.2		7.9	8.4
Approach LOS	A		A		A	A

Intersection Summary			
Delay	7.4		
Level of Service	A		
Intersection Capacity Utilization	29.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Enterprise Dr & State Farm Dr

4/15/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	61	76	149	312	187	81
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	69	85	167	351	210	91

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	69	85	112	406	210	91
Volume Left (vph)	69	0	0	0	210	0
Volume Right (vph)	0	0	0	351	0	91
Hadj (s)	0.53	0.03	0.03	-0.57	0.53	-0.67
Departure Headway (s)	6.6	6.1	5.7	5.1	6.6	5.5
Degree Utilization, x	0.13	0.14	0.18	0.58	0.39	0.14
Capacity (veh/h)	513	557	603	687	506	616
Control Delay (s)	9.4	8.9	8.7	13.6	12.6	8.1
Approach Delay (s)	9.1		12.6		11.2	
Approach LOS	A		B		B	

Intersection Summary			
Delay	11.6		
Level of Service	B		
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
16: Enterprise Dr/Seed Farm Dr

4/15/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	2	225	383	1	2	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	250	426	1	2	1
Pedestrians		5	5		5	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	432				691	436
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	432				691	436
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1123				406	615

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	252	427	3
Volume Left	2	0	2
Volume Right	0	1	1
cSH	1123	1700	458
Volume to Capacity	0.00	0.25	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.1	0.0	12.9
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	12.9
Approach LOS			B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
15: Enterprise Dr & State Farm Dr

4/16/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	61	76	149	312	187	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	0.97	1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1766	1863	1863	1540	1770	1539
Flt Permitted	0.65	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1211	1863	1863	1540	1770	1539
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	69	85	167	351	210	91
RTOR Reduction (vph)	0	0	0	227	0	60
Lane Group Flow (vph)	69	85	167	124	210	31
Confl. Peds. (#/hr)	5			5	5	5
Confl. Bikes (#/hr)				5		5
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	9.1	9.1	9.1	9.1	8.7	8.7
Effective Green, g (s)	9.1	9.1	9.1	9.1	8.7	8.7
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.34	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	427	657	657	543	596	518
v/s Ratio Prot		0.05	c0.09		c0.12	
v/s Ratio Perm	0.06			0.08		0.02
v/c Ratio	0.16	0.13	0.25	0.23	0.35	0.06
Uniform Delay, d1	5.7	5.7	5.9	5.9	6.4	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1	0.2	0.2	0.4	0.0
Delay (s)	5.9	5.8	6.1	6.1	6.8	5.8
Level of Service	A	A	A	A	A	A
Approach Delay (s)		5.8	6.1		6.5	
Approach LOS		A	A		A	

Intersection Summary			
HCM 2000 Control Delay	6.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	25.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
17: State Farm Dr & Town Center

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	47	4	10	24	5	115	22	350	17	106	246	32
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	51	4	11	26	5	125	24	380	18	115	267	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											561	
pX, platoon unblocked												
vC, conflicting volume	881	962	151	815	970	199	302			399		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	881	962	151	815	970	199	302			399		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	72	98	99	89	98	85	98			90		
cM capacity (veh/h)	182	225	868	239	222	808	1256			1156		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	66	157	24	254	145	115	178	124
Volume Left	51	26	24	0	0	115	0	0
Volume Right	11	125	0	0	18	0	0	35
cSH	212	543	1256	1700	1700	1156	1700	1700
Volume to Capacity	0.31	0.29	0.02	0.15	0.09	0.10	0.10	0.07
Queue Length 95th (ft)	32	30	1	0	0	8	0	0
Control Delay (s)	29.5	14.3	7.9	0.0	0.0	8.5	0.0	0.0
Lane LOS	D	B	A			A		
Approach Delay (s)	29.5	14.3	0.4			2.3		
Approach LOS	D	B						

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	36.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
17: State Farm Dr & Town Center

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	47	4	10	24	5	115	22	350	17	106	246	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1780	1583		1788	1583	1770	1863	1583	1770	1863	1583
Flt Permitted		0.73	1.00		0.77	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1364	1583		1439	1583	1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	4	11	26	5	125	24	380	18	115	267	35
RTOR Reduction (vph)	0	0	9	0	0	102	0	0	10	0	0	16
Lane Group Flow (vph)	0	55	2	0	31	23	24	380	8	115	267	19
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		8.5	8.5		8.5	8.5	0.5	20.1	20.1	5.3	24.9	24.9
Effective Green, g (s)		8.5	8.5		8.5	8.5	0.5	20.1	20.1	5.3	24.9	24.9
Actuated g/C Ratio		0.19	0.19		0.19	0.19	0.01	0.44	0.44	0.12	0.54	0.54
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		252	293		266	293	19	815	693	204	1010	858
v/s Ratio Prot							0.01	c0.20		c0.06	0.14	
v/s Ratio Perm		c0.04	0.00		0.02	0.01			0.00			0.01
v/c Ratio		0.22	0.01		0.12	0.08	1.26	0.47	0.01	0.56	0.26	0.02
Uniform Delay, d1		15.9	15.3		15.6	15.5	22.7	9.1	7.3	19.2	5.6	4.9
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.4	0.0		0.2	0.1	298.7	0.4	0.0	3.5	0.1	0.0
Delay (s)		16.3	15.3		15.8	15.6	321.4	9.5	7.3	22.7	5.7	4.9
Level of Service		B	B		B	B	F	A	A	C	A	A
Approach Delay (s)		16.1			15.6			27.2			10.4	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	45.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
1: US 101 South Ramps & Golf Course Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	638	212	166	420	0	0	0	0	455	165	485
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00					1.00	1.00	0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (prot)		3539	1532	3433	3539					1681	1728	1540
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (perm)		3539	1532	3433	3539					1681	1728	1540
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	658	219	171	433	0	0	0	0	469	170	500
RTOR Reduction (vph)	0	0	106	0	0	0	0	0	0	0	0	226
Lane Group Flow (vph)	0	658	113	171	433	0	0	0	0	314	325	274
Confl. Peds. (#/hr)			10									10
Confl. Bikes (#/hr)			10									10
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		6		5	2					8	8	
Permitted Phases			6									8
Actuated Green, G (s)		56.8	56.8	9.8	69.6					33.4	33.4	33.4
Effective Green, g (s)		56.8	56.8	9.8	69.6					33.4	33.4	33.4
Actuated g/C Ratio		0.52	0.52	0.09	0.63					0.30	0.30	0.30
Clearance Time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Vehicle Extension (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Grp Cap (vph)		1827	791	305	2239					510	524	467
v/s Ratio Prot		c0.19		c0.05	0.12					0.19	c0.19	
v/s Ratio Perm			0.07									0.18
v/c Ratio		0.36	0.14	0.56	0.19					0.62	0.62	0.59
Uniform Delay, d1		15.8	13.9	48.0	8.5					32.8	32.9	32.4
Progression Factor		0.52	0.51	1.00	1.00					1.00	1.00	1.00
Incremental Delay, d2		0.5	0.3	1.4	0.2					1.6	1.6	1.2
Delay (s)		8.7	7.3	49.4	8.6					34.4	34.5	33.7
Level of Service		A	A	D	A					C	C	C
Approach Delay (s)		8.4			20.2			0.0			34.1	
Approach LOS		A			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Commerce Blvd & Golf Course Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	569	465	319	311	77	290	195	520	183	212	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	13	12	12	12
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.0	4.5	4.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.95		0.97	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	0.99		1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1562	3433	3402		3433	1863	1619	1770	1842	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1562	3433	3402		3433	1863	1619	1770	1842	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	27	593	484	332	324	80	302	203	542	191	221	15
RTOR Reduction (vph)	0	0	201	0	16	0	0	0	212	0	2	0
Lane Group Flow (vph)	27	593	283	332	388	0	302	203	330	191	234	0
Confl. Peds. (#/hr)			10			10						10
Confl. Bikes (#/hr)			10			10			10			10
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	1	6	4	5	2		4	4	5	3	3	
Permitted Phases			6						4			
Actuated Green, G (s)	2.6	19.9	35.1	11.8	29.1		15.2	15.2	27.0	17.3	17.3	
Effective Green, g (s)	2.6	19.9	35.1	11.8	29.1		15.2	15.2	27.0	17.3	17.3	
Actuated g/C Ratio	0.03	0.24	0.43	0.14	0.36		0.19	0.19	0.33	0.21	0.21	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.0	4.5	4.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	56	1238	671	495	1211		638	346	535	374	390	
v/s Ratio Prot	0.02	c0.12	0.08	c0.10	0.11		0.09	0.11	c0.09	0.11	c0.13	
v/s Ratio Perm			0.10						0.11			
v/c Ratio	0.48	0.48	0.42	0.67	0.32		0.47	0.59	0.62	0.51	0.60	
Uniform Delay, d1	38.9	26.5	16.2	33.1	19.1		29.7	30.4	23.0	28.5	29.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.4	0.1	0.2	2.8	0.1		0.2	1.6	1.5	0.5	1.7	
Delay (s)	41.3	26.6	16.4	35.9	19.2		29.9	32.0	24.5	29.0	30.7	
Level of Service	D	C	B	D	B		C	C	C	C	C	
Approach Delay (s)		22.5			26.7			27.5			29.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	81.7	Sum of lost time (s)	17.5
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Commerce Blvd & US 101 North Ramps

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	411	0	24	3	4	1	331	561	1	4	508	461
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		0.98		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.98		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1793	1681	1794		1756		1770	3538		1770	3539	1546
Flt Permitted	0.95	0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1793	1681	1794		1756		1770	3538		1770	3539	1546
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	433	0	25	3	4	1	348	591	1	4	535	485
RTOR Reduction (vph)	0	0	14	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	216	217	11	0	7	0	348	592	0	4	535	485
Confl. Peds. (#/hr)						10			10			
Confl. Bikes (#/hr)									10			10
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA		Prot	NA	Free
Protected Phases	8	8	1	7	7		1	6		5	2	
Permitted Phases			8									Free
Actuated Green, G (s)	11.8	11.8	26.4		0.6		14.6	31.9		0.6	17.9	58.9
Effective Green, g (s)	11.8	11.8	26.4		0.6		14.6	31.9		0.6	17.9	58.9
Actuated g/C Ratio	0.20	0.20	0.45		0.01		0.25	0.54		0.01	0.30	1.00
Clearance Time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0		2.0		2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	359	336	804		17		438	1916		18	1075	1546
v/s Ratio Prot	0.12	c0.13	0.00		0.00		c0.20	0.17		0.00	c0.15	
v/s Ratio Perm			0.00									c0.31
v/c Ratio	0.60	0.65	0.01		0.41		0.79	0.31		0.22	0.50	0.31
Uniform Delay, d1	21.4	21.6	9.0		29.0		20.7	7.4		28.9	16.8	0.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.9	3.2	0.0		5.8		9.0	0.1		2.3	0.5	0.5
Delay (s)	23.4	24.8	9.0		34.8		29.7	7.6		31.2	17.3	0.5
Level of Service	C	C	A		C		C	A		C	B	A
Approach Delay (s)		23.3			34.8			15.8			9.4	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	58.9	Sum of lost time (s)	14.0
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr

4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	32	404	483	16	230	343
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	36	459	549	18	261	390
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1470	558			567	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1470	558			567	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	65	13			74	
cM capacity (veh/h)	104	529			1005	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	495	567	261	390
Volume Left	36	0	261	0
Volume Right	459	18	0	0
cSH	407	1700	1005	1700
Volume to Capacity	1.22	0.33	0.26	0.23
Queue Length 95th (ft)	507	0	26	0
Control Delay (s)	148.2	0.0	9.8	0.0
Lane LOS	F		A	
Approach Delay (s)	148.2	0.0	3.9	
Approach LOS	F			

Intersection Summary			
Average Delay	44.3		
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	32	404	483	16	230	343
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1855		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	1855		1770	1863
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	36	459	549	18	261	390
RTOR Reduction (vph)	0	127	1	0	0	0
Lane Group Flow (vph)	36	332	566	0	261	390
Turn Type	Prot	pm+ov	NA		Prot	NA
Protected Phases	8	1	2		1	6
Permitted Phases		8				
Actuated Green, G (s)	6.5	22.2	25.9		15.7	46.1
Effective Green, g (s)	6.5	22.2	25.9		15.7	46.1
Actuated g/C Ratio	0.11	0.36	0.42		0.25	0.75
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	186	686	779		451	1394
v/s Ratio Prot	0.02	c0.12	c0.31		c0.15	0.21
v/s Ratio Perm		0.09				
v/c Ratio	0.19	0.48	0.73		0.58	0.28
Uniform Delay, d1	25.2	15.3	14.9		20.1	2.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.5	3.4		1.8	0.1
Delay (s)	25.7	15.8	18.3		21.9	2.6
Level of Service	C	B	B		C	A
Approach Delay (s)	16.5		18.3			10.3
Approach LOS	B		B			B

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	61.6	Sum of lost time (s)	13.5
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	11	12	58	39	9	31	71	287	22	13	269	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	13	15	71	48	11	38	87	350	27	16	328	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	762	921	175	810	918	188	350			377		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	762	921	175	810	918	188	350			377		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	94	92	79	96	95	93			99		
cM capacity (veh/h)	254	246	838	222	247	821	1206			1178		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	13	85	96	87	233	143	16	219	131
Volume Left	13	0	48	87	0	0	16	0	0
Volume Right	0	71	38	0	0	27	0	0	22
cSH	254	594	316	1206	1700	1700	1178	1700	1700
Volume to Capacity	0.05	0.14	0.30	0.07	0.14	0.08	0.01	0.13	0.08
Queue Length 95th (ft)	4	12	31	6	0	0	1	0	0
Control Delay (s)	20.0	12.1	21.3	8.2	0.0	0.0	8.1	0.0	0.0
Lane LOS	C	B	C	A			A		
Approach Delay (s)	13.2		21.3	1.5			0.4		
Approach LOS	B		C						

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	33.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	11	12	58	39	9	31	71	287	22	13	269	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	13	15	71	48	11	38	87	350	27	16	328	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	937	921	339	974	918	363	350			377		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	937	921	339	974	918	363	350			377		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	94	90	74	96	94	93			99		
cM capacity (veh/h)	209	248	703	186	249	681	1209			1182		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	13	85	96	87	377	16	350
Volume Left	13	0	48	87	0	16	0
Volume Right	0	71	38	0	27	0	22
cSH	209	535	271	1209	1700	1182	1700
Volume to Capacity	0.06	0.16	0.36	0.07	0.22	0.01	0.21
Queue Length 95th (ft)	5	14	39	6	0	1	0
Control Delay (s)	23.4	13.0	25.5	8.2	0.0	8.1	0.0
Lane LOS	C	B	D	A		A	
Approach Delay (s)	14.4		25.5	1.5		0.4	
Approach LOS	B		D				

Intersection Summary				
Average Delay	4.6			
Intersection Capacity Utilization	41.0%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
6: Commerce Blvd & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	279	4	83	313	72	1	61	44	82	81	59
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	15	340	5	101	382	88	1	74	54	100	99	72
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			TWLTL							
Median storage veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	470			345			1077	1044	343	1088	1002	426
vC1, stage 1 conf vol							372	372		628	628	
vC2, stage 2 conf vol							705	672		460	374	
vCu, unblocked vol	470			345			1077	1044	343	1088	1002	426
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			92			99	80	92	67	74	89
cM capacity (veh/h)	1092			1214			242	367	700	300	374	629

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	15	345	101	470	129	100	171
Volume Left	15	0	101	0	1	100	0
Volume Right	0	5	0	88	54	0	72
cSH	1092	1700	1214	1700	454	300	451
Volume to Capacity	0.01	0.20	0.08	0.28	0.28	0.33	0.38
Queue Length 95th (ft)	1	0	7	0	29	35	44
Control Delay (s)	8.3	0.0	8.2	0.0	16.1	22.9	17.8
Lane LOS	A		A		C	C	C
Approach Delay (s)	0.3		1.5		16.1	19.6	
Approach LOS					C	C	

Intersection Summary				
Average Delay	6.3			
Intersection Capacity Utilization	45.4%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
7: Commerce Blvd & Padre Pkwy
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	13	5	102	163	4	45	87	431	149	39	571	11
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	15	6	115	183	4	51	98	484	167	44	642	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								480				
pX, platoon unblocked												
vC, conflicting volume	1226	1583	327	1289	1505	326	654			652		
vC1, stage 1 conf vol	735	735		763	763							
vC2, stage 2 conf vol	490	847		526	742							
vCu, unblocked vol	1226	1583	327	1289	1505	326	654			652		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	98	83	20	98	92	89			95		
cM capacity (veh/h)	278	246	669	229	248	670	929			931		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	135	238	98	323	329	44	428	226
Volume Left	15	183	98	0	0	44	0	0
Volume Right	115	51	0	0	167	0	0	12
cSH	546	266	929	1700	1700	931	1700	1700
Volume to Capacity	0.25	0.89	0.11	0.19	0.19	0.05	0.25	0.13
Queue Length 95th (ft)	24	196	9	0	0	4	0	0
Control Delay (s)	13.7	72.2	9.3	0.0	0.0	9.1	0.0	0.0
Lane LOS	B	F	A			A		
Approach Delay (s)	13.7	72.2	1.2			0.6		
Approach LOS	B	F						

Intersection Summary			
Average Delay	11.2		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
7: Commerce Blvd & Padre Pkwy
4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	5	102	163	4	45	87	431	149	39	571	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.89			0.97		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.96		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1641			1742		1770	1863	1583	1770	1858	
Flt Permitted		0.96			0.70		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1579			1273		1770	1863	1583	1770	1858	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	15	6	115	183	4	51	98	484	167	44	642	12
RTOR Reduction (vph)	0	87	0	0	15	0	0	0	81	0	1	0
Lane Group Flow (vph)	0	49	0	0	223	0	98	484	86	44	653	0
Turn Type	Perm	NA		Perm	NA		Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8					2			
Actuated Green, G (s)		15.9			15.9		4.2	33.7	33.7	2.3	31.8	
Effective Green, g (s)		15.9			15.9		4.2	33.7	33.7	2.3	31.8	
Actuated g/C Ratio		0.24			0.24		0.06	0.52	0.52	0.04	0.49	
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		383			309		113	959	815	62	903	
v/s Ratio Prot							c0.06	0.26		0.02	c0.35	
v/s Ratio Perm		0.03			c0.18				0.05			
v/c Ratio		0.13			0.72		0.87	0.50	0.11	0.71	0.72	
Uniform Delay, d1		19.3			22.7		30.3	10.4	8.1	31.2	13.3	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.2			8.0		45.7	1.9	0.3	31.0	5.0	
Delay (s)		19.5			30.8		76.1	12.3	8.4	62.2	18.3	
Level of Service		B			C		E	B	A	E	B	
Approach Delay (s)		19.5			30.8			19.8			21.1	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	65.4	Sum of lost time (s)	13.5
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis

8: State Farm Dr & City Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	11	156	123	6	31	81	269	98	32	444	31
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	28	12	173	137	7	34	90	299	109	36	493	34
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								456				
pX, platoon unblocked												
vC, conflicting volume	949	1169	264	1031	1132	204	528			408		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	949	1169	264	1031	1132	204	528			408		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	85	93	76	0	96	96	91			97		
cM capacity (veh/h)	182	170	735	124	178	803	1035			1147		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	34	179	137	41	90	199	209	36	329	199
Volume Left	28	0	137	0	90	0	0	36	0	0
Volume Right	0	173	0	34	0	0	109	0	0	34
cSH	180	660	124	512	1035	1700	1700	1147	1700	1700
Volume to Capacity	0.19	0.27	1.11	0.08	0.09	0.12	0.12	0.03	0.19	0.12
Queue Length 95th (ft)	17	28	201	7	7	0	0	2	0	0
Control Delay (s)	29.6	12.5	180.9	12.6	8.8	0.0	0.0	8.2	0.0	0.0
Lane LOS	D	B	F	B	A			A		
Approach Delay (s)	15.2		142.0		1.6			0.5		
Approach LOS	C		F							

Intersection Summary				
Average Delay	20.4			
Intersection Capacity Utilization	44.0%		ICU Level of Service	A
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis

8: State Farm Dr & City Center Dr

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	11	156	123	6	31	81	269	98	32	444	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85	1.00	0.88		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.97	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1800	1583	1770	1631		1770	1863	1583	1770	1845	
Flt Permitted		0.83	1.00	0.73	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1537	1583	1362	1631		1770	1863	1583	1770	1845	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	28	12	173	137	7	34	90	299	109	36	493	34
RTOR Reduction (vph)	0	0	135	0	26	0	0	0	52	0	3	0
Lane Group Flow (vph)	0	40	38	137	15	0	90	299	57	36	524	0
Turn Type	Perm	NA	Perm	Perm	NA		Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8					2			
Actuated Green, G (s)		13.7	13.7	13.7	13.7		4.6	32.6	32.6	2.0	30.0	
Effective Green, g (s)		13.7	13.7	13.7	13.7		4.6	32.6	32.6	2.0	30.0	
Actuated g/C Ratio		0.22	0.22	0.22	0.22		0.07	0.53	0.53	0.03	0.49	
Clearance Time (s)		4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		340	350	301	361		131	982	835	57	895	
v/s Ratio Prot					0.01		c0.05	c0.16		0.02	c0.28	
v/s Ratio Perm		0.03	0.02	c0.10					0.04			
v/c Ratio		0.12	0.11	0.46	0.04		0.69	0.30	0.07	0.63	0.59	
Uniform Delay, d1		19.2	19.2	20.8	18.9		27.9	8.2	7.2	29.5	11.4	
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.2	0.1	1.1	0.0		13.9	0.8	0.2	20.6	2.8	
Delay (s)		19.4	19.3	21.9	18.9		41.8	9.0	7.3	50.1	14.2	
Level of Service		B	B	C	B		D	A	A	D	B	
Approach Delay (s)		19.3			21.2			14.6			16.5	
Approach LOS		B			C			B			B	

Intersection Summary				
HCM 2000 Control Delay	16.8		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55			
Actuated Cycle Length (s)	61.8		Sum of lost time (s)	13.5
Intersection Capacity Utilization	54.5%		ICU Level of Service	A
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
9: US 101 SB Ramps & Rohnert Park Expressway
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰	↑↑↑		↰		↱	↰↰		↱
Volume (vph)	0	1252	321	37	1118	0	4	0	19	865	0	287
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.5	4.5	3.5	4.5		4.0		4.0	4.0		4.0
Lane Util. Factor		0.91	1.00	1.00	0.91		1.00		1.00	0.97		1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)		5085	1531	1770	5085		1770		1583	3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (perm)		5085	1531	1770	5085		1770		1583	3433		1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	1304	334	39	1165	0	4	0	20	901	0	299
RTOR Reduction (vph)	0	0	93	0	0	0	0	0	19	0	0	94
Lane Group Flow (vph)	0	1304	241	39	1165	0	4	0	1	901	0	205
Turn Type		NA	Perm	Prot	NA		Prot		Prot	Prot		Perm
Protected Phases		2		1	6		3		3	4		
Permitted Phases			2									4
Actuated Green, G (s)		72.8	72.8	6.8	83.1		3.8		3.8	50.6		50.6
Effective Green, g (s)		72.8	72.8	6.8	83.1		3.8		3.8	50.6		50.6
Actuated g/C Ratio		0.49	0.49	0.05	0.55		0.03		0.03	0.34		0.34
Clearance Time (s)		4.5	4.5	3.5	4.5		4.0		4.0	4.0		4.0
Vehicle Extension (s)		4.0	4.0	2.0	4.0		3.0		3.0	2.0		2.0
Lane Grp Cap (vph)		2467	743	80	2817		44		40	1158		533
v/s Ratio Prot		c0.26		c0.02	0.23		c0.00		0.00	c0.26		
v/s Ratio Perm			0.16									0.13
v/c Ratio		0.53	0.32	0.49	0.41		0.09		0.01	0.78		0.38
Uniform Delay, d1		26.7	23.6	69.9	19.4		71.4		71.3	44.7		37.8
Progression Factor		1.00	1.00	1.02	0.71		1.00		1.00	1.00		1.00
Incremental Delay, d2		0.8	1.2	1.6	0.4		0.9		0.1	3.1		0.2
Delay (s)		27.5	24.7	73.0	14.2		72.3		71.4	47.7		38.0
Level of Service		C	C	E	B		E		E	D		D
Approach Delay (s)		27.0			16.1			71.6			45.3	
Approach LOS		C			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	29.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: US 101 NB Ramps & Rohnert Park Expressway
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↑			↑↑↑	↱	↰	↰↑	↱↱	↰		↱
Volume (vph)	43	1683	0	0	1256	668	297	18	442	11	0	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0			6.0	6.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.86			0.91	1.00	0.95	0.95	0.88	1.00		1.00
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (prot)	1770	6408			5085	1583	1681	1695	2787	1770		1583
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (perm)	1770	6408			5085	1583	1681	1695	2787	1770		1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	45	1753	0	0	1308	696	309	19	460	11	0	15
RTOR Reduction (vph)	0	0	0	0	0	270	0	0	103	0	0	15
Lane Group Flow (vph)	45	1753	0	0	1308	426	164	164	357	11	0	0
Turn Type	Prot	NA			NA	Perm	Split	NA	Perm	Prot		Perm
Protected Phases	5	2			6		3	3		4		
Permitted Phases						6			3			4
Actuated Green, G (s)	7.3	104.2			91.9	91.9	26.3	26.3	26.3	3.5		3.5
Effective Green, g (s)	7.3	104.2			91.9	91.9	26.3	26.3	26.3	3.5		3.5
Actuated g/C Ratio	0.05	0.69			0.61	0.61	0.18	0.18	0.18	0.02		0.02
Clearance Time (s)	5.0	6.0			6.0	6.0	5.0	5.0	5.0	5.0		5.0
Vehicle Extension (s)	2.0	4.0			4.0	4.0	2.0	2.0	2.0	2.0		2.0
Lane Grp Cap (vph)	86	4451			3115	969	294	297	488	41		36
v/s Ratio Prot	0.03	c0.27			0.26		0.10	0.10		c0.01		
v/s Ratio Perm						c0.27			c0.13			0.00
v/c Ratio	0.52	0.39			0.42	0.44	0.56	0.55	0.73	0.27		0.01
Uniform Delay, d1	69.7	9.6			15.1	15.4	56.5	56.5	58.5	72.0		71.6
Progression Factor	1.12	1.23			0.84	3.49	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.2	0.2			0.3	1.1	1.3	1.3	4.8	1.3		0.0
Delay (s)	80.3	12.0			13.0	54.9	57.8	57.7	63.3	73.3		71.6
Level of Service	F	B			B	D	E	E	E	E		E
Approach Delay (s)		13.7			27.6			61.0			72.3	
Approach LOS		B			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	281	1169	716	182	998	82	524	248	255	165	277	393
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1558	1770	5017		3433	1863	1547	1610	3378	1561
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1558	1770	5017		3433	1863	1547	1610	3378	1561
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	293	1218	746	190	1040	85	546	258	266	172	289	409
RTOR Reduction (vph)	0	0	105	0	5	0	0	0	209	0	0	68
Lane Group Flow (vph)	293	1218	641	190	1120	0	546	258	57	150	311	341
Confl. Peds. (#/hr)			13			10			5			7
Confl. Bikes (#/hr)						2			5			2
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	Perm	Split	NA	pm+ov
Protected Phases	5	2	3	1	6		3	3		4	4	5
Permitted Phases			2						3			4
Actuated Green, G (s)	11.0	50.4	82.7	25.3	64.7		32.3	32.3	32.3	22.0	22.0	33.0
Effective Green, g (s)	11.0	50.4	82.7	25.3	64.7		32.3	32.3	32.3	22.0	22.0	33.0
Actuated g/C Ratio	0.07	0.34	0.55	0.17	0.43		0.22	0.22	0.22	0.15	0.15	0.22
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	1.5	1.5	1.0	1.0	1.0
Lane Grp Cap (vph)	251	1189	910	298	2163		739	401	333	236	495	343
v/s Ratio Prot	0.09	c0.34	c0.15	c0.11	0.22		0.16	0.14		0.09	0.09	c0.07
v/s Ratio Perm			0.26						0.04			0.15
v/c Ratio	1.17	1.02	0.70	0.64	0.52		0.74	0.64	0.17	0.64	0.63	0.99
Uniform Delay, d1	69.5	49.8	24.7	58.1	31.2		54.9	53.6	48.0	60.2	60.2	58.4
Progression Factor	0.80	0.71	1.10	0.85	1.49		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	107.5	31.4	1.9	2.3	0.6		3.3	2.6	0.1	4.1	1.8	46.8
Delay (s)	163.3	66.8	29.0	51.6	47.1		58.3	56.2	48.0	64.3	62.0	105.2
Level of Service	F	E	C	D	D		E	E	D	E	E	F
Approach Delay (s)		66.8			47.7			55.2			82.7	
Approach LOS		E			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	62.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	281	1169	716	182	998	82	524	248	255	165	277	393
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	4.0	5.0	4.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1553	1770	5017		3433	1863	1551	1770	3539	1565
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1553	1770	5017		3433	1863	1551	1770	3539	1565
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	293	1218	746	190	1040	85	546	258	266	172	289	409
RTOR Reduction (vph)	0	0	77	0	6	0	0	0	64	0	0	71
Lane Group Flow (vph)	293	1218	669	190	1119	0	546	258	202	172	289	338
Confl. Peds. (#/hr)			13			10			5			7
Confl. Bikes (#/hr)						2			5			2
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	5	2	3	1	6		3	8	1	7	4	5
Permitted Phases			2						8			4
Actuated Green, G (s)	16.5	54.4	85.6	14.0	51.9		31.2	33.6	47.6	18.0	18.4	34.9
Effective Green, g (s)	16.5	54.4	85.6	14.0	51.9		31.2	33.6	47.6	18.0	18.4	34.9
Actuated g/C Ratio	0.12	0.39	0.62	0.10	0.38		0.23	0.24	0.34	0.13	0.13	0.25
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	4.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	3.0	1.0	3.0	1.0	1.0
Lane Grp Cap (vph)	410	1395	1019	179	1886		776	453	534	230	471	395
v/s Ratio Prot	0.09	c0.34	c0.15	c0.11	0.22		0.16	0.14	0.04	0.10	0.08	c0.10
v/s Ratio Perm			0.28						0.09			0.11
v/c Ratio	0.71	0.87	0.66	1.06	0.59		0.70	0.57	0.38	0.75	0.61	0.86
Uniform Delay, d1	58.5	38.6	16.8	62.0	34.6		49.1	45.8	34.1	57.8	56.4	49.2
Progression Factor	0.95	0.61	0.55	0.69	0.53		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.5	7.2	1.1	73.3	1.0		2.4	1.6	0.2	12.5	1.7	15.9
Delay (s)	60.3	30.9	10.3	116.2	19.5		51.5	47.5	34.2	70.3	58.1	65.0
Level of Service	E	C	B	F	B		D	D	C	E	E	E
Approach Delay (s)		27.9			33.4			46.3			63.8	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	38.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	138.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: State Farm Dr & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	187	882	256	274	807	95	384	160	216	231	235	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1539	1770	3539	1553	1610	3300	1548	1610	3149	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1539	1770	3539	1553	1610	3300	1548	1610	3149	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	212	1002	291	311	917	108	436	182	245	262	267	206
RTOR Reduction (vph)	0	0	222	0	0	61	0	0	202	0	80	0
Lane Group Flow (vph)	212	1002	69	311	917	47	218	400	43	236	419	0
Confl. Peds. (#/hr)			12			5			10			4
Confl. Bikes (#/hr)			1			1						1
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			6			3			
Actuated Green, G (s)	29.6	35.4	35.4	38.9	44.7	44.7	26.4	26.4	26.4	29.3	29.3	
Effective Green, g (s)	29.6	35.4	35.4	38.9	44.7	44.7	26.4	26.4	26.4	29.3	29.3	
Actuated g/C Ratio	0.20	0.24	0.24	0.26	0.30	0.30	0.18	0.18	0.18	0.20	0.20	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)	349	835	363	459	1054	462	283	580	272	314	615	
v/s Ratio Prot	0.12	c0.28		c0.18	c0.26		c0.14	0.12		c0.15	0.13	
v/s Ratio Perm			0.05			0.03			0.03			
v/c Ratio	0.61	1.20	0.19	0.68	0.87	0.10	0.77	0.69	0.16	0.75	0.68	
Uniform Delay, d1	54.9	57.3	45.8	49.9	49.9	38.1	58.9	58.0	52.4	56.9	56.0	
Progression Factor	1.57	0.46	0.36	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	95.9	0.6	3.1	9.8	0.4	11.2	2.7	0.1	8.7	2.5	
Delay (s)	87.1	122.3	16.9	53.0	59.7	38.6	70.1	60.7	52.5	65.6	58.5	
Level of Service	F	F	B	D	E	D	E	E	D	E	E	
Approach Delay (s)		97.0			56.4			60.7			60.8	
Approach LOS		F			E			E			E	

Intersection Summary			
HCM 2000 Control Delay	71.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	94.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: State Farm Dr & Rohnert Park Expressway

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	187	882	256	274	807	95	384	160	216	231	235	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	11	11	11
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1534	1770	3539	1550	3433	1863	1565	3319	1801	1516
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1534	1770	3539	1550	3433	1863	1565	3319	1801	1516
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	212	1002	291	311	917	108	436	182	245	262	267	206
RTOR Reduction (vph)	0	0	116	0	0	50	0	0	30	0	0	31
Lane Group Flow (vph)	212	1002	175	311	917	58	436	182	215	262	267	175
Confl. Peds. (#/hr)			12			5			10			4
Confl. Bikes (#/hr)			1			1						1
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	21.0	45.7	67.6	24.0	48.7	74.3	21.9	24.7	48.7	25.6	27.4	48.4
Effective Green, g (s)	21.0	45.7	67.6	24.0	48.7	74.3	21.9	24.7	48.7	25.6	27.4	48.4
Actuated g/C Ratio	0.15	0.33	0.49	0.17	0.35	0.54	0.16	0.18	0.35	0.19	0.20	0.35
Clearance Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	3.0	1.0	1.0	3.0	3.0	3.0	1.0	3.0	1.0	1.0
Lane Grp Cap (vph)	269	1171	795	307	1248	879	544	333	608	615	357	586
v/s Ratio Prot	0.12	c0.28	0.03	c0.18	0.26	0.01	c0.13	0.10	0.06	c0.08	c0.15	0.05
v/s Ratio Perm			0.08			0.03			0.08			0.07
v/c Ratio	0.79	0.86	0.22	1.01	0.73	0.07	0.80	0.55	0.35	0.43	0.75	0.30
Uniform Delay, d1	56.4	43.1	20.1	57.0	39.0	15.2	56.0	51.6	33.0	49.7	52.0	32.5
Progression Factor	0.83	0.64	0.39	0.76	0.67	0.22	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.3	5.1	0.1	53.1	3.6	0.0	8.3	1.8	0.1	0.5	7.3	0.1
Delay (s)	55.3	32.6	8.0	96.2	29.6	3.3	64.3	53.4	33.1	50.2	59.4	32.6
Level of Service	E	C	A	F	C	A	E	D	C	D	E	C
Approach Delay (s)		31.1			43.0			53.1			48.6	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	41.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	138.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Commerce Blvd & Enterprise Dr

4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	175	56	605	94	48	682
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3433	1583	3468		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3433	1583	3468		1770	3539
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	186	60	644	100	51	726
RTOR Reduction (vph)	0	48	17	0	0	0
Lane Group Flow (vph)	186	12	727	0	51	726
Turn Type	Prot	Perm	NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	7.7	7.7	16.8		1.1	21.9
Effective Green, g (s)	7.7	7.7	16.8		1.1	21.9
Actuated g/C Ratio	0.20	0.20	0.45		0.03	0.58
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	703	324	1549		51	2061
v/s Ratio Prot	c0.05		c0.21		c0.03	0.21
v/s Ratio Perm		0.01				
v/c Ratio	0.26	0.04	0.47		1.00	0.35
Uniform Delay, d1	12.6	12.0	7.3		18.2	4.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.0	0.2		126.0	0.1
Delay (s)	12.8	12.0	7.5		144.3	4.2
Level of Service	B	B	A		F	A
Approach Delay (s)	12.6		7.5			13.4
Approach LOS	B		A			B

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	37.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	146	2	7	179	132	2	3	0	223	2	30
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	154	2	7	188	139	2	3	0	235	2	32

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	79	79	102	233	5	268
Volume Left (vph)	2	0	7	0	2	235
Volume Right (vph)	0	2	0	139	0	32
Hadj (s)	0.05	0.02	0.07	-0.38	0.11	0.14
Departure Headway (s)	5.7	5.7	5.6	5.1	5.6	5.2
Degree Utilization, x	0.13	0.12	0.16	0.33	0.01	0.39
Capacity (veh/h)	590	597	618	678	571	653
Control Delay (s)	8.3	8.3	8.4	9.4	8.7	11.5
Approach Delay (s)	8.3		9.1		8.7	11.5
Approach LOS	A		A		A	B

Intersection Summary			
Delay	9.8		
Level of Service	A		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

14: Enterprise Dr & Hunter Dr

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	146	2	7	179	132	2	3	0	223	2	30
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	154	2	7	188	139	2	3	0	235	2	32

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	2	156	196	139	5	268
Volume Left (vph)	2	0	7	0	2	235
Volume Right (vph)	0	2	0	139	0	32
Hadj (s)	0.53	0.02	0.05	-0.67	0.11	0.14
Departure Headway (s)	6.2	5.7	5.5	4.8	5.7	5.2
Degree Utilization, x	0.00	0.25	0.30	0.19	0.01	0.39
Capacity (veh/h)	544	598	622	713	567	650
Control Delay (s)	8.0	9.3	9.7	7.7	8.7	11.5
Approach Delay (s)	9.3		8.9		8.7	11.5
Approach LOS	A		A		A	B

Intersection Summary			
Delay	9.9		
Level of Service	A		
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

15: Enterprise Dr & State Farm Dr

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	107	248	167	318	528	152
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	115	267	180	342	568	163

