4.1 AIR QUALITY

4.1.1 Introduction

This section describes the project's impacts on air quality and the project's contribution to regional air quality emissions, identifies associated regulatory requirements, and evaluates potential impacts and identifies mitigation measures required (if any) during implementation of the Roberts' Ranch Specific Plan Project (proposed project).

A number of comments regarding air quality were received from the Yolo-Solano Air Quality Management District (YSAQMD) in response to the Notice of Preparation (NOP), which included recommendations for the air quality assessment approach to discuss whether the project design incorporates features that could reduce vehicle trips and support the use of clean technology vehicles, ensuring on-street bike lanes are included in the project circulation design, and that the environmental analysis include an assessment of potential toxic air contaminants (TACs) and odor exposure and impacts. All of the air quality concerns raised during the NOP process are addressed in this section. A copy of the NOP and letters received in response to it are included in Appendix A. The air quality model outputs are included in Appendix C.

The background information and impact analysis presented in this section is based on proposed project plans, the California Emissions Estimator Model (CalEEMod) (used to estimate project emissions), the *City of Vacaville General Plan* (City of Vacaville 2015a) and *City of Vacaville General Plan and Energy and Conservation Action Strategy Final EIR* (City of Vacaville 2014), and the YSAQMD *Handbook for Assessing and Mitigating Air Quality Impacts* (YSAQMD 2007). A copy of the Roberts' Ranch Specific Plan is available on the City's website at http://www.ci.vacaville.ca.us/index.aspx?page=874.

4.1.2 Environmental Setting

Ambient air quality is generally affected by climatological conditions, the topography of the air basin, the type and amounts of pollutants emitted, and, for some pollutants, sunlight. The proposed project site is located the within Sacramento Valley Air Basin (SVAB). Topographical and climatic factors in the SVAB create the potential for high concentrations of regional and local air pollutants. This section describes relevant characteristics of the air basin, types of air pollutants, health effects, and existing air quality levels.

The SVAB includes Sacramento, Shasta, Tehama, Butte, Glenn, Colusa, Sutter, Yuba, Yolo, and portions of Solano and Placer counties. The SVAB extends from south of Sacramento to north of Redding and is bounded on the west by the Coast Ranges and on the north and east by the Cascade Range and Sierra Nevada. The San Joaquin Valley Air Basin is located to the south.

Climate and Topography

Hot dry summers and mild rainy winters characterize the Mediterranean climate of the valley. During the year the temperature may range from 20 to 115 degrees Fahrenheit (°F) with summer highs usually in the 90s and winter lows occasionally below freezing. The high average summer temperatures, combined with very low relative humidity, produces hot, dry summers that contribute to ozone (O_3) buildup. Average annual rainfall is about 20 inches with snowfall being very rare. The prevailing winds are moderate in strength and vary from moist clean breezes from the south to dry land flows from the north.

Weather patterns throughout the SVAB are affected by geography. Mountain ranges tend to buffer the basin from the marine weather systems that originate over the Pacific. However, the Carquinez Strait creates a breach in the Coast Range on the west of this basin, which exposes the midsection of the SVAB to marine weather. This marine influence moderates climatic extremes, such as the cooling that sea breezes provide in summer evenings. These breezes also help to move pollutants out of the valley. During about half of the days from July to September, however, a phenomenon called the "Schultz Eddy" prevents this from occurring. Instead of allowing for the prevailing wind patterns to move north carrying the pollutants out of the valley, the Schultz Eddy causes the wind pattern to circle back south. This effect exacerbates the pollution levels in the area and increases the likelihood of violating federal or state standards. The effect normally dissipates around noon when the delta sea breeze arrives.

The mountains surrounding the valley can also contribute to elevated pollutant concentrations during periods of surface of elevated surface inversions. These inversions are most common in late summer and fall. Surface inversions are formed when the air close to the surface cools more rapidly than the warm layer of air above it. Elevated inversions occur when a layer of cool air is suspended between warm air layers above and below it. Both situations result in air stagnation. Air pollutants accumulate under and within inversions, subjecting people in the region to elevated pollution levels and associated health concerns. The surface concentrations of pollutants are highest when these conditions are combined with smoke from agricultural burning or when temperature inversions trap cool air, fog, and pollutants near the ground.

Pollutants and Effects

Criteria Air Pollutants

Criteria air pollutants are defined as pollutants for which the federal and state governments have established ambient air quality standards, or criteria, for outdoor concentrations to protect public health. The federal and state standards have been set, with an adequate margin of safety, at levels above which concentrations could be harmful to human health and welfare. These standards are designed to protect the most sensitive persons from illness or discomfort.

Pollutants of concern include O_3, nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter equal to or less than 10 microns (PM_{10}), particulate matter with an aerodynamic diameter equal to or less than 2.5 microns ($PM_{2.5}$), and lead. These pollutants, as well as TACs, are discussed in the following text.[1] In California, sulfates, vinyl chloride, hydrogen sulfide, and visibility-reducing particles are also regulated as criteria air pollutants.

Ozone. O_3 is a strong-smelling, pale blue, reactive, toxic chemical gas consisting of three oxygen atoms. It is a secondary pollutant formed in the atmosphere by a photochemical process involving the sun's energy and O_3 precursors, such as reactive organic gases (ROG) and nitrogen oxides (NO_x). The maximum effects of precursor emissions on O_3 concentrations usually occur several hours after they are emitted and many miles from the source. Meteorology and terrain play major roles in O_3 formation, and ideal conditions occur during summer and early autumn on days with low wind speeds or stagnant air, warm temperatures, and cloudless skies. O_3 exists in the upper atmosphere O_3 layer (stratospheric ozone) and at the Earth's surface (tropospheric ozone).

O_3 in the troposphere causes numerous adverse health effects; short-term exposures (lasting for a few hours) to high O_3 at levels can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. These health problems are particularly acute in sensitive receptors such as the sick, the elderly, and young children.

Nitrogen Dioxide. NO_2 is a brownish, highly reactive gas that is present in all urban atmospheres. The major mechanism for the formation of NO_2 in the atmosphere is the oxidation of the primary air pollutant nitric oxide, which is a colorless, odorless gas. NO_x plays a major role, together with ROG, in the atmospheric reactions that produce O_3. NO_x is formed from fuel combustion under high temperature or pressure. In addition, NO_x is an important precursor to acid rain and may affect both terrestrial and aquatic ecosystems. The two major emissions sources are transportation and stationary fuel combustion sources such as electric utility and industrial boilers.

NO_2 can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections.

Carbon Monoxide. CO is a colorless, odorless gas formed by the incomplete combustion of hydrocarbon, or fossil fuels. CO is emitted almost exclusively from motor vehicles, power plants, refineries, industrial boilers, ships, aircraft, and trains. In urban areas, such as the project

[1] The descriptions of each of the criteria air pollutants and associated health effects are based on the EPA's Criteria Air Pollutants (EPA 2016a) and the CARB Glossary of Air Pollutant Terms (CARB 2016a).

location, automobile exhaust accounts for the majority of CO emissions. CO is a nonreactive air pollutant that dissipates relatively quickly; therefore, ambient CO concentrations generally follow the spatial and temporal distributions of vehicular traffic. CO concentrations are influenced by local meteorological conditions—primarily wind speed, topography, and atmospheric stability. CO from motor vehicle exhaust can become locally concentrated when surface-based temperature inversions are combined with calm atmospheric conditions, which is a typical situation at dusk in urban areas from November to February. The highest levels of CO typically occur during the colder months of the year, when inversion conditions are more frequent.

In terms of adverse health effects, CO competes with oxygen, often replacing it in the blood, reducing the blood's ability to transport oxygen to vital organs. The results of excess CO exposure can include dizziness, fatigue, and impairment of central nervous system functions.

Sulfur Dioxide. SO_2 is a colorless, pungent gas formed primarily from incomplete combustion of sulfur-containing fossil fuels. The main sources of SO_2 are coal and oil used in power plants and industries; as such, the highest levels of SO_2 are generally found near large industrial complexes. In recent years, SO_2 concentrations have been reduced by the increasingly stringent controls placed on stationary source emissions of SO_2 and limits on the sulfur content of fuels.

SO_2 is an irritant gas that attacks the throat and lungs and can cause acute respiratory symptoms and diminished ventilator function in children. When combined with particulate matter, SO_2 can injure lung tissue and reduce visibility and the level of sunlight. SO_2 can also yellow plant leaves and erode iron and steel.

