4.2 AIR QUALITY

INTRODUCTION

This section evaluates the potential air quality impacts of the proposed project. The analysis considers both operational and construction effects. The primary focus of the air quality analysis is the evaluation of future project-related emissions on regional air quality as well as existing sources of air pollution near the project sites that could affect the new sensitive receptors. A refined health risk analysis was also conducted for emissions from temporary construction at both sites. This analysis was conducted following guidance provided by the Bay Area Air Quality Management District (BAAQMD, 2011a).

ENVIRONMENTAL SETTING

SAN FRANCISCO BAY AIR BASIN

The California Air Resources Board (CARB) divides the state into air basins that share similar meteorological and topographical features. Sunnyvale is located in the San Francisco Bay Area Air Basin (SFBAAB) composed of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara counties. The SFBAAB is affected by a Mediterranean climate of warm, dry summers and cool, damp winters.

Sunnyvale is located in the northern portion of the Santa Clara Valley sub-region. The northwest-southeast oriented Santa Clara Valley is bounded by the Santa Cruz Mountains to the west, the Diablo Range to the east, San Francisco Bay to the north, and the convergence of the Gabilan Range and the Diablo Range to the south. Temperatures are warm in summer, under mostly clear skies, although a relatively large diurnal range results in cool nights. Winter temperatures are mild, except for very cool but generally frostless mornings. At the northern end of the Santa Clara Valley, the San Jose Airport mean maximum temperatures range from the high 70s to the low 80s during the summer to the high 50s to low 60s during the winter, and mean minimum temperatures range from the high 50s during the summer to the low 40s during the winter. Sunnyvale's annual average rainfall is about 15 inches per year (WRCC, 2012, as measured at Santa Clara University). The wind patterns in the valley are influenced greatly by the terrain, resulting in a prevailing flow roughly parallel to the valley's northwest-southeast axis with a north-northwesterly sea breeze extending up the valley during the afternoon and early evening and a light south-southeasterly drainage flow occurring during the late evening and early morning.

The air pollution potential of the Santa Clara Valley is high. The valley has a large population and the largest complex of mobile sources in the Bay Area, making it a major source of carbon monoxide, particulate, and photochemical air pollution. In addition, photochemical precursors from San Francisco, San Mateo, and Alameda counties can be carried along by the prevailing winds to the Santa Clara Valley, making it also a major ozone receptor.

AIR POLLUTANTS OF CONCERN AND HEALTH EFFECTS

The most problematic pollutants in the Sunnyvale area include ozone and particulate matter. The health effects and major sources of these pollutants, as well as other key pollutants, are described below. Toxic air contaminants are a separate class of pollutants and are discussed later in this section.

Ozone

Ground-level ozone (O_3), commonly referred to as smog, is greatest on warm, windless, sunny days. O_3 is not emitted directly into the air, but is formed through a complex series of chemical reactions between reactive organic gases (ROG) and nitrogen oxides (NO_X). These reactions occur over time in the presence of sunlight. O_3 formation can occur in a matter of hours under ideal conditions. The time required for O_3 formation allows the reacting compounds to spread over a large area, producing a regional pollution concern. Once formed, O_3 can remain in the atmosphere for one or two days.

O_3 is also a public health concern because it is a respiratory irritant that increases susceptibility to respiratory infections and diseases, and because it can harm lung tissue at high concentrations. In addition, O_3 can cause substantial damage to leaf tissues of crops and natural vegetation and can damage many natural and manmade materials by acting as a chemical oxidizing agent. The principal sources of the O_3 precursors (ROG and NO_X) are the combustion of fuels and the evaporation of solvents, paints, and fuels.

Particulate Matter

Particulate matter (PM) can be divided into several size fractions. Coarse particles (PM_{10}) are smaller than 10 microns in diameter and arise primarily from natural processes, such as wind-blown dust or soil. Fine particles ($PM_{2.5}$) are less than 2.5 microns in diameter and are produced mostly from combustion or burning activities. Fuel burned in cars and trucks, power plants, factories, fireplaces, and wood stoves produces fine particles. $PM_{2.5,}$ and to some extent $PM_{10,}$ contains particles formed in the air from primary gaseous emissions. Examples include sulfates formed from sulfur dioxide (SO_2) emissions from power plants and industrial facilities, nitrates formed from NOx emissions from power plants, automobiles, and other combustion sources, and carbon formed from organic gas emissions from automobiles and industrial facilities.

The level of $PM_{2.5}$ in the air is a public health concern because it can bypass the body's natural filtration system more easily than larger particles and can lodge deep in the lungs. The health effects vary depending on a variety of factors, including the type and size of particles. Research has demonstrated a correlation between high PM concentrations and increased mortality rates. Elevated PM concentrations can also aggravate chronic respiratory illnesses such as bronchitis and asthma.

Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless gas that is formed by the incomplete combustion of fuels. Motor vehicle emissions are the dominant source of CO in the SFBAAB. At high concentrations, CO reduces the oxygen-carrying capacity of the blood and can cause dizziness,

headaches, unconsciousness, and even death. CO can also aggravate cardiovascular disease. Relatively low concentrations of CO can significantly affect the amount of oxygen in the bloodstream because CO binds to hemoglobin 220 to 245 times more strongly than oxygen.

CO emissions and ambient concentrations have decreased significantly in recent years. These improvements are due largely to the introduction of cleaner-burning motor vehicles and motor vehicle fuels. CO is still a pollutant that must be closely monitored, however, due to its severe effect on human health.

Elevated CO concentrations are usually localized and are often the result of a combination of high traffic volumes and traffic congestion. Elevated CO levels develop primarily during winter periods of light winds or calm conditions combined with the formation of ground-level temperature inversions. Wintertime CO concentrations are higher because of reduced dispersion of vehicle emissions and because CO emission rates from motor vehicles increase as temperature decreases.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a brownish, highly reactive gas that is present in all urban environments. The major human-made sources of NO_2 are combustion devices such as boilers, gas turbines, and mobile and stationary reciprocating internal combustion engines. Construction devices emit primarily nitric oxide (NO), which reacts through oxidation in the atmosphere to form NO_2. The combined emissions of NO and NO_2 are referred to as NO_X. Because NO_2 is formed and depleted by reactions associated with O_3, the NO_2 concentration in a particular geographic area may not be representative of the local NO_X emission sources.

Inhalation is the most common route of exposure to NO_2. Because NO_2 has relatively low solubility in water, the principal site of toxicity is in the lower respiratory tract. The severity of adverse health effects depends primarily on the concentration inhaled rather than the duration of the exposure. Exposure can result in a variety of acute symptoms, including coughing, difficulty with breathing, vomiting, headache, and eye irritation. Symptoms that are more significant may include chemical pneumonitis or pulmonary edema with breathing abnormalities, cyanosis, chest pain, and rapid heartbeat.

Sulfur Dioxide

Sulfur dioxide (SO_2) is produced by such stationary sources as coal and oil combustion, steel mills, refineries, and pulp and paper mills. The major adverse health effects associated with exposure to SO_2 pertain to the upper respiratory tract. SO_2 is a respiratory irritant, with constriction of the bronchioles occurring with inhalation of SO_2 at 5 parts per million (ppm) or more. On contact with the moist mucous membranes, SO_2 produces sulfurous acid, which is a direct irritant. Similar to NO_2, the severity of adverse health effects depends primarily on the concentration inhaled rather than the duration of the exposure. Exposure to high concentrations of SO_2 may result in edema of the lungs or glottis and respiratory paralysis.

Toxic Air Contaminants

In addition to the criteria pollutants discussed above, toxic air contaminants (TACs) are another group of pollutants of concern. TACs are considered either carcinogenic or noncarcinogenic based on the nature of the health effects associated with exposure to the pollutant. For regulatory purposes, carcinogenic TACs are assumed to have no safe threshold below which health impacts would not occur, and cancer risk is expressed as excess cancer cases per one million exposed individuals. Noncarcinogenic TACs differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis.

There are many different types of TACs, with varying degrees of toxicity. Sources of TACs include industrial processes such as petroleum refining and chrome plating operations, commercial operations such as gasoline stations and dry cleaners, and motor vehicle exhaust. Public exposure to TACs can result from emissions from normal operations, as well as from accidental releases of hazardous materials during upset conditions. The health effects of TACs include cancer, birth defects, neurological damage, and death.

Diesel particulate matter (DPM) is a TAC of growing concern in California. According to the California Almanac of Emissions and Air Quality (CARB, 2009), the majority of the estimated health risk from TACs can be attributed to relatively few compounds, the most important being DPM. In 1998, after a 10-year scientific assessment process, CARB identified DPM as a TAC. DPM differs from other TACs in that it is not a single substance but rather a complex mixture of hundreds of substances. The exhaust from diesel engines contains hundreds of different gaseous and particulate components, many of which are toxic. Many of these compounds adhere to the particles, and because diesel particles are so small, they penetrate deep into the lungs. DPM has been identified as a human carcinogen. Mobile sources, such as trucks, buses, automobiles, trains, ships, and farm equipment, are by far the largest source of diesel emissions. Studies show that DPM concentrations are much higher near heavily traveled highways and intersections.