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	115	267	120	402	568	163
Volume Left (vph)	115	0	0	0	568	0
Volume Right (vph)	0	0	0	342	0	163
Hadj (s)	0.53	0.03	0.03	-0.56	0.53	-0.67
Departure Headway (s)	8.0	7.5	7.3	6.8	7.6	6.4
Degree Utilization, x	0.26	0.56	0.24	0.75	1.0	0.29
Capacity (veh/h)	440	463	480	523	479	550
Control Delay (s)	12.5	18.3	11.5	26.4	132.0	10.8
Approach Delay (s)	16.6		23.0		104.9	
Approach LOS	C		C		F	

Intersection Summary			
Delay	58.1		
Level of Service	F		
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
15: Enterprise Dr & State Farm Dr

4/16/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	107	248	167	318	528	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.64	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1199	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	115	267	180	342	568	163
RTOR Reduction (vph)	0	0	0	233	0	86
Lane Group Flow (vph)	115	267	180	109	568	77
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	12.1	12.1	12.1	12.1	17.9	17.9
Effective Green, g (s)	12.1	12.1	12.1	12.1	17.9	17.9
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.47	0.47
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	381	593	593	504	833	745
v/s Ratio Prot		c0.14	0.10		c0.32	
v/s Ratio Perm	0.10			0.07		0.05
v/c Ratio	0.30	0.45	0.30	0.22	0.68	0.10
Uniform Delay, d1	9.8	10.3	9.8	9.5	7.8	5.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.5	0.3	0.2	2.3	0.1
Delay (s)	10.2	10.8	10.1	9.7	10.1	5.6
Level of Service	B	B	B	A	B	A
Approach Delay (s)		10.7	9.8		9.1	
Approach LOS		B	A		A	

Intersection Summary			
HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	38.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
16: Enterprise Dr/Seed Farm Dr

4/15/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	1	685	401	0	1	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	745	436	0	1	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	436				1183	436
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	436				1183	436
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1124				209	620

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	746	436	1
Volume Left	1	0	1
Volume Right	0	0	0
cSH	1124	1700	209
Volume to Capacity	0.00	0.26	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	22.3
Lane LOS	A		C
Approach Delay (s)	0.0	0.0	22.3
Approach LOS			C

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
17: State Farm Dr & Town Center

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	159	6	65	26	6	148	33	428	28	149	539	113
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	173	7	71	28	7	161	36	465	30	162	586	123
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											575	
pX, platoon unblocked												
vC, conflicting volume	1440	1539	354	1243	1585	248	709			496		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1440	1539	354	1243	1585	248	709			496		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	93	89	70	93	79	96			85		
cM capacity (veh/h)	59	93	642	95	87	752	886			1064		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	250	196	36	310	186	162	391	318
Volume Left	173	28	36	0	0	162	0	0
Volume Right	71	161	0	0	30	0	0	123
cSH	81	333	886	1700	1700	1064	1700	1700
Volume to Capacity	3.09	0.59	0.04	0.18	0.11	0.15	0.23	0.19
Queue Length 95th (ft)	Err	89	3	0	0	13	0	0
Control Delay (s)	Err	30.1	9.2	0.0	0.0	9.0	0.0	0.0
Lane LOS	F	D	A			A		
Approach Delay (s)	Err	30.1	0.6			1.7		
Approach LOS	F	D						

Intersection Summary			
Average Delay	1357.0		
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
17: State Farm Dr & Town Center

4/16/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	159	6	65	26	6	148	33	428	28	149	539	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1777	1583		1791	1583	1770	1863	1583	1770	1863	1583
Flt Permitted		0.71	1.00		0.74	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1320	1583		1386	1583	1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	173	7	71	28	7	161	36	465	30	162	586	123
RTOR Reduction (vph)	0	0	56	0	0	126	0	0	18	0	0	45
Lane Group Flow (vph)	0	180	15	0	35	35	36	465	12	162	586	78
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		11.4	11.4		11.4	11.4	1.3	21.7	21.7	7.6	28.0	28.0
Effective Green, g (s)		11.4	11.4		11.4	11.4	1.3	21.7	21.7	7.6	28.0	28.0
Actuated g/C Ratio		0.22	0.22		0.22	0.22	0.02	0.41	0.41	0.14	0.53	0.53
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		285	342		299	342	43	767	651	255	989	841
v/s Ratio Prot							0.02	0.25		c0.09	c0.31	
v/s Ratio Perm		c0.14	0.01		0.03	0.02			0.01			0.05
v/c Ratio		0.63	0.04		0.12	0.10	0.84	0.61	0.02	0.64	0.59	0.09
Uniform Delay, d1		18.7	16.3		16.6	16.5	25.6	12.2	9.2	21.2	8.4	6.1
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		4.5	0.1		0.2	0.1	76.6	1.4	0.0	5.1	1.0	0.0
Delay (s)		23.3	16.4		16.8	16.7	102.2	13.5	9.2	26.3	9.4	6.1
Level of Service		C	B		B	B	F	B	A	C	A	A
Approach Delay (s)		21.3			16.7			19.3			12.1	
Approach LOS		C			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	52.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Appendix D

Future plus Project Intersection LOS Calculations

HCM Signalized Intersection Capacity Analysis
1: US 101 South Ramps & Golf Course Drive West/Golf Course Dr
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	475	259	300	850	0	0	0	0	445	133	521
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	0.97	0.95					1.00	0.95	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.91	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3539	1583	3433	3539					1770	1609	1504
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3539	1583	3433	3539					1770	1609	1504
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	500	273	316	895	0	0	0	0	468	140	548
RTOR Reduction (vph)	0	0	155	0	0	0	0	0	0	0	58	60
Lane Group Flow (vph)	0	500	118	316	895	0	0	0	0	468	296	274
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		6		5	2					8	8	
Permitted Phases			6									8
Actuated Green, G (s)		48.6	48.6	13.7	65.3					39.7	39.7	39.7
Effective Green, g (s)		48.6	48.6	13.7	65.3					39.7	39.7	39.7
Actuated g/C Ratio		0.43	0.43	0.12	0.58					0.35	0.35	0.35
Clearance Time (s)		4.0	4.0	3.0	4.0					3.0	3.0	3.0
Vehicle Extension (s)		1.5	1.5	1.0	1.5					1.5	1.5	1.5
Lane Grp Cap (vph)		1535	686	419	2063					627	570	533
v/s Ratio Prot		0.14		c0.09	c0.25					c0.26	0.18	
v/s Ratio Perm			0.07									0.18
v/c Ratio		0.33	0.17	0.75	0.43					0.75	0.52	0.51
Uniform Delay, d1		20.9	19.4	47.5	13.0					31.7	28.6	28.5
Progression Factor		0.70	1.33	1.00	1.00					1.00	1.00	1.00
Incremental Delay, d2		0.5	0.5	6.7	0.7					4.2	0.3	0.3
Delay (s)		15.1	26.2	54.2	13.7					36.0	28.9	28.9
Level of Service		B	C	D	B					D	C	C
Approach Delay (s)		19.0			24.3			0.0			31.8	
Approach LOS		B			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	25.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	112.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Commerce Blvd & Golf Course Dr
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	56	259	588	454	638	76	449	87	213	59	104	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	13	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.95		0.97	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	3472		3433	1863	1636	1770	1786	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	3472		3433	1863	1636	1770	1786	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	59	273	619	478	672	80	473	92	224	62	109	37
RTOR Reduction (vph)	0	0	324	0	7	0	0	0	131	0	11	0
Lane Group Flow (vph)	59	273	295	478	745	0	473	92	93	62	135	0
Confl. Peds. (#/hr)						5						1
Confl. Bikes (#/hr)						1						
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	1	6	4	5	2		4	4	5	3	3	
Permitted Phases			6						4			
Actuated Green, G (s)	6.0	17.0	35.9	15.9	26.9		18.9	18.9	34.8	16.0	16.0	
Effective Green, g (s)	6.0	17.0	35.9	15.9	26.9		18.9	18.9	34.8	16.0	16.0	
Actuated g/C Ratio	0.07	0.20	0.43	0.19	0.32		0.23	0.23	0.42	0.19	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	1.0	1.5	1.5	1.0	1.5		1.5	1.5	1.0	1.5	1.5	
Lane Grp Cap (vph)	126	1031	678	651	1114		774	420	757	337	341	
v/s Ratio Prot	0.03	0.05	0.10	c0.14	c0.21		c0.14	0.05	0.02	0.04	c0.08	
v/s Ratio Perm			0.09						0.03			
v/c Ratio	0.47	0.26	0.43	0.73	0.67		0.61	0.22	0.12	0.18	0.39	
Uniform Delay, d1	37.4	28.1	16.8	32.0	24.6		29.1	26.4	15.1	28.4	29.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.1	0.2	3.7	1.2		1.0	0.1	0.0	0.1	0.3	
Delay (s)	38.4	28.2	17.0	35.7	25.8		30.2	26.5	15.1	28.5	29.9	
Level of Service	D	C	B	D	C		C	C	B	C	C	
Approach Delay (s)		21.5			29.6			25.5			29.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	83.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Commerce Blvd & US 101 North Ramps

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	354	4	63	1	1	2	176	396	5	4	683	441
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.93		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1793	1687	1794		1716		1770	3532		1770	3539	1583
Flt Permitted	0.95	0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1793	1687	1794		1716		1770	3532		1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	373	4	66	1	1	2	185	417	5	4	719	464
RTOR Reduction (vph)	0	0	46	0	2	0	0	1	0	0	0	0
Lane Group Flow (vph)	190	187	20	0	2	0	185	421	0	4	719	464
Confl. Peds. (#/hr)									2			
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA		Prot	NA	Free
Protected Phases	8	8	1	7	7		1	6		5	2	
Permitted Phases			8									Free
Actuated Green, G (s)	8.0	8.0	15.5		0.6		7.5	28.4		0.6	21.5	51.6
Effective Green, g (s)	8.0	8.0	15.5		0.6		7.5	28.4		0.6	21.5	51.6
Actuated g/C Ratio	0.16	0.16	0.30		0.01		0.15	0.55		0.01	0.42	1.00
Clearance Time (s)	4.0	4.0	3.0		3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0		4.0		2.0	2.0		2.0	4.0	
Lane Grp Cap (vph)	277	261	538		19		257	1943		20	1474	1583
v/s Ratio Prot	0.11	c0.11	0.01		0.00		c0.10	0.12		0.00	c0.20	
v/s Ratio Perm			0.01									c0.29
v/c Ratio	0.69	0.72	0.04		0.11		0.72	0.22		0.20	0.49	0.29
Uniform Delay, d1	20.6	20.7	12.8		25.2		21.0	5.9		25.3	11.0	0.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.5	7.6	0.0		3.4		7.8	0.0		1.8	0.3	0.5
Delay (s)	26.1	28.3	12.8		28.6		28.8	5.9		27.1	11.4	0.5
Level of Service	C	C	B		C		C	A		C	B	A
Approach Delay (s)		25.1			28.6			12.9			7.2	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	51.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr

4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	17	402	178	31	410	309
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	18	423	187	33	432	325
Pedestrians	5		5			5
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	0		0			0
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1402	214			225	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1402	214			225	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	48			68	
cM capacity (veh/h)	104	819			1338	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	441	220	432	325
Volume Left	18	0	432	0
Volume Right	423	33	0	0
cSH	640	1700	1338	1700
Volume to Capacity	0.69	0.13	0.32	0.19
Queue Length 95th (ft)	136	0	35	0
Control Delay (s)	22.1	0.0	9.0	0.0
Lane LOS	C		A	
Approach Delay (s)	22.1	0.0	5.1	
Approach LOS	C			

Intersection Summary			
Average Delay	9.6		
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr

4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	17	402	178	31	410	309
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1825		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	1825		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	18	423	187	33	432	325
RTOR Reduction (vph)	0	233	9	0	0	0
Lane Group Flow (vph)	18	190	211	0	432	325
Turn Type	Prot	pm+ov	NA		Prot	NA
Protected Phases	8	1	2		1	6
Permitted Phases		8				
Actuated Green, G (s)	3.3	21.1	12.4		17.8	34.7
Effective Green, g (s)	3.3	21.1	12.4		17.8	34.7
Actuated g/C Ratio	0.07	0.45	0.26		0.38	0.74
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	124	862	481		670	1375
v/s Ratio Prot	0.01	c0.08	c0.12		c0.24	0.17
v/s Ratio Perm		0.04				
v/c Ratio	0.15	0.22	0.44		0.64	0.24
Uniform Delay, d1	20.5	7.9	14.4		12.0	1.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.1	0.6		2.1	0.1
Delay (s)	21.1	8.0	15.0		14.1	2.0
Level of Service	C	A	B		B	A
Approach Delay (s)	8.6		15.0			8.9
Approach LOS	A		B			A

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	47.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	34	10	34	17	2	5	63	380	28	20	333	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	36	11	36	18	2	5	66	400	29	21	351	19
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	751	974	195	816	969	225	374			434		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	751	974	195	816	969	225	374			434		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	87	95	96	92	99	99	94			98		
cM capacity (veh/h)	275	230	807	231	231	772	1176			1117		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	36	46	25	66	267	163	21	234	136
Volume Left	36	0	18	66	0	0	21	0	0
Volume Right	0	36	5	0	0	29	0	0	19
cSH	275	514	270	1176	1700	1700	1117	1700	1700
Volume to Capacity	0.13	0.09	0.09	0.06	0.16	0.10	0.02	0.14	0.08
Queue Length 95th (ft)	11	7	8	4	0	0	1	0	0
Control Delay (s)	20.1	12.7	19.7	8.2	0.0	0.0	8.3	0.0	0.0
Lane LOS	C	B	C	A			A		
Approach Delay (s)	15.9		19.7	1.1			0.4		
Approach LOS	C		C						

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	34.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	34	10	34	17	2	5	63	380	28	20	333	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	36	11	36	18	2	5	66	400	29	21	351	19
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	941	964	360	981	959	415	369			429		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	941	964	360	981	959	415	369			429		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	84	96	95	91	99	99	94			98		
cM capacity (veh/h)	226	236	684	198	238	638	1189			1130		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	36	46	25	66	429	21	369
Volume Left	36	0	18	66	0	21	0
Volume Right	0	36	5	0	29	0	19
cSH	226	478	235	1189	1700	1130	1700
Volume to Capacity	0.16	0.10	0.11	0.06	0.25	0.02	0.22
Queue Length 95th (ft)	14	8	9	4	0	1	0
Control Delay (s)	23.9	13.3	22.2	8.2	0.0	8.2	0.0
Lane LOS	C	B	C	A		A	
Approach Delay (s)	17.9		22.2	1.1		0.4	
Approach LOS	C		C				

Intersection Summary				
Average Delay	2.8			
Intersection Capacity Utilization	43.0%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
6: Commerce Blvd & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	45	200	0	22	178	91	0	50	62	65	34	16
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	47	211	0	23	187	96	0	53	65	68	36	17
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			TWLTL							
Median storage veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	288			216			584	645	221	688	597	245
vC1, stage 1 conf vol							310	310		287	287	
vC2, stage 2 conf vol							273	334		402	310	
vCu, unblocked vol	288			216			584	645	221	688	597	245
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			98			100	90	92	85	93	98
cM capacity (veh/h)	1268			1349			537	512	812	446	538	787

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	47	211	23	283	118	68	53
Volume Left	47	0	23	0	0	68	0
Volume Right	0	0	0	96	65	0	17
cSH	1268	1700	1349	1700	644	446	598
Volume to Capacity	0.04	0.12	0.02	0.17	0.18	0.15	0.09
Queue Length 95th (ft)	3	0	1	0	17	13	7
Control Delay (s)	7.9	0.0	7.7	0.0	11.8	14.5	11.6
Lane LOS	A		A		B	B	B
Approach Delay (s)	1.5		0.6		11.8	13.3	
Approach LOS					B	B	

Intersection Summary				
Average Delay	4.4			
Intersection Capacity Utilization	39.2%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis

7: Commerce Blvd & Padre Pkwy 4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	22	5	59	76	3	16	57	442	157	25	258	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	23	5	62	80	3	17	60	465	165	26	272	14
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								480				
pX, platoon unblocked												
vC, conflicting volume	712	1092	153	931	1016	325	290			636		
vC1, stage 1 conf vol	336	336		673	673							
vC2, stage 2 conf vol	376	756		258	343							
vCu, unblocked vol	712	1092	153	931	1016	325	290			636		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	98	93	77	99	97	95			97		
cM capacity (veh/h)	469	341	859	352	379	665	1263			940		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	91	100	60	310	320	26	181	104
Volume Left	23	80	60	0	0	26	0	0
Volume Right	62	17	0	0	165	0	0	14
cSH	660	383	1263	1700	1700	940	1700	1700
Volume to Capacity	0.14	0.26	0.05	0.18	0.19	0.03	0.11	0.06
Queue Length 95th (ft)	12	26	4	0	0	2	0	0
Control Delay (s)	11.3	17.7	8.0	0.0	0.0	8.9	0.0	0.0
Lane LOS	B	C	A			A		
Approach Delay (s)	11.3	17.7	0.7			0.8		
Approach LOS	B	C						

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis

7: Commerce Blvd & Padre Pkwy 4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	5	59	76	3	16	57	442	157	25	258	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.92			0.98		1.00	1.00	0.89	1.00	0.99	
Flpb, ped/bikes		0.99			0.98		1.00	1.00	1.00	1.00	1.00	
Frt		0.91			0.98		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99			0.96		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1512			1673		1770	1863	1415	1770	1839	
Flt Permitted		0.90			0.79		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1375			1381		1770	1863	1415	1770	1839	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	23	5	62	80	3	17	60	465	165	26	272	14
RTOR Reduction (vph)	0	51	0	0	14	0	0	0	76	0	2	0
Lane Group Flow (vph)	0	39	0	0	86	0	60	465	89	26	284	0
Confl. Peds. (#/hr)	50		50	50		50			50			50
Confl. Bikes (#/hr)			20			20			20			20
Turn Type	Perm	NA		Perm	NA		Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8					2			
Actuated Green, G (s)		8.8			8.8		1.9	27.5	27.5	1.2	26.8	
Effective Green, g (s)		8.8			8.8		1.9	27.5	27.5	1.2	26.8	
Actuated g/C Ratio		0.17			0.17		0.04	0.54	0.54	0.02	0.53	
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		237			238		65	1004	762	41	966	
v/s Ratio Prot							c0.03	c0.25		0.01	0.15	
v/s Ratio Perm		0.03			c0.06				0.06			
v/c Ratio		0.16			0.36		0.92	0.46	0.12	0.63	0.29	
Uniform Delay, d1		18.0			18.6		24.5	7.2	5.8	24.7	6.8	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			0.9		84.3	1.5	0.3	27.9	0.8	
Delay (s)		18.3			19.6		108.8	8.8	6.1	52.5	7.6	
Level of Service		B			B		F	A	A	D	A	
Approach Delay (s)		18.3			19.6			16.8			11.3	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	51.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	16	10	85	90	4	38	60	529	142	49	195	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	17	11	89	95	4	40	63	557	149	52	205	14
Pedestrians		5			5			5			5	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								456				
pX, platoon unblocked												
vC, conflicting volume	772	1158	119	1068	1090	363	224			711		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	772	1158	119	1068	1090	363	224			711		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	94	90	31	98	94	95			94		
cM capacity (veh/h)	242	173	902	137	190	628	1336			880		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	22	95	95	44	63	371	335	52	137	82
Volume Left	17	0	95	0	63	0	0	52	0	0
Volume Right	0	89	0	40	0	0	149	0	0	14
cSH	221	731	137	515	1336	1700	1700	880	1700	1700
Volume to Capacity	0.10	0.13	0.69	0.09	0.05	0.22	0.20	0.06	0.08	0.05
Queue Length 95th (ft)	8	11	97	7	4	0	0	5	0	0
Control Delay (s)	23.1	10.7	75.6	12.6	7.8	0.0	0.0	9.3	0.0	0.0
Lane LOS	C	B	F	B	A			A		
Approach Delay (s)	13.0		55.5		0.6			1.8		
Approach LOS	B		F							

Intersection Summary				
Average Delay	7.9			
Intersection Capacity Utilization	44.5%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	10	85	90	4	38	60	529	142	49	195	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	0.88	1.00	0.89		1.00	1.00	0.90	1.00	0.99	
Flpb, ped/bikes		0.96	1.00	0.93	1.00		1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85	1.00	0.86		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.97	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1738	1398	1654	1437		1770	1863	1425	1770	1833	
Flt Permitted		0.86	1.00	0.74	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1542	1398	1287	1437		1770	1863	1425	1770	1833	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	11	89	95	4	40	63	557	149	52	205	14
RTOR Reduction (vph)	0	0	69	0	31	0	0	0	72	0	3	0
Lane Group Flow (vph)	0	28	20	95	13	0	63	557	77	52	216	0
Confl. Peds. (#/hr)	50		50	50		50			50			50
Confl. Bikes (#/hr)			20			20			20			20
Turn Type	Perm	NA	Perm	Perm	NA		Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8					2			
Actuated Green, G (s)		13.4	13.4	13.4	13.4		2.4	30.7	30.7	2.1	30.4	
Effective Green, g (s)		13.4	13.4	13.4	13.4		2.4	30.7	30.7	2.1	30.4	
Actuated g/C Ratio		0.22	0.22	0.22	0.22		0.04	0.51	0.51	0.04	0.51	
Clearance Time (s)		4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		346	313	288	322		71	958	732	62	933	
v/s Ratio Prot					0.01		c0.04	c0.30		0.03	0.12	
v/s Ratio Perm		0.02	0.01	c0.07					0.05			
v/c Ratio		0.08	0.06	0.33	0.04		0.89	0.58	0.10	0.84	0.23	
Uniform Delay, d1		18.3	18.2	19.4	18.1		28.5	10.0	7.4	28.6	8.2	
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1	0.1	0.7	0.1		68.6	2.6	0.3	60.1	0.6	
Delay (s)		18.4	18.3	20.1	18.2		97.1	12.6	7.7	88.7	8.7	
Level of Service		B	B	C	B		F	B	A	F	A	
Approach Delay (s)		18.3			19.5			18.6			24.1	
Approach LOS		B			B			B			C	

Intersection Summary				
HCM 2000 Control Delay	19.8	HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio	0.53			
Actuated Cycle Length (s)	59.7	Sum of lost time (s)		13.5
Intersection Capacity Utilization	62.2%	ICU Level of Service		B
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
9: US 101 SB Ramps & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	872	310	14	715	0	1	0	0	746	0	369
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.5	4.5	3.5	4.5		4.0			4.0		4.0
Lane Util. Factor		0.91	*0.75	1.00	0.91		1.00			0.97		1.00
Frpb, ped/bikes		1.00	0.92	1.00	1.00		1.00			1.00		1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00			1.00		1.00
Frt		1.00	0.85	1.00	1.00		1.00			1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95			0.95		1.00
Satd. Flow (prot)		5085	1061	1770	5085		1770			3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.95			0.95		1.00
Satd. Flow (perm)		5085	1061	1770	5085		1770			3433		1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	918	326	15	753	0	1	0	0	785	0	388
RTOR Reduction (vph)	0	0	147	0	0	0	0	0	0	0	0	147
Lane Group Flow (vph)	0	918	179	15	753	0	1	0	0	785	0	241
Confl. Peds. (#/hr)			20			20						
Confl. Bikes (#/hr)			20			20						
Turn Type		NA	Perm	Prot	NA		Prot		Prot	Prot		Perm
Protected Phases		2		1	6		3		3	4		
Permitted Phases			2									4
Actuated Green, G (s)		69.2	69.2	4.6	77.3		1.2			59.0		59.0
Effective Green, g (s)		69.2	69.2	4.6	77.3		1.2			59.0		59.0
Actuated g/C Ratio		0.46	0.46	0.03	0.52		0.01			0.39		0.39
Clearance Time (s)		4.5	4.5	3.5	4.5		4.0			4.0		4.0
Vehicle Extension (s)		4.0	4.0	2.0	4.0		3.0			2.0		2.0
Lane Grp Cap (vph)		2345	489	54	2620		14			1350		622
v/s Ratio Prot		c0.18		0.01	c0.15		c0.00			c0.23		
v/s Ratio Perm			0.17									0.15
v/c Ratio		0.39	0.37	0.28	0.29		0.07			0.58		0.39
Uniform Delay, d1		26.6	26.2	71.1	20.7		73.8			35.8		32.6
Progression Factor		0.21	0.62	0.79	0.62		1.00			1.00		1.00
Incremental Delay, d2		0.4	1.9	1.0	0.3		2.2			0.4		0.1
Delay (s)		6.1	18.1	57.1	13.0		76.0			36.2		32.7
Level of Service		A	B	E	B		E			D		C
Approach Delay (s)		9.2			13.9			76.0			35.0	
Approach LOS		A			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	19.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: US 101 NB Ramps & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	1391	0	0	967	938	187	19	383	1	0	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.86			0.91	1.00	0.95	0.95	0.88	1.00		1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	1.00	1.00	1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (prot)	1770	6408			5085	1550	1681	1700	2787	1770		1583
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00	0.95		1.00
Satd. Flow (perm)	1770	6408			5085	1550	1681	1700	2787	1770		1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	25	1464	0	0	1018	987	197	20	403	1	0	9
RTOR Reduction (vph)	0	0	0	0	0	236	0	0	164	0	0	9
Lane Group Flow (vph)	25	1464	0	0	1018	751	108	109	239	1	0	0
Confl. Peds. (#/hr)			4			4						
Turn Type	Prot	NA			NA	Perm	Split	NA	Perm	Prot		Perm
Protected Phases	5	2			6		3	3		4		
Permitted Phases						6			3			4
Actuated Green, G (s)	4.8	117.1			108.3	108.3	16.7	16.7	16.7	1.2		1.2
Effective Green, g (s)	4.8	117.1			108.3	108.3	16.7	16.7	16.7	1.2		1.2
Actuated g/C Ratio	0.03	0.78			0.72	0.72	0.11	0.11	0.11	0.01		0.01
Clearance Time (s)	4.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Vehicle Extension (s)	2.0	4.0			2.0	2.0	2.0	2.0	2.0	4.0		4.0
Lane Grp Cap (vph)	56	5002			3671	1119	187	189	310	14		12
v/s Ratio Prot	c0.01	0.23			0.20		0.06	0.06		c0.00		
v/s Ratio Perm						c0.48			c0.09			0.00
v/c Ratio	0.45	0.29			0.28	0.67	0.58	0.58	0.77	0.07		0.01
Uniform Delay, d1	71.3	4.7			7.2	11.2	63.3	63.3	64.8	73.8		73.8
Progression Factor	1.25	1.77			0.63	4.98	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	1.9	0.1			0.2	2.7	2.7	2.6	9.9	2.9		0.3
Delay (s)	90.9	8.4			4.7	58.6	66.0	65.9	74.7	76.8		74.1
Level of Service	F	A			A	E	E	E	E	E		E
Approach Delay (s)		9.8			31.2			71.6			74.4	
Approach LOS		A			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	29.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

11: Commerce Blvd & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	349	1058	369	97	1285	132	406	199	135	76	111	214
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00	0.95	1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	0.99	1.00
Satd. Flow (prot)	3433	3539	1539	1770	4994		3433	1863	1509	1610	3370	1541
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	0.99	1.00
Satd. Flow (perm)	3433	3539	1539	1770	4994		3433	1863	1509	1610	3370	1541
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	367	1114	388	102	1353	139	427	209	142	80	117	225
RTOR Reduction (vph)	0	0	112	0	5	0	0	0	118	0	0	71
Lane Group Flow (vph)	367	1114	276	102	1487	0	427	209	24	64	133	154
Confl. Peds. (#/hr)			20			20			20			20
Confl. Bikes (#/hr)			10			10			10			10
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	Perm	Split	NA	pm+ov
Protected Phases	5	2	3	1	6		3	3		4	4	5
Permitted Phases			2						3			4
Actuated Green, G (s)	11.0	75.1	100.8	12.1	76.2		25.7	25.7	25.7	17.1	17.1	28.1
Effective Green, g (s)	11.0	75.1	100.8	12.1	76.2		25.7	25.7	25.7	17.1	17.1	28.1
Actuated g/C Ratio	0.07	0.50	0.67	0.08	0.51		0.17	0.17	0.17	0.11	0.11	0.19
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	1.5	1.5	1.0	1.0	1.0
Lane Grp Cap (vph)	251	1771	1085	142	2536		588	319	258	183	384	288
v/s Ratio Prot	c0.11	c0.31	0.04	c0.06	0.30		c0.12	0.11		0.04	0.04	c0.04
v/s Ratio Perm			0.14						0.02			0.06
v/c Ratio	1.46	0.63	0.25	0.72	0.59		0.73	0.66	0.09	0.35	0.35	0.54
Uniform Delay, d1	69.5	27.3	9.7	67.3	25.9		58.8	58.0	52.3	61.3	61.3	55.1
Progression Factor	0.72	0.40	1.72	1.14	1.05		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	227.4	1.6	0.0	11.6	0.9		3.8	3.7	0.1	0.4	0.2	1.0
Delay (s)	277.3	12.5	16.8	88.1	28.1		62.6	61.7	52.4	61.7	61.5	56.0
Level of Service	F	B	B	F	C		E	E	D	E	E	E
Approach Delay (s)		65.4			31.9			60.5			58.6	
Approach LOS		E			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	52.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	93.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

11: Commerce Blvd & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	349	1058	369	97	1285	132	406	199	135	76	111	214
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	4.0	5.0	4.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1548	1770	5002		3433	1863	1549	1770	3539	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1548	1770	5002		3433	1863	1549	1770	3539	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	367	1114	388	102	1353	139	427	209	142	80	117	225
RTOR Reduction (vph)	0	0	119	0	7	0	0	0	77	0	0	73
Lane Group Flow (vph)	367	1114	269	102	1485	0	427	209	65	80	117	152
Confl. Peds. (#/hr)			13			10			5			7
Confl. Bikes (#/hr)						2			5			2
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	5	2	3	1	6		3	8	1	7	4	5
Permitted Phases			2						8			4
Actuated Green, G (s)	15.0	69.2	90.1	8.0	62.2		20.9	23.0	31.0	11.8	11.9	26.9
Effective Green, g (s)	15.0	69.2	90.1	8.0	62.2		20.9	23.0	31.0	11.8	11.9	26.9
Actuated g/C Ratio	0.12	0.53	0.69	0.06	0.48		0.16	0.18	0.24	0.09	0.09	0.21
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	4.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	3.0	1.0	3.0	1.0	1.0
Lane Grp Cap (vph)	396	1883	1132	108	2393		551	329	428	160	323	384
v/s Ratio Prot	c0.11	0.31	0.04	0.06	c0.30		c0.12	c0.11	0.01	0.05	0.03	0.05
v/s Ratio Perm			0.14						0.03			0.05
v/c Ratio	0.93	0.59	0.24	0.94	0.62		0.77	0.64	0.15	0.50	0.36	0.40
Uniform Delay, d1	57.0	20.8	7.3	60.8	25.1		52.3	49.6	39.1	56.3	55.5	44.5
Progression Factor	0.92	0.65	0.44	0.83	0.30		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.0	1.3	0.0	55.2	0.9		6.2	4.0	0.1	2.4	0.3	0.2
Delay (s)	78.4	14.8	3.2	105.6	8.3		58.4	53.6	39.2	58.7	55.7	44.8
Level of Service	E	B	A	F	A		E	D	D	E	E	D
Approach Delay (s)		24.9			14.5			53.6			50.5	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	28.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	246	809	175	227	1071	351	286	195	155	126	120	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1548	1770	3539	1560	1610	3324	1554	1610	3096	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1548	1770	3539	1560	1610	3324	1554	1610	3096	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	259	852	184	239	1127	369	301	205	163	133	126	147
RTOR Reduction (vph)	0	0	97	0	0	99	0	0	138	0	128	0
Lane Group Flow (vph)	259	852	87	239	1127	270	166	340	25	120	158	0
Confl. Peds. (#/hr)			8			2			5			2
Confl. Bikes (#/hr)									1			1
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			6			3			
Actuated Green, G (s)	11.0	71.2	71.2	16.8	77.0	77.0	22.8	22.8	22.8	19.2	19.2	
Effective Green, g (s)	11.0	71.2	71.2	16.8	77.0	77.0	22.8	22.8	22.8	19.2	19.2	
Actuated g/C Ratio	0.07	0.47	0.47	0.11	0.51	0.51	0.15	0.15	0.15	0.13	0.13	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)	129	1679	734	198	1816	800	244	505	236	206	396	
v/s Ratio Prot	c0.15	0.24		c0.14	c0.32		c0.10	0.10		c0.07	0.05	
v/s Ratio Perm			0.06			0.17			0.02			
v/c Ratio	2.01	0.51	0.12	1.21	0.62	0.34	0.68	0.67	0.10	0.58	0.40	
Uniform Delay, d1	69.5	27.3	21.9	66.6	26.1	21.5	60.2	60.1	54.8	61.6	60.1	
Progression Factor	0.99	0.35	0.24	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	475.6	0.9	0.3	130.9	1.6	1.1	6.1	2.8	0.1	2.7	0.2	
Delay (s)	544.7	10.5	5.6	197.5	27.7	22.6	66.2	62.9	54.9	64.6	60.4	
Level of Service	F	B	A	F	C	C	E	E	D	E	E	
Approach Delay (s)		116.6			50.0			61.8			61.6	
Approach LOS		F			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	74.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	246	809	175	227	1071	351	286	195	155	126	120	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	11	11	11
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.97	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1528	1770	3539	1541	3433	1863	1563	3319	1801	1517
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1528	1770	3539	1541	3433	1863	1563	3319	1801	1517
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	259	852	184	239	1127	369	301	205	163	133	126	147
RTOR Reduction (vph)	0	0	86	0	0	154	0	0	58	0	0	63
Lane Group Flow (vph)	259	852	98	239	1127	216	301	205	105	133	126	84
Confl. Peds. (#/hr)			12			5			10			4
Confl. Bikes (#/hr)			1			1						1
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	19.0	54.4	69.2	19.7	55.1	65.0	14.8	28.0	47.7	9.9	22.1	41.1
Effective Green, g (s)	19.0	54.4	69.2	19.7	55.1	65.0	14.8	28.0	47.7	9.9	22.1	41.1
Actuated g/C Ratio	0.15	0.42	0.53	0.15	0.42	0.50	0.11	0.22	0.37	0.08	0.17	0.32
Clearance Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	3.0	1.0	1.0	3.0	3.0	3.0	1.0	3.0	1.0	1.0
Lane Grp Cap (vph)	258	1480	813	268	1499	770	390	401	573	252	306	537
v/s Ratio Prot	c0.15	0.24	0.01	c0.14	c0.32	0.02	c0.09	c0.11	0.03	c0.04	0.07	0.02
v/s Ratio Perm			0.05			0.12			0.04			0.03
v/c Ratio	1.00	0.58	0.12	0.89	0.75	0.28	0.77	0.51	0.18	0.53	0.41	0.16
Uniform Delay, d1	55.5	29.0	15.2	54.1	31.7	18.9	56.0	45.0	27.9	57.8	48.1	32.0
Progression Factor	0.88	0.74	1.24	1.10	0.71	0.78	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	52.5	1.4	0.1	23.7	2.8	0.2	9.1	1.1	0.1	2.0	0.3	0.0
Delay (s)	101.1	22.9	18.9	83.1	25.2	14.9	65.1	46.1	28.0	59.8	48.5	32.0
Level of Service	F	C	B	F	C	B	E	D	C	E	D	C
Approach Delay (s)		38.0			31.0			50.2			46.2	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Commerce Blvd & Enterprise Dr
4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	93	57	559	78	23	338
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	0.98	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3433	1550	3467		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3433	1550	3467		1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	98	60	588	82	24	356
RTOR Reduction (vph)	0	51	14	0	0	0
Lane Group Flow (vph)	98	9	656	0	24	356
Confl. Peds. (#/hr)		5		5		
Confl. Bikes (#/hr)		5		5		
Turn Type	Prot	Perm	NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	5.0	5.0	15.7		0.3	20.0
Effective Green, g (s)	5.0	5.0	15.7		0.3	20.0
Actuated g/C Ratio	0.15	0.15	0.48		0.01	0.61
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	520	234	1649		16	2144
v/s Ratio Prot	c0.03		c0.19		c0.01	0.10
v/s Ratio Perm		0.01				
v/c Ratio	0.19	0.04	0.40		1.50	0.17
Uniform Delay, d1	12.2	11.9	5.6		16.4	2.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.1	0.2		410.1	0.0
Delay (s)	12.4	12.0	5.8		426.5	2.9
Level of Service	B	B	A		F	A
Approach Delay (s)	12.3		5.8			29.6
Approach LOS	B		A			C

Intersection Summary			
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	33.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	15	91	0	3	144	137	1	2	0	68	0	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	16	96	0	3	152	144	1	2	0	72	0	5

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	64	48	79	220	3	77
Volume Left (vph)	16	0	3	0	1	72
Volume Right (vph)	0	0	0	144	0	5
Hadj (s)	0.16	0.03	0.05	-0.42	0.10	0.18
Departure Headway (s)	5.1	5.0	4.9	4.4	5.0	5.0
Degree Utilization, x	0.09	0.07	0.11	0.27	0.00	0.11
Capacity (veh/h)	687	699	718	802	664	673
Control Delay (s)	7.4	7.1	7.2	7.8	8.0	8.5
Approach Delay (s)	7.3		7.6		8.0	8.5
Approach LOS	A		A		A	A

Intersection Summary			
Delay	7.7		
Level of Service	A		
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	15	91	0	3	144	137	1	2	0	68	0	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	16	96	0	3	152	144	1	2	0	72	0	5

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	16	96	155	144	3	77
Volume Left (vph)	16	0	3	0	1	72
Volume Right (vph)	0	0	0	144	0	5
Hadj (s)	0.53	0.03	0.04	-0.67	0.10	0.18
Departure Headway (s)	5.5	5.0	4.9	4.1	5.0	4.9
Degree Utilization, x	0.02	0.13	0.21	0.17	0.00	0.11
Capacity (veh/h)	640	699	721	846	666	675
Control Delay (s)	7.4	7.5	7.9	6.8	8.0	8.5
Approach Delay (s)	7.5		7.4		8.0	8.5
Approach LOS	A		A		A	A

Intersection Summary			
Delay	7.6		
Level of Service	A		
Intersection Capacity Utilization	28.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Enterprise Dr & State Farm Dr
4/15/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	67	92	164	390	309	96
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	71	97	173	411	325	101