Particulate Matter. Particulate matter pollution consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. Particulate matter can form when gases emitted from industries and motor vehicles undergo chemical reactions in the atmosphere. $PM_{2.5}$ and PM_{10} represent fractions of particulate matter. Fine particulate matter ($PM_{2.5}$) is roughly 1/28 the diameter of a human hair. $PM_{2.5}$ results from fuel combustion (e.g., from motor vehicles and power generation and industrial facilities), residential fireplaces, and woodstoves. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as sulfur oxides (SO_x), NO_x, and ROG. Coarse particulate matter (PM_{10}) is about 1/7 the thickness of a human hair. Major sources of PM_{10} include crushing or grinding operations; dust stirred up by vehicles traveling on roads; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions.

$PM_{2.5}$ and PM_{10} pose a greater health risk than larger-size particles. When inhaled, these tiny particles can penetrate the human respiratory system's natural defenses and damage the

respiratory tract. $PM_{2.5}$ and PM_{10} can increase the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. Very small particles of substances such as lead, sulfates, and nitrates can cause lung damage directly or be absorbed into the blood stream, causing damage elsewhere in the body. Additionally, these substances can transport adsorbed gases such as chlorides or ammonium into the lungs, also causing injury. Whereas PM_{10} tends to collect in the upper portion of the respiratory system, $PM_{2.5}$ is so tiny that it can penetrate deeper into the lungs and damage lung tissue. Suspended particulates also damage and discolor surfaces on which they settle and produce haze and reduce regional visibility.

People with influenza, people with chronic respiratory and cardiovascular diseases, and the elderly may suffer worsening illness and premature death as a result of breathing particulate matter. People with bronchitis can expect aggravated symptoms from breathing in particulate matter. Children may experience a decline in lung function due to breathing in PM_{10} and $PM_{2.5}$. Other groups considered sensitive are smokers, people who cannot breathe well through their noses, and exercising athletes (because many breathe through their mouths).

Lead. Lead in the atmosphere occurs as particulate matter. Sources of lead include leaded gasoline; the manufacturing of batteries, paints, ink, ceramics, and ammunition; and secondary lead smelters. Prior to 1978, mobile emissions were the primary source of atmospheric lead. Between 1978 and 1987, the phase out of leaded gasoline reduced the overall inventory of airborne lead by nearly 95%. With the phase out of leaded gasoline, secondary lead smelters, battery recycling, and manufacturing facilities are becoming lead-emissions sources of greater concern.

Prolonged exposure to atmospheric lead poses a serious threat to human health. Health effects associated with exposure to lead include gastrointestinal disturbances, anemia, kidney disease, and in severe cases, neuromuscular and neurological dysfunction. Of particular concern are low-level lead exposures during infancy and childhood. Such exposures are associated with decrements in neurobehavioral performance, including intelligence quotient performance, psychomotor performance, reaction time, and growth. Children are highly susceptible to the effects of lead.

Reactive Organic Gases. Hydrocarbons are organic gases that are formed from hydrogen and carbon and sometimes other elements. Hydrocarbons that contribute to formation of O_3 are referred to and regulated as ROG (also referred to as volatile organic compounds). Combustion engine exhaust, oil refineries, and fossil-fueled power plants are the sources of hydrocarbons. Other sources of hydrocarbons include evaporation from petroleum fuels, solvents, dry cleaning solutions, and paint.

The primary health effects of ROG result from the formation of O_3 and its related health effects. High levels of ROG in the atmosphere can interfere with oxygen intake by reducing the amount

of available oxygen through displacement. Carcinogenic forms of hydrocarbons, such as benzene, are considered TACs. There are no separate health standards for ROG as a group.

Non-Criteria Air Pollutants

Toxic Air Contaminants. A substance is considered toxic if it has the potential to cause adverse health effects in humans, including increasing the risk of cancer upon exposure, or acute and/or chronic noncancer health effects. A toxic substance released into the air is considered a TAC. TACs are identified by federal and state agencies based on a review of available scientific evidence. In the state of California, TACs are identified through a two-step process that was established in 1983 under the Toxic Air Contaminant Identification and Control Act. This two-step process of risk identification and risk management and reduction was designed to protect residents from the health effects of toxic substances in the air. In addition, the California Air Toxics "Hot Spots" Information and Assessment Act, Assembly Bill (AB) 2588, was enacted by the legislature in 1987 to address public concern over the release of TACs into the atmosphere. The law requires facilities emitting toxic substances to provide local air pollution control districts with information that will allow an assessment of the air toxics problem, identification of air toxics emissions sources, location of resulting hotspots, notification of the public exposed to significant risk, and development of effective strategies to reduce potential risks to the public over 5 years.

Examples include certain aromatic and chlorinated hydrocarbons, certain metals, and asbestos. TACs are generated by a number of sources, including stationary sources, such as dry cleaners, gas stations, combustion sources, and laboratories; mobile sources, such as automobiles; and area sources, such as landfills. Adverse health effects associated with exposure to TACs may include carcinogenic (i.e., cancer-causing) and noncarcinogenic effects. Noncarcinogenic effects typically affect one or more target organ systems and may be experienced on either short-term (acute) or long-term (chronic) exposure to a given TAC.

Sacramento Valley Air Basin Attainment Designation

Pursuant to the 1990 federal Clean Air Act amendments, the U.S. Environmental Protection Agency (EPA) classifies air basins (or portions thereof) as "attainment" or "nonattainment" for each criteria air pollutant, based on whether the National Ambient Air Quality Standards (NAAQS) have been achieved. Generally, if the recorded concentrations of a pollutant are lower than the standard, the area is classified as "attainment" for that pollutant. If an area exceeds the standard, the area is classified as "nonattainment" for that pollutant. If there is not enough data available to determine whether the standard is exceeded in an area, the area is designated as "unclassified" or "unclassifiable." The designation of "unclassifiable/attainment" means that the area meets the standard or is expected to be meet the standard despite a lack of monitoring data. Areas that

achieve the standards after a nonattainment designation are re-designated as maintenance areas and must have approved Maintenance Plans to ensure continued attainment of the standards. The California Clean Air Act, like its federal counterpart, called for the designation of areas as "attainment" or "nonattainment," but based on California Ambient Air Quality Standards (CAAQS) rather than the NAAQS. Table 4.1-1 depicts the current attainment status of the proposed project site with respect to the NAAQS and CAAQS.

Table 4.1-1
Sacramento Valley Air Basin Attainment Classification

Pollutant	Averaging Time	Designation/Classification
Federal Standards		
O_3	8 hours	Nonattainment/Severe-15
NO_2	1 hour; annual arithmetic mean	Unclassifiable/attainment
CO	1 hour; 8 hours	Unclassifiable/attainment
SO_2	24 hours; annual arithmetic mean	Unclassifiable/attainment
PM_{10}	24 hours	Unclassifiable/attainment
$PM_{2.5}$	24 hours; annual arithmetic mean 24 hours	Unclassifiable/Attainment (1997 NAAQS) Nonattainment/Moderate (2006 NAAQS)
Lead	Quarter; 3-month average	Unclassifiable/attainment
State Standards		
O3	1 hour; 8 hours	Nonattainment
NO_2	1 hour; annual arithmetic mean	Attainment
CO	1 hour; 8 hours	Attainment
SO_2	1 hour; 24 hours	Attainment
PM_{10}	24 hours; annual arithmetic mean	Nonattainment
$PM_{2.5}$	Annual arithmetic mean	Attainment
Lead[a]	30-day average	Attainment
SO_4	24 hours	Attainment
H_2S	1 hour	Unclassified
Vinyl chloride[a]	24 hours	No designation
Visibility-reducing particles	8 hours (10:00 a.m.–6:00 p.m.)	Unclassified

Sources: EPA 2016b (federal); CARB 2016b (state).
Notes: CO = carbon monoxide; H2S = hydrogen sulfide; NO2 = nitrogen dioxide; O3 = ozone; PM10 = coarse particulate matter; PM2.5 = fine particulate matter; SO2 = sulfur dioxide; SO4 = sulfates
[a] CARB has identified lead and vinyl chloride as TACs with no threshold level of exposure for adverse health effects determined.

In summary, the SVAB is designated as a nonattainment area for federal and state O_3 standards, as well as the federal $PM_{2.5}$ and state PM_{10} standards. The SVAB is designated as an attainment area for federal and state CO standards, federal and state NO_2 standards, and federal and state SO_2 standards (CARB 2016b; EPA 2016b).