Although DPM is emitted by diesel-fueled internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emission control system is present. No ambient monitoring data are available for DPM because no routine measurement method currently exists. However, CARB has made preliminary concentration estimates based on a PM exposure method. This method uses CARB's emissions inventory PM_{10} database, ambient PM_{10} monitoring data, and the results from several studies to estimate concentrations of DPM. In addition to DPM, benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene pose the greatest existing ambient risk, for which data are available, in California. However, DPM poses the greatest health risk among the ten TACs mentioned. Since 1990, the health risk from DPM has been reduced by 52 percent. Overall, levels of most TACs have decreased since 1990 except for para-dichlorobenzene and formaldehyde (CARB, 2009).

Unlike criteria pollutants like carbon monoxide, TACs do not have ambient air quality standards. Since no safe levels of TACs can be determined, there are no air quality standards for TACs. Instead, TAC impacts are evaluated by calculating the health risks associated with a given exposure. Two types of risk are usually assessed: chronic non-cancer risk and acute non-cancer

risk. DPM has been identified as a carcinogenic material but is not considered to have acute non-cancer risks. The State of California has begun a program of identifying and reducing risks associated with DPM. The plan consists of new regulatory standards for all new on-road, off-road, and stationary diesel-fueled engines and vehicles, new retrofit requirements for existing on-road, off-road, and stationary diesel-fueled engines and vehicles, and new diesel fuel regulations to reduce the sulfur content of diesel fuel as required by advanced diesel emission control systems. Land uses where individuals could be exposed to high levels of diesel exhaust include:

- Railroad operations
- Warehouses
- Schools with a high volume of bus traffic
- High-volume highways
- High-volume arterials and local roadways with a high level of diesel traffic

WOOD SMOKE

Wood smoke has long been identified as a significant source of pollutants in urban and suburban areas. Wood smoke contributes to particulate matter and CO concentrations, reduces visibility, and contains numerous TACs. Present controls on this source include the adoption of emission standards for wood stoves and fireplace inserts. In 2008, the Bay Area Air Quality Management District (BAAQMD) adopted Regulation 6, Rule 3: Wood-burning Devices, to reduce the harmful emissions that come from wood smoke. The new rule includes the following:

- Restricts wood burning when air quality is unhealthy and a Spare the Air Advisory is issued
- Places limits on excessive smoke (exceeding 20 percent opacity)
- Requires only cleaner-burning Environmental Protection Agency (EPA)-certified stoves and inserts be sold
- Requires only cleaner-burning EPA-certified stoves and inserts in new construction or remodels
- Prohibits the burning of garbage and other harmful materials
- Requires labeling on firewood and solid fuels sold within the Bay Area

SENSITIVE RECEPTORS

There are groups of people who are more affected by air pollution than others. CARB has identified the following persons who are most likely to be affected by air pollution: children under 14, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks.

REGULATORY FRAMEWORK

Air quality in the SFBAAB is addressed through the efforts of various federal, state, regional, and local government agencies. These agencies work jointly, as well as individually, to improve air

quality through legislation, regulations, planning, policy-making, education, and a variety of programs. The agencies primarily responsible for improving the air quality in Sunnyvale are discussed below along with their individual responsibilities.

AMBIENT AIR QUALITY STANDARDS

Both the U.S. Environmental Protection Agency (U.S. EPA) and CARB established ambient air quality standards for common air pollutants. These ambient air quality standards are levels of contaminants that represent safe levels that avoid specific adverse health effects associated with each pollutant. The ambient air quality standards cover what are called "criteria" pollutants because the health and other effects of each pollutant are described in criteria documents. The federal and California ambient air quality standards for important pollutants are summarized in **Table 4.2-1.** The federal and state ambient standards were developed independently with differing purposes and methods, although both processes attempted to avoid health-related effects. As a result, federal and state standards differ in some cases. In general, California standards are more stringent. This is particularly true for nitrogen dioxide (NO_2) and coarse particulate matter (PM_{10}).

Table 4.2-1 Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	Federal Primary Standard	State Standard
Ozone (O_3)	1-Hour 8-Hour	-- 0.075 ppm	0.09 ppm 0.07 ppm
Coarse Particulate Matter (PM_{10})	24-Hour Annual Average	150 µg/m3 –	50 µg/m3 20 µg/m3
Fine Particulate Matter ($PM_{2.5}$)	24-Hour Annual Average	35 µg/m3 12µg/m3	– 12 µg/m3
Carbon Monoxide (CO)	1-Hour 8-Hour	35 ppm 9.0 ppm	20 ppm 9.0 ppm
Nitrogen Dioxide (NO_2)	1-Hour Annual Average	0.100 ppm 0.053 ppm	0.18 ppm 0.03 ppm
Sulfur Dioxide (SO_2)	1-Hour 24-Hour Annual Average	0.075 ppm 0.14 ppm 0.03 ppm	0.25 ppm 0.04 ppm --

Notes: ppm = parts per million; µg/m3 = micrograms per cubic meter.
Source: BAAQMD, 2012a; U.S. EPA, 2013.