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	71	97	115	468	325	101
Volume Left (vph)	71	0	0	0	325	0
Volume Right (vph)	0	0	0	411	0	101
Hadj (s)	0.53	0.03	0.03	-0.58	0.53	-0.67
Departure Headway (s)	7.3	6.8	6.2	5.6	7.0	5.8
Degree Utilization, x	0.14	0.18	0.20	0.73	0.63	0.16
Capacity (veh/h)	461	497	552	620	495	591
Control Delay (s)	10.3	10.1	9.6	21.2	19.8	8.7
Approach Delay (s)	10.2		18.9		17.2	
Approach LOS	B		C		C	

Intersection Summary			
Delay	17.0		
Level of Service	C		
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
15: Enterprise Dr & State Farm Dr

4/15/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	67	92	164	390	309	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.65	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1207	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	71	97	173	411	325	101
RTOR Reduction (vph)	0	0	0	269	0	63
Lane Group Flow (vph)	71	97	173	142	325	38
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	9.8	9.8	9.8	9.8	10.6	10.6
Effective Green, g (s)	9.8	9.8	9.8	9.8	10.6	10.6
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.37	0.37
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	416	642	642	546	660	590
v/s Ratio Prot		0.05	c0.09		c0.18	
v/s Ratio Perm	0.06			0.09		0.02
v/c Ratio	0.17	0.15	0.27	0.26	0.49	0.06
Uniform Delay, d1	6.5	6.4	6.7	6.7	6.8	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1	0.2	0.3	0.6	0.0
Delay (s)	6.7	6.5	6.9	6.9	7.4	5.8
Level of Service	A	A	A	A	A	A
Approach Delay (s)		6.6	6.9		7.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM 2000 Control Delay	6.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	28.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
16: Enterprise Dr/Seed Farm Dr

4/15/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	64	285	479	12	5	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	67	300	504	13	5	18
Pedestrians		5	5		5	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	522				955	521
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	522				955	521
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				98	97
cM capacity (veh/h)	1040				266	551

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	367	517	23
Volume Left	67	0	5
Volume Right	0	13	18
cSH	1040	1700	443
Volume to Capacity	0.06	0.30	0.05
Queue Length 95th (ft)	5	0	4
Control Delay (s)	2.2	0.0	13.6
Lane LOS	A		B
Approach Delay (s)	2.2	0.0	13.6
Approach LOS			B

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
17: State Farm Dr & Town Center

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	52	4	11	24	5	115	25	451	17	106	361	34
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	55	4	12	25	5	121	26	475	18	112	380	36
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											561	
pX, platoon unblocked												
vC, conflicting volume	1035	1166	208	963	1175	246	416			493		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1035	1166	208	963	1175	246	416			493		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	60	97	99	86	97	84	98			90		
cM capacity (veh/h)	138	168	798	184	166	754	1140			1067		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	71	152	26	316	176	112	253	162
Volume Left	55	25	26	0	0	112	0	0
Volume Right	12	121	0	0	18	0	0	36
cSH	162	460	1140	1700	1700	1067	1700	1700
Volume to Capacity	0.44	0.33	0.02	0.19	0.10	0.10	0.15	0.10
Queue Length 95th (ft)	49	36	2	0	0	9	0	0
Control Delay (s)	43.5	16.6	8.2	0.0	0.0	8.8	0.0	0.0
Lane LOS	E	C	A			A		
Approach Delay (s)	43.5	16.6	0.4			1.9		
Approach LOS	E	C						

Intersection Summary				
Average Delay	5.3			
Intersection Capacity Utilization	39.3%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
17: State Farm Dr & Town Center

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	52	4	11	24	5	115	25	451	17	106	361	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.90		1.00	0.90	1.00	1.00	0.90	1.00	1.00	0.90
Flpb, ped/bikes		0.96	1.00		0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1712	1422		1730	1422	1770	1863	1428	1770	1863	1432
Flt Permitted		0.73	1.00		0.77	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1301	1422		1392	1422	1770	1863	1428	1770	1863	1432
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	4	12	25	5	121	26	475	18	112	380	36
RTOR Reduction (vph)	0	0	10	0	0	100	0	0	9	0	0	16
Lane Group Flow (vph)	0	59	2	0	30	21	26	475	9	112	380	20
Confl. Peds. (#/hr)	50		50	50		50			50			50
Confl. Bikes (#/hr)			20			20			20			20
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		8.7	8.7		8.7	8.7	0.6	23.4	23.4	5.2	28.0	28.0
Effective Green, g (s)		8.7	8.7		8.7	8.7	0.6	23.4	23.4	5.2	28.0	28.0
Actuated g/C Ratio		0.18	0.18		0.18	0.18	0.01	0.47	0.47	0.11	0.57	0.57
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		229	250		245	250	21	884	677	186	1058	813
v/s Ratio Prot							0.01	c0.26		c0.06	0.20	
v/s Ratio Perm		c0.05	0.00		0.02	0.02			0.01			0.01
v/c Ratio		0.26	0.01		0.12	0.09	1.24	0.54	0.01	0.60	0.36	0.03
Uniform Delay, d1		17.5	16.7		17.1	17.0	24.3	9.1	6.8	21.1	5.8	4.7
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.6	0.0		0.2	0.1	278.6	0.6	0.0	5.4	0.2	0.0
Delay (s)		18.1	16.8		17.3	17.1	302.9	9.8	6.9	26.5	6.0	4.7
Level of Service		B	B		B	B	F	A	A	C	A	A
Approach Delay (s)		17.9			17.2			24.3			10.2	
Approach LOS		B			B			C			B	

Intersection Summary				
HCM 2000 Control Delay	17.3	HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio	0.48			
Actuated Cycle Length (s)	49.3	Sum of lost time (s)		12.0
Intersection Capacity Utilization	75.7%	ICU Level of Service		D
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
61: Lynn Conde Way & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱			↑↑	↱			↱			↱
Volume (vph)	0	1059	31	0	1627	5	0	0	15	0	0	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0			3.0			3.0
Lane Util. Factor		0.95			0.95	1.00			1.00			1.00
Frt		1.00			1.00	0.85			0.86			0.86
Flt Protected		1.00			1.00	1.00			1.00			1.00
Satd. Flow (prot)		3524			3539	1583			1611			1611
Flt Permitted		1.00			1.00	1.00			1.00			1.00
Satd. Flow (perm)		3524			3539	1583			1611			1611
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1081	32	0	1660	5	0	0	15	0	0	22
RTOR Reduction (vph)	0	1	0	0	0	1	0	0	12	0	0	17
Lane Group Flow (vph)	0	1112	0	0	1660	4	0	0	3	0	0	5
Turn Type		NA			NA	Perm			Perm			Perm
Protected Phases		2			6							
Permitted Phases						6			8			8
Actuated Green, G (s)		93.9			93.9	93.9			28.1			28.1
Effective Green, g (s)		93.9			93.9	93.9			28.1			28.1
Actuated g/C Ratio		0.72			0.72	0.72			0.22			0.22
Clearance Time (s)		5.0			5.0	5.0			3.0			3.0
Vehicle Extension (s)		3.0			3.0	3.0			3.0			3.0
Lane Grp Cap (vph)		2545			2556	1143			348			348
v/s Ratio Prot		0.32			c0.47							
v/s Ratio Perm						0.00			0.00			c0.00
v/c Ratio		0.44			0.65	0.00			0.01			0.01
Uniform Delay, d1		7.3			9.4	5.0			40.0			40.1
Progression Factor		1.12			0.03	0.00			1.00			1.00
Incremental Delay, d2		0.5			1.0	0.0			0.0			0.0
Delay (s)		8.7			1.3	0.0			40.0			40.1
Level of Service		A			A	A			D			D
Approach Delay (s)		8.7			1.3			40.0			40.1	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	4.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
64: SMART midblock & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑							
Volume (vph)	0	1074	0	0	1632	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0							
Lane Util. Factor		0.95			0.95							
Frt		1.00			1.00							
Flt Protected		1.00			1.00							
Satd. Flow (prot)		3539			3539							
Flt Permitted		1.00			1.00							
Satd. Flow (perm)		3539			3539							
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1096	0	0	1665	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1096	0	0	1665	0	0	0	0	0	0	0
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Actuated Green, G (s)		95.0			95.0							
Effective Green, g (s)		95.0			95.0							
Actuated g/C Ratio		0.73			0.73							
Clearance Time (s)		5.0			5.0							
Vehicle Extension (s)		3.0			3.0							
Lane Grp Cap (vph)		2586			2586							
v/s Ratio Prot		0.31			c0.47							
v/s Ratio Perm												
v/c Ratio		0.42			0.64							
Uniform Delay, d1		6.8			8.9							
Progression Factor		1.14			1.00							
Incremental Delay, d2		0.5			1.2							
Delay (s)		8.3			10.1							
Level of Service		A			B							
Approach Delay (s)		8.3			10.1			0.0			0.0	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
1: US 101 South Ramps & Golf Course Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1269	769	186	1207	0	0	0	0	480	202	1246
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lane Util. Factor		0.95	1.00	0.97	0.95					1.00	0.95	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.89	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3539	1583	3433	3539					1770	1577	1504
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3539	1583	3433	3539					1770	1577	1504
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1295	785	190	1232	0	0	0	0	490	206	1271
RTOR Reduction (vph)	0	0	330	0	0	0	0	0	0	0	19	35
Lane Group Flow (vph)	0	1295	455	190	1232	0	0	0	0	490	734	689
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		6		5	2					8	8	
Permitted Phases			6									8
Actuated Green, G (s)		39.5	39.5	6.5	50.5					46.5	46.5	46.5
Effective Green, g (s)		39.5	39.5	6.5	50.5					46.5	46.5	46.5
Actuated g/C Ratio		0.37	0.37	0.06	0.48					0.44	0.44	0.44
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Vehicle Extension (s)		1.5	1.5	1.0	1.5					1.5	1.5	1.5
Lane Grp Cap (vph)		1318	589	210	1686					776	691	659
v/s Ratio Prot		c0.37		0.06	c0.35					0.28	c0.47	
v/s Ratio Perm			0.29									0.46
v/c Ratio		0.98	0.77	0.90	0.73					0.63	1.06	1.05
Uniform Delay, d1		32.9	29.3	49.4	22.3					23.1	29.8	29.8
Progression Factor		0.59	0.41	0.93	0.79					1.00	1.00	1.00
Incremental Delay, d2		13.0	4.4	29.3	2.1					1.2	52.2	47.6
Delay (s)		32.4	16.3	75.1	19.8					24.3	81.9	77.4
Level of Service		C	B	E	B					C	F	E
Approach Delay (s)		26.4			27.2			0.0			65.9	
Approach LOS		C			C			A			E	

Intersection Summary			
HCM 2000 Control Delay	40.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	100.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Commerce Blvd & Golf Course Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	721	999	399	409	112	957	213	655	208	285	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	13	12	12	12
Total Lost time (s)	3.5	4.1	4.1	4.1	4.1		4.1	4.1	4.1	4.1	4.1	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.95		0.97	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	3425		3433	1863	1636	1770	1838	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	3425		3433	1863	1636	1770	1838	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	30	736	1019	407	417	114	977	217	668	212	291	28
RTOR Reduction (vph)	0	0	24	0	23	0	0	0	42	0	3	0
Lane Group Flow (vph)	30	736	995	407	508	0	977	217	626	212	316	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	1	6	4	5	2		4	4	5	3	3	
Permitted Phases			6						4			
Actuated Green, G (s)	4.3	15.1	59.0	14.7	26.1		43.9	43.9	58.6	15.9	15.9	
Effective Green, g (s)	4.3	15.1	59.0	14.7	26.1		43.9	43.9	58.6	15.9	15.9	
Actuated g/C Ratio	0.04	0.14	0.56	0.14	0.25		0.41	0.41	0.55	0.15	0.15	
Clearance Time (s)	3.5	4.1	4.1	4.1	4.1		4.1	4.1	4.1	4.1	4.1	
Vehicle Extension (s)	1.0	1.5	1.5	1.0	1.5		1.5	1.5	1.0	1.5	1.5	
Lane Grp Cap (vph)	71	724	942	476	843		1421	771	904	265	275	
v/s Ratio Prot	0.02	0.14	c0.44	c0.12	0.15		0.28	0.12	0.10	0.12	c0.17	
v/s Ratio Perm			0.19						0.29			
v/c Ratio	0.42	1.02	1.06	0.86	0.60		0.69	0.28	0.69	0.80	1.15	
Uniform Delay, d1	49.6	45.5	23.5	44.6	35.4		25.4	20.6	17.2	43.5	45.0	
Progression Factor	0.65	0.85	0.66	0.77	0.68		0.89	0.99	0.86	1.00	1.00	
Incremental Delay, d2	0.7	26.4	36.3	12.8	3.0		0.8	0.1	1.4	14.9	100.2	
Delay (s)	32.9	65.2	51.7	47.0	26.9		23.6	20.4	16.3	58.4	145.2	
Level of Service	C	E	D	D	C		C	C	B	E	F	
Approach Delay (s)		57.0			35.6			20.6			110.6	
Approach LOS		E			D			C			F	

Intersection Summary			
HCM 2000 Control Delay	45.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	100.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Commerce Blvd & US 101 North Ramps

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	984	2	66	4	5	13	546	828	2	8	829	846
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	14	12	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	3.5		3.5		3.5	4.0		3.5	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.92		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1793	1686	1794		1699		1770	3538		1770	3539	1546
Flt Permitted	0.95	0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1793	1686	1794		1699		1770	3538		1770	3539	1546
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	1004	2	67	4	5	13	557	845	2	8	846	863
RTOR Reduction (vph)	0	0	27	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	502	504	40	0	9	0	557	847	0	8	846	863
Confl. Bikes (#/hr)												10
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA		Prot	NA	Free
Protected Phases	8	8	1	7	7		1	6		5	2	
Permitted Phases			8									Free
Actuated Green, G (s)	32.1	32.1	63.6		1.6		31.5	56.5		0.8	25.8	106.0
Effective Green, g (s)	32.1	32.1	63.6		1.6		31.5	56.5		0.8	25.8	106.0
Actuated g/C Ratio	0.30	0.30	0.60		0.02		0.30	0.53		0.01	0.24	1.00
Clearance Time (s)	4.0	4.0	3.5		3.5		3.5	4.0		3.5	4.0	
Vehicle Extension (s)	1.5	1.5	1.0		1.0		1.0	1.5		1.0	1.5	
Lane Grp Cap (vph)	542	510	1076		25		525	1885		13	861	1546
v/s Ratio Prot	0.28	c0.30	0.01		0.01		c0.31	0.24		0.00	c0.24	
v/s Ratio Perm			0.01									c0.56
v/c Ratio	0.93	0.99	0.04		0.37		1.06	0.45		0.62	0.98	0.56
Uniform Delay, d1	35.8	36.8	8.7		51.7		37.2	15.2		52.4	39.9	0.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.05	0.91	1.00
Incremental Delay, d2	24.1	37.1	0.0		3.3		56.4	0.1		5.4	5.9	0.1
Delay (s)	59.9	73.8	8.7		55.0		93.7	15.3		60.6	42.3	0.1
Level of Service	E	E	A		E		F	B		E	D	A
Approach Delay (s)		63.3			55.0			46.4			21.2	
Approach LOS		E			E			D			C	

Intersection Summary			
HCM 2000 Control Delay	40.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr

4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	34	623	598	19	401	429
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	35	636	610	19	409	438
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1876	620			630	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1876	620			630	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	23	0			57	
cM capacity (veh/h)	45	488			953	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	670	630	409	438
Volume Left	35	0	409	0
Volume Right	636	19	0	0
cSH	323	1700	953	1700
Volume to Capacity	2.08	0.37	0.43	0.26
Queue Length 95th (ft)	1215	0	55	0
Control Delay (s)	520.7	0.0	11.6	0.0
Lane LOS	F		B	
Approach Delay (s)	520.7	0.0	5.6	
Approach LOS	F			

Intersection Summary			
Average Delay	164.8		
Intersection Capacity Utilization	105.3%	ICU Level of Service	G
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
4: Commerce Blvd & State Farm Dr

4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	34	623	598	19	401	429
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1855		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	1855		1770	1863
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	35	636	610	19	409	438
RTOR Reduction (vph)	0	76	1	0	0	0
Lane Group Flow (vph)	35	560	628	0	409	438
Turn Type	Prot	pm+ov	NA		Prot	NA
Protected Phases	8	1	2		1	6
Permitted Phases		8				
Actuated Green, G (s)	7.3	30.1	29.4		22.8	56.7
Effective Green, g (s)	7.3	30.1	29.4		22.8	56.7
Actuated g/C Ratio	0.10	0.41	0.40		0.31	0.78
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	177	750	747		552	1447
v/s Ratio Prot	0.02	c0.23	c0.34		0.23	0.24
v/s Ratio Perm		0.12				
v/c Ratio	0.20	0.75	0.84		0.74	0.30
Uniform Delay, d1	30.2	18.2	19.7		22.5	2.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	4.1	8.4		5.3	0.1
Delay (s)	30.7	22.3	28.1		27.8	2.5
Level of Service	C	C	C		C	A
Approach Delay (s)	22.7		28.1			14.7
Approach LOS	C		C			B

Intersection Summary			
HCM 2000 Control Delay	21.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	14	62	44	10	35	79	397	25	15	358	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	12	14	63	45	10	36	81	405	26	15	365	20
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	811	998	193	863	995	215	386			431		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	811	998	193	863	995	215	386			431		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	94	92	78	95	95	93			99		
cM capacity (veh/h)	234	223	816	205	223	789	1169			1125		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	12	78	91	81	270	161	15	244	142
Volume Left	12	0	45	81	0	0	15	0	0
Volume Right	0	63	36	0	0	26	0	0	20
cSH	234	547	293	1169	1700	1700	1125	1700	1700
Volume to Capacity	0.05	0.14	0.31	0.07	0.16	0.09	0.01	0.14	0.08
Queue Length 95th (ft)	4	12	32	6	0	0	1	0	0
Control Delay (s)	21.2	12.7	22.7	8.3	0.0	0.0	8.2	0.0	0.0
Lane LOS	C	B	C	A			A		
Approach Delay (s)	13.8		22.7	1.3			0.3		
Approach LOS	B		C						

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: State Farm Dr & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	14	62	44	10	35	79	397	25	15	358	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	12	14	63	45	10	36	81	405	26	15	365	20
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1013	998	376	1045	995	418	386			431		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1013	998	376	1045	995	418	386			431		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	94	91	73	95	94	93			99		
cM capacity (veh/h)	186	224	671	167	225	635	1173			1129		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	12	78	91	81	431	15	386
Volume Left	12	0	45	81	0	15	0
Volume Right	0	63	36	0	26	0	20
cSH	186	491	245	1173	1700	1129	1700
Volume to Capacity	0.07	0.16	0.37	0.07	0.25	0.01	0.23
Queue Length 95th (ft)	5	14	41	6	0	1	0
Control Delay (s)	25.7	13.7	28.1	8.3	0.0	8.2	0.0
Lane LOS	D	B	D	A		A	
Approach Delay (s)	15.4		28.1	1.3		0.3	
Approach LOS	C		D				

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Commerce Blvd & Professional Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	14	335	5	84	376	77	1	61	45	92	81	68
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	14	342	5	86	384	79	1	62	46	94	83	69
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			TWLTL							
Median storage veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	462			347			1039	1007	344	1042	970	423
vC1, stage 1 conf vol							373	373		594	594	
vC2, stage 2 conf vol							666	634		447	376	
vCu, unblocked vol	462			347			1039	1007	344	1042	970	423
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			93			100	84	93	71	79	89
cM capacity (veh/h)	1099			1212			274	385	698	329	391	631

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	14	347	86	462	109	94	152
Volume Left	14	0	86	0	1	94	0
Volume Right	0	5	0	79	46	0	69
cSH	1099	1700	1212	1700	472	329	473
Volume to Capacity	0.01	0.20	0.07	0.27	0.23	0.29	0.32
Queue Length 95th (ft)	1	0	6	0	22	29	34
Control Delay (s)	8.3	0.0	8.2	0.0	14.9	20.2	16.2
Lane LOS	A		A		B	C	C
Approach Delay (s)	0.3		1.3		14.9	17.7	
Approach LOS					B	C	

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	14	6	107	235	5	50	92	521	229	44	618	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	14	6	109	240	5	51	94	532	234	45	631	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								480				
pX, platoon unblocked												
vC, conflicting volume	1234	1680	321	1354	1569	383	643			765		
vC1, stage 1 conf vol	727	727		836	836							
vC2, stage 2 conf vol	507	953		517	733							
vCu, unblocked vol	1234	1680	321	1354	1569	383	643			765		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	97	84	0	98	92	90			95		
cM capacity (veh/h)	274	223	674	220	241	615	938			844		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	130	296	94	354	411	45	420	222
Volume Left	14	240	94	0	0	45	0	0
Volume Right	109	51	0	0	234	0	0	12
cSH	537	248	938	1700	1700	844	1700	1700
Volume to Capacity	0.24	1.19	0.10	0.21	0.24	0.05	0.25	0.13
Queue Length 95th (ft)	23	348	8	0	0	4	0	0
Control Delay (s)	13.8	160.8	9.3	0.0	0.0	9.5	0.0	0.0
Lane LOS	B	F	A			A		
Approach Delay (s)	13.8	160.8	1.0			0.6		
Approach LOS	B	F						

Intersection Summary			
Average Delay	25.7		
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	14	6	107	235	5	50	92	521	229	44	618	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.93			0.98		1.00	1.00	0.87	1.00	1.00	
Flpb, ped/bikes		1.00			0.97		1.00	1.00	1.00	1.00	1.00	
Frt		0.89			0.98		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.96		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1524			1662		1770	1863	1377	1770	1853	
Flt Permitted		0.95			0.71		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1460			1223		1770	1863	1377	1770	1853	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	14	6	109	240	5	51	94	532	234	45	631	12
RTOR Reduction (vph)	0	79	0	0	12	0	0	0	120	0	1	0
Lane Group Flow (vph)	0	50	0	0	284	0	94	532	114	45	642	0
Confl. Peds. (#/hr)	50		50	50		50			50			50
Confl. Bikes (#/hr)			20			20			20			20
Turn Type	Perm	NA		Perm	NA		Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8					2			
Actuated Green, G (s)		18.7			18.7		4.2	32.7	32.7	2.3	30.8	
Effective Green, g (s)		18.7			18.7		4.2	32.7	32.7	2.3	30.8	
Actuated g/C Ratio		0.28			0.28		0.06	0.49	0.49	0.03	0.46	
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		406			340		110	906	670	60	849	
v/s Ratio Prot							c0.05	0.29		0.03	c0.35	
v/s Ratio Perm		0.03			c0.23				0.08			
v/c Ratio		0.12			0.84		0.85	0.59	0.17	0.75	0.76	
Uniform Delay, d1		18.1			22.8		31.2	12.4	9.7	32.2	15.1	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1			16.2		43.8	2.8	0.5	40.4	6.2	
Delay (s)		18.3			39.0		75.0	15.2	10.2	72.6	21.3	
Level of Service		B			D		E	B	B	E	C	
Approach Delay (s)		18.3			39.0			20.4			24.7	
Approach LOS		B			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	67.2	Sum of lost time (s)	13.5
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	28	34	171	131	7	36	90	414	118	115	508	35
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	29	35	174	134	7	37	92	422	120	117	518	36
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								456				
pX, platoon unblocked												
vC, conflicting volume	1206	1497	277	1352	1455	271	554			543		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1206	1497	277	1352	1455	271	554			543		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	73	64	76	0	93	95	91			89		
cM capacity (veh/h)	107	98	720	51	104	726	1012			1022		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	46	192	134	44	92	282	261	117	346	209
Volume Left	29	0	134	0	92	0	0	117	0	0
Volume Right	0	174	0	37	0	0	120	0	0	36
cSH	103	457	51	367	1012	1700	1700	1022	1700	1700
Volume to Capacity	0.45	0.42	2.61	0.12	0.09	0.17	0.15	0.11	0.20	0.12
Queue Length 95th (ft)	48	51	348	10	7	0	0	10	0	0
Control Delay (s)	65.4	18.5	900.2	16.1	8.9	0.0	0.0	9.0	0.0	0.0
Lane LOS	F	C	F	C	A			A		
Approach Delay (s)	27.5		681.7		1.3			1.6		
Approach LOS	D		F							

Intersection Summary			
Average Delay	75.2		
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
8: State Farm Dr & City Center Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	34	171	131	7	36	90	414	118	115	508	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	0.88	1.00	0.90		1.00	1.00	0.90	1.00	0.99	
Flpb, ped/bikes		0.97	1.00	0.94	1.00		1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85	1.00	0.87		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.98	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1768	1398	1659	1467		1770	1863	1423	1770	1832	
Flt Permitted		0.88	1.00	0.72	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1583	1398	1249	1467		1770	1863	1423	1770	1832	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	29	35	174	134	7	37	92	422	120	117	518	36
RTOR Reduction (vph)	0	0	134	0	29	0	0	0	63	0	3	0
Lane Group Flow (vph)	0	64	40	134	15	0	92	422	57	117	551	0
Confl. Peds. (#/hr)	50		50	50		50			50			50
Confl. Bikes (#/hr)			20			20			20			20
Turn Type	Perm	NA	Perm	Perm	NA		Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8					2			
Actuated Green, G (s)		13.8	13.8	13.8	13.8		4.2	28.7	28.7	4.2	28.7	
Effective Green, g (s)		13.8	13.8	13.8	13.8		4.2	28.7	28.7	4.2	28.7	
Actuated g/C Ratio		0.23	0.23	0.23	0.23		0.07	0.48	0.48	0.07	0.48	
Clearance Time (s)		4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		362	320	286	336		123	888	678	123	873	
v/s Ratio Prot					0.01		0.05	0.23		c0.07	c0.30	
v/s Ratio Perm		0.04	0.03	c0.11					0.04			
v/c Ratio		0.18	0.12	0.47	0.05		0.75	0.48	0.08	0.95	0.63	
Uniform Delay, d1		18.6	18.4	20.0	18.1		27.5	10.7	8.6	27.9	11.8	
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.2	0.2	1.2	0.1		21.7	1.8	0.2	65.7	3.5	
Delay (s)		18.9	18.6	21.2	18.1		49.2	12.5	8.8	93.6	15.2	
Level of Service		B	B	C	B		D	B	A	F	B	
Approach Delay (s)		18.7			20.5			17.1			28.9	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	60.2	Sum of lost time (s)	13.5
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1473	646	42	1725	0	5	0	41	955	0	384
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.5	4.5	3.5	4.5		4.0		4.0	4.0		4.0
Lane Util. Factor		0.91	1.00	1.00	0.91		1.00		1.00	0.97		1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)		5085	1531	1770	5085		1770		1583	3433		1583
Flt Permitted		1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (perm)		5085	1531	1770	5085		1770		1583	3433		1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1503	659	43	1760	0	5	0	42	974	0	392
RTOR Reduction (vph)	0	0	170	0	0	0	0	0	41	0	0	46
Lane Group Flow (vph)	0	1503	489	43	1760	0	5	0	1	974	0	346
Turn Type		NA	Perm	Prot	NA		Prot		Prot	Prot		Perm
Protected Phases		2		1	6		3		3	4		
Permitted Phases			2									4
Actuated Green, G (s)		78.0	78.0	6.8	88.3		4.0		4.0	53.2		53.2
Effective Green, g (s)		78.0	78.0	6.8	88.3		4.0		4.0	53.2		53.2
Actuated g/C Ratio		0.49	0.49	0.04	0.56		0.03		0.03	0.34		0.34
Clearance Time (s)		4.5	4.5	3.5	4.5		4.0		4.0	4.0		4.0
Vehicle Extension (s)		4.0	4.0	2.0	4.0		3.0		3.0	2.0		2.0
Lane Grp Cap (vph)		2510	755	76	2841		44		40	1155		533
v/s Ratio Prot		0.30		0.02	c0.35		c0.00		0.00	c0.28		
v/s Ratio Perm			c0.32									0.22
v/c Ratio		0.60	0.65	0.57	0.62		0.11		0.03	0.84		0.65
Uniform Delay, d1		28.8	29.8	74.2	23.5		75.3		75.1	48.5		44.5
Progression Factor		0.36	0.24	0.82	0.50		1.00		1.00	1.00		1.00
Incremental Delay, d2		0.8	3.0	4.9	0.9		1.2		0.3	5.5		2.1
Delay (s)		11.1	10.1	65.5	12.7		76.4		75.4	54.1		46.5
Level of Service		B	B	E	B		E		E	D		D
Approach Delay (s)		10.8			13.9			75.5			51.9	
Approach LOS		B			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	22.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	158.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	49	1987	0	0	1512	809	604	16	557	29	0	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0			6.0	6.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.86			0.91	1.00	0.95	0.95	0.88	1.00		1.00
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.95	1.00	0.95		1.00
Satd. Flow (prot)	1770	6408			5085	1583	1681	1689	2787	1770		1583
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.95	1.00	0.95		1.00
Satd. Flow (perm)	1770	6408			5085	1583	1681	1689	2787	1770		1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	50	2028	0	0	1543	826	616	16	568	30	0	16
RTOR Reduction (vph)	0	0	0	0	0	331	0	0	73	0	0	15
Lane Group Flow (vph)	50	2028	0	0	1543	495	314	318	495	30	0	1
Turn Type	Prot	NA			NA	Perm	Split	NA	Perm	Prot		Perm
Protected Phases	5	2			6		3	3		4		
Permitted Phases						6			3			4
Actuated Green, G (s)	8.0	97.8			84.8	84.8	38.8	38.8	38.8	5.4		5.4
Effective Green, g (s)	8.0	97.8			84.8	84.8	38.8	38.8	38.8	5.4		5.4
Actuated g/C Ratio	0.05	0.62			0.54	0.54	0.25	0.25	0.25	0.03		0.03
Clearance Time (s)	5.0	6.0			6.0	6.0	5.0	5.0	5.0	5.0		5.0
Vehicle Extension (s)	2.0	4.0			4.0	4.0	2.0	2.0	2.0	2.0		2.0
Lane Grp Cap (vph)	89	3966			2729	849	412	414	684	60		54
v/s Ratio Prot	0.03	c0.32			0.30		0.19	c0.19		c0.02		
v/s Ratio Perm						c0.31			0.18			0.00
v/c Ratio	0.56	0.51			0.57	0.58	0.76	0.77	0.72	0.50		0.01
Uniform Delay, d1	73.3	16.8			24.3	24.7	55.3	55.4	54.7	75.0		73.7
Progression Factor	0.85	0.48			0.66	0.79	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	3.9	0.4			0.5	1.8	7.3	7.5	3.2	2.4		0.0
Delay (s)	66.0	8.5			16.5	21.3	62.7	62.9	57.9	77.3		73.7
Level of Service	E	A			B	C	E	E	E	E		E
Approach Delay (s)		9.9			18.2			60.5			76.1	
Approach LOS		A			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	158.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	412	1303	812	216	1313	120	592	282	289	192	304	443
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1560	1770	5010		3433	1863	1548	1610	3375	1562
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1560	1770	5010		3433	1863	1548	1610	3375	1562
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	420	1330	829	220	1340	122	604	288	295	196	310	452
RTOR Reduction (vph)	0	0	89	0	5	0	0	0	190	0	0	64
Lane Group Flow (vph)	420	1330	740	220	1457	0	604	288	105	165	341	388
Confl. Peds. (#/hr)			13			10			5			7
Confl. Bikes (#/hr)						2			5			2
Turn Type	Prot	NA	pm+ov	Prot	NA		Split	NA	Perm	Split	NA	pm+ov
Protected Phases	5	2	3	1	6		3	3		4	4	5
Permitted Phases			2						3			4
Actuated Green, G (s)	13.0	44.9	84.6	29.7	61.6		39.7	39.7	39.7	23.7	23.7	36.7
Effective Green, g (s)	13.0	44.9	84.6	29.7	61.6		39.7	39.7	39.7	23.7	23.7	36.7
Actuated g/C Ratio	0.08	0.28	0.54	0.19	0.39		0.25	0.25	0.25	0.15	0.15	0.23
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	1.5	1.5	1.0	1.0	1.0
Lane Grp Cap (vph)	282	1005	835	332	1953		862	468	388	241	506	412
v/s Ratio Prot	0.12	c0.38	c0.22	0.12	c0.29		0.18	0.15		0.10	0.10	c0.08
v/s Ratio Perm			0.25						0.07			0.17
v/c Ratio	1.49	1.32	0.89	0.66	0.75		0.70	0.62	0.27	0.68	0.67	0.94
Uniform Delay, d1	72.5	56.5	32.5	59.5	41.5		53.8	52.4	47.5	63.6	63.5	59.6
Progression Factor	0.80	0.75	1.75	0.54	0.66		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	235.6	151.5	9.5	1.2	0.8		2.1	1.7	0.1	6.3	2.8	29.7
Delay (s)	293.9	193.8	66.4	33.6	28.3		55.9	54.1	47.7	69.9	66.3	89.3
Level of Service	F	F	E	C	C		E	D	D	E	E	F
Approach Delay (s)		169.1			29.0			53.4			77.8	
Approach LOS		F			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	97.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	158.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	98.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Commerce Blvd & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	412	1303	812	216	1313	120	592	282	289	192	304	443
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	4.0	5.0	4.0	5.0	5.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1547	1770	5010		3433	1863	1553	1770	3539	1565
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1547	1770	5010		3433	1863	1553	1770	3539	1565
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	420	1330	829	220	1340	122	604	288	295	196	310	452
RTOR Reduction (vph)	0	0	65	0	7	0	0	0	62	0	0	37
Lane Group Flow (vph)	420	1330	764	220	1455	0	604	288	233	196	310	415
Confl. Peds. (#/hr)			13			10			5			7
Confl. Bikes (#/hr)						2			5			2
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	5	2	3	1	6		3	8	1	7	4	5
Permitted Phases			2						8			4
Actuated Green, G (s)	20.0	64.0	88.0	16.0	60.0		24.0	29.0	45.0	21.0	24.0	44.0
Effective Green, g (s)	20.0	64.0	88.0	16.0	60.0		24.0	29.0	45.0	21.0	24.0	44.0
Actuated g/C Ratio	0.14	0.43	0.59	0.11	0.41		0.16	0.20	0.30	0.14	0.16	0.30
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	4.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	1.5	1.0	1.0		1.5	3.0	1.0	3.0	1.0	1.0
Lane Grp Cap (vph)	463	1530	919	191	2031		556	365	472	251	573	465
v/s Ratio Prot	c0.12	c0.38	0.13	c0.12	0.29		c0.18	c0.15	0.05	0.11	0.09	0.12
v/s Ratio Perm			0.36						0.10			0.14
v/c Ratio	0.91	0.87	0.83	1.15	0.72		1.09	0.79	0.49	0.78	0.54	0.89
Uniform Delay, d1	63.1	38.2	24.1	66.0	36.9		62.0	56.6	42.2	61.3	56.9	49.8
Progression Factor	0.88	0.60	1.11	0.81	0.43		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.3	6.0	5.3	97.9	1.3		63.7	10.8	0.3	14.5	0.6	18.7
Delay (s)	73.9	29.0	32.0	151.5	17.2		125.7	67.4	42.5	75.8	57.5	68.5
Level of Service	E	C	C	F	B		F	E	D	E	E	E
Approach Delay (s)		37.3			34.8			90.9			66.4	
Approach LOS		D			C			F			E	

Intersection Summary			
HCM 2000 Control Delay	50.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	148.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	295	1068	349	305	1052	195	425	180	245	339	256	258
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1538	1770	3539	1552	1610	3301	1547	1610	3118	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1538	1770	3539	1552	1610	3301	1547	1610	3118	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	301	1090	356	311	1073	199	434	184	250	346	261	263
RTOR Reduction (vph)	0	0	192	0	0	84	0	0	199	0	105	0
Lane Group Flow (vph)	301	1090	164	311	1073	115	217	401	51	298	467	0
Confl. Peds. (#/hr)			12			5			10			4
Confl. Bikes (#/hr)			1			1						1
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			6			3			
Actuated Green, G (s)	38.4	61.5	61.5	16.0	39.1	39.1	27.1	27.1	27.1	33.4	33.4	
Effective Green, g (s)	38.4	61.5	61.5	16.0	39.1	39.1	27.1	27.1	27.1	33.4	33.4	
Actuated g/C Ratio	0.24	0.39	0.39	0.10	0.25	0.25	0.17	0.17	0.17	0.21	0.21	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)	430	1377	598	179	875	384	276	566	265	340	659	
v/s Ratio Prot	0.17	c0.31		c0.18	c0.30		c0.13	0.12		c0.19	0.15	
v/s Ratio Perm			0.11			0.07			0.03			
v/c Ratio	0.70	0.79	0.27	1.74	1.23	0.30	0.79	0.71	0.19	0.88	0.71	
Uniform Delay, d1	54.5	42.6	33.0	71.0	59.5	48.3	62.7	61.7	56.1	60.3	57.8	
Progression Factor	0.47	0.37	0.71	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	0.4	0.1	354.0	112.0	2.0	12.7	3.3	0.1	20.9	2.9	
Delay (s)	26.1	16.2	23.7	425.0	171.4	50.3	75.4	65.0	56.2	81.2	60.7	
Level of Service	C	B	C	F	F	D	E	E	E	F	E	
Approach Delay (s)		19.4			206.0			65.1			67.7	
Approach LOS		B			F			E			E	