Local Ambient Air Quality

CARB, air districts, and other agencies monitor ambient air quality at approximately 250 air quality monitoring stations across the state. The proposed project site's local ambient air quality is monitored by the YSAQMD. Air quality monitoring stations usually measure pollutant concentrations 10 feet above ground level; therefore, air quality is often referred to in terms of ground-level concentrations. The most recent background ambient air quality data from 2013 to 2015 are presented in Table 4.1-2. The Ulatis Drive monitoring station, located at 2012 Ulatis Drive, Vacaville, California 95687, is the nearest air quality monitoring station to the project site, located approximately 1.2 miles to the northwest. The data collected at this station are considered representative of the air quality experienced in the project vicinity. Air quality data for O_3 from the Ulatis Drive monitoring station are provided in Table 4.1-2. PM_{10} data from the station located at 650 Merchant Street, Vacaville, California 95688 (approximately 3.3 miles northwest of the project site) and $PM_{2.5}$, NO_2, and CO data from the station located at 304 Tuolumne Street, Vallejo, California 94590 (approximately 23 miles southwest of the project site) are also provided in Table 4.1-2. The number of days exceeding the ambient air quality standards is also shown in Table 4.1-2.

Table 4.1-2
Local Ambient Air Quality Data

Concentration or Exceedances	Ambient Air Quality Standard	2013	2014	2015
Ozone (O_3) *(Vacaville Ulatis Drive Monitoring Station)*				
Maximum 1-hour concentration (ppm)	0.09 ppm (state)	0.084	0.089	0.085
Number of days exceeding state standard (days)		*0*	*0*	*0*
Maximum 8-hour concentration (ppm)	0.070 ppm (state)	0.073	0.072	0.071
	0.070 ppm (federal)	0.072	0.072	0.070
Number of days exceeding state standard (days)		*2*	*1*	*1*
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Nitrogen Dioxide (NO_2) *(Vallejo Tuolumne Street Monitoring Station)*				
Maximum 1-hour concentration (ppm)	0.18 ppm (state)	0.49	0.50	0.44
	0.100 ppm (federal)	0.494	0.501	0.443
Number of days exceeding state standard (days)		*0*	*0*	*0*
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Annual concentration (ppm)	0.030 ppm (state)	0.009	0.008	0.008
	0.053 ppm (federal)	—	—	—

Table 4.1-2
Local Ambient Air Quality Data

Concentration or Exceedances	Ambient Air Quality Standard	2013	2014	2015
Carbon Monoxide (CO) (Vallejo Tuolumne Street Monitoring Station)				
Maximum 1-hour concentration (ppm)	20 ppm (state)	—	—	—
	35 ppm (federal)	2.8	2.5	2.4
Number of days exceeding state standard (days)		—	—	—
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Maximum 8-hour concentration (ppm)	9.0 ppm (state)	—	—	—
	9 ppm (federal)	2.3	2.1	1.9
Number of days exceeding state standard (days)		—	—	—
Number of days exceeding federal standard (days)		*0*	*0*	*0*
Coarse Particulate Matter (PM_{10}) (Vacaville Merchant Street Monitoring Station)				
Maximum 24-hour concentration ($\mu g/m^3$)	50 $\mu g/m^3$ (state)	—	—	—
	150 $\mu g/m^3$ (federal)	35	28	41
Number of days exceeding state standard (days)[a]		—	—	—
Number of days exceeding federal standard (days)[a]		*0.0 (0)*	*0.0 (0)*	*0.0 (0)*
Fine Particulate Matter ($PM_{2.5}$) (Vallejo Tuolumne Street Monitoring Station)				
Maximum 24-hour concentration ($\mu g/m^3$)	35 $\mu g/m^3$ (federal)	42.6	39.6	41.4
Number of days exceeding federal standard (days)[a]		*6.0 (6)*	*1.1 (1)*	*3.0 (3)*
Annual concentration ($\mu g/m^3$)	12 $\mu g/m^3$ (state)	11.3	10.0	ND
	12.0 $\mu g/m^3$ (federal)	9.9	9.9	9.6

Sources: CARB 2016c; EPA 2016c.

Notes: — = not available; µg/m3 = micrograms per cubic meter; ND = insufficient data available to determine the value; ppm = parts per million Data taken from CARB iADAM (http://www.arb.ca.gov/adam) and EPA AirData (http://www.epa.gov/airdata/) represent the highest concentrations experienced over a given year.

Exceedances of federal and state standards are only shown for O_3 and particulate matter. Daily exceedances for particulate matter are estimated days because PM_{10} and $PM_{2.5}$ are not monitored daily. All other criteria pollutants did not exceed federal or state standards during the years shown. There is no federal standard for 1-hour ozone, annual PM_{10}, or 24-hour SO_2, nor is there a state 24-hour standard for $PM_{2.5}$.

[a] Measurements of PM_{10} and $PM_{2.5}$ are usually collected every 6 days and every 1 to 3 days, respectively. Number of days exceeding the standards is a mathematical estimate of the number of days concentrations would have been greater than the level of the standard had each day been monitored. The numbers in parentheses are the measured number of samples that exceeded the standard.

Sensitive Receptors

Some land uses are considered more sensitive to changes in air quality than others, depending on the population groups and the activities involved. People most likely to be affected by air pollution include children, the elderly, athletes, and people with cardiovascular and chronic respiratory diseases. Facilities and structures where these air pollution-sensitive people live or spend considerable amounts of time are known as sensitive receptors. Land uses where air

pollution-sensitive individuals are most likely to spend time include schools and schoolyards, parks and playgrounds, daycare centers, nursing homes, hospitals, and residential communities (sensitive sites or sensitive land uses) (CARB 2005). Adjacent sensitive receptors to the proposed project include a single-family residential development directly west of the project site across Leisure Town Road and the recently approved Brighton Landing project currently under construction directly north of the project site. In addition, the proposed project would result in the development of residences and a school site, which would be considered sensitive receptors.

4.1.3 Regulatory Setting

Federal Regulations

Criteria Air Pollutants

The federal Clean Air Act, passed in 1970 and last amended in 1990, forms the basis for the national air pollution control effort. The EPA is responsible for implementing most aspects of the Clean Air Act, including setting NAAQS for major air pollutants; setting hazardous air pollutant (HAP) standards; approving state attainment plans; setting motor vehicle emission standards; issuing stationary source emission standards and permits; and establishing acid rain control measures, stratospheric O_3 protection measures, and enforcement provisions. Under the Clean Air Act, NAAQS are established for the following criteria pollutants: O_3, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and lead.

The NAAQS describe acceptable air quality conditions designed to protect the health and welfare of the citizens of the nation. The NAAQS (other than for O_3, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and those based on annual averages or arithmetic mean) are not to be exceeded more than once per year. NAAQS for O_3, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ are based on statistical calculations over 1- to 3-year periods, depending on the pollutant. The Clean Air Act requires the EPA to reassess the NAAQS at least every 5 years to determine whether adopted standards are adequate to protect public health based on current scientific evidence. States with areas that exceed the NAAQS must prepare a state implementation plan that demonstrates how those areas will attain the standards within mandated time frames.

Hazardous Air Pollutants

The 1977 federal Clean Air Act amendments required the EPA to identify National Emission Standards for Hazardous Air Pollutants to protect public health and welfare. HAPs include certain volatile organic chemicals, pesticides, herbicides, and radionuclides that present a tangible hazard, based on scientific studies of exposure to humans and other mammals. Under the 1990 federal Clean Air Act Amendments, which expanded the control program for HAPs, 189 substances and chemical families were identified as HAPs.

State Regulations

Criteria Air Pollutants

The federal Clean Air Act delegates the regulation of air pollution control and the enforcement of the NAAQS to the states. In California, the task of air quality management and regulation has been legislatively granted to CARB, with subsidiary responsibilities assigned to air quality management districts and air pollution control districts at the regional and county levels. CARB, which became part of the California Environmental Protection Agency in 1991, is responsible for ensuring implementation of the California Clean Air Act of 1988, responding to the federal Clean Air Act, and regulating emissions from motor vehicles and consumer products.

CARB has established CAAQS, which are generally more restrictive than the NAAQS. The CAAQS describe adverse conditions; that is, pollution levels must be below these standards before a basin can attain the standard. Air quality is considered "in attainment" if pollutant levels are continuously below the CAAQS and violate the standards no more than once each year. The CAAQS for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, PM_{10}, and $PM_{2.5}$ and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. The NAAQS and CAAQS are presented in Table 4.1-3.

Table 4.1-3
Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a]	National Standards[b]	
		Concentration[c]	*Primary*[c,d]	*Secondary*[c,e]
O_3	1 hour	0.09 ppm (180 μg/m^3)	—	Same as Primary Standard[f]
	8 hours	0.070 ppm (137 μg/m^3)	0.070 ppm (137 μg/m^3)[f]	
NO_2[g]	1 hour	0.18 ppm (339 μg/m^3)	0.100 ppm (188 μg/m^3)	Same as Primary Standard
	Annual Arithmetic Mean	0.030 ppm (57 μg/m^3)	0.053 ppm (100 μg/m^3)	
CO	1 hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	None
	8 hours	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	
SO_2[h]	1 hour	0.25 ppm (655 μg/m^3)	0.075 ppm (196 μg/m^3)	—
	3 hours	—	—	0.5 ppm (1,300 μg/m^3)
	24 hours	0.04 ppm (105 μg/m^3)	0.14 ppm (for certain areas)[g]	—

Table 4.1-3
Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a]	National Standards[b]	
		Concentration[c]	*Primary*[c,d]	*Secondary*[c,e]
	Annual	—	0.030 ppm (for certain areas)[g]	—
PM_{10}[i]	24 hours	50 μg/m^3	150 μg/m^3	Same as Primary Standard
	Annual Arithmetic Mean	20 μg/m^3	—	
$PM_{2.5}$[i]	24 hours	—	35 μg/m^3	Same as Primary Standard
	Annual Arithmetic Mean	12 μg/m^3	12.0 μg/m^3	15.0 μg/m^3
Lead[j,k]	30-day Average	1.5 μg/m^3	—	—
	Calendar Quarter	—	1.5 μg/m^3 (for certain areas)[k]	Same as Primary Standard
	Rolling 3-Month Average	—	0.15 μg/m^3	
Hydrogen sulfide	1 hour	0.03 ppm (42 μg/m^3)	—	—
Vinyl chloride[j]	24 hours	0.01 ppm (26 μg/m^3)	—	—
Sulfates	24- hours	25 μg/m^3	—	—
Visibility reducing particles	8 hour (10:00 a.m. to 6:00 p.m. PST)	Insufficient amount to produce an extinction coefficient of 0.23 per kilometer due to the number of particles when the relative humidity is less than 70%	—	—

Source: CARB 2016d.

Notes: μg/m^3 = micrograms per cubic meter; CO = carbon monoxide; mg/m^3= milligrams per cubic meter; NO_2 = nitrogen dioxide; O_3 = ozone; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns; ppm = parts per million by volume; SO_2 = sulfur dioxide

a California standards for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, suspended particulate matter (PM_{10}, $PM_{2.5}$), and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. CAAQS are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

b National standards (other than O_3, NO_2, SO_2, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once per year. The O_3 standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m^3 is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over 3 years, are equal to or less than the standard.

c Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based on a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[d] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[e] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[f] On October 1, 2015, the EPA Administrator signed the notice for the final rule to revise the primary and secondary NAAQS for O_3. The EPA is revising the levels of both standards from 0.075 ppm to 0.070 ppm and retaining their indicators (O_3), forms (fourth-highest daily maximum, averaged across 3 consecutive years) and averaging times (8 hours). The EPA is in the process of submitting the rule for publication in the Federal Register. The final rule will be effective 60 days after the date of publication in the Federal Register. The lowered national 8-hour standards are reflected in the table.

[g] To attain the national 1-hour standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 parts per billion (ppb). Note that the national 1-hour standard is in units of ppb. California standards are in units of ppm. To directly compare the national 1-hour standard to the California standards, the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

[h] On June 2, 2010, a new 1-hour SO_2 standard was established, and the existing 24-hour and annual primary standards were revoked. To attain the national 1-hour standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except that in areas designated nonattainment of the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

[i] On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24-hour $PM_{2.5}$ standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM_{10} standards (primary and secondary) of 150 $\mu g/m^3$ were also retained. The form of the annual primary and secondary standards is the annual mean averaged over 3 years.

[j] CARB has identified lead and vinyl chloride as TACs with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[k] The national standard for lead was revised on October 15, 2008, to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

Toxic Air Contaminants

The state Air Toxics Program was established in 1983 under AB 1807 (Tanner). The California TAC list identifies more than 700 pollutants, of which carcinogenic and noncarcinogenic toxicity criteria have been established for a subset of these pollutants pursuant to the California Health and Safety Code. In accordance with AB 2728, the state list includes the (federal) HAPs. The Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources; however, AB 2588 does not regulate air toxics emissions. TAC emissions from individual facilities are quantified and prioritized. "High-priority" facilities are required to perform a health risk assessment, and if specific thresholds are exceeded, are required to communicate the results to the public in the form of notices and public meetings.

In 2000, CARB approved a comprehensive Diesel Risk Reduction Plan to reduce emissions of diesel particulate matter (DPM) from both new and existing diesel-fueled vehicles and engines (CARB 2000). The regulation is anticipated to result in an 80% decrease in statewide diesel health risk in 2020 compared with the diesel risk in 2000. Additional regulations apply to new trucks and diesel fuel, including the On-Road Heavy Duty Diesel Vehicle (In-Use) Regulation, the On-Road Heavy Duty (New) Vehicle Program, the In-Use Off-Road Diesel Vehicle Regulation, and the New Off-Road Compression-Ignition (Diesel) Engines and Equipment program. All of these regulations and programs have timetables by which manufacturers must comply and existing operators must upgrade their diesel powered

equipment. Several Airborne Toxic Control Measures (ATCMs) that reduce diesel emissions include In-Use Off-Road Diesel-Fueled Fleets (13 CCR 2449 et seq.) and In-Use On-Road Diesel-Fueled Vehicles (13 CCR 2025).

Despite these reduction efforts, the CARB recommends that proximity to sources of DPM emissions be considered in the siting of new sensitive land uses. In April 2005, the CARB published the *Air Quality and Land Use Handbook: a Community Health Perspective*. This handbook is intended to give guidance to local governments in the siting of sensitive land uses near sources of air pollution. Recent studies have shown that public exposure to air pollution can be substantially elevated near freeways and certain other facilities such as ports, rail yards and distribution centers. Specifically, the document focuses on risks from emissions of DPM, a known carcinogen, and establishes recommended siting distances of sensitive receptors. The CARB notes that these recommendations are advisory and should not be interpreted as defined "buffer zones," and that local agencies must balance other considerations, including transportation needs, the benefits of urban infill, community economic development priorities, and other quality of life issues. With careful evaluation of exposure, health risks, and affirmative steps to reduce risk where necessary the CARB's position is that infill development, mixed use, higher density, transit-oriented development, and other concepts that benefit regional air quality can be compatible with protecting the health of individuals at the neighborhood level (CARB 2005).

Local Regulations

Yolo-Solano Air Quality Management District

The YSAQMD is the primary local agency responsible for protecting human health and property from the harmful effects of air pollution for all of Yolo County and northeastern Solano County. The YSAQMD develops rules and regulations for stationary sources and equipment, prepares emissions inventory and air quality management planning documents, and conducts source testing and inspections. The YSAQMD's air quality management plans include control measures and strategies to be implemented to attain state and federal ambient air quality standards within the jurisdiction. The YSAQMD then implements these control measures as regulations to control or reduce criteria pollutant emissions from stationary sources or equipment. Applicable YSAQMD attainment plans include:

- ***Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2013 SIP Revisions):*** The 8-Hour Ozone Attainment and Reasonable Further Program Plan (2013 Ozone Plan) describes measures to be implemented by the air districts in the Sacramento Federal Nonattainment Area (SFNA) to achieve the 1997 O_3 NAAQS. The 2013 Ozone Plan shows that the region continues to meet federal progress requirements and demonstrates that the region will meet the 1997 O_3 NAAQS by 2018.

The 2013 Ozone Plan updates the emissions inventory, provides photochemical modeling results, updates the reasonable further progress and attainment demonstrations, revises adoption dates for control measures, and sets new motor vehicle emission budgets for transportation conformity purposes. The 2013 Ozone Plan also includes a VMT offset demonstration that showed the emissions reduction from transportation control measures are sufficient to offset the emissions increase due to VMT growth (YSAQMD et al. 2013a).