Intersection Summary			
HCM 2000 Control Delay	93.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	158.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	100.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	295	1068	349	305	1052	195	425	180	245	339	256	258
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	11	11	11
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1531	1770	3539	1549	3433	1863	1566	3319	1801	1517
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1531	1770	3539	1549	3433	1863	1566	3319	1801	1517
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	301	1090	356	311	1073	199	434	184	250	346	261	263
RTOR Reduction (vph)	0	0	107	0	0	74	0	0	51	0	0	52
Lane Group Flow (vph)	301	1090	249	311	1073	125	434	184	199	346	261	211
Confl. Peds. (#/hr)			12			5			10			4
Confl. Bikes (#/hr)			1			1						1
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	26.0	49.6	72.2	28.9	52.5	78.7	22.6	25.3	54.2	26.2	27.9	53.9
Effective Green, g (s)	26.0	49.6	72.2	28.9	52.5	78.7	22.6	25.3	54.2	26.2	27.9	53.9
Actuated g/C Ratio	0.18	0.34	0.49	0.20	0.35	0.53	0.15	0.17	0.37	0.18	0.19	0.36
Clearance Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	1.0	1.0	3.0	1.0	1.0	3.0	3.0	3.0	1.0	3.0	1.0	1.0
Lane Grp Cap (vph)	310	1186	746	345	1255	865	524	318	573	587	339	603
v/s Ratio Prot	0.17	c0.31	0.05	0.18	c0.30	0.03	c0.13	0.10	0.07	c0.10	c0.14	0.06
v/s Ratio Perm			0.11			0.05			0.06			0.08
v/c Ratio	0.97	0.92	0.33	0.90	0.85	0.14	0.83	0.58	0.35	0.59	0.77	0.35
Uniform Delay, d1	60.6	47.3	23.2	58.2	44.2	17.6	60.8	56.4	34.0	56.0	57.0	34.3
Progression Factor	0.71	0.64	0.38	1.12	0.75	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	31.4	8.2	0.2	21.0	6.1	0.1	10.4	2.5	0.1	1.5	9.1	0.1
Delay (s)	74.5	38.3	9.1	86.3	39.3	17.5	71.2	59.0	34.2	57.5	66.1	34.4
Level of Service	E	D	A	F	D	B	E	E	C	E	E	C
Approach Delay (s)		38.6			45.8			58.0			53.1	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM 2000 Control Delay	46.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	148.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Commerce Blvd & Enterprise Dr

4/15/2015

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	196	63	686	106	77	772
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3433	1583	3468		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3433	1583	3468		1770	3539
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	200	64	700	108	79	788
RTOR Reduction (vph)	0	52	17	0	0	0
Lane Group Flow (vph)	200	12	791	0	79	788
Turn Type	Prot	Perm	NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	7.7	7.7	18.4		2.9	25.3
Effective Green, g (s)	7.7	7.7	18.4		2.9	25.3
Actuated g/C Ratio	0.19	0.19	0.45		0.07	0.62
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	644	297	1556		125	2183
v/s Ratio Prot	c0.06		c0.23		c0.04	0.22
v/s Ratio Perm		0.01				
v/c Ratio	0.31	0.04	0.51		0.63	0.36
Uniform Delay, d1	14.4	13.6	8.1		18.5	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	0.1	0.3		10.0	0.1
Delay (s)	14.6	13.7	8.3		28.5	4.0
Level of Service	B	B	A		C	A
Approach Delay (s)	14.4		8.3			6.2
Approach LOS	B		A			A

Intersection Summary				
HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.47			
Actuated Cycle Length (s)	41.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	42.2%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	187	2	8	208	147	2	3	0	247	2	34
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	2	191	2	8	212	150	2	3	0	252	2	35

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	97	97	114	256	5	289
Volume Left (vph)	2	0	8	0	2	252
Volume Right (vph)	0	2	0	150	0	35
Hadj (s)	0.04	0.02	0.07	-0.38	0.11	0.14
Departure Headway (s)	5.9	5.8	5.7	5.2	5.9	5.4
Degree Utilization, x	0.16	0.16	0.18	0.37	0.01	0.43
Capacity (veh/h)	576	581	603	659	528	632
Control Delay (s)	8.8	8.7	8.7	10.1	9.0	12.4
Approach Delay (s)	8.7		9.7		9.0	12.4
Approach LOS	A		A		A	B

Intersection Summary			
Delay	10.4		
Level of Service	B		
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
14: Enterprise Dr & Hunter Dr

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	187	2	8	208	147	2	3	0	247	2	34
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	2	191	2	8	212	150	2	3	0	252	2	35

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	2	193	220	150	5	289
Volume Left (vph)	2	0	8	0	2	252
Volume Right (vph)	0	2	0	150	0	35
Hadj (s)	0.53	0.03	0.05	-0.67	0.11	0.14
Departure Headway (s)	6.4	5.9	5.7	5.0	5.9	5.4
Degree Utilization, x	0.00	0.31	0.35	0.21	0.01	0.43
Capacity (veh/h)	531	583	606	692	522	627
Control Delay (s)	8.2	10.3	10.5	8.0	9.0	12.5
Approach Delay (s)	10.3		9.5		9.0	12.5
Approach LOS	B		A		A	B

Intersection Summary			
Delay	10.7		
Level of Service	B		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Enterprise Dr & State Farm Dr

4/15/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	130	275	185	442	610	170
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	133	281	189	451	622	173

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	133	281	126	514	622	173
Volume Left (vph)	133	0	0	0	622	0
Volume Right (vph)	0	0	0	451	0	173
Hadj (s)	0.53	0.03	0.03	-0.58	0.53	-0.67
Departure Headway (s)	8.2	7.7	7.4	6.8	8.0	6.7
Degree Utilization, x	0.30	0.60	0.26	0.97	1.0	0.32
Capacity (veh/h)	430	452	475	514	463	528
Control Delay (s)	13.6	20.5	11.8	57.8	203.7	11.7
Approach Delay (s)	18.3		48.8		161.9	
Approach LOS	C		E		F	

Intersection Summary			
Delay	90.7		
Level of Service	F		
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	130	275	185	442	610	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.64	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1189	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	133	281	189	451	622	173
RTOR Reduction (vph)	0	0	0	310	0	88
Lane Group Flow (vph)	133	281	189	141	622	85
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	12.7	12.7	12.7	12.7	19.8	19.8
Effective Green, g (s)	12.7	12.7	12.7	12.7	19.8	19.8
Actuated g/C Ratio	0.31	0.31	0.31	0.31	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	372	584	584	496	865	773
v/s Ratio Prot		c0.15	0.10		c0.35	
v/s Ratio Perm	0.11			0.09		0.05
v/c Ratio	0.36	0.48	0.32	0.29	0.72	0.11
Uniform Delay, d1	10.7	11.2	10.6	10.5	8.2	5.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.6	0.3	0.3	2.9	0.1
Delay (s)	11.3	11.9	10.9	10.8	11.0	5.7
Level of Service	B	B	B	B	B	A
Approach Delay (s)		11.7	10.8		9.9	
Approach LOS		B	B		A	

Intersection Summary			
HCM 2000 Control Delay	10.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	40.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	18	870	499	12	10	52
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	18	888	509	12	10	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	521				1440	515
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	521				1440	515
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				93	91
cM capacity (veh/h)	1045				144	560

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	906	521	63
Volume Left	18	0	10
Volume Right	0	12	53
cSH	1045	1700	381
Volume to Capacity	0.02	0.31	0.17
Queue Length 95th (ft)	1	0	15
Control Delay (s)	0.5	0.0	16.3
Lane LOS	A		C
Approach Delay (s)	0.5	0.0	16.3
Approach LOS			C

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
17: State Farm Dr & Town Center
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	177	6	73	26	6	148	37	521	28	149	596	125
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	181	6	74	27	6	151	38	532	29	152	608	128
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											575	
pX, platoon unblocked												
vC, conflicting volume	1471	1612	368	1307	1661	280	736			560		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1471	1612	368	1307	1661	280	736			560		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	93	88	68	92	79	96			85		
cM capacity (veh/h)	56	84	629	84	78	717	866			1007		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	261	184	38	354	206	152	405	330
Volume Left	181	27	38	0	0	152	0	0
Volume Right	74	151	0	0	29	0	0	128
cSH	77	303	866	1700	1700	1007	1700	1700
Volume to Capacity	3.40	0.61	0.04	0.21	0.12	0.15	0.24	0.19
Queue Length 95th (ft)	Err	92	3	0	0	13	0	0
Control Delay (s)	Err	33.6	9.3	0.0	0.0	9.2	0.0	0.0
Lane LOS	F	D	A			A		
Approach Delay (s)	Err	33.6	0.6			1.6		
Approach LOS	F	D						

Intersection Summary				
Average Delay	1357.0			
Intersection Capacity Utilization	62.6%	ICU Level of Service		B
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
17: State Farm Dr & Town Center
4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	177	6	73	26	6	148	37	521	28	149	596	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.90		1.00	0.90	1.00	1.00	0.89	1.00	1.00	0.89
Flpb, ped/bikes		0.95	1.00		0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1697	1432		1735	1432	1770	1863	1409	1770	1863	1415
Flt Permitted		0.71	1.00		0.76	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1261	1432		1375	1432	1770	1863	1409	1770	1863	1415
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	181	6	74	27	6	151	38	532	29	152	608	128
RTOR Reduction (vph)	0	0	55	0	0	112	0	0	17	0	0	48
Lane Group Flow (vph)	0	187	19	0	33	39	38	532	12	152	608	80
Confl. Peds. (#/hr)	50		50	50		50			50			50
Confl. Bikes (#/hr)			20			20			20			20
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		14.5	14.5		14.5	14.5	1.4	22.9	22.9	7.2	28.7	28.7
Effective Green, g (s)		14.5	14.5		14.5	14.5	1.4	22.9	22.9	7.2	28.7	28.7
Actuated g/C Ratio		0.26	0.26		0.26	0.26	0.02	0.40	0.40	0.13	0.51	0.51
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		323	366		352	366	43	753	570	225	944	717
v/s Ratio Prot							0.02	0.29		c0.09	c0.33	
v/s Ratio Perm		c0.15	0.01		0.02	0.03			0.01			0.06
v/c Ratio		0.58	0.05		0.09	0.11	0.88	0.71	0.02	0.68	0.64	0.11
Uniform Delay, d1		18.4	15.9		16.0	16.1	27.5	14.0	10.1	23.6	10.2	7.3
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.5	0.1		0.1	0.1	92.7	3.0	0.0	7.8	1.5	0.1
Delay (s)		20.9	15.9		16.2	16.2	120.2	17.1	10.1	31.4	11.7	7.4
Level of Service		C	B		B	B	F	B	B	C	B	A
Approach Delay (s)		19.5			16.2			23.3			14.5	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	56.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
60: Lynn Conde Way & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱			↑↑	↱			↱			↱
Volume (vph)	0	1609	43	0	1531	6	0	0	19	0	0	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0			3.0			3.0
Lane Util. Factor		0.95			0.95	1.00			1.00			1.00
Frt		1.00			1.00	0.85			0.86			0.86
Flt Protected		1.00			1.00	1.00			1.00			1.00
Satd. Flow (prot)		3525			3539	1583			1611			1611
Flt Permitted		1.00			1.00	1.00			1.00			1.00
Satd. Flow (perm)		3525			3539	1583			1611			1611
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1642	44	0	1562	6	0	0	19	0	0	21
RTOR Reduction (vph)	0	1	0	0	0	1	0	0	14	0	0	16
Lane Group Flow (vph)	0	1685	0	0	1562	5	0	0	5	0	0	5
Turn Type		NA			NA	Perm			Perm			Perm
Protected Phases		2			6							
Permitted Phases						6			8			8
Actuated Green, G (s)		104.0			104.0	104.0			36.0			36.0
Effective Green, g (s)		104.0			104.0	104.0			36.0			36.0
Actuated g/C Ratio		0.70			0.70	0.70			0.24			0.24
Clearance Time (s)		5.0			5.0	5.0			3.0			3.0
Vehicle Extension (s)		3.0			3.0	3.0			3.0			3.0
Lane Grp Cap (vph)		2477			2486	1112			391			391
v/s Ratio Prot		c0.48			0.44							
v/s Ratio Perm						0.00			0.00			c0.00
v/c Ratio		0.68			0.63	0.00			0.01			0.01
Uniform Delay, d1		12.5			11.7	6.6			42.5			42.5
Progression Factor		0.60			0.01	0.00			1.00			1.00
Incremental Delay, d2		0.9			1.0	0.0			0.0			0.0
Delay (s)		8.5			1.1	0.0			42.5			42.5
Level of Service		A			A	A			D			D
Approach Delay (s)		8.5			1.1			42.5			42.5	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	5.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	148.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
63: SMART midblock & Rohnert Park Expressway

4/15/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑							
Volume (vph)	0	1628	0	0	1537	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0							
Lane Util. Factor		0.95			0.95							
Frt		1.00			1.00							
Flt Protected		1.00			1.00							
Satd. Flow (prot)		3539			3539							
Flt Permitted		1.00			1.00							
Satd. Flow (perm)		3539			3539							
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1661	0	0	1568	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1661	0	0	1568	0	0	0	0	0	0	0
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Actuated Green, G (s)		104.0			104.0							
Effective Green, g (s)		104.0			104.0							
Actuated g/C Ratio		0.70			0.70							
Clearance Time (s)		5.0			5.0							
Vehicle Extension (s)		3.0			3.0							
Lane Grp Cap (vph)		2486			2486							
v/s Ratio Prot		c0.47			0.44							
v/s Ratio Perm												
v/c Ratio		0.67			0.63							
Uniform Delay, d1		12.3			11.7							
Progression Factor		0.73			1.00							
Incremental Delay, d2		1.1			1.2							
Delay (s)		10.1			13.0							
Level of Service		B			B							
Approach Delay (s)		10.1			13.0			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	148.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Freeway LOS Calculations

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US 101	**Analysis Period**	AM Peak
Analysis Date	3/31/2015 4:53:13 PM	**From**	Railroad Ave	**Version Date**	10/10/2012
Agency		**To**	Todd Rd		
Location	Sonoma County, CA	**Analysis Direction**	Northbound		

User Notes	Central Rohnert Park PDA Plan - AM Peak Hour Existing Conditions - Northbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.78800**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	SR 116 Off	SR 116 On	Basic Segment	2375	Level	2190	4.00	1.00	2	70
2	SR 116	RP Expressway	Weaving	4370	Level	3017	4.00	0.73	3	70
3	RP Expressway Off	RP Expressway EB On	Basic Segment	1065	Level	2604	4.32	0.84	2	70
4	RP Expressway EB On		On Ramp	1500	Level	2834	4.13	0.77	2	70
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	450	Level	2834	4.13	0.77	2	70
6	RP Expressway	Commerce Blvd	Weaving	2315	Level	3481	3.73	0.63	3	70
7	Commerce Off	Commerce On	Basic Segment	650	Level	3278	3.84	0.67	2	70
8	Commerce Blvd	Santa Rosa Ave	Weaving	3000	Level	3711	3.63	0.59	3	70
9	Santa Rosa Ave	Todd Rd	Basic Segment	4275	Level	3471	3.74	0.63	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
4	On Ramp	230	2.00	0.00	1	765	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
2	0.050	827	4.00	0.00	1	40	413	2.00	0.00	1	50
6	0.050	647	2.00	0.00	1	40	203	2.00	0.00	1	40
8	0.050	433	2.00	0.00	1	40	240	2.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
2	3000	2	1	1	0	
6	1782	2	1	1	0	
8	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS

1	SR 116 Off	SR 116 On	Basic Segment	2190	2190	4800	4697	0.47	0.47	0	70.0	16.0	15.6	0.39	0.39	0.0	0.0	246.3	246.3	3.5	0.0	B
2	SR 116	RP Expressway	Weaving	3017	3017	6290	6158	0.49	0.49	0	57.9	17.8	17.4	0.86	0.71	0.1	0.1	624.3	624.3	10.8	1.9	B
3	RP Expressway Off	RP Expressway EB On	Basic Segment	2604	2604	4800	4691	0.56	0.56	0	69.8	19.1	18.7	0.17	0.17	0.0	0.0	131.3	131.3	1.9	0.0	C
4	RP Expressway EB On		On Ramp	2834	2834	4800	4696	0.60	0.60	0	60.8	23.8	23.3	0.28	0.24	0.0	0.0	201.3	201.3	3.3	0.4	C
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	2834	2834	4800	4696	0.60	0.60	0	68.1	21.3	20.8	0.08	0.07	0.0	0.0	60.4	60.4	0.9	0.0	C
6	RP Expressway	Commerce Blvd	Weaving	3481	3481	6513	6386	0.55	0.55	0	58.7	20.1	19.8	0.45	0.38	0.1	0.1	381.6	381.6	6.5	1.0	C
7	Commerce Off	Commerce On	Basic Segment	3278	3278	4800	4703	0.70	0.70	0	67.4	24.8	24.3	0.11	0.11	0.0	0.0	100.9	100.9	1.5	0.1	C
8	Commerce Blvd	Santa Rosa Ave	Weaving	3711	3711	6922	6791	0.55	0.55	0	59.6	21.2	20.8	0.57	0.49	0.1	0.1	527.1	527.1	8.8	1.3	C
9	Santa Rosa Ave	Todd Rd	Basic Segment	3471	3471	4800	4706	0.74	0.74	0	66.2	26.7	26.2	0.73	0.69	0.0	0.0	702.6	702.6	10.6	0.6	D

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
SR 116 Off-SR 116 On	Basic	0.47	70.0	16.0	15.6	0.39	0.39	0,246.3	0,246.3	3.52	0.00
SR 116-RP Expressway	Weaving	0.49	57.9	17.8	17.4	0.86	0.71	0,624.3	0,624.3	10.79	1.87
RP Expressway Off-RP Expressway EB On	Basic	0.56	69.8	19.1	18.7	0.17	0.17	0,131.3	0,131.3	1.88	0.01
RP Expressway EB On-	OnRamp	0.60	60.8	23.8	23.3	0.28	0.24	0,201.3	0,201.3	3.31	0.44
RP Expressway EB On-RP Expressway WB On	Basic	0.60	68.1	21.3	20.8	0.08	0.07	0,060.4	0,060.4	0.89	0.02
RP Expressway-Commerce Blvd	Weaving	0.55	58.7	20.1	19.8	0.45	0.38	0,381.6	0,381.6	6.50	1.05
Commerce Off-Commerce On	Basic	0.70	67.4	24.8	24.3	0.11	0.11	0,100.9	0,100.9	1.50	0.06
Commerce Blvd-Santa Rosa Ave	Weaving	0.55	59.6	21.2	20.8	0.57	0.49	0,527.1	0,527.1	8.85	1.32
Santa Rosa Ave-Todd Rd	Basic	0.74	66.2	26.7	26.2	0.73	0.69	0,702.6	0,702.6	10.61	0.57
Freeway			62.2	20.8	20.3	3.64	3.25	2,975.7	2,975.7	0,047.8	0,005.3

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US101	**Analysis Period**	AM Peak
Analysis Date	3/31/2015 10:36:29 AM	**From**	Todd Rd	**Version Date**	10/10/2012
Agency		**To**	Railroad Ave		
Location	Sonoma County, CA	**Analysis Direction**	Southbound		

User Notes	Central Rohnert Park PDA Plan - AM Peak Hour Existing Conditions - Southbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.75600**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	Todd Rd	Golf Course Dr	Basic Segment	2500	Level	3689	4.00	1.00	2	70
2	Golf Course Off		Off Ramp	1500	Level	3689	4.00	1.00	2	70
3	Golf Course Off	Golf Course On	Basic Segment	3840	Level	3030	4.43	1.22	2	70
4	Golf Course Dr	RP Expressway	Weaving	3225	Level	3498	4.11	1.05	3	70
5	RP Expressway Off	RP Expressway WB On	Basic Segment	1560	Level	2648	4.79	1.39	2	70
6	RP Expressway WB On		On Ramp	545	Level	2971	4.48	1.24	2	70
7	RP Expressway	SR 116	Weaving	4580	Level	3144	4.35	1.17	3	70
8	SR 116 Off	SR 116 On	Basic Segment	2080	Level	2653	4.41	1.39	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	Off Ramp	659	2.00	0.00	1	200	50
6	On Ramp	323	2.00	0.00	1	200	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
4	0.050	468	2.00	0.00	1	40	850	2.00	0.00	1	40
7	0.050	173	2.00	0.00	1	40	491	4.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
4	3000	2	1	1	0	
7	300	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	Todd Rd	Golf Course Dr	Basic Segment	3689	3689	4800	4697	0.79	0.79	0	64.6	29.2	28.6	0.44	0.41	0.0	0.0	436.7	436.7	6.8	0.5	D
2	Golf Course		Off Ramp	3689	3689	4800	4697	0.79	0.79	0	61.8	30.5	29.8	0.28	0.24	0.0	0.0	262.0	262.0	4.2	0.5	D

	Off																					
3	Golf Course Off	Golf Course On	Basic Segment	3030	3030	4800	4685	0.65	0.65	0	68.6	22.6	22.1	0.64	0.62	0.0	0.0	550.9	550.9	8.0	0.2	C
4	Golf Course Dr	RP Expressway	Weaving	3498	3498	6461	6318	0.55	0.55	0	56.6	21.1	20.6	0.65	0.52	0.1	0.1	534.1	534.1	9.4	1.8	C
5	RP Expressway Off	RP Expressway WB On	Basic Segment	2648	2648	4800	4675	0.57	0.57	0	69.7	19.5	19.0	0.25	0.25	0.0	0.0	195.6	195.6	2.8	0.0	C
6	RP Expressway WB On		On Ramp	2971	2971	4800	4683	0.63	0.63	0	59.2	25.7	25.1	0.10	0.09	0.0	0.0	76.7	76.7	1.3	0.2	C
7	RP Expressway	SR 116	Weaving	3144	3144	6219	6073	0.52	0.52	0	58.3	18.4	18.0	0.89	0.74	0.1	0.1	681.8	681.8	11.7	2.0	B
8	SR 116 Off	SR 116 On	Basic Segment	2653	2653	4800	4684	0.57	0.57	0	69.7	19.5	19.0	0.34	0.34	0.0	0.0	261.3	261.3	3.7	0.0	C

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
Todd Rd-Golf Course Dr	Basic	0.79	64.6	29.2	28.6	0.44	0.41	0,436.7	0,436.7	6.76	0.53
Golf Course Off-	OffRamp	0.79	61.8	30.5	29.8	0.28	0.24	0,262.0	0,262.0	4.24	0.50
Golf Course Off-Golf Course On	Basic	0.65	68.6	22.6	22.1	0.64	0.62	0,550.9	0,550.9	8.04	0.17
Golf Course Dr-RP Expressway	Weaving	0.55	56.6	21.1	20.6	0.65	0.52	0,534.1	0,534.1	9.44	1.81
RP Expressway Off-RP Expressway WB On	Basic	0.57	69.7	19.5	19.0	0.25	0.25	0,195.6	0,195.6	2.81	0.01
RP Expressway WB On-	OnRamp	0.63	59.2	25.7	25.1	0.10	0.09	0,076.7	0,076.7	1.30	0.20
RP Expressway-SR 116	Weaving	0.52	58.3	18.4	18.0	0.89	0.74	0,681.8	0,681.8	11.69	1.95
SR 116 Off-SR 116 On	Basic	0.57	69.7	19.5	19.0	0.34	0.34	0,261.3	0,261.3	3.75	0.02
Freeway			62.5	21.9	21.4	3.59	3.22	2,999.1	2,999.1	0,048.0	0,005.2

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US 101	**Analysis Period**	PM Peak
Analysis Date	3/31/2015 4:53:13 PM	**From**	Railroad Ave	**Version Date**	10/10/2012
Agency		**To**	Todd Rd		
Location	Sonoma County, CA	**Analysis Direction**	Northbound		

User Notes	Central Rohnert Park PDA Plan - PM Peak Hour Existing Conditions - Northbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.78800**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	SR 116 Off	SR 116 On	Basic Segment	2375	Level	3711	4.00	1.00	2	70
2	SR 116	RP Expressway	Weaving	4370	Level	4336	4.00	0.86	3	70
3	RP Expressway Off	RP Expressway EB On	Basic Segment	1065	Level	3520	4.46	1.05	2	70
4	RP Expressway EB On		On Ramp	1500	Level	3881	4.23	0.96	2	70
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	450	Level	3881	4.23	0.96	2	70
6	RP Expressway	Commerce Blvd	Weaving	2315	Level	4412	3.97	0.84	3	70
7	Commerce Off	Commerce On	Basic Segment	650	Level	3794	4.29	0.98	2	70
8	Commerce Blvd	Santa Rosa Ave	Weaving	3000	Level	4729	3.83	0.78	3	70
9	Santa Rosa Ave	Todd Rd	Basic Segment	4275	Level	4401	3.97	0.84	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
4	On Ramp	361	2.00	0.00	1	765	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
2	0.050	625	4.00	0.00	1	40	816	2.00	0.00	1	50
6	0.050	531	2.00	0.00	1	40	618	2.00	0.00	1	40
8	0.050	935	2.00	0.00	1	40	328	2.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
2	3000	2	1	1	0	
6	1782	2	1	1	0	
8	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS

1	SR 116 Off	SR 116 On	Basic Segment	3711	3711	4800	4697	0.79	0.79	0	64.4	29.5	28.8	0.42	0.39	0.0	0.0	417.3	417.3	6.5	0.5	D
2	SR 116	RP Expressway	Weaving	4336	4336	6569	6429	0.67	0.67	0	54.7	27.0	26.4	0.91	0.71	0.2	0.2	897.2	897.2	16.4	3.6	C
3	RP Expressway Off	RP Expressway EB On	Basic Segment	3520	3520	4800	4686	0.75	0.75	0	65.8	27.4	26.8	0.18	0.17	0.0	0.0	177.5	177.5	2.7	0.2	D
4	RP Expressway EB On		On Ramp	3881	3881	4800	4692	0.83	0.83	0	57.0	34.8	34.0	0.30	0.24	0.1	0.1	275.6	275.6	4.8	0.9	D
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	3881	3881	4800	4692	0.83	0.83	0	62.8	31.6	30.9	0.08	0.07	0.0	0.0	82.7	82.7	1.3	0.1	D
6	RP Expressway	Commerce Blvd	Weaving	4412	4412	6460	6324	0.70	0.70	0	55.5	27.1	26.5	0.47	0.38	0.1	0.1	483.6	483.6	8.7	1.8	C
7	Commerce Off	Commerce On	Basic Segment	3794	3794	4800	4690	0.81	0.81	0	63.6	30.5	29.8	0.12	0.11	0.0	0.0	116.8	116.8	1.8	0.2	D
8	Commerce Blvd	Santa Rosa Ave	Weaving	4729	4729	6742	6605	0.72	0.72	0	55.0	29.2	28.7	0.62	0.49	0.1	0.1	671.7	671.7	12.2	2.6	D
9	Santa Rosa Ave	Todd Rd	Basic Segment	4401	4401	4800	4699	0.94	0.94	0	57.3	39.3	38.4	0.85	0.69	0.2	0.2	890.8	890.8	15.6	2.8	E

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
SR 116 Off-SR 116 On	Basic	0.79	64.4	29.5	28.8	0.42	0.39	0,417.3	0,417.3	6.48	0.52
SR 116-RP Expressway	Weaving	0.67	54.7	27.0	26.4	0.91	0.71	0,897.2	0,897.2	16.41	3.60
RP Expressway Off-RP Expressway EB On	Basic	0.75	65.8	27.4	26.8	0.18	0.17	0,177.5	0,177.5	2.70	0.16
RP Expressway EB On-	OnRamp	0.83	57.0	34.8	34.0	0.30	0.24	0,275.6	0,275.6	4.84	0.90
RP Expressway EB On-RP Expressway WB On	Basic	0.83	62.8	31.6	30.9	0.08	0.07	0,082.7	0,082.7	1.32	0.13
RP Expressway-Commerce Blvd	Weaving	0.70	55.5	27.1	26.5	0.47	0.38	0,483.6	0,483.6	8.71	1.81
Commerce Off-Commerce On	Basic	0.81	63.6	30.5	29.8	0.12	0.11	0,116.8	0,116.8	1.84	0.17
Commerce Blvd-Santa Rosa Ave	Weaving	0.72	55.0	29.2	28.7	0.62	0.49	0,671.7	0,671.7	12.21	2.61
Santa Rosa Ave-Todd Rd	Basic	0.94	57.3	39.3	38.4	0.85	0.69	0,890.8	0,890.8	15.56	2.83
Freeway			57.3	30.4	29.8	3.95	3.25	4,013.3	4,013.3	0,070.1	0,012.7

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US101	**Analysis Period**	PM Peak
Analysis Date	3/31/2015 10:36:29 AM	**From**	Todd Rd	**Version Date**	10/10/2012
Agency		**To**	Railroad Ave		
Location	Sonoma County, CA	**Analysis Direction**	Southbound		

User Notes	Central Rohnert Park PDA Plan - PM Peak Hour Existing Conditions - Southbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.75600**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	Todd Rd	Golf Course Dr	Basic Segment	2500	Level	3699	4.00	1.00	2	70
2	Golf Course Off		Off Ramp	1500	Level	3699	4.00	1.00	2	70
3	Golf Course Off	Golf Course On	Basic Segment	3840	Level	2932	4.52	1.26	2	70
4	Golf Course Dr	RP Expressway	Weaving	3225	Level	3592	4.06	1.03	3	70
5	RP Expressway Off	RP Expressway WB On	Basic Segment	1560	Level	2563	4.89	1.44	2	70
6	RP Expressway WB On		On Ramp	545	Level	2782	4.66	1.33	2	70
7	RP Expressway	SR 116	Weaving	4580	Level	3254	4.27	1.14	3	70
8	SR 116 Off	SR 116 On	Basic Segment	2080	Level	2490	4.36	1.49	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	Off Ramp	767	2.00	0.00	1	200	50
6	On Ramp	219	2.00	0.00	1	200	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
4	0.050	660	2.00	0.00	1	40	1029	2.00	0.00	1	40
7	0.050	472	2.00	0.00	1	40	764	4.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
4	3000	2	1	1	0	
7	300	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	Todd Rd	Golf Course Dr	Basic Segment	3699	3699	4800	4697	0.79	0.79	0	64.5	29.3	28.7	0.44	0.41	0.0	0.0	437.9	437.9	6.8	0.5	D
2	Golf Course		Off Ramp	3699	3699	4800	4697	0.79	0.79	0	61.5	30.7	30.1	0.28	0.24	0.0	0.0	262.7	262.7	4.3	0.5	D

	Off																					
3	Golf Course Off	Golf Course On	Basic Segment	2932	2932	4800	4682	0.63	0.63	0	68.9	21.8	21.3	0.63	0.62	0.0	0.0	533.1	533.1	7.7	0.1	C
4	Golf Course Dr	RP Expressway	Weaving	3592	3592	5379	5261	0.68	0.68	0	55.1	22.2	21.7	0.66	0.52	0.1	0.1	548.5	548.5	10.0	2.1	C
5	RP Expressway Off	RP Expressway WB On	Basic Segment	2563	2563	4800	4672	0.55	0.55	0	69.7	18.9	18.4	0.25	0.25	0.0	0.0	189.3	189.3	2.7	0.0	C
6	RP Expressway WB On		On Ramp	2782	2782	4800	4679	0.59	0.59	0	59.6	23.9	23.3	0.10	0.09	0.0	0.0	71.8	71.8	1.2	0.2	C
7	RP Expressway	SR 116	Weaving	3254	3254	5832	5697	0.57	0.57	0	52.6	21.1	20.6	0.99	0.74	0.2	0.2	705.6	705.6	13.4	3.3	C
8	SR 116 Off	SR 116 On	Basic Segment	2490	2490	4800	4684	0.53	0.53	0	69.9	18.2	17.8	0.34	0.34	0.0	0.0	245.2	245.2	3.5	0.0	C

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
Todd Rd-Golf Course Dr	Basic	0.79	64.5	29.3	28.7	0.44	0.41	0,437.9	0,437.9	6.79	0.54
Golf Course Off-	OffRamp	0.79	61.5	30.7	30.1	0.28	0.24	0,262.7	0,262.7	4.27	0.52
Golf Course Off-Golf Course On	Basic	0.63	68.9	21.8	21.3	0.63	0.62	0,533.1	0,533.1	7.73	0.12
Golf Course Dr-RP Expressway	Weaving	0.68	55.1	22.2	21.7	0.66	0.52	0,548.5	0,548.5	9.95	2.12
RP Expressway Off-RP Expressway WB On	Basic	0.55	69.7	18.9	18.4	0.25	0.25	0,189.3	0,189.3	2.72	0.01
RP Expressway WB On-	OnRamp	0.59	59.6	23.9	23.3	0.10	0.09	0,071.8	0,071.8	1.21	0.18
RP Expressway-SR 116	Weaving	0.57	52.6	21.1	20.6	0.99	0.74	0,705.6	0,705.6	13.41	3.33
SR 116 Off-SR 116 On	Basic	0.53	69.9	18.2	17.8	0.34	0.34	0,245.2	0,245.2	3.51	0.00
Freeway			60.4	22.6	22.1	3.70	3.22	2,994.1	2,994.1	0,049.6	0,006.8

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US 101	**Analysis Period**	AM Peak
Analysis Date	3/31/2015 4:53:13 PM	**From**	Railroad Ave	**Version Date**	10/10/2012
Agency		**To**	Todd Rd		
Location	Sonoma County, CA	**Analysis Direction**	Northbound		

User Notes	Central Rohnert Park PDA Plan - AM Peak Hour Existing plus Project - Northbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.78800**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	SR 116 Off	SR 116 On	Basic Segment	2375	Level	2296	4.00	1.00	2	70
2	SR 116	RP Expressway	Weaving	4370	Level	3123	4.00	0.74	3	70
3	RP Expressway Off	RP Expressway EB On	Basic Segment	1065	Level	2616	4.39	0.88	2	70
4	RP Expressway EB On		On Ramp	1500	Level	2846	4.19	0.81	2	70
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	450	Level	2846	4.19	0.81	2	70
6	RP Expressway	Commerce Blvd	Weaving	2315	Level	3586	3.74	0.64	3	70
7	Commerce Off	Commerce On	Basic Segment	650	Level	3371	3.85	0.68	2	70
8	Commerce Blvd	Santa Rosa Ave	Weaving	3000	Level	3819	3.64	0.60	3	70
9	Santa Rosa Ave	Todd Rd	Basic Segment	4275	Level	3579	3.75	0.64	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
4	On Ramp	230	2.00	0.00	1	765	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
2	0.050	827	4.00	0.00	1	40	507	2.00	0.00	1	50
6	0.050	740	2.00	0.00	1	40	215	2.00	0.00	1	40
8	0.050	448	2.00	0.00	1	40	240	2.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
2	3000	2	1	1	0	
6	1782	2	1	1	0	
8	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS

1	SR 116 Off	SR 116 On	Basic Segment	2296	2296	4800	4697	0.49	0.49	0	70.0	16.8	16.4	0.39	0.39	0.0	0.0	258.2	258.2	3.7	0.0	B
2	SR 116	RP Expressway	Weaving	3123	3123	6025	5898	0.53	0.53	0	57.3	18.6	18.2	0.87	0.71	0.2	0.2	646.2	646.2	11.3	2.0	B
3	RP Expressway Off	RP Expressway EB On	Basic Segment	2616	2616	4800	4689	0.56	0.56	0	69.8	19.2	18.7	0.17	0.17	0.0	0.0	131.9	131.9	1.9	0.0	C
4	RP Expressway EB On		On Ramp	2846	2846	4800	4694	0.61	0.61	0	60.7	23.9	23.4	0.28	0.24	0.0	0.0	202.1	202.1	3.3	0.4	C
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	2846	2846	4800	4694	0.61	0.61	0	68.1	21.4	20.9	0.08	0.07	0.0	0.0	60.6	60.6	0.9	0.0	C
6	RP Expressway	Commerce Blvd	Weaving	3586	3586	6466	6339	0.57	0.57	0	58.0	21.0	20.6	0.45	0.38	0.1	0.1	393.1	393.1	6.8	1.2	C
7	Commerce Off	Commerce On	Basic Segment	3371	3371	4800	4703	0.72	0.72	0	66.9	25.7	25.2	0.11	0.11	0.0	0.0	103.7	103.7	1.6	0.1	C
8	Commerce Blvd	Santa Rosa Ave	Weaving	3819	3819	6925	6793	0.56	0.56	0	59.3	21.9	21.5	0.57	0.49	0.1	0.1	542.5	542.5	9.1	1.4	C
9	Santa Rosa Ave	Todd Rd	Basic Segment	3579	3579	4800	4706	0.76	0.76	0	65.5	27.9	27.3	0.74	0.69	0.0	0.0	724.4	724.4	11.1	0.7	D

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
SR 116 Off-SR 116 On	Basic	0.49	70.0	16.8	16.4	0.39	0.39	0,258.2	0,258.2	3.69	0.00
SR 116-RP Expressway	Weaving	0.53	57.3	18.6	18.2	0.87	0.71	0,646.2	0,646.2	11.28	2.05
RP Expressway Off-RP Expressway EB On	Basic	0.56	69.8	19.2	18.7	0.17	0.17	0,131.9	0,131.9	1.89	0.01
RP Expressway EB On-	OnRamp	0.61	60.7	23.9	23.4	0.28	0.24	0,202.1	0,202.1	3.33	0.44
RP Expressway EB On-RP Expressway WB On	Basic	0.61	68.1	21.4	20.9	0.08	0.07	0,060.6	0,060.6	0.89	0.02
RP Expressway-Commerce Blvd	Weaving	0.57	58.0	21.0	20.6	0.45	0.38	0,393.1	0,393.1	6.78	1.16
Commerce Off-Commerce On	Basic	0.72	66.9	25.7	25.2	0.11	0.11	0,103.7	0,103.7	1.55	0.07
Commerce Blvd-Santa Rosa Ave	Weaving	0.56	59.3	21.9	21.5	0.57	0.49	0,542.5	0,542.5	9.14	1.39
Santa Rosa Ave-Todd Rd	Basic	0.76	65.5	27.9	27.3	0.74	0.69	0,724.4	0,724.4	11.07	0.72
Freeway			61.7	21.5	21.1	3.66	3.25	3,062.8	3,062.8	0,049.6	0,005.9

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US101	**Analysis Period**	AM Peak
Analysis Date	3/31/2015 10:36:29 AM	**From**	Todd Rd	**Version Date**	10/10/2012
Agency		**To**	Railroad Ave		
Location	Sonoma County, CA	**Analysis Direction**	Southbound		