- ***$PM_{2.5}$ Implementation/Maintenance Plan and Redesignation Request for Sacramento $PM_{2.5}$ Nonattainment Area:*** On May 9, 2012, CARB submitted a request that EPA find the Sacramento region in attainment for the 2006 24-hour PM2.5 NAAQS. On August 14, 2013, the EPA officially determined that the SFNA had attained the 24-hour $PM_{2.5}$ NAAQS by the attainment deadline. On October 24, 2013, the YSAQMD, Sacramento Metropolitan Air Quality Management District, El Dorado County Air Quality Management District, and the Placer County Air Pollution Control District approved the $PM_{2.5}$ maintenance plan and request for redesignation for the 2006 $PM_{2.5}$ NAAQS (YSAQMD et al. 2013b) to meet the EPA redesignation requirements.
- ***Triennial Assessment and Plan Update:*** This plan is intended to comply with the requirements of the California Clean Air Act as related to bringing the region into compliance with the CAAQS for O_3. The YSAQMD has prepared several triennial progress reports that build upon the 1992 Triennial Plan. The *Triennial Assessment and Plan Update* (YSAQMD 2013) is the most recent report. The triennial progress report describes historical trends in air quality, includes updated emissions inventories, and identifies feasible control measures the YSAQMD will study or adopt over the triennial period. The YSAQMD has also published a *Draft Triennial Assessment and Plan Update* (YSAQMD 2016a), which has not yet been adopted.

In addition, the YSAQMD has several rules that relate to the proposed project, which are summarized below.

- **Rule 2.3 – Ringelmann Chart**: Prohibits individuals from discharging into the atmosphere from any source of emissions whatsoever any air contaminant whose opacity exceeds certain specified limits.
- **Rule 2.5 – Nuisance**: To protect the public health, Rule 2.5 prohibits any person from discharging such quantities of air contaminants that cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public.
- **Rule 2.14 – Architectural Coatings**: Sets ROG content limits for coatings that are supplied, sold, offered for sale, applied, solicited for application, or manufactured for use within the YSAQMD.

- **Rule 2.28 – Cutback and Emulsified Asphalts:** Asphalt paving operations that may be associated with implementation of the project would be subject to Rule 2.28. This rule applies to the manufacture, storage, and use of cutback asphalt and emulsified asphalt for paving and maintenance operations.
- **Rule 2.40 – Wood Burning Appliances**: This rule establishes which types of wood burning appliances can be sold, supplied, and installed in new or existing development.
- **Rule 3.1 – General Permit Requirements**: Requires any project that includes the use of certain equipment capable of releasing emissions to the atmosphere to obtain an Authority to Construct and Permit to Operate from the YSAQMD.

The YSAQMD issued its *Handbook for Assessing and Mitigating Air Quality Impacts* (YSAQMD 2007) to assist lead agencies in determining when potential air quality impacts would be considered significant under CEQA. The analysis herein uses this YSAQMD guidance document to determine the proposed project's significance with respect to air pollutant emissions.

City of Vacaville General Plan

As discussed in the City of Vacaville General Plan, policies pertaining to improving air quality applicable to the project are listed below (City of Vacaville 2015):

Policy COS-P12.3 Encourage project designs that protect and improve air quality and minimize direct and indirect air pollutant emissions by including components that reduce vehicle trips and promote energy efficiency.

Policy COS-P12.4 Require that development projects implement best management practices (BMPs) to reduce air pollutant emissions associated with the construction and operation of the project.

Policy COS-P12.5 Require dust control measures as a condition of approval for subdivision maps, site plans, and all grading permits.

Policy COS-P12.6 Consistent with the YSAQMD's standards, require that any fireplaces in new and significantly renovated residential projects, or commercial projects are pellet-fueled heaters, EPA Phase II-certified wood burning heaters, or gas fireplaces.

Policy COS-P12.10 Encourage the use of roadway materials that minimize particulate emissions.

4.1.4 Impacts

Methods of Analysis

Project-related air quality impacts fall into two categories: short-term impacts due to construction and long-term impacts due to project operation. First, during project construction (short-term), the proposed project would result in an increase in emissions primarily due to off-road construction equipment, on-road vehicles, architectural coating and asphalt off-gassing, and fugitive dust from earth moving. Under operations (long-term), the proposed project would result in an increase in emissions due to motor vehicle trips and on-site stationary sources such as certain commercial uses. Other sources include minor area sources such as landscaping and use of consumer products.

The proposed project's short-term construction-related and long-term operational emissions were estimated using the CalEEMod software (version 2013.2.2), a statewide model designed to provide a uniform platform for government agencies, land use planners, and environmental professionals to quantify air quality emissions from land use projects. The model applies inherent default values for various land uses, including trip generation rates based on the Institute of Transportation Engineers Trip Generation Manual, vehicle mix, trip length, average speed, etc. However, where project-specific data was available, such data were input into the model (e.g., construction phases, timing, equipment, and estimated daily project trips). All project modeling results are included in Appendix C.

Issues Addressed in the Modified Initial Study

The proposed project is consistent with the City's current General Plan and the population and employment growth assumptions incorporated in the Sacramento Regional 8-Hour Ozone Attainment Plan and Reasonable Further Progress Plan. Therefore, the proposed project would not conflict with or obstruct implementation of the applicable air quality plan. This is addressed in the Modified Initial Study included in Appendix B. The proposed project would also not create objectionable odors affecting a substantial number of people. As a general matter, the types of land use developments that pose potential odor problems include wastewater treatment plants, refineries, landfills, composting facilities, and transfer stations. Although the proposed project would be located approximately 1-mile east of the Easterly Waste Water Treatment Plant and adjacent to a detention basin, no odor complaints have been received for these sources within the last 3 years (YSAQMD 2016b) and therefore the proposed project would not be located in an area where existing odors are a concern. The proposed project would also not introduce a new source of odors. Therefore, impacts related to odors would be less than significant and are addressed in the Modified Initial Study.

Thresholds of Significance

Consistent with Appendix G of the CEQA Guidelines, the City's General Plan, and professional judgment, a significant impact would occur if development of the proposed project would do any of the following:

- Violate any air quality standard or contribute substantially to an existing or projected air quality violation. The YSAQMD further defines the thresholds of significance as follows:
  - Generation of ROG or NO_x emissions for construction or operations in excess of 10 tons per year; or
  - Generation of PM_{10} emissions for construction or operations in excess of 80 pounds per day.
  - The YSAQMD does not have a board adopted threshold for $PM_{2.5}$ emissions, the YSAQMD recommends using an adopted $PM_{2.5}$ threshold from another jurisdiction in the nonattainment area (Jones 2016). As such, the Sacramento Metropolitan Air Quality Management District (SMAQMD) threshold of 82 pounds per day of $PM_{2.5}$ emissions has been applied to this analysis during construction and operations.
- 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, which exceed quantitative thresholds for O_3 precursors). The YSAQMD further defines the threshold of significance as follows:
  - Emissions would be considered cumulatively considerable if they are individually significant;
  - CO impacts are also cumulatively considerable when an exceedance of CO air quality standards results from project CO emissions combined with and CO emissions from other planned projects.
- Expose sensitive receptors to substantial pollutant concentrations.

Impacts and Mitigation Measures

4.1-1: Construction of the proposed project could result in emissions of ROG, NO_x, or $PM_{10/2.5}$ at levels that could substantially contribute to a potential violation of applicable air quality standards or to nonattainment conditions. This would be a potentially significant impact.

Construction of the proposed project would result in a temporary addition of pollutants to the local air shed caused by soil disturbance, fugitive dust emissions, and combustion pollutants from on-site construction equipment, as well as from off-site trucks hauling building materials and from construction workers travelling to and from the site. Construction emissions can vary substantially

from day to day, depending on the level of activity, the specific type of operation and, for dust, the prevailing weather conditions. Therefore, an increment of day-to-day variability exists. In the absence of mitigation, construction activities may result in significant quantities of dust, and as a result, local visibility and PM_{10} and $PM_{2.5}$ concentrations may be adversely affected on a temporary and intermittent basis. In addition, fugitive dust generated by construction would include not only PM_{10} and $PM_{2.5}$ but also larger particles, which would fall out of the atmosphere within several hundred feet of the site and could result in nuisance-type impacts.

Pollutant emissions associated with construction activity were quantified using CalEEMod. Default values provided by the program were used where detailed project information was not available. A detailed depiction of the construction schedule—including information regarding phasing, equipment utilized during each phase, haul trucks, vendor trucks, and worker vehicles—is contained in the CalEEMod outputs, provided in Appendix C.

It is anticipated that construction of the proposed project would occur over 3 phases for a period of 10-years, from approximately June 2018 through May 2028. The analysis contained herein is based on the following assumptions in Table 4.1-4.