User Notes	Central Rohnert Park PDA Plan - AM Peak Hour Existing plus Project - Southbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.75600**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	Todd Rd	Golf Course Dr	Basic Segment	2500	Level	3868	4.00	1.00	2	70
2	Golf Course Off		Off Ramp	1500	Level	3868	4.00	1.00	2	70
3	Golf Course Off	Golf Course On	Basic Segment	3840	Level	3153	4.45	1.23	2	70
4	Golf Course Dr	RP Expressway	Weaving	3225	Level	3624	4.13	1.07	3	70
5	RP Expressway Off	RP Expressway WB On	Basic Segment	1560	Level	2651	4.92	1.46	2	70
6	RP Expressway WB On		On Ramp	545	Level	3043	4.54	1.27	2	70
7	RP Expressway	SR 116	Weaving	4580	Level	3216	4.41	1.20	3	70
8	SR 116 Off	SR 116 On	Basic Segment	2080	Level	2725	4.48	1.42	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	Off Ramp	715	2.00	0.00	1	200	50
6	On Ramp	392	2.00	0.00	1	200	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
4	0.050	471	2.00	0.00	1	40	973	2.00	0.00	1	40
7	0.050	173	2.00	0.00	1	40	491	4.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
4	3000	2	1	1	0	
7	300	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	Todd Rd	Golf Course Dr	Basic Segment	3868	3868	4800	4697	0.82	0.82	0	63.0	31.4	30.7	0.45	0.41	0.0	0.0	457.9	457.9	7.3	0.7	D
2	Golf Course		Off Ramp	3868	3868	4800	4697	0.82	0.82	0	61.7	32.1	31.4	0.28	0.24	0.0	0.0	274.7	274.7	4.5	0.5	D

	Off																					
3	Golf Course Off	Golf Course On	Basic Segment	3153	3153	4800	4684	0.67	0.67	0	68.0	23.8	23.2	0.64	0.62	0.0	0.0	573.3	573.3	8.4	0.2	C
4	Golf Course Dr	RP Expressway	Weaving	3624	3624	6311	6170	0.59	0.59	0	55.9	22.1	21.6	0.66	0.52	0.1	0.1	553.4	553.4	9.9	2.0	C
5	RP Expressway Off	RP Expressway WB On	Basic Segment	2651	2651	4800	4671	0.57	0.57	0	69.7	19.5	19.0	0.25	0.25	0.0	0.0	195.8	195.8	2.8	0.0	C
6	RP Expressway WB On		On Ramp	3043	3043	4800	4682	0.65	0.65	0	59.0	26.4	25.8	0.10	0.09	0.0	0.0	78.5	78.5	1.3	0.2	C
7	RP Expressway	SR 116	Weaving	3216	3216	6230	6081	0.53	0.53	0	58.2	18.9	18.4	0.89	0.74	0.2	0.2	697.4	697.4	12.0	2.0	B
8	SR 116 Off	SR 116 On	Basic Segment	2725	2725	4800	4682	0.58	0.58	0	69.6	20.1	19.6	0.34	0.34	0.0	0.0	268.4	268.4	3.9	0.0	C

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
Todd Rd-Golf Course Dr	Basic	0.82	63.0	31.4	30.7	0.45	0.41	0,457.9	0,457.9	7.27	0.73
Golf Course Off-	OffRamp	0.82	61.7	32.1	31.4	0.28	0.24	0,274.7	0,274.7	4.46	0.53
Golf Course Off-Golf Course On	Basic	0.67	68.0	23.8	23.2	0.64	0.62	0,573.3	0,573.3	8.43	0.24
Golf Course Dr-RP Expressway	Weaving	0.59	55.9	22.1	21.6	0.66	0.52	0,553.4	0,553.4	9.90	2.00
RP Expressway Off-RP Expressway WB On	Basic	0.57	69.7	19.5	19.0	0.25	0.25	0,195.8	0,195.8	2.81	0.01
RP Expressway WB On-	OnRamp	0.65	59.0	26.4	25.8	0.10	0.09	0,078.5	0,078.5	1.33	0.21
RP Expressway-SR 116	Weaving	0.53	58.2	18.9	18.4	0.89	0.74	0,697.4	0,697.4	11.98	2.01
SR 116 Off-SR 116 On	Basic	0.58	69.6	20.1	19.6	0.34	0.34	0,268.4	0,268.4	3.86	0.02
Freeway			61.9	22.8	22.3	3.62	3.22	3,099.3	3,099.3	0,050.0	0,005.8

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US 101	**Analysis Period**	PM Peak
Analysis Date	3/31/2015 4:53:13 PM	**From**	Railroad Ave	**Version Date**	10/10/2012
Agency		**To**	Todd Rd		
Location	Sonoma County, CA	**Analysis Direction**	Northbound		

User Notes	Central Rohnert Park PDA Plan - PM Peak Hour Existing + Project - Northbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.78800**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	SR 116 Off	SR 116 On	Basic Segment	2375	Level	3823	4.00	1.00	2	70
2	SR 116	RP Expressway	Weaving	4370	Level	4448	4.00	0.86	3	70
3	RP Expressway Off	RP Expressway EB On	Basic Segment	1065	Level	3529	4.52	1.08	2	70
4	RP Expressway EB On		On Ramp	1500	Level	3890	4.29	0.98	2	70
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	450	Level	3890	4.29	0.98	2	70
6	RP Expressway	Commerce Blvd	Weaving	2315	Level	4598	3.93	0.83	3	70
7	Commerce Off	Commerce On	Basic Segment	650	Level	3971	4.24	0.96	2	70
8	Commerce Blvd	Santa Rosa Ave	Weaving	3000	Level	4983	3.79	0.77	3	70
9	Santa Rosa Ave	Todd Rd	Basic Segment	4275	Level	4655	3.91	0.82	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
4	On Ramp	361	2.00	0.00	1	765	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
2	0.050	625	4.00	0.00	1	40	919	2.00	0.00	1	50
6	0.050	708	2.00	0.00	1	40	627	2.00	0.00	1	40
8	0.050	1012	2.00	0.00	1	40	328	2.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
2	3000	2	1	1	0	
6	1782	2	1	1	0	
8	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS

1	SR 116 Off	SR 116 On	Basic Segment	3823	3823	4800	4697	0.81	0.81	0	63.4	30.8	30.1	0.43	0.39	0.0	0.0	429.9	429.9	6.8	0.6	D
2	SR 116	RP Expressway	Weaving	4448	4448	6532	6393	0.70	0.70	0	54.0	28.0	27.4	0.92	0.71	0.2	0.2	920.3	920.3	17.0	3.9	D
3	RP Expressway Off	RP Expressway EB On	Basic Segment	3529	3529	4800	4684	0.75	0.75	0	65.7	27.5	26.9	0.18	0.17	0.0	0.0	178.0	178.0	2.7	0.2	D
4	RP Expressway EB On		On Ramp	3890	3890	4800	4690	0.83	0.83	0	56.9	35.0	34.2	0.30	0.24	0.1	0.1	276.3	276.3	4.9	0.9	D
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	3890	3890	4800	4690	0.83	0.83	0	62.8	31.7	31.0	0.08	0.07	0.0	0.0	82.9	82.9	1.3	0.1	D
6	RP Expressway	Commerce Blvd	Weaving	4598	4598	6397	6263	0.73	0.73	0	54.3	28.8	28.2	0.48	0.38	0.1	0.1	504.0	504.0	9.3	2.1	D
7	Commerce Off	Commerce On	Basic Segment	3971	3971	4800	4692	0.85	0.85	0	62.0	32.8	32.0	0.12	0.11	0.0	0.0	122.2	122.2	2.0	0.2	D
8	Commerce Blvd	Santa Rosa Ave	Weaving	4983	4983	6739	6604	0.75	0.75	0	54.3	31.2	30.6	0.63	0.49	0.1	0.1	707.8	707.8	13.0	2.9	D
9	Santa Rosa Ave	Todd Rd	Basic Segment	4655	4655	4800	4700	0.99	0.99	0	53.9	44.1	43.2	0.90	0.69	0.2	0.2	942.2	942.2	17.5	4.0	E

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
SR 116 Off-SR 116 On	Basic	0.81	63.4	30.8	30.1	0.43	0.39	0,429.9	0,429.9	6.78	0.64
SR 116-RP Expressway	Weaving	0.70	54.0	28.0	27.4	0.92	0.71	0,920.3	0,920.3	17.04	3.89
RP Expressway Off-RP Expressway EB On	Basic	0.75	65.7	27.5	26.9	0.18	0.17	0,178.0	0,178.0	2.71	0.17
RP Expressway EB On-	OnRamp	0.83	56.9	35.0	34.2	0.30	0.24	0,276.3	0,276.3	4.86	0.91
RP Expressway EB On-RP Expressway WB On	Basic	0.83	62.8	31.7	31.0	0.08	0.07	0,082.9	0,082.9	1.32	0.14
RP Expressway-Commerce Blvd	Weaving	0.73	54.3	28.8	28.2	0.48	0.38	0,504.0	0,504.0	9.28	2.08
Commerce Off-Commerce On	Basic	0.85	62.0	32.8	32.0	0.12	0.11	0,122.2	0,122.2	1.97	0.23
Commerce Blvd-Santa Rosa Ave	Weaving	0.75	54.3	31.2	30.6	0.63	0.49	0,707.8	0,707.8	13.05	2.94
Santa Rosa Ave-Todd Rd	Basic	0.99	53.9	44.1	43.2	0.90	0.69	0,942.2	0,942.2	17.47	4.01
Freeway			55.9	32.3	31.7	4.04	3.25	4,163.6	4,163.6	0,074.5	0,015.0

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US101	**Analysis Period**	PM Peak
Analysis Date	3/31/2015 10:36:29 AM	**From**	Todd Rd	**Version Date**	10/10/2012
Agency		**To**	Railroad Ave		
Location	Sonoma County, CA	**Analysis Direction**	Southbound		

User Notes	Central Rohnert Park PDA Plan - PM Peak Hour Existing + Project - Southbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.75600**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	Todd Rd	Golf Course Dr	Basic Segment	2500	Level	3878	4.00	1.00	2	70
2	Golf Course Off		Off Ramp	1500	Level	3878	4.00	1.00	2	70
3	Golf Course Off	Golf Course On	Basic Segment	3840	Level	3076	4.52	1.26	2	70
4	Golf Course Dr	RP Expressway	Weaving	3225	Level	3754	4.07	1.03	3	70
5	RP Expressway Off	RP Expressway WB On	Basic Segment	1560	Level	2581	5.01	1.50	2	70
6	RP Expressway WB On		On Ramp	545	Level	2934	4.64	1.32	2	70
7	RP Expressway	SR 116	Weaving	4580	Level	3406	4.28	1.14	3	70
8	SR 116 Off	SR 116 On	Basic Segment	2080	Level	2642	4.36	1.47	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	Off Ramp	802	2.00	0.00	1	200	50
6	On Ramp	353	2.00	0.00	1	200	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
4	0.050	678	2.00	0.00	1	40	1173	2.00	0.00	1	40
7	0.050	472	2.00	0.00	1	40	764	4.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
4	3000	2	1	1	0	
7	300	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	Todd Rd	Golf Course Dr	Basic Segment	3878	3878	4800	4697	0.83	0.83	0	62.9	31.5	30.8	0.45	0.41	0.0	0.0	459.0	459.0	7.3	0.7	D
2	Golf Course		Off Ramp	3878	3878	4800	4697	0.83	0.83	0	61.4	32.3	31.6	0.28	0.24	0.0	0.0	275.4	275.4	4.5	0.5	D

	Off																					
3	Golf Course Off	Golf Course On	Basic Segment	3076	3076	4800	4682	0.66	0.66	0	68.4	23.1	22.5	0.64	0.62	0.0	0.0	559.3	559.3	8.2	0.2	C
4	Golf Course Dr	RP Expressway	Weaving	3754	3754	5118	5006	0.75	0.75	0	54.3	23.6	23.1	0.68	0.52	0.2	0.2	573.2	573.2	10.6	2.4	C
5	RP Expressway Off	RP Expressway WB On	Basic Segment	2581	2581	4800	4669	0.55	0.55	0	69.7	19.0	18.5	0.25	0.25	0.0	0.0	190.6	190.6	2.7	0.0	C
6	RP Expressway WB On		On Ramp	2934	2934	4800	4679	0.63	0.63	0	59.3	25.4	24.7	0.10	0.09	0.0	0.0	75.7	75.7	1.3	0.2	C
7	RP Expressway	SR 116	Weaving	3406	3406	5872	5736	0.59	0.59	0	52.5	22.1	21.6	0.99	0.74	0.2	0.2	738.6	738.6	14.1	3.5	C
8	SR 116 Off	SR 116 On	Basic Segment	2642	2642	4800	4684	0.56	0.56	0	69.7	19.4	18.9	0.34	0.34	0.0	0.0	260.2	260.2	3.7	0.0	C

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
Todd Rd-Golf Course Dr	Basic	0.83	62.9	31.5	30.8	0.45	0.41	0,459.0	0,459.0	7.30	0.74
Golf Course Off-	OffRamp	0.83	61.4	32.3	31.6	0.28	0.24	0,275.4	0,275.4	4.48	0.55
Golf Course Off-Golf Course On	Basic	0.66	68.4	23.1	22.5	0.64	0.62	0,559.3	0,559.3	8.18	0.19
Golf Course Dr-RP Expressway	Weaving	0.75	54.3	23.6	23.1	0.68	0.52	0,573.2	0,573.2	10.56	2.37
RP Expressway Off-RP Expressway WB On	Basic	0.55	69.7	19.0	18.5	0.25	0.25	0,190.6	0,190.6	2.74	0.01
RP Expressway WB On-	OnRamp	0.63	59.3	25.4	24.7	0.10	0.09	0,075.7	0,075.7	1.28	0.20
RP Expressway-SR 116	Weaving	0.59	52.5	22.1	21.6	0.99	0.74	0,738.6	0,738.6	14.07	3.52
SR 116 Off-SR 116 On	Basic	0.56	69.7	19.4	18.9	0.34	0.34	0,260.2	0,260.2	3.73	0.01
Freeway			59.8	23.8	23.3	3.73	3.22	3,132.1	3,132.1	0,052.3	0,007.6

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US 101	**Analysis Period**	AM Peak
Analysis Date	3/31/2015 4:53:13 PM	**From**	Railroad Ave	**Version Date**	10/10/2012
Agency		**To**	Todd Rd		
Location	Sonoma County, CA	**Analysis Direction**	Northbound		

User Notes	Central Rohnert Park PDA Plan - AM Peak Hour Future Conditions - Northbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.78800**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	SR 116 Off	SR 116 On	Basic Segment	2375	Level	2410	4.00	1.00	2	70
2	SR 116	RP Expressway	Weaving	4370	Level	3532	4.00	0.68	3	70
3	RP Expressway Off	RP Expressway EB On	Basic Segment	1065	Level	3065	4.30	0.79	2	70
4	RP Expressway EB On		On Ramp	1500	Level	3340	4.11	0.72	2	70
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	450	Level	3340	4.11	0.72	2	70
6	RP Expressway	Commerce Blvd	Weaving	2315	Level	4228	3.67	0.57	3	70
7	Commerce Off	Commerce On	Basic Segment	650	Level	3819	3.85	0.63	2	70
8	Commerce Blvd	Santa Rosa Ave	Weaving	3000	Level	4422	3.60	0.55	3	70
9	Santa Rosa Ave	Todd Rd	Basic Segment	4275	Level	3967	3.78	0.61	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
4	On Ramp	275	2.00	0.00	1	765	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
2	0.050	1122	4.00	0.00	1	40	467	2.00	0.00	1	50
6	0.050	888	2.00	0.00	1	40	409	2.00	0.00	1	40
8	0.050	603	2.00	0.00	1	40	455	2.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
2	3000	2	1	1	0	
6	1782	2	1	1	0	
8	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS

1	SR 116 Off	SR 116 On	Basic Segment	2410	2410	4800	4697	0.51	0.51	0	70.0	17.6	17.2	0.39	0.39	0.0	0.0	271.0	271.0	3.9	0.0	B
2	SR 116	RP Expressway	Weaving	3532	3532	5769	5648	0.63	0.63	0	55.7	21.6	21.1	0.89	0.71	0.2	0.2	730.8	730.8	13.1	2.7	C
3	RP Expressway Off	RP Expressway EB On	Basic Segment	3065	3065	4800	4692	0.65	0.65	0	68.4	22.9	22.4	0.18	0.17	0.0	0.0	154.6	154.6	2.3	0.1	C
4	RP Expressway EB On		On Ramp	3340	3340	4800	4697	0.71	0.71	0	59.4	28.7	28.1	0.29	0.24	0.0	0.0	237.2	237.2	4.0	0.6	D
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	3340	3340	4800	4697	0.71	0.71	0	67.0	25.5	24.9	0.08	0.07	0.0	0.0	71.2	71.2	1.1	0.0	C
6	RP Expressway	Commerce Blvd	Weaving	4228	4228	6370	6248	0.68	0.68	0	55.2	26.0	25.5	0.48	0.38	0.1	0.1	463.4	463.4	8.4	1.8	C
7	Commerce Off	Commerce On	Basic Segment	3819	3819	4800	4704	0.81	0.81	0	63.5	30.7	30.1	0.12	0.11	0.0	0.0	117.5	117.5	1.9	0.2	D
8	Commerce Blvd	Santa Rosa Ave	Weaving	4422	4422	6792	6665	0.66	0.66	0	56.4	26.6	26.1	0.60	0.49	0.1	0.1	628.1	628.1	11.1	2.2	C
9	Santa Rosa Ave	Todd Rd	Basic Segment	3967	3967	4800	4705	0.84	0.84	0	62.1	32.6	31.9	0.78	0.69	0.1	0.1	803.0	803.0	12.9	1.5	D

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
SR 116 Off-SR 116 On	Basic	0.51	70.0	17.6	17.2	0.39	0.39	0,271.0	0,271.0	3.87	0.00
SR 116-RP Expressway	Weaving	0.63	55.7	21.6	21.1	0.89	0.71	0,730.8	0,730.8	13.12	2.68
RP Expressway Off-RP Expressway EB On	Basic	0.65	68.4	22.9	22.4	0.18	0.17	0,154.6	0,154.6	2.26	0.05
RP Expressway EB On-	OnRamp	0.71	59.4	28.7	28.1	0.29	0.24	0,237.2	0,237.2	3.99	0.60
RP Expressway EB On-RP Expressway WB On	Basic	0.71	67.0	25.5	24.9	0.08	0.07	0,071.2	0,071.2	1.06	0.05
RP Expressway-Commerce Blvd	Weaving	0.68	55.2	26.0	25.5	0.48	0.38	0,463.4	0,463.4	8.40	1.78
Commerce Off-Commerce On	Basic	0.81	63.5	30.7	30.1	0.12	0.11	0,117.5	0,117.5	1.85	0.17
Commerce Blvd-Santa Rosa Ave	Weaving	0.66	56.4	26.6	26.1	0.60	0.49	0,628.1	0,628.1	11.14	2.16
Santa Rosa Ave-Todd Rd	Basic	0.84	62.1	32.6	31.9	0.78	0.69	0,803.0	0,803.0	12.92	1.45
Freeway			59.3	25.4	24.9	3.80	3.25	3,476.8	3,476.8	0,058.6	0,008.9

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US101	**Analysis Period**	AM Peak
Analysis Date	3/31/2015 10:36:29 AM	**From**	Todd Rd	**Version Date**	10/10/2012
Agency		**To**	Railroad Ave		
Location	Sonoma County, CA	**Analysis Direction**	Southbound		

User Notes	Central Rohnert Park PDA Plan - AM Peak Hour Future Conditions - Southbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.75600**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	Todd Rd	Golf Course Dr	Basic Segment	2500	Level	5093	4.00	1.00	2	70
2	Golf Course Off		Off Ramp	1500	Level	5093	4.00	1.00	2	70
3	Golf Course Off	Golf Course On	Basic Segment	3840	Level	4183	4.44	1.22	2	70
4	Golf Course Dr	RP Expressway	Weaving	3225	Level	4872	4.09	1.05	3	70
5	RP Expressway Off	RP Expressway WB On	Basic Segment	1560	Level	3880	4.63	1.31	2	70
6	RP Expressway WB On		On Ramp	545	Level	4230	4.41	1.20	2	70
7	RP Expressway	SR 116	Weaving	4580	Level	4554	4.24	1.12	3	70
8	SR 116 Off	SR 116 On	Basic Segment	2080	Level	3937	4.27	1.29	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	Off Ramp	910	2.00	0.00	1	200	50
6	On Ramp	350	2.00	0.00	1	200	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
4	0.050	689	2.00	0.00	1	40	992	2.00	0.00	1	40
7	0.050	324	2.00	0.00	1	40	617	4.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
4	3000	2	1	1	0	
7	300	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/ln)	Density (veh/mi/ln)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	Todd Rd	Golf Course Dr	Basic Segment	5093	4680	4800	4697	1.08	1.00	0	53.5	44.7	43.7	0.53	0.41	0.1	0.1	602.9	554.0	10.3	2.4	E
2	Golf Course		Off Ramp	5093	4680	4800	4697	1.08	1.00	0	57.5	41.6	40.7	0.30	0.24	0.1	0.1	361.7	332.4	5.8	1.0	E

	Off																					
3	Golf Course Off	Golf Course On	Basic Segment	4183	3840	4800	4685	0.89	0.82	0	63.2	31.1	30.4	0.69	0.62	0.1	0.1	760.5	698.2	11.1	1.1	D
4	Golf Course Dr	RP Expressway	Weaving	4872	4560	6542	6398	0.76	0.71	0	51.8	35.2	34.5	0.71	0.52	0.2	0.2	743.9	696.3	13.4	3.5	E
5	RP Expressway Off	RP Expressway WB On	Basic Segment	3880	3600	4800	4679	0.83	0.77	0	65.2	28.3	27.6	0.27	0.25	0.0	0.0	286.6	265.9	4.1	0.3	D
6	RP Expressway WB On		On Ramp	4230	3960	4800	4685	0.90	0.85	0	55.2	36.7	35.8	0.11	0.09	0.0	0.0	109.2	102.2	1.9	0.4	E
7	RP Expressway	SR 116	Weaving	4554	4320	6233	6090	0.75	0.71	0	54.7	24.5	24.0	0.95	0.74	0.2	0.2	987.6	936.8	17.1	3.8	C
8	SR 116 Off	SR 116 On	Basic Segment	3937	3720	4800	4688	0.84	0.79	0	64.2	29.6	29.0	0.37	0.34	0.0	0.0	387.7	366.4	5.7	0.5	D

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
Todd Rd-Golf Course Dr	Basic	1.08	53.5	44.7	43.7	0.53	0.41	0,602.9	0,554.0	10.35	2.43
Golf Course Off-	OffRamp	1.08	57.5	41.6	40.7	0.30	0.24	0,361.7	0,332.4	5.78	1.03
Golf Course Off-Golf Course On	Basic	0.89	63.2	31.1	30.4	0.69	0.62	0,760.5	0,698.2	11.05	1.08
Golf Course Dr-RP Expressway	Weaving	0.76	51.8	35.2	34.5	0.71	0.52	0,743.9	0,696.3	13.43	3.49
RP Expressway Off-RP Expressway WB On	Basic	0.83	65.2	28.3	27.6	0.27	0.25	0,286.6	0,265.9	4.08	0.28
RP Expressway WB On-	OnRamp	0.90	55.2	36.7	35.8	0.11	0.09	0,109.2	0,102.2	1.85	0.39
RP Expressway-SR 116	Weaving	0.75	54.7	24.5	24.0	0.95	0.74	0,987.6	0,936.8	17.13	3.75
SR 116 Off-SR 116 On	Basic	0.84	64.2	29.6	29.0	0.37	0.34	0,387.7	0,366.4	5.70	0.47
Freeway			57.0	32.0	31.2	3.93	3.22	4,240.1	3,952.1	0,069.4	0,012.9

HCS 2010 Freeway Facilities

Project Properties

Analyst		**Freeway Name**	US 101	**Analysis Period**	PM Peak
Analysis Date	4/7/2015 4:53:13 PM	**From**	Railroad Ave	**Version Date**	10/10/2012
Agency		**To**	Todd Rd		
Location	Sonoma County, CA	**Analysis Direction**	Northbound		

User Notes	Central Rohnert Park PDA Plan - PM Peak Hour Future Conditions - Northbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.69300**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	SR 116 Off	SR 116 On	Basic Segment	2375	Level	3955	4.00	1.00	3	70
2	SR 116	RP Expressway	Weaving	4370	Level	4636	4.00	0.85	3	70
3	RP Expressway Off	RP Expressway EB On	Basic Segment	1065	Level	3925	4.36	1.01	2	70
4	RP Expressway EB On		On Ramp	1500	Level	4358	4.13	0.91	2	70
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	450	Level	4358	4.13	0.91	2	70
6	RP Expressway	Commerce Blvd	Weaving	2315	Level	4931	3.88	0.80	3	70
7	Commerce Off	Commerce On	Basic Segment	650	Level	4350	4.13	0.91	2	70
8	Commerce Blvd	Santa Rosa Ave	Weaving	3000	Level	5605	3.65	0.71	3	70
9	Santa Rosa Ave	Todd Rd	Basic Segment	3775	Level	5185	3.79	0.76	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
4	On Ramp	433	2.00	0.00	1	765	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
2	0.050	681	4.00	0.00	1	40	711	2.00	0.00	1	50
6	0.050	573	2.00	0.00	1	40	581	2.00	0.00	1	40
8	0.050	1255	2.00	0.00	1	40	420	2.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
2	3000	2	1	0	0	
6	1782	2	1	1	0	
8	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS

1	SR 116 Off	SR 116 On	Basic Segment	3955	3960	7200	7045	0.56	0.56	0	69.7	19.3	18.9	0.39	0.39	0.0	0.0	444.8	445.3	6.4	0.0	C
2	SR 116	RP Expressway	Weaving	4636	4620	6648	6507	0.71	0.71	0	57.8	29.6	29.0	0.86	0.71	0.1	0.1	959.2	955.9	16.5	2.9	D
3	RP Expressway Off	RP Expressway EB On	Basic Segment	3925	3900	4800	4688	0.84	0.83	0	62.6	31.9	31.1	0.19	0.17	0.0	0.0	197.9	196.7	3.1	0.3	D
4	RP Expressway EB On		On Ramp	4358	4380	4800	4695	0.93	0.93	0	53.2	42.0	41.1	0.32	0.24	0.1	0.1	309.5	311.1	5.8	1.4	E
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	4358	4380	4800	4695	0.93	0.93	0	57.5	39.0	38.1	0.09	0.07	0.0	0.0	92.9	93.3	1.6	0.3	E
6	RP Expressway	Commerce Blvd	Weaving	4931	4877	6522	6388	0.77	0.76	402	51.1	31.8	31.2	0.51	0.38	0.1	0.1	540.5	534.6	10.5	2.8	D
7	Commerce Off	Commerce On	Basic Segment	4350	4271	4800	4694	0.93	0.91	650	47.9	44.6	43.6	0.15	0.11	0.0	0.0	133.9	131.4	2.7	0.9	E
8	Commerce Blvd	Santa Rosa Ave	Weaving	5605	5098	6672	6543	0.86	0.78	3000	24.6	69.2	67.8	1.39	0.49	0.9	1.5	796.2	724.1	29.5	19.1	F
9	Santa Rosa Ave	Todd Rd	Basic Segment	5185	4680	4800	4704	1.10	0.99	0	53.6	44.5	43.6	0.80	0.61	0.2	0.2	926.8	836.5	15.6	3.6	E

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
SR 116 Off-SR 116 On	Basic	0.56	69.7	19.3	18.9	0.39	0.39	0,444.8	0,445.3	6.39	0.02
SR 116-RP Expressway	Weaving	0.71	57.8	29.6	29.0	0.86	0.71	0,959.2	0,955.9	16.53	2.87
RP Expressway Off-RP Expressway EB On	Basic	0.84	62.6	31.9	31.1	0.19	0.17	0,197.9	0,196.7	3.14	0.33
RP Expressway EB On-	OnRamp	0.93	53.2	42.0	41.1	0.32	0.24	0,309.5	0,311.1	5.85	1.40
RP Expressway EB On-RP Expressway WB On	Basic	0.93	57.5	39.0	38.1	0.09	0.07	0,092.9	0,093.3	1.62	0.29
RP Expressway-Commerce Blvd	Weaving	0.77	51.1	31.8	31.2	0.51	0.38	0,540.5	0,534.6	10.47	2.83
Commerce Off-Commerce On	Basic	0.93	47.9	44.6	43.6	0.15	0.11	0,133.9	0,131.4	2.75	0.87
Commerce Blvd-Santa Rosa Ave	Weaving	0.86	24.6	69.2	67.8	1.39	0.49	0,796.2	0,724.1	29.48	19.13
Santa Rosa Ave-Todd Rd	Basic	1.10	53.6	44.5	43.6	0.80	0.61	0,926.8	0,836.5	15.60	3.65
Freeway			46.1	39.0	38.2	4.71	3.17	4,401.6	4,229.0	0,091.8	0,031.4

HCS 2010 Freeway Facilities

Project Properties

Analyst		**Freeway Name**	US101	**Analysis Period**	PM Peak
Analysis Date	4/7/2015 10:36:29 AM	**From**	Todd Rd	**Version Date**	10/10/2012
Agency		**To**	Railroad Ave		
Location	Sonoma County, CA	**Analysis Direction**	Southbound		

User Notes	Central Rohnert Park PDA Plan - PM Peak Hour Future Conditions - Southbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.75600**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	Todd Rd	Golf Course Dr	Basic Segment	2500	Level	4916	4.00	1.00	2	70
2	Golf Course Off		Off Ramp	1500	Level	4916	4.00	1.00	2	70
3	Golf Course Off	Golf Course On	Basic Segment	3840	Level	3954	4.49	1.24	2	70
4	Golf Course Dr	RP Expressway	Weaving	3225	Level	4710	4.09	1.04	3	70
5	RP Expressway Off	RP Expressway WB On	Basic Segment	1560	Level	3681	4.67	1.34	2	70
6	RP Expressway WB On		On Ramp	545	Level	3900	4.52	1.26	2	70
7	RP Expressway	SR 116	Weaving	4580	Level	4264	4.31	1.15	3	70
8	SR 116 Off	SR 116 On	Basic Segment	2080	Level	3477	4.38	1.41	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	Off Ramp	962	2.00	0.00	1	200	50
6	On Ramp	219	2.00	0.00	1	200	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
4	0.050	756	2.00	0.00	1	40	1029	2.00	0.00	1	40
7	0.050	364	2.00	0.00	1	40	787	4.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
4	3000	2	1	1	0	
7	3000	2	1	0	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	Todd Rd	Golf Course Dr	Basic Segment	4916	4680	4800	4697	1.05	1.00	0	53.5	44.7	43.7	0.53	0.41	0.1	0.1	581.9	554.0	10.3	2.4	E
2	Golf Course		Off Ramp	4916	4680	4800	4697	1.05	1.00	0	57.4	41.7	40.8	0.30	0.24	0.1	0.1	349.1	332.4	5.8	1.0	E

	Off																					
3	Golf Course Off	Golf Course On	Basic Segment	3954	3780	4800	4683	0.84	0.81	0	63.7	30.4	29.7	0.69	0.62	0.1	0.1	718.9	687.3	10.8	1.0	D
4	Golf Course Dr	RP Expressway	Weaving	4710	4560	6462	6320	0.75	0.72	0	51.3	36.0	35.3	0.71	0.52	0.2	0.2	719.2	696.3	13.6	3.6	E
5	RP Expressway Off	RP Expressway WB On	Basic Segment	3681	3540	4800	4678	0.79	0.76	0	65.6	27.7	27.0	0.27	0.25	0.0	0.0	271.9	261.5	4.0	0.3	D
6	RP Expressway WB On		On Ramp	3900	3780	4800	4682	0.83	0.81	0	56.2	34.4	33.6	0.11	0.09	0.0	0.0	100.6	97.5	1.7	0.3	D
7	RP Expressway	SR 116	Weaving	4264	4140	6706	6550	0.65	0.63	0	61.2	21.9	21.4	0.85	0.74	0.1	0.1	924.7	897.8	14.7	1.8	C
8	SR 116 Off	SR 116 On	Basic Segment	3477	3360	4800	4684	0.74	0.72	0	66.8	25.8	25.1	0.35	0.34	0.0	0.0	342.4	330.9	5.0	0.2	C

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
Todd Rd-Golf Course Dr	Basic	1.05	53.5	44.7	43.7	0.53	0.41	0,581.9	0,554.0	10.35	2.43
Golf Course Off-	OffRamp	1.05	57.4	41.7	40.8	0.30	0.24	0,349.1	0,332.4	5.79	1.04
Golf Course Off-Golf Course On	Basic	0.84	63.7	30.4	29.7	0.69	0.62	0,718.9	0,687.3	10.79	0.97
Golf Course Dr-RP Expressway	Weaving	0.75	51.3	36.0	35.3	0.71	0.52	0,719.2	0,696.3	13.58	3.63
RP Expressway Off-RP Expressway WB On	Basic	0.79	65.6	27.7	27.0	0.27	0.25	0,271.9	0,261.5	3.99	0.25
RP Expressway WB On-	OnRamp	0.83	56.2	34.4	33.6	0.11	0.09	0,100.6	0,097.5	1.73	0.34
RP Expressway-SR 116	Weaving	0.65	61.2	21.9	21.4	0.85	0.74	0,924.7	0,897.8	14.67	1.85
SR 116 Off-SR 116 On	Basic	0.74	66.8	25.8	25.1	0.35	0.34	0,342.4	0,330.9	4.95	0.22
Freeway			58.6	30.8	30.1	3.81	3.22	4,008.8	3,857.7	0,065.8	0,010.7

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US 101	**Analysis Period**	AM Peak
Analysis Date	3/31/2015 4:53:13 PM	**From**	Railroad Ave	**Version Date**	10/10/2012
Agency		**To**	Todd Rd		
Location	Sonoma County, CA	**Analysis Direction**	Northbound		

User Notes	Central Rohnert Park PDA Plan - AM Peak Hour Future plus Project - Northbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.78800**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	SR 116 Off	SR 116 On	Basic Segment	2375	Level	2516	4.00	1.00	2	70
2	SR 116	RP Expressway	Weaving	4370	Level	3638	4.00	0.69	3	70
3	RP Expressway Off	RP Expressway EB On	Basic Segment	1065	Level	3077	4.36	0.82	2	70
4	RP Expressway EB On		On Ramp	1500	Level	3352	4.17	0.75	2	70
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	450	Level	3352	4.17	0.75	2	70
6	RP Expressway	Commerce Blvd	Weaving	2315	Level	4333	3.68	0.58	3	70
7	Commerce Off	Commerce On	Basic Segment	650	Level	3912	3.86	0.64	2	70
8	Commerce Blvd	Santa Rosa Ave	Weaving	3000	Level	4530	3.61	0.56	3	70
9	Santa Rosa Ave	Todd Rd	Basic Segment	4275	Level	4075	3.79	0.62	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
4	On Ramp	275	2.00	0.00	1	765	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
2	0.050	1122	4.00	0.00	1	40	561	2.00	0.00	1	50
6	0.050	981	2.00	0.00	1	40	421	2.00	0.00	1	40
8	0.050	618	2.00	0.00	1	40	455	2.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
2	3000	2	1	1	0	
6	1782	2	1	1	0	
8	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS

1	SR 116 Off	SR 116 On	Basic Segment	2516	2516	4800	4697	0.54	0.54	0	69.9	18.4	18.0	0.39	0.39	0.0	0.0	282.9	282.9	4.0	0.0	C
2	SR 116	RP Expressway	Weaving	3638	3638	5589	5472	0.66	0.66	0	55.2	22.5	22.0	0.90	0.71	0.2	0.2	752.7	752.7	13.6	2.9	C
3	RP Expressway Off	RP Expressway EB On	Basic Segment	3077	3077	4800	4690	0.66	0.66	0	68.4	23.0	22.5	0.18	0.17	0.0	0.0	155.2	155.2	2.3	0.1	C
4	RP Expressway EB On		On Ramp	3352	3352	4800	4695	0.71	0.71	0	59.4	28.8	28.2	0.29	0.24	0.0	0.0	238.1	238.1	4.0	0.6	D
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	3352	3352	4800	4695	0.71	0.71	0	66.9	25.6	25.0	0.08	0.07	0.0	0.0	71.4	71.4	1.1	0.0	C
6	RP Expressway	Commerce Blvd	Weaving	4333	4333	6333	6212	0.70	0.70	0	54.5	27.0	26.5	0.48	0.38	0.1	0.1	474.9	474.9	8.7	1.9	C
7	Commerce Off	Commerce On	Basic Segment	3912	3912	4800	4703	0.83	0.83	0	62.6	31.9	31.2	0.12	0.11	0.0	0.0	120.4	120.4	1.9	0.2	D
8	Commerce Blvd	Santa Rosa Ave	Weaving	4530	4530	6798	6670	0.68	0.68	0	56.2	27.4	26.9	0.61	0.49	0.1	0.1	643.5	643.5	11.5	2.3	C
9	Santa Rosa Ave	Todd Rd	Basic Segment	4075	4075	4800	4705	0.87	0.87	0	61.0	34.0	33.4	0.80	0.69	0.1	0.1	824.8	824.8	13.5	1.7	D

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
SR 116 Off-SR 116 On	Basic	0.54	69.9	18.4	18.0	0.39	0.39	0,282.9	0,282.9	4.05	0.00
SR 116-RP Expressway	Weaving	0.66	55.2	22.5	22.0	0.90	0.71	0,752.7	0,752.7	13.65	2.89
RP Expressway Off-RP Expressway EB On	Basic	0.66	68.4	23.0	22.5	0.18	0.17	0,155.2	0,155.2	2.27	0.05
RP Expressway EB On-	OnRamp	0.71	59.4	28.8	28.2	0.29	0.24	0,238.1	0,238.1	4.01	0.61
RP Expressway EB On-RP Expressway WB On	Basic	0.71	66.9	25.6	25.0	0.08	0.07	0,071.4	0,071.4	1.07	0.05
RP Expressway-Commerce Blvd	Weaving	0.70	54.5	27.0	26.5	0.48	0.38	0,474.9	0,474.9	8.71	1.93
Commerce Off-Commerce On	Basic	0.83	62.6	31.9	31.2	0.12	0.11	0,120.4	0,120.4	1.92	0.20
Commerce Blvd-Santa Rosa Ave	Weaving	0.68	56.2	27.4	26.9	0.61	0.49	0,643.5	0,643.5	11.46	2.26
Santa Rosa Ave-Todd Rd	Basic	0.87	61.0	34.0	33.4	0.80	0.69	0,824.8	0,824.8	13.51	1.73
Freeway			58.8	26.3	25.8	3.83	3.25	3,564.0	3,564.0	0,060.6	0,009.7

HCS 2010 Freeway Facilities

Project Properties

Analyst	W-Trans	**Freeway Name**	US101	**Analysis Period**	AM Peak
Analysis Date	3/31/2015 10:36:29 AM	**From**	Todd Rd	**Version Date**	10/10/2012
Agency		**To**	Railroad Ave		
Location	Sonoma County, CA	**Analysis Direction**	Southbound		

User Notes	Central Rohnert Park PDA Plan - AM Peak Hour Future plus Project - Southbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.75600**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	Todd Rd	Golf Course Dr	Basic Segment	2500	Level	5271	4.00	1.00	2	70
2	Golf Course Off		Off Ramp	1500	Level	5271	4.00	1.00	2	70
3	Golf Course Off	Golf Course On	Basic Segment	3840	Level	4305	4.45	1.22	2	70
4	Golf Course Dr	RP Expressway	Weaving	3225	Level	4997	4.11	1.05	3	70
5	RP Expressway Off	RP Expressway WB On	Basic Segment	1560	Level	3882	4.72	1.36	2	70
6	RP Expressway WB On		On Ramp	545	Level	4301	4.45	1.23	2	70
7	RP Expressway	SR 116	Weaving	4580	Level	4625	4.28	1.14	3	70
8	SR 116 Off	SR 116 On	Basic Segment	2080	Level	4008	4.32	1.32	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	Off Ramp	966	2.00	0.00	1	200	50
6	On Ramp	419	2.00	0.00	1	200	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
4	0.050	692	2.00	0.00	1	40	1115	2.00	0.00	1	40
7	0.050	324	2.00	0.00	1	40	617	4.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
4	3000	2	1	1	0	
7	300	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	Todd Rd	Golf Course Dr	Basic Segment	5271	4680	4800	4697	1.12	1.00	0	53.5	44.7	43.7	0.53	0.41	0.1	0.1	623.9	554.0	10.3	2.4	E
2	Golf Course		Off Ramp	5271	4680	4800	4697	1.12	1.00	0	57.4	41.7	40.8	0.30	0.24	0.1	0.1	374.4	332.4	5.8	1.0	E

	Off																					
3	Golf Course Off	Golf Course On	Basic Segment	4305	3840	4800	4684	0.92	0.82	0	63.2	31.1	30.4	0.69	0.62	0.1	0.1	782.7	698.2	11.1	1.1	D
4	Golf Course Dr	RP Expressway	Weaving	4997	4500	6500	6356	0.79	0.71	0	51.3	35.6	34.8	0.71	0.52	0.2	0.2	763.0	687.1	13.4	3.6	E
5	RP Expressway Off	RP Expressway WB On	Basic Segment	3882	3540	4800	4677	0.83	0.76	0	65.6	27.7	27.0	0.27	0.25	0.0	0.0	286.7	261.5	4.0	0.3	D
6	RP Expressway WB On		On Ramp	4301	3960	4800	4684	0.92	0.85	0	55.2	36.7	35.8	0.11	0.09	0.0	0.0	111.0	102.2	1.9	0.4	E
7	RP Expressway	SR 116	Weaving	4625	4260	6240	6096	0.76	0.70	0	54.8	24.1	23.5	0.95	0.74	0.2	0.2	1003.0	923.8	16.9	3.7	C
8	SR 116 Off	SR 116 On	Basic Segment	4008	3720	4800	4686	0.86	0.79	0	64.2	29.7	29.0	0.37	0.34	0.0	0.0	394.7	366.4	5.7	0.5	D

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
Todd Rd-Golf Course Dr	Basic	1.12	53.5	44.7	43.7	0.53	0.41	0,623.9	0,554.0	10.35	2.43
Golf Course Off-	OffRamp	1.12	57.4	41.7	40.8	0.30	0.24	0,374.4	0,332.4	5.79	1.04
Golf Course Off-Golf Course On	Basic	0.92	63.2	31.1	30.4	0.69	0.62	0,782.7	0,698.2	11.05	1.08
Golf Course Dr-RP Expressway	Weaving	0.79	51.3	35.6	34.8	0.71	0.52	0,763.0	0,687.1	13.40	3.58
RP Expressway Off-RP Expressway WB On	Basic	0.83	65.6	27.7	27.0	0.27	0.25	0,286.7	0,261.5	3.99	0.25
RP Expressway WB On-	OnRamp	0.92	55.2	36.7	35.8	0.11	0.09	0,111.0	0,102.2	1.85	0.39
RP Expressway-SR 116	Weaving	0.76	54.8	24.1	23.5	0.95	0.74	1,003.0	0,923.8	16.87	3.67
SR 116 Off-SR 116 On	Basic	0.86	64.2	29.7	29.0	0.37	0.34	0,394.7	0,366.4	5.70	0.47
Freeway			56.9	31.9	31.1	3.93	3.22	4,339.5	3,925.5	0,069.0	0,012.9

HCS 2010 Freeway Facilities

Project Properties

Analyst		**Freeway Name**	US 101	**Analysis Period**	PM Peak
Analysis Date	4/7/2015 4:53:13 PM	**From**	Railroad Ave	**Version Date**	10/10/2012
Agency		**To**	Todd Rd		
Location	Sonoma County, CA	**Analysis Direction**	Northbound		

User Notes	Central Rohnert Park PDA Plan - PM Peak Hour Future plus Project - Northbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.69300**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	SR 116 Off	SR 116 On	Basic Segment	2375	Level	4067	4.00	1.00	3	70
2	SR 116	RP Expressway	Weaving	4370	Level	4748	4.00	0.86	3	70
3	RP Expressway Off	RP Expressway EB On	Basic Segment	1065	Level	3934	4.41	1.03	2	70
4	RP Expressway EB On		On Ramp	1500	Level	4367	4.17	0.93	2	70
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	450	Level	4367	4.17	0.93	2	70
6	RP Expressway	Commerce Blvd	Weaving	2315	Level	5117	3.86	0.79	3	70
7	Commerce Off	Commerce On	Basic Segment	650	Level	4527	4.10	0.90	2	70
8	Commerce Blvd	Santa Rosa Ave	Weaving	3000	Level	5859	3.62	0.69	3	70
9	Santa Rosa Ave	Todd Rd	Basic Segment	3775	Level	5439	3.75	0.75	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
4	On Ramp	433	2.00	0.00	1	765	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
2	0.050	681	4.00	0.00	1	40	814	2.00	0.00	1	50
6	0.050	750	2.00	0.00	1	40	590	2.00	0.00	1	40
8	0.050	1332	2.00	0.00	1	40	420	2.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
2	3000	2	1	1	0	
6	1782	2	1	1	0	
8	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS

1	SR 116 Off	SR 116 On	Basic Segment	4067	4080	7200	7045	0.58	0.58	0	69.6	20.0	19.5	0.39	0.39	0.0	0.0	457.3	458.8	6.6	0.0	C
2	SR 116	RP Expressway	Weaving	4748	4740	6612	6471	0.73	0.73	0	52.9	33.5	32.8	0.94	0.71	0.2	0.2	982.4	980.8	18.5	4.5	D
3	RP Expressway Off	RP Expressway EB On	Basic Segment	3934	3960	4800	4687	0.84	0.84	0	62.1	32.7	31.9	0.20	0.17	0.0	0.0	198.4	199.7	3.2	0.4	D
4	RP Expressway EB On		On Ramp	4367	4380	4800	4693	0.93	0.93	0	53.2	42.0	41.1	0.32	0.24	0.1	0.1	310.2	311.1	5.8	1.4	E
5	RP Expressway EB On	RP Expressway WB On	Basic Segment	4367	4380	4800	4693	0.93	0.93	0	57.5	39.0	38.1	0.09	0.07	0.0	0.0	93.0	93.3	1.6	0.3	E
6	RP Expressway	Commerce Blvd	Weaving	5117	4906	6463	6331	0.81	0.77	1924	36.4	44.9	44.0	0.72	0.38	0.3	0.3	560.9	537.8	14.8	7.1	E
7	Commerce Off	Commerce On	Basic Segment	4527	4286	4800	4695	0.96	0.91	650	40.5	53.0	51.8	0.18	0.11	0.1	0.1	139.3	131.9	3.3	1.4	F
8	Commerce Blvd	Santa Rosa Ave	Weaving	5859	5070	6672	6544	0.90	0.77	3000	22.2	76.0	74.5	1.53	0.49	1.0	2.5	832.2	720.2	32.4	22.1	F
9	Santa Rosa Ave	Todd Rd	Basic Segment	5439	4680	4800	4705	1.16	0.99	0	53.6	44.5	43.6	0.80	0.61	0.2	0.2	972.2	836.5	15.6	3.6	E

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
SR 116 Off-SR 116 On	Basic	0.58	69.6	20.0	19.5	0.39	0.39	0,457.3	0,458.8	6.59	0.04
SR 116-RP Expressway	Weaving	0.73	52.9	33.5	32.8	0.94	0.71	0,982.4	0,980.8	18.53	4.52
RP Expressway Off-RP Expressway EB On	Basic	0.84	62.1	32.7	31.9	0.20	0.17	0,198.4	0,199.7	3.22	0.37
RP Expressway EB On-	OnRamp	0.93	53.2	42.0	41.1	0.32	0.24	0,310.2	0,311.1	5.85	1.40
RP Expressway EB On-RP Expressway WB On	Basic	0.93	57.5	39.0	38.1	0.09	0.07	0,093.0	0,093.3	1.62	0.29
RP Expressway-Commerce Blvd	Weaving	0.81	36.4	44.9	44.0	0.72	0.38	0,560.9	0,537.8	14.77	7.09
Commerce Off-Commerce On	Basic	0.96	40.5	53.0	51.8	0.18	0.11	0,139.3	0,131.9	3.26	1.38
Commerce Blvd-Santa Rosa Ave	Weaving	0.90	22.2	76.0	74.5	1.53	0.49	0,832.2	0,720.2	32.38	22.09
Santa Rosa Ave-Todd Rd	Basic	1.16	53.6	44.5	43.6	0.80	0.61	0,972.2	0,836.5	15.59	3.64
Freeway			41.9	43.3	42.5	5.17	3.17	4,546.0	4,270.0	0,101.8	0,040.8

HCS 2010 Freeway Facilities

Project Properties

Analyst		**Freeway Name**	US101	**Analysis Period**	PM Peak
Analysis Date	4/7/2015 10:36:29 AM	**From**	Todd Rd	**Version Date**	10/10/2012
Agency		**To**	Railroad Ave		
Location	Sonoma County, CA	**Analysis Direction**	Southbound		

User Notes	Central Rohnert Park PDA Plan - PM Peak Hour Future plus Project - Southbound Direction
File Name	C:\Users\zmatley\AppData\Local\Temp\preview.xml

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**3.75600**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	Todd Rd	Golf Course Dr	Basic Segment	2500	Level	5095	4.00	1.00	2	70
2	Golf Course Off		Off Ramp	1500	Level	5095	4.00	1.00	2	70
3	Golf Course Off	Golf Course On	Basic Segment	3840	Level	4098	4.49	1.24	2	70
4	Golf Course Dr	RP Expressway	Weaving	3225	Level	4872	4.09	1.05	3	70
5	RP Expressway Off	RP Expressway WB On	Basic Segment	1560	Level	3699	4.75	1.38	2	70
6	RP Expressway WB On		On Ramp	545	Level	4052	4.51	1.26	2	70
7	RP Expressway	SR 116	Weaving	4580	Level	4416	4.31	1.15	3	70
8	SR 116 Off	SR 116 On	Basic Segment	2080	Level	3629	4.37	1.40	2	70

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	Off Ramp	997	2.00	0.00	1	200	50
6	On Ramp	353	2.00	0.00	1	200	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
4	0.050	774	2.00	0.00	1	40	1173	2.00	0.00	1	40
7	0.050	364	2.00	0.00	1	40	787	4.00	0.00	1	40

Time Period Independent Weaving Segment Data

Seg #	Configuration	Short Length	# Weaving Lanes	Min. Lane Changes Freeway-Ramp	Min. Lane Changes Ramp-Freeway	Min. Lane Changes Ramp-Ramp
4	3000	2	1	1	0	
7	3000	2	1	1	0	

Time Period Results

Time Period 1

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length (ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	Todd Rd	Golf Course Dr	Basic Segment	5095	4680	4800	4697	1.08	1.00	0	53.5	44.7	43.7	0.53	0.41	0.1	0.1	603.1	554.0	10.3	2.4	E
2	Golf Course		Off Ramp	5095	4680	4800	4697	1.08	1.00	0	57.3	41.7	40.8	0.30	0.24	0.1	0.1	361.9	332.4	5.8	1.1	E

	Off																					
3	Golf Course Off	Golf Course On	Basic Segment	4098	3780	4800	4683	0.88	0.81	0	63.7	30.4	29.7	0.69	0.62	0.1	0.1	745.1	687.3	10.8	1.0	D
4	Golf Course Dr	RP Expressway	Weaving	4872	4560	6336	6196	0.79	0.74	0	50.6	36.7	35.9	0.72	0.52	0.2	0.2	743.9	696.3	13.8	3.8	E
5	RP Expressway Off	RP Expressway WB On	Basic Segment	3699	3480	4800	4676	0.79	0.74	0	66.0	27.1	26.4	0.27	0.25	0.0	0.0	273.2	257.0	3.9	0.2	D
6	RP Expressway WB On		On Ramp	4052	3780	4800	4683	0.87	0.81	0	56.2	34.4	33.5	0.11	0.09	0.0	0.0	104.6	97.5	1.7	0.3	D
7	RP Expressway	SR 116	Weaving	4416	4200	6728	6571	0.67	0.64	0	56.8	22.8	22.2	0.92	0.74	0.2	0.2	957.6	910.8	16.0	3.0	C
8	SR 116 Off	SR 116 On	Basic Segment	3629	3420	4800	4684	0.77	0.73	0	66.5	26.4	25.7	0.36	0.34	0.0	0.0	357.4	336.8	5.1	0.3	D

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
Todd Rd-Golf Course Dr	Basic	1.08	53.5	44.7	43.7	0.53	0.41	0,603.1	0,554.0	10.35	2.43
Golf Course Off-	OffRamp	1.08	57.3	41.7	40.8	0.30	0.24	0,361.9	0,332.4	5.80	1.05
Golf Course Off-Golf Course On	Basic	0.88	63.7	30.4	29.7	0.69	0.62	0,745.1	0,687.3	10.79	0.97
Golf Course Dr-RP Expressway	Weaving	0.79	50.6	36.7	35.9	0.72	0.52	0,743.9	0,696.3	13.77	3.82
RP Expressway Off-RP Expressway WB On	Basic	0.79	66.0	27.1	26.4	0.27	0.25	0,273.2	0,257.0	3.89	0.22
RP Expressway WB On-	OnRamp	0.87	56.2	34.4	33.5	0.11	0.09	0,104.6	0,097.5	1.73	0.34
RP Expressway-SR 116	Weaving	0.67	56.8	22.8	22.2	0.92	0.74	0,957.6	0,910.8	16.04	3.03
SR 116 Off-SR 116 On	Basic	0.77	66.5	26.4	25.7	0.36	0.34	0,357.4	0,336.8	5.07	0.26
Freeway			57.4	31.2	30.5	3.89	3.22	4,146.8	3,872.1	0,067.4	0,012.1

Appendix F

NCHRP Internal Capture Calculation Worksheets

NCHRP 8-51 Internal Trip Capture Estimation Tool			
Project Name:	Rohnert Park PDA Plan	**Organization:**	W-Trans
Project Location:	Rohnert Park	**Performed By:**	
Scenario Description:		**Date:**	
Analysis Year:		**Checked By:**	
Analysis Period:	**AM Street Peak Hour**	**Date:**	2015

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office	710	98	ksf	153	135	18
Retail	826	249	ksf	220	136	84
Restaurant			ksf	0		
Cinema/Entertainment				0		
Residential	220	675	units	348	69	279
Hotel				0		
All Other Land Uses[2]				0		
Total				721	340	381

Table 2-A: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized	Veh. Occ.	% Transit	% Non-Motorized
Office	1.09	2%	8%	1.09	2%	8%
Retail	1.30	2%	8%	1.30	2%	8%
Restaurant						
Cinema/Entertainment						
Residential	1.39	2%	8%	1.39	2%	8%
Hotel						
All Other Land Uses[2]						

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		6	0	0	0	0
Retail	6		0	0	2	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	4	4	0	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary

	Total	Entering	Exiting
All Person-Trips	937	420	517
Internal Capture Percentage	5%	5%	4%
External Vehicle-Trips[3]	617	289	328
External Transit-Trips[4]	18	8	10
External Non-Motorized Trips[4]	71	32	39

Table 6-A: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	7%	30%
Retail	6%	7%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	2%	2%
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.
[2]Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator
[3]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A
[4]Person-Trips
*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas Transportation Institute

Project Name:	Rohnert Park PDA Plan
Analysis Period:	**AM Street Peak Hour**

Table 7-A: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-A (D): Entering Trips			Table 7-A (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.09	135	147	1.09	18	20
Retail	1.30	136	177	1.30	84	109
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.39	69	96	1.39	279	388
Hotel	1.00	0	0	1.00	0	0

Table 8-A (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		6	13	0	0	0
Retail	32		14	0	15	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	8	4	78	0		0
Hotel	0	0	0	0	0	

Table 8-A (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		57	0	0	0	0
Retail	6		0	0	2	0
Restaurant	21	14		0	5	0
Cinema/Entertainment	0	0	0		0	0
Residential	4	30	0	0		0
Hotel	4	7	0	0	0	

Table 9-A (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	10	137	147	113	3	11
Retail	10	167	177	116	3	13
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	2	94	96	60	2	8
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

Table 9-A (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	6	14	20	12	0	1
Retail	8	101	109	70	2	8
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	8	380	388	246	8	30
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

[1]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A
[2]Person-Trips
[3]Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator
*Indicates computation that has been rounded to the nearest whole number.

NCHRP 8-51 Internal Trip Capture Estimation Tool			
Project Name:	Rohnert Park PDA Plan	**Organization:**	W-Trans
Project Location:	Rohnert Park	**Performed By:**	
Scenario Description:		**Date:**	
Analysis Year:		**Checked By:**	
Analysis Period:	**PM Street Peak Hour**	**Date:**	2015

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office	710	98	ksf	146	25	121
Retail	826	249	ksf	619	273	346
Restaurant				0		
Cinema/Entertainment				0		
Residential	220	675	units	418	272	146
Hotel				0		
All Other Land Uses[2]				0		
Total				1183	570	613

Table 2-P: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized	Veh. Occ.	% Transit	% Non-Motorized
Office	1.09	2%	8%	1.09	2%	8%
Retail	1.30	2%	8%	1.30	2%	8%
Restaurant						
Cinema/Entertainment						
Residential	1.39	2%	8%	1.39	2%	8%
Hotel						
All Other Land Uses[2]						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		800	800		800	
Retail					800	
Restaurant						
Cinema/Entertainment						
Residential		800	800			
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		22	0	0	3	0
Retail	8		0	0	116	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	8	29	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary

	Total	Entering	Exiting
All Person-Trips	1,545	760	785
Internal Capture Percentage	24%	24%	24%
External Vehicle-Trips[3]	809	388	421
External Transit-Trips[4]	23	11	12
External Non-Motorized Trips[4]	94	46	48

Table 6-P: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	59%	19%
Retail	14%	28%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	31%	18%
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.
[2]Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator
[3]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P
[4]Person-Trips
*Indicates computation that has been rounded to the nearest whole number.
Estimation Tool Developed by the Texas Transportation Institute

Project Name:	Rohnert Park PDA Plan
Analysis Period:	**PM Street Peak Hour**

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-P (D): Entering Trips			Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.09	25	27	1.09	121	132
Retail	1.30	273	355	1.30	346	450
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.39	272	378	1.39	146	203
Hotel	1.00	0	0	1.00	0	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		22	4	0	3	0
Retail	9		131	18	116	23
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	8	70	35	0		6
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		23	0	0	15	0
Retail	8		0	0	174	0
Restaurant	8	178		0	60	0
Cinema/Entertainment	2	14	0		15	0
Residential	15	29	0	0		0
Hotel	0	7	0	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	16	11	27	9	0	1
Retail	51	304	355	211	6	24
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	119	259	378	168	5	21
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	25	107	132	88	2	9
Retail	124	326	450	225	7	26
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	37	166	203	108	3	13
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

[1]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P
[2]Person-Trips
[3]Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator
*Indicates computation that has been rounded to the nearest whole number.

APPENDIX F

Water Supply Assessment

Water Supply Assessment for the Central Rohnert Park Priority Development Area

City of Rohnert Park
November 2015

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1. INTRODUCTION

This Water Supply Assessment (WSA) has been prepared to assist the City of Rohnert Park (City) in satisfying the requirements of Water Code Section 10910 et. seq. - Water Supply Planning to Support Existing & Future Uses. The City is preparing the Central Rohnert Park Priority Development Area Plan (PDA Plan) and is the lead agency under the California Environmental Quality Act (CEQA) for the PDA Plan. Both CEQA and the California Water Code require a lead agency to consider water supply and demand as part of the development review process.

1.1 REQUIREMENTS FOR A WSA

The requirement to prepare a WSA was established in 2002 by Senate Bill (SB) 610, which emphasizes the interrelationships between land use and water supply planning, and requires the incorporation of water supply and demand analyses at the earliest possible stage in the land use planning process. The stated intent of SB 610 is to strengthen the process by which local agencies determine the adequacy and sufficiency of current and future water supplies to meet current and future demands.

SB 610 amended the California Public Resources Code to incorporate Water Code findings within the CEQA process for certain types of projects. SB 610 added Water Code Sections 10910, 10911, 10912, 10913, and 10915 (Water Supply Planning to Support Existing and Planned Future Uses), which describe when a WSA needs to be prepared and the required elements of that WSA. The WSA is then used as an informational document to support the CEQA process. SB 610 also amended Water Code Section 10631 (the Urban Water Management Planning Act) to create a clear relationship between an agency's Urban Water Management Plan (UWMP) and subsequent WSAs and to allow the UWMP to serve as a foundational document for the analysis in the WSA.

Water Code Section 10910 et. seq. defines the "projects" that require a WSA and the lead agency's responsibilities related to the WSA. A WSA is required for:

- A proposed residential development of more than 500 dwelling units;
- A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space;
- A proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space;
- A proposed hotel or motel, or both, having more than 500 rooms;
- A proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet;
- A mixed-use development that includes one or more of the uses described above;
- A development that would demand an amount of water equivalent to or greater than the amount of water required by a 500-dwelling-unit project; and
- For lead agencies with fewer than 5,000 water service connections, any new development that will increase the number of water service connections in the service area by ten percent or more.

A WSA must provide:

- A description of all relevant water supply entitlements, water rights, and/or water contracts;
- A description of the available water supplies, in normal, dry and multiple dry years, and the infrastructure, either existing or proposed, to deliver the water; and
- An analysis of the demand placed on those supplies, by the project, and relevant existing and planned future uses in the area for at least a 20-year period.

The lead agency may incorporate the water suppliers' UWMP by reference, if the supplier included the proposed development's demands in the UWMP.

While water supply is clearly an important consideration in approval of a development, nothing in SB 610 prevents a lead agency from approving a proposed project even in the face of information concluding that there is not sufficient water supply for build-out of the project. However, where the description of existing water supply entitlements, water rights, and/or water contracts shows insufficient water supplies to serve the proposed project, as well as existing and planned uses over the 20-year planning horizon, additional information is required to describe how and where sufficient supplies may be obtained. Such information must include the estimated costs, financing methods, and regulatory approvals needed to obtain new supplies, as well as a projected time frame for obtaining them.

1.2 Summary of the Project

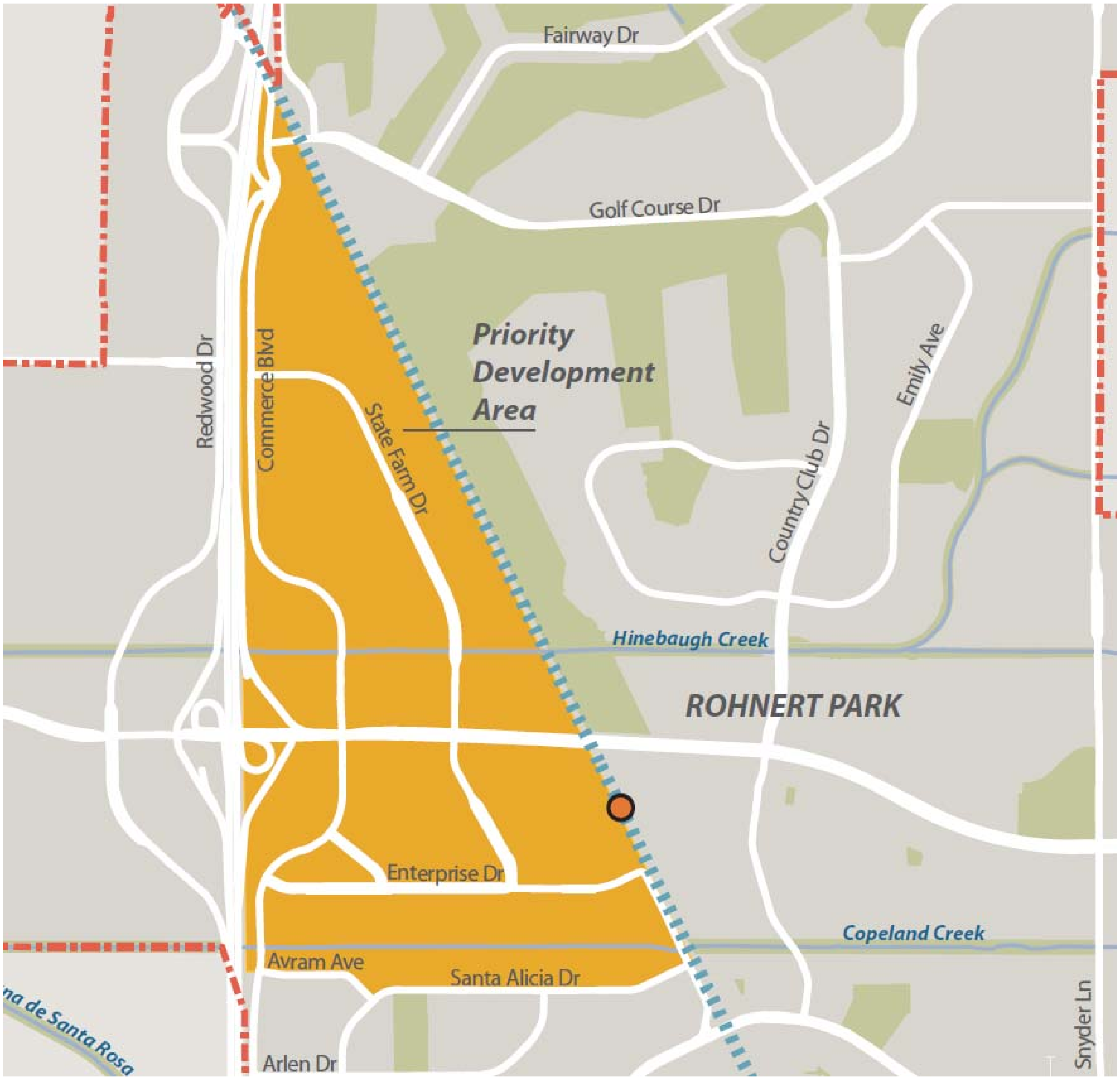
This WSA considers the proposed Central Rohnert Park Priority Development Area. The Project involves changes to the land use in an approximately 330 acre area within the central portion of Rohnert Park, bounded by US 101 to the west, the Sonoma Marin Area Rail Transit (SMART) right-of way to the east, Golf Course Drive to the north and Avram Avenue/Santa Alicia Drive to the south. The PDA Plan Area is illustrated in Figure 1. The existing and proposed land uses are summarized in Table 1 below.

TABLE 1 – PROPOSED LAND USE CHANGES IN THE PROPOSED CENTRAL ROHNERT PARK PDA

Land Use	EXISTING	PROJECT BUILD-OUT
Residential	1,390 units	2,225 units
Retail and Services*	700,700 sf	1,141,600 sf
Office	1,081,800 sf	987,900 sf
Public-Institutional	166,500 sf	222,100 sf
Industrial	768,400 sf	897,800 sf
Notes: sf = square feet *Also permits up to a 500-room hotel within the PDA.		

The City estimates that each additional housing unit within the PDA area will house 2 persons on average (the persons per household average for a multi-family dwelling in Rohnert Park). The corresponding population increase within the project area will be 1,670 persons .

Figure 1 central rohnert park Priority development area



1.3 Scope of Analysis

This WSA describes the relationship between the future demands associated with the PDA Plan and the availability of the City's water supply under different climatic conditions. This WSA has been prepared to assist the City in evaluating the impacts of the Project on the water supply. Specifically, this WSA:

- Provides information on the City's water supply that is consistent with Water Code Sections 10620 et. seq. (the Urban Water Management Act) and 10910 et. seq. (Water Supply Planning to Support Existing and Planned Future Uses);
- Provides information on current water demands and projected water demands associated with the Central Rohnert Park PDA; and
- Compares water supplies and water demands for the normal, single dry and multiple dry years.

1.3.1 Urban Water Management Plans

The City adopted its "2010 UWMP" on June 14, 2011. The UWMP, which is incorporated by reference, can be found at http://www.ci.rohnert-park.ca.us/gcsearch.aspx?q=2010+water+supply+assessment. The UWMP conforms to the requirements of the Urban Water Management Planning Act and includes:

- A description of the water service area including climate, current and projected population and other demographic factors that affect water management planning;
- A description and quantification of the existing and planned water sources;
- A description of the reliability and vulnerability of the water supply to seasonal or climatic shortages in the average water year, single dry water year and multiple dry water year;
- Contingency plans including demand management and conjunctive use potential;
- A description of current and projected water demands among all user classes in 5-year increments; and
- A description of all water supply projects and water supply programs that may be undertaken by the City, its wholesale supplier the Sonoma County Water Agency and its wholesale recycled water supplier, the Santa Rosa Subregional System.

The 2010 UWMP concluded that the City's total projected water demand, including recycled water, would be 7,286 acre-feet per year (AFY) in the year 2035 (Table 3.15, 2010 UWMP). The 2010 UWMP concluded that the City had adequate supply, under all hydrologic conditions, to meet the demand. By way of comparison, the City's current total demand, including recycled water, is approximately 6,000 AFY (City of Rohnert Park production data).

In order to comply with the requirements of the Water Conservation Act of 2009 (SBx7-7) the 2010 UWMP includes a "baseline" water use and water use targets for 2015 and 2020. These targets, which are expressed as water use in gallons per capita per day (gpcd) will be used to validate the City's compliance with SBx7-7 requirements to reduce water use by 20 percent from the baseline by 2020. The targets, which are discussed in detail in Chapter 4 of this WSA, effectively serve to cap future demands.

1.3.2 Previous Water Supply Assessments

Two previous WSAs have been prepared for the City. The City's 2004 Water Supply Assessment (the 2004 WSA) was developed to document the relationship between the City's water supply and the build-out of its

General Plan. The 2004 WSA included projected growth in the City's Northeast, Northwest, University District and Southeast Specific Plan Areas, Stadium Lands Planned Development Area and infill development. The 2004 WSA documented the City's total available water supply of 10,355 AFY from the City's Sonoma County Water Agency, groundwater and recycled water supplies. The 2004 documented a total anticipated water demand of 8,112 AFY in the year 2025 and concluded that the City has adequate water supply to manage its planned growth. Because of the City's ongoing water conservation efforts, subsequent Urban Water Management Plans have projected lower demands.

In July 2010, the City considered a Final Environmental Impact Report (EIR) for its Sonoma Mountain Village Planned Development Area, which was not included in the City's General Plan projections. This EIR included an updated Water Supply Assessment (SMV WSA) reflecting the land uses changes proposed by the Sonoma Mountain Village PDA. The SMV WSA documented a City's total available water supply 10,249 AFY, which is very similar to the 2004 WSA. Using a methodology similar to the 2004 WSA, the SMV WSA documented the total anticipated water demand, including the new Sonoma Mountain Village Project, to be 9,610 AFY in 2030 and it also concluded that the City had adequate water supply to manage its planned growth. As with the 2004 WSA, the demand projections in the SMV WSA do not reflect the effects of the City's water conservation efforts which have significantly reduced demand.

1.4 Structure of this Report

This report is structured to facilitate the presentation of information required by the Water Code and to outline the analysis necessary to evaluate the sufficiency of water supply to meet planned growth. Table 2 below outlines where each element requirement under SB 610 is located in this report.

TABLE 2 – INDEX OF SB 610 REQUIREMENTS

Required Element	LOCATION IN DOCUMENT
Description of Service Area	Section 2
Population Projections in 5-year Increments	Table 3
Description and Quantification of Water Supplies	Section 3
Description of Supply Reliability to Climate Conditions	Section 3
Description of Contingency Plans	*
Description of Demand Management Potential	Section 4.1
Projection of Water Demands in 5-year Increments	Tables 7, 12, 13, and 14
Description of Projects & Programs Undertaken to Meet Demands	Section 5.1
Description of Demand Management Measures Employed	Appendix
Determination of Supply Sufficiency under Normal, Single & Multiple Dry Years	Section 5
Identification of Water Supply Entitlements & Rights and water received under rights	Section 3
Information related to capital outlay programs for financing delivery of water supply	Section 5.1
Information on permits needed and regulatory requirements associated with water supply	Section 5.1

* Demand Management and Contingency Planning is included in the City's 2010 Urban Water Management Plan and incorporated by reference

2 WATER SERVICE AREA

The City of Rohnert Park is located in Central Sonoma County, approximately 50 miles north of San Francisco. The water service area under consideration in this WSA is bounded by the City's Sphere of Influence as outlined in its 2000 General Plan. The City's General Plan identified six major Specific Plan Areas (SPAs):

- Northeast SPA
- University District SPA
- Southeast SPA
- Canon Manor SPA
- Wilfred Dowdell SPA
- Northwest SPA

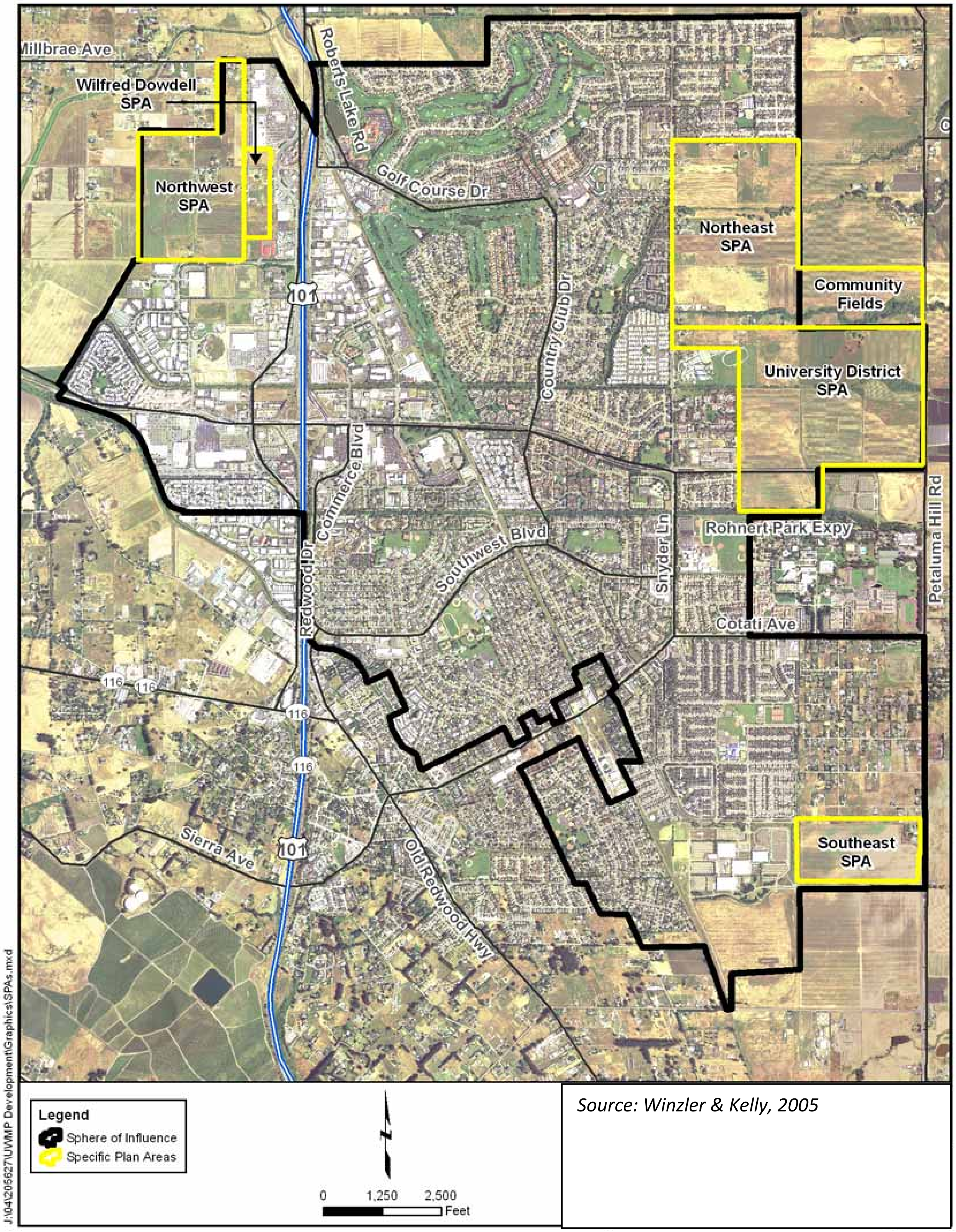
The City's General Plan anticipated annexation and development of all of the SPAs except Canon Manor. As described above, the City's 2004 WSA considered build-out of all the SPAs, except Canon Manor, as well as the Stadium Lands PD. The City's SMV WSA considered build-out of all the SPAs, except Canon Manor, and build-out of the Stadium Lands and Sonoma Mountain Village PDA. The City's 2010 UWMP also considered build-out of all the SPAs, except Canon Manor, along with Stadium Lands PD and the Sonoma Mountain Village PD. While both WSAs and the 2010 UWMP included the land area covered by the Central Rohnert Park PDA, these documents did not include the density of land uses proposed by the PDA Plan.