Table 4.1-4
Estimated Construction Schedule

Activity	Start Date	End Date	Total Construction Days
Phase 1			
Site Preparation	2018/06/01	2018/07/06	26
Grading/Trenching	2018/07/07	2018/10/15	71
Building Construction	2018/10/16	2021/07/14	717
Paving	2021/07/15	2021/09/20	48
Architectural Coatings	2021/09/21	2021/11/25	48
Phase 2			
Site Preparation	2021/11/26	2021/12/24	21
Grading/Trenching	2021/12/25	2022/03/09	53
Building Construction	2022/03/10	2024/03/20	530
Paving	2024/03/21	2024/05/13	38
Architectural Coatings	2024/05/14	2024/07/04	38
Phase 3			
Site Preparation	2024/07/05	2024/08/16	31
Grading/Trenching	2024/08/17	2024/12/05	79
Building Construction	2024/12/06	2027/12/15	789
Paving	2027/12/16	2028/03/02	56
Architectural Coatings	2028/03/03	2028/05/19	56

Source: See Appendix C for detailed results.
Notes: Types of activities under each phase are based on the CalEEMod defaults and the land uses proposed. Total duration of construction is from June 2018 through May 2028 (10 years), with the duration of each phase of construction apportioned based on the number of residential dwelling units to be developed in the phase (based on the tentative map for the proposed project).

CalEEMod was used to quantify construction ROG, NO_x, PM_{10}, and $PM_{2.5}$ emissions from off-road equipment, fugitive dust, on-road worker vehicle emissions, and vendor delivery trips. Predicted unmitigated daily and annual construction emissions for each phase of project development are presented in Table 4.1-5 and compared to the applicable YSAQMD threshold.

Table 4.1-5
Estimated Daily and Annual Construction Emissions

Year	ROG	NO_x	PM_{10}	$PM_{2.5}$
Daily Emissions (Pounds Per Day)				
2018	5.8	63.9	20.7	12.2
2019	4.4	30.1	5.6	2.5
2020	4.1	27.1	5.5	2.3
2021	133.2	48.3	20.0	11.6
2022	6.0	42.1	11.1	5.5
2023	5.7	28.6	11.0	3.6
2024	137.6	35.6	19.5	11.1
2025	3.1	18.5	5.3	1.8
2026	3.0	18.4	5.3	1.8
2027	3.0	18.3	5.3	1.8
2028	126.6	8.5	0.8	0.4
Maximum Daily	*137.6*	*63.9*	*20.7*	*12.2*
Pollutant Threshold	*NA*	*NA*	*80*	*82*
Threshold Exceeded?	**NA**	**NA**	**No**	**No**
Annual Emissions (Tons Per Year)				
2018	0.4	3.8	0.9	0.5
2019	0.6	3.9	0.7	0.3
2020	0.5	3.5	0.7	0.3
2021	3.5	2.5	0.8	0.4
2022	0.7	4.2	1.4	0.5
2023	0.7	3.6	1.4	0.5
2024	3.0	3.0	1.1	0.5
2025	0.4	2.4	0.7	0.2
2026	0.4	2.4	0.7	0.2
2027	0.4	2.3	0.6	0.2
2028	3.6	0.2	0.0	0.0
Maximum Annual	*3.6*	*4.2*	*1.4*	*0.5*
Pollutant Threshold	*10*	*10*	*NA*	*NA*
Threshold Exceeded?	**No**	**No**	**NA**	**NA**

Source: See Appendix C for detailed results.
Notes: Construction emissions were modeled with CalEEMod and do not reflect any mitigation measures. The maximum daily emissions of ROG, NO_x, and PM_{10} are estimated to occur during the winter season. For years where multiple phase development would occur (i.e., 2021 and 2024), the CalEEMod daily emissions were compared and the maximum selected (since the phase construction would not occur on the

same day), whereas the annual emissions for the phases were summed together (since the construction would occur in the same year). YSAQMD has adopted annual construction thresholds for ROG and NO_x, as well as a daily threshold for PM_{10}.
The SMAQMD threshold for daily $PM_{2.5}$ emissions was also applied to this analysis.
ROG = reactive organic gases; NO_x = oxides of nitrogen; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter

As shown in Table 4.1-5, daily construction emissions of PM_{10} and $PM_{2.5}$ and annual emissions of ROG and NO_x would not exceed the YSAQMD applicable significance thresholds during any construction year. However, there could still be nuisance issues from localized fugitive dust and this could be considered a **potentially significant impact**.

Mitigation Measures

The YSAQMD recommends implementation of Best Management Practices (BMPs) during construction, even for projects that do not exceed the PM_{10} threshold. Implementation of BMPS specified in Mitigation Measure AQ-1 during construction would ensure that emissions of fugitive dust would be minimized as recommended by the YSAQMD and that the impact would be less than significant.

AQ-1 The applicant shall implement Best Management Practices and shall submit a construction dust control plan for the project that includes the following conditions:

- Water all active construction sites at least twice daily. Frequency should be based on the type of operation, soil, and wind exposure.
- Ensure haul trucks maintain at least 2 feet of freeboard.
- Cover all trucks hauling dirt, sand, or loose materials.
- Apply non-toxic binders (e.g. latex acrylic copolymer) to exposed areas after cut and fill operations and hydroseed area.
- Apply chemical soil stabilizers on inactive construction areas (disturbed lands within construction projects that are unused for at least four consecutive days).
- Plant vegetative ground cover in disturbed areas as soon as possible.
- Cover inactive storage piles.
- Sweep streets if visible soil material is carried out from the construction site.

4.1-2: Operation of the proposed project would result in emissions of ROG, NOx, or $PM_{10/2.5}$ at levels that could substantially contribute to a potential violation of applicable air quality standards or to nonattainment conditions. This would be a significant and unavoidable impact.

Following the completion of construction activities, the proposed project would generate criteria pollutant emissions from vehicular traffic, area sources (consumer products, architectural coatings, landscaping equipment), and energy sources (natural gas appliances, space and water heating). The emissions associated with on-road mobile sources include running and

starting exhaust emissions, evaporative emissions, brake and tire wear, and fugitive dust entrainment. Default trip generation rates and trip lengths included in CalEEMod for each analyzed land use for the project were adjusted to match the overall weekday daily trips (7,743 trips) and total average daily vehicle miles traveled (VMT) length data (12.41 miles per trip, for a total of 92,721-weekday daily VMT) provided by Kittelson and Associates (see Section 4.7, Transportation and Circulation). Area sources include gasoline-powered landscape maintenance equipment, consumer products, and architectural coatings for the maintenance of buildings. Emissions from energy sources include natural gas combustion for appliances and space and water heating. Notably, the year 2025 was selected in CalEEMod to conservatively approximate buildout of the project in the year 2028, since 2028 is not an option in the current version of CalEEMod.

CalEEMod default values for energy consumption for each land use were applied for the project analysis, which account for 2008 Title 24 standards. Title 24 of the California Code of Regulations serves to enhance and regulate California's building standards. The most recent amendments to Title 24, Part 6, referred to as the 2016 standards, will become effective on January 1, 2017. The previous amendments were referred to as the 2013 standards and are currently effective. Buildings constructed in accordance with the 2013 standards will use 25% less energy for lighting, heating, cooling, ventilation, and water heating than the 2008 standards. Single family residential buildings constructed in compliance with the 2016 standards will use approximately 28% less energy than the 2013 standards (CEC 2015). For the purposes of estimating project-generated energy emissions, a mitigation measure was applied to assume a 46% reduction from the 2008 standards (the basis for the default energy usage factors in CalEEMod) to reflect the benefits of compliance with the 2016 standards.

CalEEMod was used to estimate unmitigated daily and annual emissions of ROG, NO_x, PM_{10}, and $PM_{2.5}$ from the operational sources, with emissions depicted in Table 4.1-6.