The City's water service area is approximately 6.4 square miles in area. The distribution system consists of approximately 115 miles of water distribution system mains and two pressure zones. Most of the distribution system mains are 6- to 8-inch diameter pipes with a small number in the 10- to 12-inch diameter range. The City's water system includes seven water storage tanks ranging in size from 300,000 gallons to 1.3 million gallons. The total storage available to the City's system is 4.2 million gallons.

The City also delivers tertiary treated recycled water to customers. The recycled water is produced by the Santa Rosa Subregional System. The Subregional System operates a low-pressure and a high-pressure distribution system. The low-pressure system is delivered through an 18-inch diameter pipeline that runs along Wilfred Avenue and Golf Course Drive and ends at Foxtail Golf Course near the northern city limits. This low-pressure system delivers approximately 500 acre-feet per year (AFY) to 5 customers. The high-pressure system begins at the Rohnert Park Pump Station, located at the intersection of Stony Point Road and Rohnert Park Expressway. The high-pressure system delivers 500 AFY to 27 customers.

Figure 2 illustrates the City's water service area.

FIGURE 2 WATER SERVICE AREA MAP



Source: Winzler & Kelly, 2005

2.1 POPULATION

In its 2010 UWMP, the City elected to use population and employment projections based on the 2009 Association of Bay Area Governments (ABAG) data. ABAG published the projections report in 2009, which includes population and employment estimates for each city in the Bay Area. Table 3 illustrates the population projections used in the 2010 UWMP, which include the anticipated development in the SPAs and PDs described above.

TABLE 3 – POPULATION PROJECTIONS FROM THE 2010 UWMP

	2010	2015	2020	2025	2030	2035	Data Source
Population	43,398	46,440	47,900	49,300	51,000	53,000	2009 ABAG

The City is in the process of preparing its 2015 UWMP and has already developed its population and employment projections based on ABAG's 2013 population report which anticipates the development of the Central Rohnert Park PDA. Table 4 illustrates the population projections that will be utilized in this WSA and the City's 2015 UWMP. The 2013 ABAG projections take into account the slow growth experienced during the recession period. The projections indicate that the City will recover from this slow growth trend by approximately 2030.

TABLE 4 - POPULATION PROJECTIONS FOR THE 2015 UWMP AND THIS WSA

	2015	2020	2025	2030	2035	2040	Data Source
Population	45,465	47,232	49,045	51,060	53,232	55,524	2013 ABAG Subregional

2.2 CLIMATE

The City is located in the Russian River watershed. The climate and hydrology of the Russian River watershed directly affect the City because its wholesale supply from the Sonoma County Water Agency is drawn from the Russian River. The climate of the Russian River watershed is tempered by its proximity to the Pacific Ocean and is characterized by seasonal rainfall patterns. Over 90 percent of the total annual precipitation falls between October and April, with a large percentage of the rainfall typically occurring during three or four major winter storms. The regional averages for rainfall, temperature and the rate of evapo-transpiration of common turf grass (ETo) are summarized in Table 5.

TABLE 5 – CLIMATE DATA

	Average ETo (in)	Average Rainfall (in)	Average Temp °F
January	1.2	6.25	47.0
February	1.7	5.32	50.5
March	2.8	4.09	52.8
April	3.7	2.06	55.8
May	5.0	0.97	59.8
June	6.0	0.26	64.6
July	6.1	0.03	66.5
August	5.9	0.08	66.6
September	4.5	0.38	65.9
October	2.9	1.60	61.2
November	1.5	3.64	53.4
December	0.7	5.50	47.6
Annual	42.0	30.18	57.6
Source: Western Regional Climate Center wrcc.dri.edu Santa Rosa Station			

3 WATER SUPPLY

This section provides an overview of the City's water supply water, which has been documented extensively in the 2004 WSA, the SMV WSA, and the City's 2005 and 2010 Urban Water Management Plans, all of which are incorporated by reference. The City of Rohnert Park has three sources of water: Sonoma County Water Agency (Agency) supply, local groundwater and recycled water. The City manages these supplies using a "conjunctive use" strategy, drawing on the Agency and recycled water supplies first and utilizing its local groundwater to manage peak demands. The total reliable supply available to the City through these three sources is 10,299 AFY, including 8,949 AFY of potable water and 1,350 AFY of recycled water. Table 6 summarizes the water supply available from each source. Due to the framework of the Sonoma County Water Agency's existing water rights, the City's reliable water supply remains the same under the normal, single dry and multiple-dry year conditions.

TABLE 6 – CITY OF ROHNERT PARK – WATER SUPPLY SOURCES IN AYF

Water Source	Normal Year Supply	Single Dry Year Supply	Multiple Dry Year Supply		
			Year 1	Year 2	Year 3
Sonoma County Water Agency	6,372	6,372	6,372	6,372	6,372
Groundwater	2,577	2,577	2,577	2,577	2,577
Recycled Water	1,350	1,350	1,350	1,350	1,350
Total	10,299	10,299	10,299	10,299	10,299
The City's contract with the Sonoma County Water Agency provides for a supply of up to 7,500 AFY					

3.1 SONOMA COUNTY WATER AGENCY SUPPLY

This section describes the Agency supply, its hydrologic availability and the various contracts that affect this supply. This information is brought forward from the City's previous WSAs and its 2005 and 2010 UWMPs and is used to project the Agency supply that is reasonably available to the City under all hydrologic conditions.

The City's contract for water supply with Sonoma County Water Agency is the Restructured Agreement for Water Supply. Under this contract the City has access to as much as 7,500 acre feet per year (AFY). The water supply allocation in the Restructured Agreement, presumes the Agency is able to secure modifications to its water rights permits that will allow it to increase its diversions from 75,000 AFY to 101,000 AFY. (See Sections 3.1.1 and 3.1.2 for additional discussion of the Agency's water rights and contracts). Over the past 10 years, the City has used between 2,500 and 5,000 AFY of Agency supply, which is significantly less than its maximum allocation. This WSA projects that up to 6,372 AFY of Agency supply will be available to the City based on analysis of the legal and hydrologic constraints on the Agency's system. This projection is consistent with prior Water Supply Assessments and Urban Water Management Plans

The water supply available to the City from the Agency is measured in two ways, hydrologic availability, and legal availability. Hydrologic availability is a measure of how much water is available because of rainfall, runoff, and storage in the Russian River watershed. Normal Year, Single Dry Year and Multiple Dry Year are ways to describe the hydrologic availability of water supply under a variety of rainfall conditions. The Agency's hydrologic models, (Sonoma County Water Agency 2005 Urban Water Management Plan) indicate that its water supply is most constrained under the Single Dry Year condition when between 85,000 and 86,000 acre feet per year (AFY) are available to the system.

Legal availability is a measure of how much water the Agency is allowed to divert under the water rights permits it receives from the State Water Resources Control Board (SWRCB). The Agency currently has permits to divert and re-divert 75,000 AFY. At the present time, legal availability is the largest constraint on the Agency supply because current water rights are less than even the Single Dry Year supply. This means that even in the driest of years, the Agency is not legally able to divert all the water that is available to its Russian River System.

Because legal availability, not hydrologic availability, presents the greatest constraint to the Agency's supply, the City has analyzed its Agency water supply using 75,000 AFY as the maximum available supply. This supply will be available under all hydrologic conditions because even in the driest years, there is more than 75,000 AFY in the Russian River system and available for diversion by the Agency.

3.1.1 Agency's Water Rights

The Agency currently diverts and re-diverts water from the Russian River System under four permits issued by the SWRCB. These permits (Numbers 12947A, 12949, 12950 and 16596) provide the Agency with the rights to divert and re-divert up to 75,000 AFY, and to store water in Lake Mendocino and Lake Sonoma.

These permits also set minimum in-stream flow requirements to protect fish and wildlife and maintain recreation in the Russian River. The SWRCB's Decision 1610 provides for varying minimum in-stream flow requirements under different hydrologic cycles (i.e., in-stream flow requirements are lower in dry water years than in normal water years). The Agency works with the SWRCB on a regular basis to implement the various in-stream flow requirements of its permits based on hydrologic conditions at the time.

3.1.2 The Restructured Agreement for Water Supply

The Restructured Agreement for Water Supply (the Restructured Agreement) is the contractual document that outlines how the Agency's proposed 101,000 AFY water right is allocated among the Agency's Contractors and other customers. The Restructured Agreement was executed on June 20, 2006 and has a term of at least forty years. The Restructured Agreement allocates 7,500 AFY to the City, with an average day maximum month pumping rate of 15.0 million gallons per day (mgd) under Normal Year conditions.

Section 3.5 of the Restructured Agreement (the Water Shortage Provisions) defines how the water supply and transmission system capacity would be allocated in case of shortage. On April 18, 2006, the Agency's Board of Directors adopted a Water Shortage Allocation Methodology that provides a mathematical quantification of the Water Shortage Provisions. This allows the Contractors to calculate their reasonably expected Agency allocation under a range of supply scenarios. Based on the Water Shortage Allocation Methodology, the City expects it can receive up to 6,372 AFY as long as the Agency's water rights are limited to 75,000 AFY.

3.2 Groundwater Supply

This section describes the City's groundwater supply, its hydrologic availability and the policies that affect its use. This WSA projects that 2,577 AFY of groundwater will be available to the City.

The City's local groundwater supply is from the Santa Rosa Plain Subbasin of the Santa Rosa Valley Groundwater Basin. The City has developed 42 groundwater wells, 29 of which are currently active. The active wells have a total rated production capacity of 6.3 mgd. The City's 2010 Urban Water Management Plan provides additional detail on the individual wells and their production capability.

The City manages its groundwater supply in accordance with its 2004 Water Policy Resolution which limits groundwater pumping to 2,577 AFY. The City's 2004 WSA and 2005 and 2010 UWMPs, which are incorporated by reference, provide the technical support for this maximum pumping rate, which can be sustained over all hydrologic conditions. Over the past 10 years the City has used between 350 and 1,600 AFY of groundwater, which is significantly less than its policy limitation on groundwater use.

The City supported the development the Santa Rosa Plain Watershed Groundwater Management Plan, which was adopted in the fall of 2014, and participates actively in the implementation of this Plan. Modeling and monitoring data collected by the City and others indicate that groundwater levels are generally rising around the City's well field, an indication of stable supply (Hydrologic and Geochemical characteristic of the Santa Rosa Plain Watershed).

The California Department of Water Resources defines the Santa Rosa Valley Groundwater Basin as a "medium priority basin". As a result, and in accordance with the requirements of the Groundwater Sustainability Act of 2014, the City is working with the County of Sonoma, the Sonoma County Water Agency, the cities of Cotati, Santa Rosa and Sebastopol and the Town of Windsor to form a Groundwater Sustainability Agency and develop a Groundwater Sustainability Plan. These agencies all expect that the Groundwater Sustainability Plan will build upon the adopted Groundwater Management Plan and continue to provide a strong framework for managing the groundwater supply.

3.3 Recycled Water Supply

The City's tertiary-treated recycled water supply is produced by the Santa Rosa Subregional Water Reclamation System. The City and the Subregional System have recently entered into a Producer Distributor Agreement that provides the City with access to 1,350 AFY of recycled water. The City uses recycled water primarily for irrigation purposes and recycled water demand has varied between 800 and 1,100 AFY over the past 10 years.

3.4 Drought Considerations

The State of California is experiencing a serious drought with rainfall and especially snowpack being recorded as the lowest on record in 120 years. On January 17, 2014, Governor Brown declared a statewide drought emergency, which has been followed up with several subsequent Executive Orders and two rounds of emergency drought regulations issued by the State Water Resources Control Board. The City has responded to these requirements with its own emergency drought ordinances and is currently exceeding its required conservation savings of 16% over 2013 demands.

While the State Water Project, administered by the Department of Water Resources, is extremely stressed by the lack of snowpack, the Sonoma County Water Agency's rainfall based water system is experiencing significantly less stress. Currently the Agency's primary storage reservoir, Lake Sonoma, is a 70% capacity with enough water supply to serve the Agency's contractors for the next three to four years (Grant Davis, General Manager Sonoma County Water Agency, personal communication, November 2, 2015). While the City will continue to respond to state regulations and conservation requirements, these actions are driven by the State's regulatory mandates and not by significant water supply shortages in the Russian River Basin.

4 WATER DEMANDS

This section provides an overview of the City's projected water demands, including the demands associated with the Central Rohnert Park PDA. The City has recently completed its 2015 Urban Water Management Plan Water Demand and Water Conservation Measures Update (2015 Demand Update). The 2015 Demand Update is based on the Association of Bay Area Governments population and job projections, including both the Central Rohnert Park and Sonoma Mountain Village PDAs. The 2015 Demand Update projects that the City's potable water demands through 2040 will range between 5,600 and 6,100 AFY, depending on the level of water conservation undertaken by the City. This projected demand is significantly less than the City's available water supplies. The 2015 Demand Update indicates that the City has the potential to secure approximately 500 AFY (the difference between 5,600 and 6,100 AFY) by undertaking more aggressive water conservation activities.

4.1 2015 UWMP WATER DEMAND PROJECTIONS

To prepare for the submission of its 2015 Urban Water Management Plan, the City contracted with Maddaus Water Management, Inc. (MWM) to prepare the 2015 Demand Update in order to:

1. Update its potable water demand forecast for the years 2015 to 2040; and
2. Update the range of potable water conservation savings that could be achieved and the costs of those savings under three water conservation programs that could be implemented between the years 2015 to 2040.

The 2015 Demand Update focuses specifically on potable water demand and conservation projection. As described in Section 2, the analysis was based on Association of Bay Area Governments projections for population and job growth which includes the City's projected General Plan growth as well as development of the Central Rohnert Park and Sonoma Mountain Village PDAs. Table 7 below presents the results of this analysis and illustrates the City's projected range of water demands under several scenarios with an increasing emphasis on water conservation. In every case, projected demands are well below the City's available potable water supply. For the purposes of its 2015 UWMP, including its required reporting to the Agency, the City is reporting its projected demands based on implementation of Scenario 2 (Demand with Plumbing/Building Code Only). As illustrated in Table 7, the City has the option to increase its water conservation activities in order to further reduce demands by 384 to 556 AFY, providing it with the flexibility to use increased water conservation activity as a strategy for managing planned growth.

TABLE 7 - POTABLE WATER DEMAND PROJECTIONS (AFY)

Water Demand Scenario		Projected Water Demands (AFY)					
		2015	2020	2025	2030	2035	2040
1	Demand without Plumbing/Building Code Implementation	5,415	5,675	5,887	6,111	6,372	6,644
2	Demand with Plumbing/Building Code Implementation	5,415	5,605	5,729	5,817	5,960	6,129
3	Demand with Plumbing/Building Code Implementation and Conservation Program A	5,365	5,348	5,426	5,461	5,591	5,745
4	Demand with Plumbing/Building Code Implementation and Conservation Program B	5,361	5,309	5,310	5,337	5,459	5,605
5	Demand with Plumbing/Building Code Implementation and Conservation Program C	5,356	5,277	5,268	5,304	5,427	5,573

4.2 PROJECT SPECIFIC WATER DEMAND PROJECTIONS

While the City believes that the ABAG projections used in its 2015 Demand Update account for planned development including development within the Central Rohnert Park PDA, it has also analyzed the increase in water demand that will be created by the increased density within the PDA Plan area. Conceptual water demands were developed for each land use within the PDA based on current usage rates. These usage rates do not account for future reductions resulting from the City's water conservation activities. Water usage rates for new development in the PDA were calculated by applying the savings anticipated from the implementation of the CalGreen Building Code to the existing usage pattern (this is consistent with Scenario 2 in the 2015 Demand Update). Implementation of the CalGreen requirements will result of savings of approximately 18% for nonresidential uses and approximately 30% for residential uses. These water demand projections are illustrated in Table 8.

TABLE 8 – ESTIMATED WATER DEMANDS IN THE CENTRAL ROHNERT PARK PDA

	Residential	Retail	Office	Public	Industrial
Existing Development	129.6 gpd/unit	0.11 GPD/SF	0.04 GPD/SF	0.04 GPD/SF	0.62 GPD/SF
New Development	92 gpd/unit	0.09 gpd/sf	0.03 gpd/sf	0.03 gpd/sf	0.51 gpd/sf

Notes: gpd/sf = gallons per day per square foot; gpd/unit = gallons per day per unit
Consumption rates Appendix I "Utilities and Service System Data" of the City of Rohnert Park Northwest Specific Plan and generally following the City's 2010 Urban Water Management Plan and the AWWA Research Foundation "Commercial and End Uses of Water" (2000)

The increased water demand associated with the PDA land uses can be estimated by applying these water consumption rates outlined in Table 8 to the increased intensity of land use illustrated in Table 9. This results in relatively conservative water demand estimates for the build out of the PDA, because the estimates take into account the impacts of the CalGreen Building Code but do not account for efficiency improvements in the existing development. Table 9 illustrates the results of this calculation and concludes that build-out of the Central Rohnert Park PDA could result in approximately 205 AFY of increased demand, above that projected in the 2015 Demand Update.

TABLE 9 – SUMMARY OF INCREASED LAND USE INTENSITY IN THE CENTRAL ROHNERT PARK PDA

Land Use	Existing Units / Building Area	Project Build-Out	Increase (Decrease)
Residential	1,390 units	2,225 units	835 Units
Retail & Services*	700,700 sf	1,141,600 sf	440,900 sf
Office	1,081,800 sf	987,900 sf	(93,900 sf)
Public – Institutional	166,500 sf	222,100 sf	55,600 sf
Industrial	768,400 sf	897,800 sf	129,400 sf
Notes: SF= Square Feet *Land Use also permits up to a 500-room hotel within the PDA.			

TABLE 10 – SUMMARY OF POTENTIAL INCREASED WATER DEMAND WITH BUILD OUT OF CENTRAL ROHNERT PARK PDA

Land Use	Increase/ (Decrease) Units / SF of Building Area	Demand per Unit / SF (gpd)	Total Increase/(Decrease) Demand (gpd)	Total Increase/(Decrease) Demand (AFY)
Residential	835 Units	92	76,820	86.05
Retail & Services	440,900 sf	0.09	39,681	44.45
Office	(93,900 sf)	0.03	(2,817)	(3.16)
Public – Institutional	55,600 sf	0.03	1,668	1.87
Industrial	129,400 sf	0.51	65,994	73.92
Totals			**181,364**	**203.13**

4.3 THE WATER CONSERVATION ACT OF 2009 AND WATER USE TARGETS

The Water Conservation Act of 2009 required that all urban water suppliers calculate and adopt 2015 and 2020 Water Use Targets as part of their 2010 Urban Water Management Plans. The City calculated and adopted a local 2015 target of 140 gallons per capita per day and a local 2020 target of 119 gallons per capita per day. The City also participated in a "regional alliance" which has adopted a 2015 water use target of 142 gallons per capita per day and a 2020 target of 129 gallons per capita per day. Under the requirements of the Water Conservation Act of 2009, if all members of the regional alliance meet the regional target, the group is in compliance, otherwise the City will need to meet its locally adopted targets. As indicated in the 2015 Demand Update, the City is currently exceeding its 2020 target.

Because implementation of the PDA Plan could result in increased water demands, Table 11, provides a check on the City's compliance using the population projections presented in Section 2 and the water demands projected in the 2015 Demand Update together with the 205 AFY additional potential demand from the PDA Plan.

TABLE 11 – WATER CONSERVATION ACT OF 2009 TARGET CHECK

	2015	2020	2025	2030	2035	2040
Population	45,465	47,232	49,045	51,060	53,232	55,524
Water Demand (AFY)	5,620	5,810	5,934	6,022	6,150	6,334
Water Demand (gpd)	5,017,213	5,186,834	5,297,534	5,376,095	5,490,366	5,654,631
Per Capital Demand (gpcd)	110.35	109.82	108.01	105.29	103.14	101.84

In all cases, even with the additional demands from the PDA Plan, the City is able to meet its water use targets.

4.4 Conclusion

As illustrated in Table 10, implementing the PDA Plan has the potential to increase demands on the City's potable water supply by approximately 205 AFY. Under the City's Planning Scenario 2 (Plumbing/Building Code Implementation Only), 2040 demands would increase from 6,129 to 6,353 AFY. The City's 2015 Demand Analysis indicates that with additional conservation programs, the City could reduce its demand by 384 to 556 AFY, effectively counteracting the potential impact of increased development within the Central Rohnert Park PDA. This analysis also does not fully take into account efficiency measures that would result from improvements to existing buildings within the PDA. As the new plumbing/building code is implemented and older inefficient systems are replaced, future demand could be reduced further, but the impact of this activity cannot be quantified at this time.

5 SUFFICIENCY ANALYSIS & CONCLUSIONS

SB 610 requires that the Lead Agency make findings related to supply sufficiency under the normal, single dry and multiple dry year planning scenarios. As described in Section 3, because of the Agency's existing water rights are more constraining that hydrological conditions, the City's reliable water supply is remains the same under the normal, single dry and multiple-dry year conditions. Hydrologic variability will change, should the Agency secure permitted rights of up to 101,000 AFY at some point in the future.

As described in Section 4, the demands associated with the PDA Plan likely fall with within the ABAG projections used in the City's 2015 Demand Update. However, the City has also calculated the increased demands associated with the Central Rohnert Park PDA and acknowledges that the implementation of the PDA Plan may result in a demand of approximately 205 AFY above what is projected in its 2015 Demand Update. Because of that, this section assumes that the PDA will result in a net potable water demand increase of 205 AFY and the sufficiency analysis is based on these higher potable water demands.

Comparisons of supply and demand under normal, single dry and multiple dry years are included in Tables 11 through 13 below. These tables illustrate that the additional water demands associated with build out of the Central Rohnert Park PDA Project will have only a small effect on the difference between supply and demand and that the supply exceeds the demand in all cases. The City will not experience water shortages associated with PDA development.

TABLE 12 - CITY OF ROHNERT PARK SUPPLY & DEMAND COMPARISON – NORMAL YEAR WITH PDA BUILD OUT (AFY)

	Planning Year					
	2015	**2020**	**2025**	**2030**	**2035**	**2040**
Potable Water Supply	8,949	8,949	8,949	8,949	8,949	8,949
Potable Water Demand (2015 Demand Update)	5,415	5,605	5,729	5,817	5,960	6,129
Additional Project Potable Demand	205	205	205	205	205	205
Difference Potable Supply (Supply – Demand)	**3,329**	**3,139**	**3,015**	**2,927**	**2,784**	**2,615**
Difference % of Potable Demand	59.2%	54.0%	50.8%	48.6%	45.2%	41.3%
Difference % of Potable Supply	37.2%	35.1%	33.7%	32.7%	31.1%	29.2%
Recycled Water Supply	1,350	1,350	1,350	1,350	1,350	1,350
Recycled Water Demand	1,000	1,300	1,300	1,300	1,300	1,300
Difference Recycled Supply (Supply – Demand)	**350**	**50**	**50**	**50**	**50**	**50**
Difference % of Recycled Demand	35.0%	3.9%	3.9%	3.9%	3.9%	3.9%
Difference % of Recycled Supply	25.9%	3.7%	3.7%	3.7%	3.7%	3.7%
Total Difference (Supply – Demand)	**3,679**	**3,189**	**3,065**	**2,977**	**2,834**	**2,665**

TABLE 13 - CITY OF ROHNERT PARK SUPPLY & DEMAND COMPARISON – SINGLE DRY YEAR WITH PDA BUILD OUT (AFY)

	Planning Year					
	2015	**2020**	**2025**	**2030**	**2035**	**2040**
Potable Water Supply	8,949	8,949	8,949	8,949	**2035**	8,949
Potable Water Demand (2015 Demand Update)	5,415	5,605	5,729	5,817	8,949	6,129
Additional Project Potable Demand	205	205	205	205	5,960	205
Difference Potable Supply (Supply – Demand)	**3,329**	**3,139**	**3,015**	**2,927**	205	**2,615**
Difference % of Potable Demand	59.2%	54.0%	50.8%	48.6%	**2,784**	41.3%
Difference % of Potable Supply	37.2%	35.1%	33.7%	32.7%	45.2%	29.2%
Recycled Water Supply	1,350	1,350	1,350	1,350	31.1%	1,350
Recycled Water Demand	1,000	1,300	1,300	1,300	1,350	1,300
Difference Recycled Supply (Supply – Demand)	**350**	**50**	**50**	**50**	1,300	**50**
Difference % of Recycled Demand	35.0%	3.9%	3.9%	3.9%	**50**	3.9%
Difference % of Recycled Supply	25.9%	3.7%	3.7%	3.7%	3.9%	3.7%
Total Difference (Supply – Demand)	**3,679**	**3,189**	**3,065**	**2,977**	3.7%	**2,665**
					2,834	

TABLE 14 - CITY OF ROHNERT PARK SUPPLY & DEMAND COMPARISON – MULTIPLE DRY YEAR WITH PDA BUILD OUT (AFY)

	Planning Year					
	2015	**2020**	**2025**	**2030**	**2035**	**2040**
Potable Water Supply	8,949	8,949	8,949	8,949	8,949	8,949
Potable Water Demand (2015 Demand Update)	5,415	5,605	5,729	5,817	5,960	6,129
Additional Project Potable Demand	205	205	205	205	205	205
Difference Potable Supply (Supply – Demand)	**3,329**	**3,139**	**3,015**	**2,927**	**2,784**	**2,615**
Difference % of Potable Demand	59.2%	54.0%	50.8%	48.6%	45.2%	41.3%
Difference % of Potable Supply	37.2%	35.1%	33.7%	32.7%	31.1%	29.2%
Recycled Water Supply	1,350	1,350	1,350	1,350	1,350	1,350
Recycled Water Demand	1,000	1,300	1,300	1,300	1,300	1,300
Difference Recycled Supply (Supply – Demand)	**350**	**50**	**50**	**50**	**50**	**50**
Difference % of Recycled Demand	35.0%	3.9%	3.9%	3.9%	3.9%	3.9%
Difference % of Recycled Supply	25.9%	3.7%	3.7%	3.7%	3.7%	3.7%
Total Difference (Supply – Demand)	**3,679**	**3,189**	**3,065**	**2,977**	**2,834**	**2,665**

5.1 Capital Outlay and Permits Necessary to Support Planned Development

While the City's water supply is sufficient to support the proposed planned development, an improvement to the distribution system is necessary to better serve the Central Rohnert Park PDA. Within the Central Rohnert Park PDA, the water distribution system consists primarily of 6 and 8-inch water mains. The City has a planned Capital Improvement project that will parallel the 4-inch distribution mains at the north end of the Central Rohnert Park with an 8-inch distribution main to improve the overall performance of the distribution system.

5.2 Summary

In general, the existing water supply sources and facilities are expected to be sufficient to provide an adequate supply of water to meet current and future demands within the PDA. A planned capital improvement project will remove the one restriction in the distribution system that serves the PDA. While the overall distribution system for both potable and recycled water is adequate, site specific improvements may be required to accommodate individual development proposals.

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APPENDIX G

Site Photos

Site Photo 1—Commerce Boulevard and Avram Avenue

This is a view of the southwest corner of the plan area looking north at the intersection of Commerce Boulevard and Avram Avenue. The west side of Commerce Boulevard is dominated by trees that buffer U.S. 101 (not pictured). Miscellaneous office buildings are east of the intersection. A traffic signal and street light can be seen at the intersection. The background is dominated by trees on the east side of Commerce Boulevard.

Site Photo 2—Seed Farm Drive and Santa Alicia Drive

This is a view near the intersection of Seed Farm Drive and Santa Alicia Drive, in the southeast corner of the plan area. A pedestrian walkway that crosses over the Northwest Pacific Railroad line is shown between Seed Farm Drive and the railroad. Residential high-density housing units (not pictured) are located along the west side of Seed Farm Drive. Trees are located along the west side of Seed Farm Drive and east of the railroad tracks.

Site Photo 3—State Farm Drive and Enterprise Drive

This is a view from the intersection of State Farm Drive and Enterprise Drive in the south-central portion of the plan area looking north from the intersection toward State Farm Drive. Parking associated with the eastern segment of the Altamont Senior Apartment complex is visible from the street to serve the apartments to the west. Redwood trees are prevalent along the east side of State Farm Drive.

Site Photo 4—Northwest Pacific Railroad

This is a view taken along the eastern boundary of the plan area, showing the Northwest Pacific Railroad tracks going north. The redwood trees west of the train tracks provide a buffer to the now-vacant State Farm complex. A mobile home park is located east of the plan area.

Site Photo 5—State Farm Drive and Rohnert Park Expressway

This is a view at the intersection of State Farm Drive and Rohnert Park Expressway, in the central portion of the plan area looking east toward the frontage of Rohnert Park Expressway and the vacant State Farm campus. A landscaped median with redwood trees separates the eastbound traffic from the westbound lanes (westbound traffic is not shown).

Site Photo 6—U.S. 101 and Rohnert Park Expressway

This view looks east along Rohnert Park Expressway, coming from the U.S. 101 off-ramp, in the west-central portion of the plan area. Various commercial businesses and streetlights are visible along the roadway. Trees are visible in the background and the hillsides east of Rohnert Park are visible in the distance.

Site Photo 7—City Center Drive

This is a view looking west from the plan area along City Center Drive. Residential development is located along the north side of the road; the Civic Center developments and plaza are located south of the road. The parking lot in the left foreground is shared by the adjacent City of Rohnert Park Public Safety Building and Rohnert Park–Cotati Regional Library (not pictured).

Site Photo 8—Commerce Boulevard and Professional Center Drive

This is a view facing west along Commerce Boulevard, at the intersection with Professional Center Drive in the west-central portion of the plan area. Commercial and office buildings are visible in the foreground, middleground, and background. An empty lot is visible north of the intersection. Trees are located along the street frontages on both sides of the roadway.

Site Photo 9—Professional Center Drive and State Farm Drive

This view looks east of the intersection of Professional Drive and State Farm Drive, in the north-central portion of the plan area. The office buildings are north of Professional Drive. Trees are located within a median, separating the east traffic lanes.

Site Photo 10—Commerce Boulevard and Cascade Court

This is a view looking northeast of the intersection of Commerce Boulevard and Cascade Court, in the northwest portion of the plan area at the now-vacant, former Yardbird property. The middleground is dominated by an empty parking lot and leveled space associated with a razed building. Adjacent light industrial buildings can be seen in the background, looking to the hillsides to the northeast.

Site Photo 11—Commerce Boulevard and Golf Course Drive

This is a view just south of the intersection of Commerce Boulevard and Golf Course Drive, near the northern corner of the plan area. The U.S. 101 northbound lane is in the middleground. Various industrial businesses are east of Commerce Boulevard. Infrastructure including signal lights, lampposts, and street trees are visible along the roadway.

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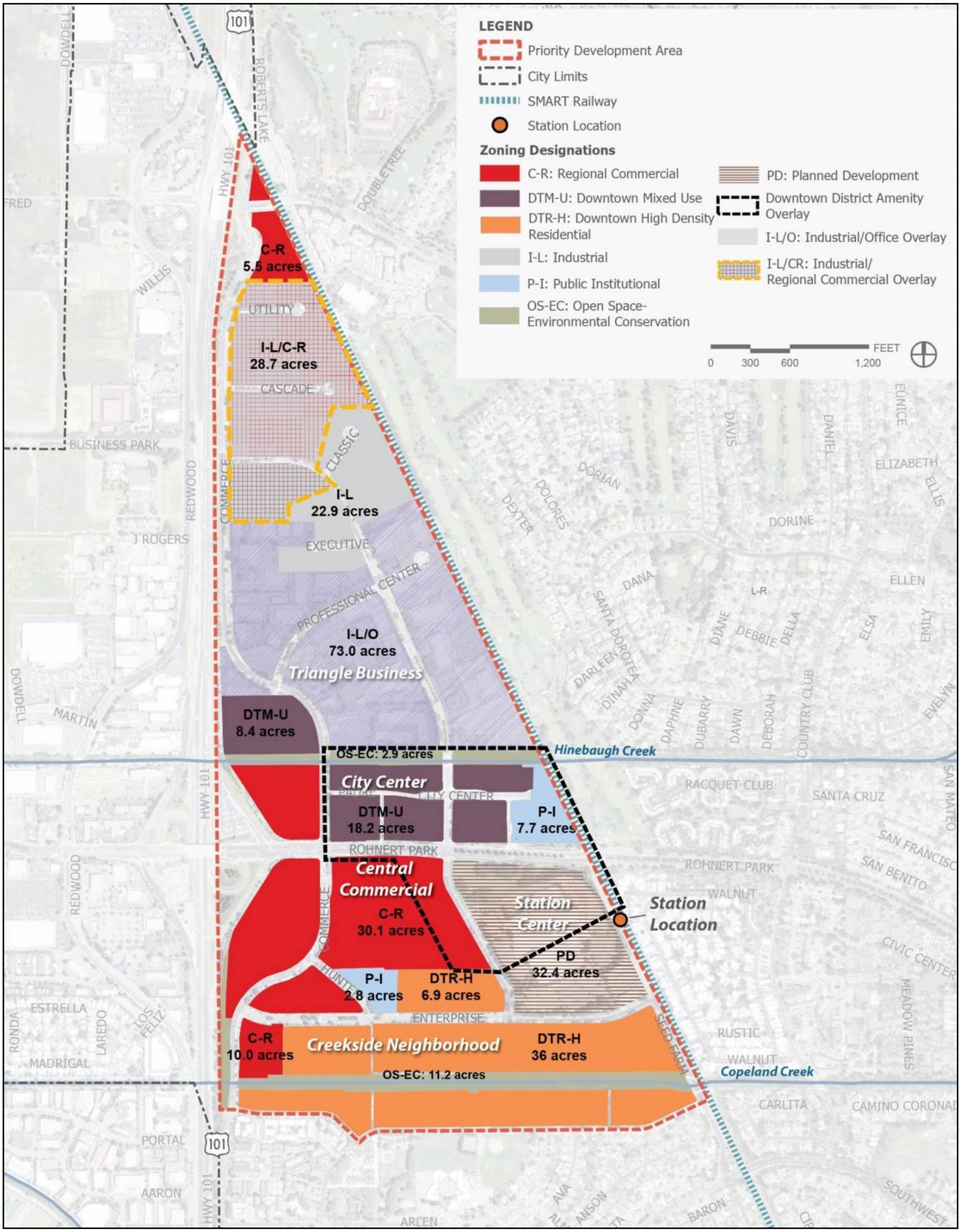
APPENDIX H

Land Use Policy Consistency Table



Sources: City of Rohnert Park, 2015; AECOM, 2015

Figure H-1: Proposed Zoning

Source: Data compiled by AECOM in 2015

Figure H-2: Proposed Station Center Land Uses

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
Land Use and Growth Management Element		
LU-2	Require sites designated as Mixed Use—University District, City Center, Southwest Shopping Center, and near Bodway Parkway/ Valley House Road—to be developed with a variety of residential and non-residential uses, in accordance with the delineated land use program for the Specific Plan areas in this chapter.	Consistent. As described in Chapter 2, “Project Description,” the proposed plan includes the Downtown Mixed Use zoning designation for the City Center subarea. The Downtown Mixed Use designation accommodates a variety of compatible businesses, stores, institutions, service organizations, and residences in a pedestrian-oriented setting. Allowable uses include multifamily residences, retail shops, financial, business and personal services, and restaurants.
LU-4	Develop the City Center and the Sonoma Mountain Village Planned Development as mixed-use, pedestrian-oriented areas.	Consistent. See consistency discussion for Policy LU-2, above.
LU-6	Locate new Medium- and High-Density Residential development adjacent to parks, creekways, or other open space, in order to maximize residents’ access to recreational uses, or adjacent to a Mixed-Use or Neighborhood Commercial Center, to maximize access to services.	Consistent. A total of 8.5 acres of public parks/open space uses are proposed for the plan area. Approximately 6 acres would be part of redevelopment in the Station Center subarea and 2.5 acres of open space are suggested for an approximately 25-foot-wide paseo between Professional Drive and Utility Court and other open space, to improve bike and pedestrian access in the Triangle Business subarea. Other suggested parks and open space uses would be dispersed within the plan area (see Figure 2-7).
LU-7	Encourage new neighborhood commercial facilities and supermarkets to be located to maximize accessibility to all residential areas.	Consistent. As shown in Table 2-3 of the draft EIR, the additional development potential of retail or service commercial would be approximately 441,000 square feet. Neighborhood commercial uses would be allowed at the ground level in the DTM-U zones (with residential above), which are primarily in the City Center and Station Center subareas, and would be accessible to residential areas.
LU-8	Require that residential development projects comply not only with the stipulated maximum density for the range, but the minimum density as well.	Consistent. Residential development in the plan area would comply and would have at least the permitted minimum and up to the maximum density for the applicable subarea.
LU-10A	Coordinate the adoption of each specific plan and planned development in a manner that provides for the systematic implementation of the General Plan, as is consistent with the growth management and public facilities goals and policies of this General Plan. In order to carry out this policy, the City Council may elect to adopt one specific plan and/or planned development at a time, determine priorities for the adoption of each specific plan/ planned development, initiate the preparation of a specific plan and/or planned development, or otherwise take action to ensure that the adoption of specific plans and planned developments adhere to the growth management and public facilities goals and policies of	

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
	this General Plan. Require that all specific plans and planned developments prepared pursuant to this General Plan include the following components:	
	• A land use program as specified for each Specific Plan and Planned Development area in the General Plan, including the maximum and minimum development for each land use type; and	Consistent. Chapter 4 of the PDA Plan provides a land use program and the maximum development for each land use type. Because the plan area includes existing development, no minimum standards have been set.
	• A detailed traffic study, prepared by a City-approved traffic/ transportation planner, and reasonable mitigation measures to mitigate traffic impacts resulting from the development; and	Consistent. Section 3.9, “Transportation and Traffic,” of this draft EIR contains a summary of a detailed traffic study conducted by AECOM for the plan area.
	• The proposed location and capacity of major infrastructure components, including wells, sewage, water, drainage, solid waste, disposal, energy, and other essential facilities proposed to be located within the area covered by the Specific Plan/Planned Development; and	Consistent. As described in Chapter 2, “Project Description,” of this draft EIR, the proposed plan would include the necessary extensions from existing infrastructure systems to supply these utilities to future development in the plan area.
	• A site-specific biological assessment of wetlands, habitat areas, and creeksides by a City-approved biologist, and a program for conservation/mitigation to the extent feasible; and	Consistent. Section 3.2, “Biological Resources,” of this draft EIR provides a biological assessment for the plan area.
	• Survey for California tiger salamander (CTS), both in breeding habitat and adjacent upland estivation habitat, with appropriate mitigation, including avoidance and minimization measures; and	Consistent. Section 3.2, “Biological Resources,” of this draft EIR provides an analysis of potential impacts on the CTS. No breeding habitat or upland habitat for CTS is present in the plan area; however, because of the potential for dispersal into the plan area, Mitigation Measure 3.2-4 would require preconstruction surveys at active construction areas for special-status amphibian species.
	• Program for conservation of the natural resources along creeks and standards for the conservation, development, and use of natural resources where applicable; and	Consistent. Section 3.2, “Biological Resources,” and Section 3.7, “Hydrology and Water Quality,” of this draft EIR provide assessments of the natural resources and water quality in the plan area. Mitigation Measures 3.2-1 through 3.2-5 and 3.7-1 require measures to protect natural resources and the creeks and would reduce impacts to a less-than-significant level. Chapter 4, Goal L-7 of the PDA Plan provides standards for the conservation, development, and use of natural resources (e.g., Hinebaugh and Copeland Creek ways).
	• Park and open space in accordance with the General Plan	Consistent. As described in Chapter 2, “Project Description,” the proposed plan provides for approximately 8.5 acres of parks/open space in the plan area.