Table 4.1-6
Estimated Daily and Annual Operational Emissions - Unmitigated

Source	ROG	NO_x	PM_{10}	$PM_{2.5}$
Daily Emissions (Pounds Per Day)				
Project Buildout - Summer				
Area	104.7	3.0	22.8	22.8
Energy	0.5	4.3	0.4	0.3
Mobile	34.0	98.6	78.0	22.3
Total Summer	**139.2**	**105.9**	**101.2**	**45.4**
Project Buildout – Winter				
Area	104.7	3.0	22.8	22.8
Energy	0.5	4.3	0.4	0.3

Table 4.1-6
Estimated Daily and Annual Operational Emissions - Unmitigated

Source	ROG	NO_x	PM_{10}	$PM_{2.5}$
Mobile	35.2	112.0	78.0	22.3
Total Winter	**140.4**	**119.3**	**101.2**	**45.4**
Maximum Daily	*140.4*	*119.3*	*101.2*	*45.4*
Pollutant Threshold	*NA*	*NA*	*80*	*82*
Threshold Exceeded?	**NA**	**NA**	**Yes**	**No**
Annual Emissions (Tons Per Year)				
Area	16.8	0.2	1.0	1.0
Energy	0.1	0.8	0.0	0.0
Mobile	5.6	18.2	13.0	3.7
Maximum Annual	*22.5*	*19.2*	*14.0*	*4.7*
Pollutant Threshold	*10*	*10*	*NA*	*NA*
Threshold Exceeded?	**Yes**	**Yes**	**NA**	**NA**

Source: See Appendix C for detailed results.
Notes: Emissions were modeled with CalEEMod and are based on the "Mitigated" CalEEMod outputs in order to incorporate the 2016 Title 24 standards (i.e., approximately a 46% reduction versus 2008 Title 24 for single family residential), 20% indoor and outdoor water conservation per CalGreen, and 75% waste diversion pursuant to AB 341 even though compliance with these standards would not be considered actual mitigation. YSAQMD has adopted annual thresholds for ROG and NO_x, as well as a daily threshold for PM_{10}.
The SMAQMD threshold for daily $PM_{2.5}$ emissions was also applied to this analysis.
ROG = reactive organic gases; NO_x = oxides of nitrogen; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter

As shown in Table 4.1-6, $PM_{2.5}$ emissions would be less than the applied threshold, whereas ROG, NO_x, and PM_{10} emissions would substantially exceed the YSAQMD thresholds of significance. Therefore, buildout of the proposed project would have a **potentially significant** effect on regional air quality. Notably, as described in the Roberts' Ranch Specific Plan (available on the City's website, www.cityofvacaville.com/RobertsRanch), although there are no current transit lines that extend to the area, adequate space is provided within the arterial and major collector street sections to accommodate future transit stop facilities. In addition, adequate sidewalks and multipurpose trails and traffic calming measures in high pedestrian areas and adjacent neighborhoods provide safe and easy pedestrian routes to the transit stops. These trails and sidewalks are planned to be integrated in the project design to provide connectivity to community parks, open spaces, and school. Shade is also provided along pedestrian routes for comfortable use. These measures would reduce motor vehicle trips and VMT, however, the traffic modeling did not account for them in order to provide a conservative analysis.

Mitigation Measures

As noted above, several of these measures have been included in the Specific Plan for the project, including transit facilities, traffic calming measures, and pedestrian and bicycle paths. These have been included as mitigation in order to ensure implementation of motor vehicle trip

reduction strategies through the environmental review process for the project. In addition, prohibiting wood burning hearths in residences would reduce PM_{10} production. As shown in Table 4.1-7, daily PM_{10} emissions would be reduced below the YSAQMD threshold. However, annual emissions of ROG and NO_x would still exceed the YSAQMD thresholds after mitigation and would result in a significant and unavoidable impact.

Overall, mitigation would be required since estimated emissions would exceed YSAQMD thresholds of significance for regional air quality. Table 4.1-7 presents emissions after incorporation of Mitigation Measure AQ-2.

Table 4.1-7
Estimated Daily and Annual Operational Emissions - Mitigated

Source	ROG	NO_x	PM_{10}	$PM_{2.5}$
Daily Emissions (Pounds Per Day)				
Project Buildout - Summer				
Area	89.8	0.8	0.7	0.7
Energy	0.5	4.3	0.3	0.3
Mobile	33.2	94.5	74.1	21.2
Total Summer	**123.5**	**99.6**	**75.1**	**22.2**
Project Buildout – Winter				
Area	89.8	0.7	0.7	0.7
Energy	0.5	4.3	0.3	0.3
Mobile	34.4	107.4	74.1	21.2
Total Winter	**124.7**	**112.4**	**75.1**	**22.2**
Maximum Daily	*124.7*	*112.4*	*75.1*	*22.2*
Pollutant Threshold	*NA*	*NA*	*80*	*82*
Threshold Exceeded?	**NA**	**NA**	**No**	**No**
Annual Emissions (Tons Per Year)				
Area	16.1	0.1	0.0	0.0
Energy	0.1	0.8	0.1	0.1
Mobile	5.5	17.5	12.3	3.5
Maximum Annual	*21.7*	*18.4*	*12.4*	*3.6*
Pollutant Threshold	*10*	*10*	*NA*	*NA*
Threshold Exceeded?	**Yes**	**Yes**	**NA**	**NA**

Source: See Appendix C for detailed results.
Notes: Emissions were modeled with CalEEMod and are based on the "Mitigated" CalEEMod outputs in order to incorporate the 2016 Title 24 standards (i.e., approximately a 46% reduction versus 2008 Title 24 for single family residential), 20% indoor and outdoor water conservation per CalGreen, and 75% waste diversion pursuant to AB 341 even though compliance with these standards would not be considered actual mitigation. Additionally, the CalEEMod measures "Only Natural Gas Hearth", "Improve Pedestrian Network – Project Site and Connecting Off-Site", and "Provide Traffic Calming Measures – 50% Roadways and 50% Intersections" were selected in the model to account for Mitigation Measure 4.1-2. YSAQMD has adopted annual thresholds for ROG and NO_x, as well as a daily threshold for PM_{10}. The SMAQMD threshold for daily $PM_{2.5}$ emissions was also applied to this analysis.
ROG = reactive organic gases; NO_x = oxides of nitrogen; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter

AQ-2 **Operational Emission Reduction Measures**. The applicant shall incorporate the following measures to reduce emissions associated with vehicle trip generation and area sources from the proposed project:

- Equip all residential garages, as well as parking lots at parks, with infrastructure to install electric vehicle charging outlets and equipment.
- Provide transit facilities (e.g., bus bulbs/turnouts, benches, shelters).
- Provide bicycle lanes and/or paths, connected to the existing community-wide network.
- Where feasible, provide sidewalks and/or paths, connected to adjacent land uses, transit stops, and the existing community-wide trail network.
- Traffic calming devices such as bulb-outs and pedestrian refuges shall be implemented on residential streets in areas of high pedestrian activity and adjacent to neighborhoods.
- The Roberts' Ranch Specific Plan shall be modified to include bicycle parking standards as follows:
    - For residential development, one, sheltered, secure bicycle parking space per dwelling unit shall be required. Garages, storage sheds, utility rooms, or similar areas that can be secured from unauthorized access and are sheltered from sun and rain would satisfy this requirement without the addition of special improvements or racks. Additional convenience bicycle parking may be provided with exterior racks but does not count toward the sheltered bicycle parking requirement.
    - New parking areas created to serve nonresidential uses should provide one bicycle parking space for every 20 vehicle parking spaces, with a minimum of four bicycle spaces.
    - For all school developments, secured bicycle parking shall be provided at a minimum rate of 10% of the student capacity plus 3% of the maximum number of employees.
- All wood burning devices shall be prohibited in residential units. Only natural gas fueled hearths shall be permitted.
- During the Design Review process for each home design application, the City shall confirm compliance with measures incorporated into the City's Energy & Conservation Action Strategy (ECAS), through use of a checklist identifying the residential design measures feasible for residential structures.

ROG and NO_x are precursors to O_3, for which the SVAB is designated as nonattainment with respect to the NAAQS and CAAQS. Thus, existing O_3 levels in the SVAB are at unhealthy levels during certain periods. The health effects associated with O_3 are generally associated with reduced lung function. The contribution of ROG and NO_x to regional ambient O_3 concentrations is the result of complex photochemistry. The increases in O_3 concentrations in the SVAB due to O_3 precursor emissions tend to be found downwind from the source location to allow time for the photochemical reactions to occur. However, the potential for exacerbating excessive O_3 concentrations would also depend on the time of year that the precursor emissions would occur because exceedances of the O_3 AAQS tend to occur in the summer and early fall on warm, windless, sunny days. Given these various factors, it is difficult to predict the magnitude of health effects from the proposed project's exceedance of significance criteria for regional ROG and NO_x emissions. The increase in emissions associated with the project represents a fraction of total regional emissions (125 new pounds per day ROG and 112 pounds per day NO_x compared to 8 tons per day ROG and 12 tons per day NO_x in the Solano County portion of the SVAB in 2012) (CARB 2014). Table 4.1-2 shows that the most stringent applicable O_3 standards have been exceeded at the Ulatis Drive monitoring station in Vacaville between 2013 and 2015. The project's ROG and NO_x increases could contribute to air quality violations in the SVAB region by contributing to more days of O_3 exceedance or result in Air Quality Index value levels that are unhealthy for sensitive groups and other populations.