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
	designation, including access and connections to the bicycle system shown on Figure 4-3; and	Section 5.7, "Recreation," provides an assessment of parks and open space in the plan area. Section 3.9, "Transportation and Traffic," concludes that the proposed plan provides improvements consistent with the *Rohnert Park Bicycle and Pedestrian Master Plan*. The proposed plan would provide bicycle access through existing and planned improvements (see Figure 2-9).
	• Hydrology and drainage for the area, with a goal to minimize runoff, and drainage practices to be incorporated as part of individual projects to meet the Specific Plan/Planned Development objectives; and • Plan to prevent stormwater pollution, including measures to be incorporated as part of development on individual sites; and	Consistent. Section 3.9, "Hydrology and Water Quality," of this draft EIR provides an assessment of hydrology and water quality in the plan area. Mitigation Measures 3.9-1 through 3.9-4 require measures to minimize runoff and stormwater pollution, and would reduce impacts to a less-than-significant level. Chapter 7, Goal U-1 of the PDA Plan provides hydrology and drainage standards and practices to be incorporated as part of the projects in the plan area.
	• Demonstration of adequate water supply.	Consistent. Section 3.17, "Utilities and Service Systems," of this draft EIR provides an analysis of water supply for the plan area. Section 3.17 concluded that there is adequate water supply to serve the plan area at buildout.
LU-10B	Include within each Specific Plan and Planned Development, standards and criteria by which development will be phased, and standards for the conservation, development, and use of natural resources.	Consistent. The PDA Plan is intended to serve as the primary document and reference guide for future development in the plan area, and it provides a policy and regulatory framework for the review of future development projects and public improvements. Chapter 4 of the PDA Plan includes permitted land uses, and the development standards for each land use designation.
LU-10C	Permit hospitals, schools, police and fire stations, parks and other facilities that serve a vital public interest, subject to findings and necessary environmental review, to be located in a Specific Plan/Planned Development area, even if a Specific Plan or Planned Development for the area has not been adopted.	Consistent. The proposed plan includes DTM-U and P-I zones, which both allow institutional uses. As described in Chapter 2, "Project Description," up to approximately 58,000 square feet of public institutional facilities is planned in the City Center and Central Commercial subareas.
LU-10D	As part of development of Specific Plans and Planned Developments, through site planning and other techniques, ensure adequate transitions between incompatible uses, while promoting the General Plan intent of integrated development of compatible uses.	Consistent. Chapter 6 of the PDA Plan contains design guidelines to provide transitions to adjacent uses and transitions from public to private space. The design guidelines in the PDA Plan supplement the Rohnert Park Design Guidelines, which includes standards for transition areas between uses.
LU-31	Allow, but do not require, mixed- or multi-use development.	Consistent. As described in Chapter 2, "Project Description," the proposed plan includes areas designated for DTM-U, which allows for a variety of uses. Multiple uses are not required in DTM-U zones, and would not preclude the construction of one type of allowed use in a DTM-U zone. Uses other than DTM-U are also planned within the plan area.

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
GM-16	As part of preparation and approval of specific plans and any other implementing ordinances, regulations, and development agreements, and allocation of development entitlements for areas of new development, balance non-residential development with residential development over the different phases, and require that the contemplated balance of housing types is attained at buildout.	Consistent. In addition, the PDA Plan provides the policy and regulatory framework for the review of future development within the plan area to confirm that the new development would be consistent with the PDA Plan, and within the balance of nonresidential and residential development at buildout. Chapter 4, Table 4.2 of the PDA Plan shows the balance between residential and nonresidential development.
Community Design Element		
CD-1	As part of preparation of specific plans, ordinances, capital improvements programs, design of public buildings, and other measures, ensure that the University District and the City Center are developed as citywide destinations and with a pedestrian orientation.	Consistent. The policies and design guidelines in the PDA Plan for the City Center subarea would require pedestrian-oriented development, and would also be consistent with the City Center Concept Plan. As described in Chapter 2, “Project Description,” one of the PDA Plan’s main objectives is to support the creation of a downtown for Central Rohnert Park in a pedestrian-oriented development pattern. Policy L-2.3 (Chapter 4) of the PDA Plan encourages the development of the City Center subarea as a citywide destination.
CD-2	Develop linkages between different parts of the city, and foster creation of unique elements that provide identity to the city and the neighborhoods and result in the creation of diverse and distinctive places.	Consistent. As described in Chapter 2, “Project Description,” the proposed plan would include a number of transportation and circulation improvements that would provide connections within the plan area and to the surrounding areas. Chapter 4, Goal L-1 and Chapter 5, Goal C-3 encourage the development of a complete community, with distinct mixed-use areas and places and support vehicular, bike, and pedestrian connections between the plan area and the rest of the city.
CD-19	As part of updating the City’s zoning regulations or applicable specific plans, adopt standards to foster pedestrian orientation of new development in Mixed-Use and Neighborhood Commercial areas by: • Developing a coherent set of standards for buildings, so that building façades and entrances *define* the streetscape and promote street activity; • Maintaining volumetric building standards that require buildings to be located at the street by *establishing* maximum setback or “build-to lines,” with appropriate step-backs for upper stories; • Ensuring that primary entrances of buildings face the street; • Requiring that parking is provided in the interior of the block, screened by the building or landscaping; • Requiring awnings and canopies for pedestrian comfort, where appropriate; and	Consistent. Chapter 3 of the PDA Plan contains development standards and Chapter 6 contains community design guidelines to establish the urban form and expectations for streetscape, site planning, and general building design in the plan area. These standards supplement the Rohnert Park Design Guidelines. · Chapter 3.2.1 of the PDA Plan includes an overview of the vision for the plan area, which would include distinctive architectural features, pedestrian-oriented identity, mixed-use development, and general accessibility. o Triangle Business subarea—Streetscape improvements; shared-use driveways; façade improvements. o City Center subarea—broad sidewalks, mixed-use and pedestrian-friendly. o Station Center subarea—Walkable street grid. o Central Commercial subarea—Parking lot landscaping and shading. · Chapter 6.2.3 of the PDA Plan includes the communitywide design

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
	• Establishing building transparency from sidewalks.	guidelines, and Chapter 6.3.1 contains the subarea and neighborhood design guidelines, specifically for commercial and commercial mixed-use. These guidelines include standards for: o Building setbacks and guidelines that specify buildings should face the street with windows, entries, and other openings facing a public street. o Building orientation that would require architectural elements such as awnings, overhands, and arcades and buildings fronting the street. o Commercial frontages that should provide a transparent façade area along the street. o Locating parking within interior parcels, adjacent to service or parking alleys.
CD-26	Design local streets to not only accommodate traffic, but also to serve as comfortable pedestrian environments. These should include, but not be limited to: • Street tree planting adjacent to curb and between the street and sidewalk to provide a buffer between the *pedestrian* and the automobile, where appropriate; • *See Figure 3.2-5 for an illustrative diagram.* • Minimum curb cuts along streets; and • Sidewalks on both *sides* of streets, where feasible.	Consistent. Chapters 5 and 6 of the PDA Plan establish the standards for roadways and community design guidelines, respectively. The guidelines include: · reducing curb cuts, · minimum sidewalk width of 15 feet, and · tree planting and landscaped planting strips in the furnishing zone to provide a buffer between pedestrians and the road.
CD-40	Use an adopted City Center Concept Plan (Policy LU-30) as the basis for the development character of the area.	Consistent. The PDA Plan contains policies and guidelines for the City Center subarea that build on the City Center Concept Plan.
CD-53	Ensure that new development in existing neighborhoods is respectful of the character of existing uses and causes minimal design intrusion.	Consistent. Chapter 6 of the PDA Plan contains design guidelines to ensure that new development is compatible with existing uses.
CD-55	Require all development within commercial subareas to provide pedestrian amenities, including: • Pedestrian walkways through parking lots to connect buildings on opposite sides of parking areas; • Sidewalks wide enough to accommodate pedestrian use; • Sidewalk intersection bulbs, to reduce the walking distance across streets; • Pedestrian lighting, benches, street trees, and other sidewalk	Consistent. Chapter 6 of the PDA Plan contains community design guidelines that address development within the commercial subarea, in addition to the requirements in the Rohnert Park Design Guidelines.

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
	amenities; and • Landscaping that complements pedestrian circulation and eliminates barriers to pedestrian access.	
Housing Element		
HO-1	Promote residential development within the current city limits.	Consistent. The plan area is within current city limits.
HO-4	Promote a diversity of housing types, including single-family detached and attached residences, mobile homes, multi-family rental and ownership units, second units, and units combined with non-residential uses.	Consistent. The proposed plan envisions a range of housing types that include detached single-family homes, townhomes, mixed-use lofts, apartments, and condominiums.
HO-10	Preserve the affordability of the city's existing affordable housing stock.	Consistent. Policy L-5.1 (Chapter 4) of the PDA Plan would require new affordable housing options in the City Center subarea. Existing affordable housing in the plan area would remain.
Open Space and Public Facilities		
OS-7	Use creek protection zones (see Section 6.2) for permanent public open space and compatible purposes, including habitat conservation, bike and walking paths, wildlife habitat, and native plant landscaping. Creeks are located in close proximity to residential neighborhoods, providing accessible open space getaways for residents. Adverse impacts on ecologically sensitive habitat, wildlife, and wetlands should be minimized in the planning, construction, and maintenance of paths.	Consistent. Chapter 4 (Policies L-7.1 through L-7.4) of the PDA Plan provides standards for the conservation, development, and use of natural resources and establishes creek protection zones (e.g., Hinebaugh and Copeland Creek ways). Section 3.2 of this draft EIR provides an assessment of biological resources in the plan area. Mitigation Measures 3.2-1 through 3.2-5 and 3.7-1 require measures to protect natural resources and the creeks, and would reduce impacts to a less-than-significant level.
OS-16	Expand the city's network of bike and pedestrian paths in areas of new development.	Consistent. As described in Chapter 2, "Project Description," the proposed plan would expand bike and pedestrian paths through existing and planned improvements within the plan area. These improvements include upgrades to existing bicycle facilities, adding new bike and pedestrian access, completing trail gaps along Hinebaugh Creek, adding bicycle connections through the Station Center subarea, adding a bike/pedestrian overcrossing of Rohnert Park Expressway to connect the City Center and Station Center subareas, and completing walkway improvements.
Environmental Conservation		
EC-2	Ensure the protection of known archaeological resources in the city by requiring a records review for any development proposed in areas that are considered archaeologically sensitive for Native American and/or historic remains. Require construction activities and development adjacent to sites of historic or archaeological	Consistent. Section 3.3, "Cultural Resources," of this draft EIR provides an assessment of archaeological resources. A records review has been conducted per this policy to determine whether the plan area is an archaeologically sensitive area for Native Americans and/or historic remains. Mitigation Measures 3.3-1 and 3.3-2 would require the implementation of procedures for inadvertent discovery of cultural

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
	resources to avoid degradation by: · Studying the potential effects of development and construction in the resource; · Requiring pre-construction surveys and monitoring during any ground disturbance for all development in areas of historical and archaeological sensitivity; and · Implementing appropriate measures to avoid the identified impacts.	resources and/or the discovery of human remains, and would reduce impacts to a less-than-significant level.
EC-3	In accordance with the California Environmental Quality Act (CEQA) and the State Public Resources Code, require the preparation of a resource mitigation plan and monitoring program by a qualified archaeologist in the event that archaeological resources are discovered.	Consistent. Section 3.3, "Cultural Resources," of this draft EIR provides an assessment of archaeological resources. Mitigation Measures 3.3-1 and 3.3-2 would require the implementation of procedures for inadvertent discovery of cultural resources and/or the discovery of human remains, and would reduce impacts to a less-than-significant level.
EC-4	Cooperate with state and federal agencies to ensure that development does not substantially affect special-status species appearing on any state or federal list of rare, endangered, or threatened species. Require assessments of biological resources prior to approval of any development within 300 feet of any creeks, high potential wetlands, or habitat areas of identified special-status species, as depicted on Figure 6.2-1.	Consistent. Section 3.2, "Biological Resources," of this draft EIR provides an assessment of biological resources for the plan area, including a discussion of special-status species and sensitive habitats that have the potential to be within the plan area. Mitigation Measures 3.2-1 through 3.2-5 would require preconstruction surveys, erosion control measures, and a tree mitigation plan; and Mitigation Measure 3.7-1 would require a site-specific SWPPP (including erosion controls), which would reduce impacts on sensitive natural communities and special-status species to a less-than-significant level.
EC-7	Encourage planting of native vegetation in new development sites, parks, public areas, and open space.	Consistent. Policy L-7.4 (Chapter 4) of the PDA Plan requires the use of native species in new development sites, parks, public areas, and open space. Chapter 6 of the PDA Plan includes guidelines to use native tree species and drought-tolerant plant materials.
EC-12	Protect oaks and other native trees that are of significant size through the establishment of a Heritage Tree Preservation Ordinance.	Consistent. Section 3.2, "Biological Resources," of this draft EIR provides an assessment of potential impacts on protected trees. Mitigation Measure 3.2-5 would require the preparation and implementation of a tree mitigation and replacement plan for trees proposed for removal that meet the definition of "protected tree" under the City's Zoning Ordinance and Municipal Code.
EC-13	Maintain creek protection zones extending a minimum of 50 feet (measured from the tops of the banks and a strip of land extending laterally outward from the top of each bank) for creeks, with extended buffers where significant habitat areas or high potential wetlands exist (Figure 6.2-2). Where high potential wetland or other biological resources exist, require appropriately wide buffers	Consistent. Development under the proposed plan would not occur within the creek protection zones. See Policy LU-10A, above, regarding protection of biological resources, hydrology, and water quality.

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
	to encompass and protect the resource. Development shall not occur within this zone, except as part of greenway enhancement (for example, trails and bikeways). Require City approval for the following activities within the creek protection zones: · Construction, alteration, or removal of any structure; · Excavation, filling, or grading; · Removal or planting of vegetation (except for removal of invasive plant species); or · Alteration of any embankment.	
EC-14	As part of specific plans, require evaluation and implementation of appropriate measures for creek bank stabilization, and any necessary steps to reduce erosion and sedimentation, but preserve natural creek channels and riparian vegetation.	Consistent. Section 3.7, "Hydrology and Water Quality," of this draft EIR provides an assessment of potential impacts on existing creeks (Copeland and Hinebaugh Creeks) from erosion and sedimentation in the plan area. Development under the proposed plan would not occur within these established waterways. Mitigation Measure 3.7-2 would require all project construction to submit site-specific erosion control plans before all grading activities that could contribute to any sedimentation.
EC-19	Require new construction to use site preparation, grading, and foundation designs for erosion control to prevent sedimentation and contamination of streams.	Consistent. Section 3.7, "Hydrology and Water Quality," of this draft EIR provides an assessment of construction activity and erosion control. Mitigation Measure 3.7-1 would require the preparation of a site-specific SWPPP for future development. Implementation of best management practices required by the SWPPP would reduce the potential of sedimentation and contamination of streams to a less-than-significant level.
EC-23	Use the City's development review process and CEQA regulations to evaluate and mitigate the local and cumulative effects of new development on air quality.	Consistent. Section 3.1, "Air Quality," of this draft EIR provides an assessment of project and cumulative impacts on air quality prepared per this policy.
Health and Safety		
HS-5	As part of the building permit process, require all development projects to comply with hydrology and drainage policies incorporated in the applicable Specific Plans. Require the project proponent to design and construct a storm drain system in accordance with the Sonoma County Water Agency (SCWA) Flood Control Design Criteria (latest revision), specific to the proposed plan. Encourage the use of environmentally sensitive drainage improvements, including flow reduction and flood bypass systems, in order to ensure protection of surface water quality and stream integrity.	Consistent. See consistency discussion in LU-10A, above.

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
HS-6	As part of the building permit process, require new development greater than 5 acres in size to prepare and implement an SWPPP that effectively reduces discharges of stormwater containing sediment and other pollutants resulting from site construction activities. In addition, require all projects, regardless of size, to comply with any other stormwater provisions of the specific plans for their respective areas.	Consistent. Section 3.7, "Hydrology and Water Quality," of this draft EIR provides an assessment of construction activity impacts on stormwater. Mitigation Measure 3.7-1 would require the preparation of a site-specific SWPPP for future development.
HS-11	In cooperation with the SCWA, maintain floodplain areas, drainage channels, and other drainage structures, and improve drainage channel capacity in ways that will preserve the natural character of habitat areas, riparian corridors, and waterways to the maximum extent feasible.	Consistent. Section 3.7, "Hydrology and Water Quality," of this draft EIR provides an analysis of hydrology and drainage impacts in the plan area. As shown in Section 3.7, impacts related to hydrology and water quality were found to be less than significant. The entire plan area is within FEMA flood hazard Zone X, which means that it is outside of both the 100-year and 500-year floodplains. Furthermore, General Plan Policy EC-13 requires maintaining creek protection zones extending a minimum of 50 feet; and Policy HS-5 requires the project proponent to design and construct a storm drain system in accordance with the SCWA Flood Control Design Criteria specific to the proposed plan.
HS-15	Require new multi-family residential and all non-residential development to incorporate attractive and convenient interior and exterior storage areas for recyclables into new or remodeled buildings, to make recycling activities more convenient for those who use the buildings.	Consistent. Chapter 6, "Community Design Guidelines," includes standards for trash enclosures.
Housing		
HO-2	Facilitate residential development within the growth areas.	Consistent. The Central Rohnert Park plan area was identified as an area in which to concentrate future growth. The PDA Plan establishes the policies, standards, and guidelines to facilitate the residential development within the plan area.
HO-3	Ensure that residential sites are served by adequate infrastructure and services.	Consistent. Section 5.6, "Public Services," Section 5.7, "Recreation," and Section 5.8, "Utilities and Service Systems," of this draft EIR provide an assessment of infrastructure and services for the plan area. These sections concluded that infrastructure and services are adequate for the plan area at build-out.
HO-4	Promote a diversity of housing types, including single-family detached and attached residences, mobile homes, multi-family rental and ownership units, second units, and units combined with non-residential uses.	Consistent. Policy L-4.1 (Chapter 4) of the PDA Plan encourages a variety of housing types and mixed use in the plan area.

Consistency of the Proposed Plan with the City of Rohnert Park General Plan

Policy Number	General Plan Policy	Proposed Plan Consistency
HO-9	Require the provision of affordable housing as part of residential development throughout the community.	Consistent. Policy L-5.1 and L-5.2 (Chapter 4) of the PDA Plan would require new affordable housing options in the City Center subarea. Existing affordable housing in the plan area would remain.
HO-24	Promote the use of energy conservation features in the design of residential development.	Consistent: Policies L-8.1 and L-8.2 (Chapter 4) of the PDA Plan require that future development under the proposed plan design for natural cooling and passive solar heating and support the use of green or sustainable building materials, including recycled-content materials. Chapter 5 of the PDA Plan also includes guidelines to promote energy conservation in site, landscape, and building design.

Note: CTS = California tiger salamander; FEMA = Federal Emergency Management Agency; EIR = initial study/mitigated negative declaration; DTM-U = Downtown Mixed Use; P-I = Public/Institutional; Rohnert Park Design Guidelines = *City of Rohnert Park Design Guidelines for Commercial, Mixed-Use and Multi-family Buildings*; SCWA = Sonoma County Water Agency; SWPPP = storm water pollution prevention plan

Source: City of Rohnert Park, 2014 (originally adopted 2000); compiled by AECOM in 2015

APPENDIX I

EIR Notice of Preparation and Scoping

NOTICE OF PREPARATION OF DRAFT ENVIRONMENTAL IMPACT REPORT

NOTICE OF PUBLIC SCOPING MEETING

AB 52 PROJECT NOTIFICATION

OCTOBER 28, 2015

Project Title: Central Rohnert Park Priority Development Area Plan

Project Location: Center of the City of Rohnert Park, bounded by U.S. 101, the Northwestern Pacific Railroad, and Avram Avenue/Santa Alicia Drive (Figure 1, Regional Location)

Lead Agency/Sponsor: City of Rohnert Park

The City of Rohnert Park (City) will prepare an Environmental Impact Report (EIR) for the proposed Central Rohnert Park Priority Development Area (PDA) Plan (proposed project). The City is the Lead Agency for the project pursuant to the California Environmental Quality Act. This Notice of Preparation (NOP) describes the proposed project that will be analyzed in the EIR and identifies areas of probable environmental effects of the project.

Agencies and interested members of the public are invited to provide input on the scope of the environmental analysis. If you are a responsible or trustee agency, we need to know the views of your agency as to the scope and content of the environmental information which is germane to your agency's statutory responsibilities in connection with the proposed project. Due to the time limits mandated by state law, your response must be sent at the earliest possible date, but <u>no later than 30 days</u> from the date of this notice.

This NOP also serves as notification to California Native American tribes that are traditionally and culturally affiliated with the geographic area of the proposed project, pursuant to Public Resources Code 21080.3.1(Assembly Bill 52). If your tribe wishes to consult on this project, please note you have 30 days to request consultation.

Written Comment:
Please submit written comments to Jeff Beiswenger, Planner III, at any of the below:

Email: Jbeiswenger@rpcity.org

Regular Mail: City of Rohnert Park, Attn: Jeffrey Beiswenger, 130 Avram Avenue, Rohnert Park, CA 94928

Public Scoping Meeting: The City will hold a scoping meeting to provide an opportunity for agency staff and interested members of the public to submit comments, either written or verbal, on the scope of the environmental issues to be addressed in the EIR. The scoping meeting will be held on **Wednesday, November 18 2015 from 4:00 p.m. to 6:00 p.m.** at the Rohnert Park City Council Chambers, 130 Avram Avenue, Rohnert Park, CA 94928.

For questions regarding this notice, please contact Jeff Beiswenger, at (707) 588-2253 or the email address above.

Project Description:

The proposed project is a programmatic land use master plan, centered on Rohnert Park Expressway (RPX) and State Farm Drive, adjacent to the planned Sonoma Marin Area Rail Transit (SMART) commuter rail station and City Center, as shown in Figure 2, Local Setting. The proposed project is funded under the ABAG Priority Development Area planning grant program and is intended to support transit-oriented development and infill growth in existing communities, adjacent to transit. The proposed project is an existing mixed-use area, envisioned as a central business district and urban neighborhood for the city that contains new mixed-use, infill areas, building reuse/repurposing, and streetscape and other public realm improvements. The proposed project generally consists of various development types, including multi-family residential units, retail/service commercial uses, public institutional uses, office uses, light industrial uses, public park facilities, and open space. New roadways, transit, bicycle, and pedestrian improvements and corresponding circulation connections are proposed to improve non-vehicular access within the PDA, connect to and complete regional trails, and support the development of existing and new a mixed-use areas of the community, with a particular focus on providing community access to the SMART station and regional multi-use path.

Potential Environmental Effect Areas:

The City has identified the following areas of probable environmental effect of the project that will be address in the EIR:

Air Quality
Biological Resources
Cultural Resources
Geology and Soils
Greenhouse Gas Emissions
Hazards and Hazardous Materials
Hydrology and Water Quality
Noise
Transportation and Traffic

Figure 1. Regional Location

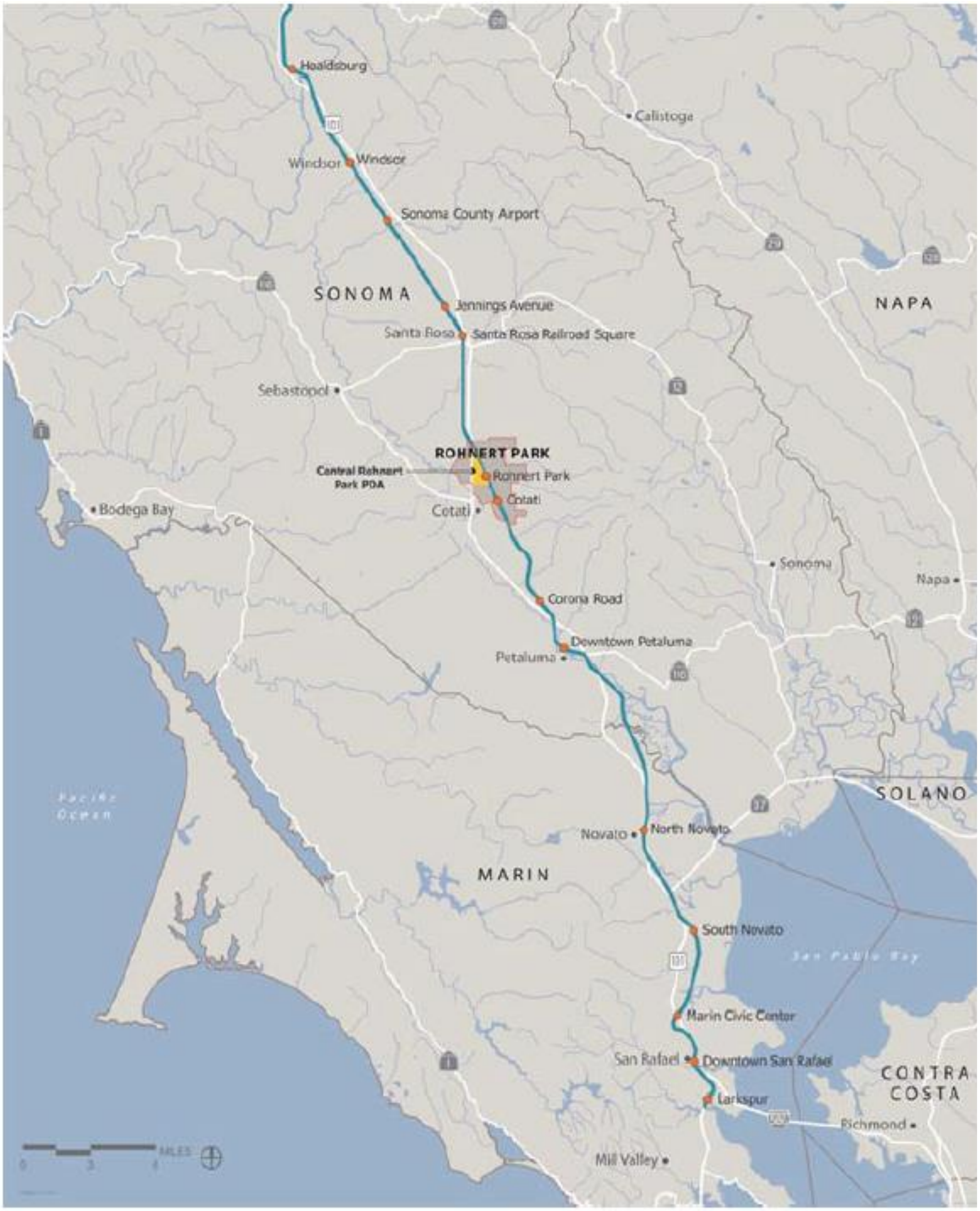
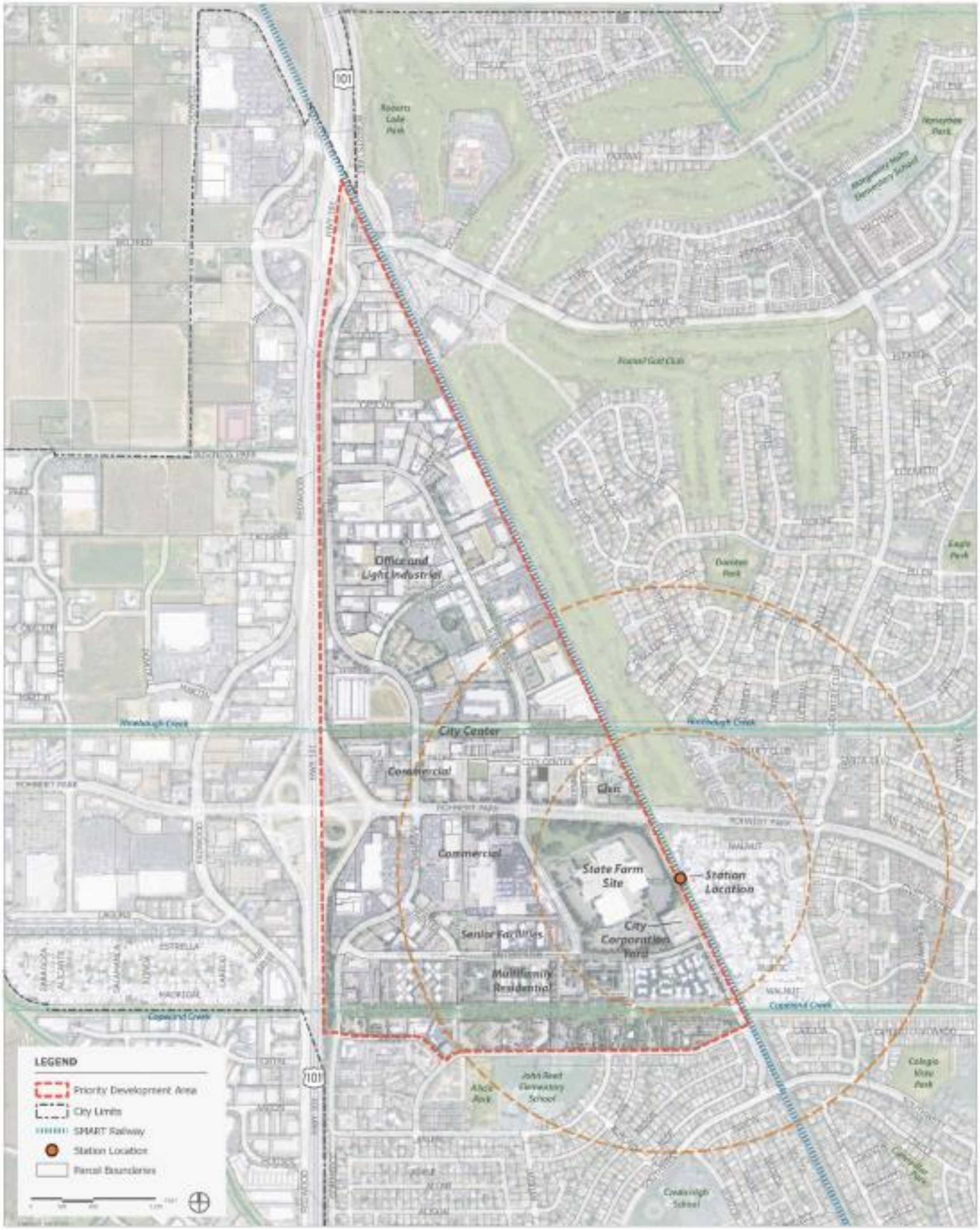


Figure 2. Local Setting



COUNTY OF SONOMA
PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
2550 Ventura Avenue, Santa Rosa, CA 95403-2829
(707) 565-1900 FAX (707) 565-1103

SENT VIA ELECTRONIC MAIL

November 25, 2015

Jeffrey Beiswenger, Planner III
City of Rohnert Park
130 Avram Avenue
Rohnert Park CA 94928
jbeiswenger@rpcity.org

Re: EIR Scope for Central Rohnert Park PDA Plan

The County of Sonoma appreciates the opportunity to comment on the scope of the forthcoming Environmental Impact Report (EIR) to be prepared for the Central Rohnert Park PDA Plan. The County supports the objectives of the proposed plan and development of a central business district with much needed mixed-use and multi-family housing opportunities.

The increased traffic impacts that accompany community development do not stop at the City boundaries. The commercial and residential development envisioned by the plan would place increased demands on the County circulation system as well. Therefore, the EIR should evaluate the cumulative impacts on both the local and regional circulation system and identify appropriate mitigation including the equitable distribution of costs through imposition of impact fees or fair share transportation contributions.

It is also recommended that Sonoma County Transit Authority's travel demand modeling program be used in the preparation of the traffic analysis for the EIR.

Thank you for considering these recommendations and for your continued partnership in planning and maintaining a sustainable County-wide transportation system.

Should you have any questions please contact me at (707) 565-7387 or email me at yolanda.solano@sonoma-county.org.

Sincerely,

Yolanda G. Solano
Planner III

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
P.O. BOX 23660
OAKLAND, CA 94623-0660
PHONE (510) 286-5528
FAX (510) 286-5559
TTY 711
www.dot.ca.gov

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November 30, 2015

SON1011921
SON-101-VAR
SCH # 2015102081

Mr. Jeffrey Beiswenger
City of Rohnert Park
Planning Department
130 Avram Avenue
Rohnert Park, CA 94928

Central Rohnert Park Priority Development Area Plan – Notice of Preparation

Dear Mr. Beiswenger:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the Central Rohnert Park Priority Development Area (PDA) Plan. Caltrans' new mission, vision, and goals signal a modernization of our approach to California's transportation system, in which we seek to reduce statewide vehicle-miles-traveled (VMT) and increase non-auto modes of active transportation. Our comments seek to promote the State's smart mobility goals and are based on the Notice of Preparation.

Project Understanding
The proposed project is a programmatic land use master plan that is intended to support transit-oriented and infill development nearby the Rohnert Park City Center and planned Sonoma Marin Area Rail Transit (SMART) commuter rail station. The proposed developments would be centered on the Rohnert Park Expressway/State Farm Drive intersection and would consist of multi-family residential units, retail/commercial, public institutional space, offices, light industrial, public park facilities and open space. In addition, new roadways, transit, bicycle and pedestrian improvements have been proposed to improve non-vehicular access within the PDA and provide community access to the planned SMART station.

Lead Agency
As the lead agency, the City of Rohnert Park is responsible for all project mitigation, including any needed improvements to State highways. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

Traffic Impact Study
Please ensure that the environmental document evaluates the proposed project's impact on U.S. 101 and State Route (SR) 116. We recommend using Caltrans' *Guide for the Preparation of Traffic Impact Studies* for determining which scenarios and methodologies to use in the analysis. The guide can be accessed from the following webpage:

www.dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa_files/tisguide.pdf

The TIS should include:

- A vicinity map, regional location map, and a site plan clearly showing project access in relation to nearby State roadways. Ingress and egress for all plan components should be clearly identified. The State right-of-way (ROW) should be clearly identified. The maps should also include project driveways, local roads and intersections, parking, and transit facilities.

- Plan-related trip generation, distribution, and assignment. The assumptions and methodologies used to develop this information should be detailed in the study, and should be supported with appropriate documentation.

- Average Daily Traffic, AM and PM peak hour volumes and levels-of-service (LOS) on all roadways where potentially significant impacts may occur, including crossroads and controlled intersections for existing, existing plus project, cumulative and cumulative plus project scenarios. Calculation of cumulative traffic volumes should consider all traffic-generating developments, both existing and future, that would affect study area roadways and intersections. The analysis should clearly identify the project's contribution to area traffic and any degradation to existing and cumulative LOS. Caltrans' LOS threshold, which is the transition between LOS C and D, and is explained in detail in the TIS Guide, should be applied to all State facilities.

- A schematic illustration of traffic conditions including the project site and study area roadways, trip distribution percentages and volumes as well as intersection geometrics, i.e., lane configurations, for the scenarios described above.

- The project site building potential as identified in the General Plan. The project's consistency with both the Circulation Element of the General Plan and the Congestion Management Agency's Congestion Management Plan should be evaluated.

- Identification of mitigation for any roadway mainline section or intersection with insufficient capacity to maintain an acceptable LOS with the addition of project-related and/or cumulative traffic. As noted above, the project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should also be fully discussed for all proposed mitigation measures.

Cultural Resources
Caltrans requires that a project environmental document include documentation of a current archaeological record search from the Northwest Information Center of the California Historical Resources Information System if construction activities are proposed within State ROW. Current record searches must be no more than five years old. Caltrans requires the records search, and if warranted, a cultural resource study by a qualified, professional archaeologist, and evidence of Native American consultation to ensure compliance with the California Environmental Quality Act (CEQA), Section 5024.5 and 5097 of the California Public Resources Code, and Volume 2 of Caltrans' Standard Environmental Reference (http://ser.dot.ca.gov). These requirements, including applicable mitigation, must be fulfilled before an encroachment permit can be issued for project-related work in state ROW; these requirements also apply to National Environmental Policy Act (NEPA) documents when there is a federal action on a project. Work subject to these requirements includes, but is not limited to: lane widening, channelization, auxiliary lanes, and/or modification of existing features such as slopes, drainage features, curbs, sidewalks and driveways within or adjacent to state ROW.

Encroachment Permit
Please be advised that any work or traffic control that encroaches onto the State ROW requires an encroachment permit that is issued by Caltrans. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating State ROW must be submitted to the following address: David Salladay, District Office Chief, Office of Permits, California Department of Transportation, District 4, P.O. Box 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. See the website linked below for more information:

http://www.dot.ca.gov/hq/traffops/developserv/permits.

Should you have any questions regarding this letter or require additional information, please contact Cole Iwamasa at (510) 286-5534 or cole.iwamasa@dot.ca.gov.

Sincerely,

Kent Way

for

PATRICIA MAURICE
District Branch Chief
Local Development - Intergovernmental Review

bcc:PMaurice/CIwamasa/ChronFile/