4.1-3: The proposed project would not result in CO concentrations that exceed the 1-hour state ambient air quality standard (i.e., 20.0 ppm) or the 8-hour state ambient standard (i.e., 9.0 ppm). This would be a less-than-significant impact.

Motor vehicles are the primary source of CO in the SVAB. The YSAQMD *Handbook for Assessing and Mitigating Air Quality Impacts* (YSAQMD 2007) provides screening criteria to determine whether air quality modeling to evaluate CO concentrations is necessary. In regards to screening for CO impacts, if either the following criteria is true of any intersection affected by the project traffic, then the project would have the potential to create a violation of the CO standard:

- A traffic study for the project indicates that the peak-hour Level of Service (LOS) on one or more streets or at one or more intersections in the project vicinity will be reduced to an unacceptable LOS (typically LOS E or F); or
- A traffic study for the project indicates that the project will substantially worsen an already existing peak-hour LOS F on one or more streets or at one or more intersections in the project vicinity. "Substantially worsen" includes situations where delay would increase by 10 seconds or more when project-generated traffic is included.

Based on the traffic analysis prepared for the project, the proposed project would pass the screening criteria and would not generate traffic volumes that necessitate CO modeling.

Therefore, the project would not generate traffic volumes that could cause CO hotspots at local intersections and would not adversely affect sensitive receptors. This impact would be **less than significant**.

Mitigation Measures

None required.

4.1-4: The proposed project would not result in the exposure of sensitive receptors to substantial pollutant concentrations. This would be a less-than-significant impact.

Some land uses are considered more sensitive to changes in air quality than others, depending on the population groups and the activities involved. Adjacent sensitive receptors to the proposed project include a single-family residential development directly west of the project site across Leisure Town Road and the recently approved Brighton Landing project currently under construction directly north of the project site. In addition, the project would result in the development and siting of new sensitive residential receptors in the area.

TACs are defined as substances that may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health. Health effects from carcinogenic air toxics are usually described in terms of cancer risk. The YSAQMD recommends an incremental cancer risk threshold of 10 in 1 million for stationary sources. YSAQMD does not have a recommended threshold for mobile source emissions. "Incremental cancer risk" is the net increased likelihood that a person continuously exposed to concentrations of TACs resulting from a project over a 9-, 30-, and 70-year exposure period would contract cancer based on the use of standard Office of Environmental Health Hazard Assessment (OEHHA) risk-assessment methodology (OEHHA 2015). In addition, some TACs have non-carcinogenic effects. The YSAQMD recommends a Hazard Index of 1 or more for acute (short-term) and chronic (long-term) effects.[2] TACs that would potentially be emitted during construction activities associated with project development would be DPM.

DPM emissions would be emitted from heavy-duty construction equipment and heavy-duty trucks. Heavy-duty construction equipment and diesel trucks are subject to CARB ATCMs (described in the Environmental Setting) to reduce DPM emissions. According to the OEHHA, health risk assessments, which determine the exposure of sensitive receptors to toxic emissions, should be based on a 30-year exposure period for the maximally exposed individual resident; however, such assessments should be limited to the period/duration of activities associated with the project. Since the proposed project involves phased construction activities in

[2] Non-cancer adverse health risks are measured against a hazard index, which is defined as the ratio of the predicted incremental exposure concentrations of the various non-carcinogens from the project to published reference exposure levels that can cause adverse health effects.

several areas across the site, the project would not require the extensive use of heavy-duty construction equipment or diesel trucks in any one location over the duration of development, which would limit the exposure of any proximate individual sensitive receptor to TACs. Due to the relatively short period of exposure at any individual sensitive receptor and minimal particulate emissions generated on-site, TACs generated during construction would not be expected to result in concentrations causing significant health risks.

In regards to operations, the proposed project does not include stationary sources that would emit air pollutants or TACs, such as commercial uses that could generate emissions, large boilers, emergency generators, or manufacturing facilities or result in a substantial increase in diesel vehicles (i.e., delivery trucks). Project operations would not result in TAC generation from on-site sources during long-term operations and would not result in significant health risk at nearby sensitive receptors.

In regards to land use compatibility of locating new sensitive receptors in the area, the Yolo-Solano *Handbook for Assessing and Mitigating Air Quality Impacts* identifies screening distances for the siting of new sensitive receptors, consistent with the CARB guidelines as previously discussed. The proposed project would not locate sensitive uses within the following distances:

- Within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day;
- Within 1,000 feet of a major service and maintenance rail yard;
- Immediately downwind of ports (in the most heavily impacted zones) and petroleum refineries;
- Within 300 feet of any dry cleaning operation (for operations with two or more machines, provide 500 feet); or
- Within 300 feet of a large gas station (defined as a facility with a throughput of 3.6 million gallons per year or greater).

Leisure Town Road and Alamo Drive are adjacent to the western border of the site but neither roadway has volumes of 50,000 or more vehicles per day (see Section 4.7, Transportation and Circulation, of this Draft EIR). The nearest residential uses proposed as part of the project are located more than 300 feet from the Union Pacific rail line. The closest railyards are located in Richmond (35 miles away) and Roseville (45 miles away). There are no ports, refineries, dry cleaning operations or large gas stations located in the vicinity of the proposed project. There are no known sources of existing substantial TACs proximate to the site that would result in land use compatibility impacts for new sensitive receptors. The City evaluates these conditions for land use compatibility and has adopted land use planning criteria for setbacks to protect sensitive receptors from existing agricultural operations or other land uses that might affect future residents of the project. These criteria are evaluated through the development review process.

In summary, the potential to expose existing and proposed sensitive receptors to substantial levels of TACs during short-term construction and long-term operations would be a **less-than-significant impact**.

Mitigation Measures

None required.

4.1.5 Cumulative Impacts

The cumulative context of an air pollutant is dependent on the specific pollutant being considered. O_3 precursors are a regional pollutant; therefore, the cumulative context would be existing and future development within the entire SVAB. This means that O_3 precursors generated in one location do not necessarily have O_3 impacts in that area. Instead, precursors from across the region can combine in the upper atmosphere and be transported by winds to various portions of the SVAB. Consequently, all O_3 precursors generated throughout the SVAB are part of the cumulative context.

The geographic scope of the area for the proposed project cumulative analysis includes the City of Vacaville and surrounding areas within the SFNA for O_3. The SFNA includes the counties of Sacramento, Yolo, Solano (partial), Sutter (partial), Placer (except Lake Tahoe Air Basin), and El Dorado (except Lake Tahoe Air Basin). The YSAQMD establishes emissions thresholds for regional emissions for projects within its jurisdiction.

4.1-5 The proposed project would result in a cumulatively considerable net increase of any criteria pollutant for which the project area is in non-attainment under an applicable federal or state ambient air quality standard (including the release of emissions that exceed quantitative thresholds for ozone precursors). This would be a significant and unavoidable impact.

The SVAB is in nonattainment for O_3 and particulate matter. Due to its nonattainment status for the federal and state O_3 standards, the geographic scope of the area for the proposed project cumulative analysis includes the City of Vacaville and surrounding areas within the SFNA for O_3. Ongoing development and operation of new land uses would generate additional emissions of O_3 precursors and particulate matter, which may adversely affect the ability of the region to achieve attainment with the applicable air quality standards and would result in a cumulatively significant impact.

According to the YSAQMD *Handbook for Assessing and Mitigating Air Quality Impacts*, projects that would individually exceed the YSAQMD thresholds (annual ROG and NO_x thresholds, or daily PM_{10} thresholds) would also be considered cumulatively considerable

and significant. As discussed in Impact 4.1-1, the proposed project's construction emissions of ROG, NO_x, PM_{10}, and $PM_{2.5}$ would not be considerable and the project's contribution to the cumulative impact would be less than significant. However, as discussed in Impact 4.1-2, the proposed project's unmitigated ROG, NO_x, and PM_{10} emissions would exceed the applicable YSAQMD thresholds. With implementation of Mitigation Measure AQ-2, daily emissions of PM_{10} would be reduced to a less-than-significant level, whereas annual ROG and NO_x would remain significant. Therefore, the proposed project's emissions of O_3 precursors would be considerable and the project's contribution to the cumulative impact would be **significant and unavoidable**.

Mitigation Measures

There is no mitigation available with currently feasible technology to reduce the cumulative regional air quality impact the project's emissions of O_3 precursors to a less-than-significant level. Therefore, the impact would remain significant and unavoidable.

AQ-3 Implement Mitigation Measure AQ-2.

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