Ambient Air Quality Monitoring

CARB maintains several air quality monitoring sites in the SFBAAB, including a site in Cupertino at 22601 Voss Avenue, which is the closest monitoring site to the project sites. **Table 4.2-2** shows historical occurrences of pollutant levels exceeding state and federal ambient air quality standards for the three-year period of 2009 through 2011. The number of days that each standard was exceeded is shown.

Table 4.2-2 Ambient Air Quality Monitoring Data for Sunnyvale

Pollutant Standards	2009	2010	2011
Ozone – *Measured in Cupertino*			
Max 1-hour concentration (ppm)	***0.127***	0.086	0.083
Max 8-hour concentration (ppm)	***0.092***	0.067	0.066
Number of Days Standard Exceeded			
State 1-hour standard	1	0	0
Federal 8-hour standard	1	0	0
State 8-hour standard	3	0	0
Coarse Particulate Matter (PM_{10}) – *Measured in Cupertino*			
Max 24-hour concentration (µg/m3) (federal/state)	28	29	42
Annual average concentration (µg/m3) (federal/state)	ND	14.2	13.5
Number of Measurement Days Standard Exceeded			
Federal 24-hour standard	0	0	0
State 24-hour standard	0	0	0
Fine Particulate Matter ($PM_{2.5}$) – *Measured in San Jose*			
Max 24-hour concentration (µg/m3) (federal/state)	42	51	38
Annual average concentration (µg/m3) (federal/state)	8.8	9.9	9.1
Number of Measurement Days Standard Exceeded			
Federal 24-hour standard	3	3	2
Carbon Monoxide (CO) – *Measured in Cupertino*			
Max 1-hour concentration (ppm)	0.93	1.2	1.9
Max 8-hour concentration (ppm)		1.0	0.8
Number of Days Standard Exceeded			
Federal 8-hour standard	0	0	0
State 8-hour standard	0	0	0
Nitrogen Dioxide (NO_2) – *Measured in Cupertino*			
Max 1-hour concentration (ppm)	0.049	0.043	0.045
Annual Average Concentration (ppm)	ND	0.009	0.008
Number of Days Standard Exceeded			
State 1-hour standard	0	0	0
Sulfur Dioxide (SO_2) – *Measured in Cupertino*			
Max 24-hour concentration (ppm)	0.003	0.035	0.028
Annual Average Concentration (ppm)	ND	0.007	0.003

Notes: ND = No Data; ppm = parts per million; µg/m3 = micrograms per cubic meter .
Values reported in ***bold italic*** exceeded ambient air quality standard. An exceedance is not necessarily a violation.
Source: BAAQMD, 2013c.

Ambient Air Quality Attainment Status

Table 4.2-3 shows the federal and state attainment status for the SFBAAB. The region is nonattainment for federal ozone and $PM_{2.5}$ standards, and nonattainment for state ozone and PM_{10} and $PM_{2.5}$ standards.

Table 4.2-3 Federal and State Ambient Air Quality Monitoring Attainment Status for San Francisco Bay Area Air Basin

Pollutant	Federal	State
1-hour Ozone (O3)	–	Nonattainment
8-hour Ozone (O3)	Nonattainment	Nonattainment
Coarse Particulate Matter (PM10)	Unclassified	Nonattainment
Fine Particulate Matter (PM2.5)	Nonattainment	Nonattainment
Carbon Monoxide (CO)	Attainment	Attainment
Nitrogen Dioxide (NO2)	Attainment	Attainment
Sulfur Dioxide (SO2)	Attainment	Attainment

Source: Ilingworth & Rodkin, Inc., 2013.

Areas with air quality that exceed adopted air quality standards are designated as “nonattainment” areas for the relevant air pollutants. Nonattainment areas are sometimes further classified by degree (marginal, moderate, serious, severe, and extreme for ozone, and moderate and serious for carbon monoxide and PM_{10}) or status (“nonattainment-transitional”). Areas that comply with air quality standards are designated as “attainment” areas for the relevant air pollutants. “Unclassified” areas are those with insufficient air quality monitoring data to support a designation of attainment or nonattainment, but are generally presumed to comply with the ambient air quality standard. State Implementation Plans must be prepared by states for areas designated as federal nonattainment areas to demonstrate how the area will come into attainment of the exceeded federal ambient air quality standard.

As detailed in the discussion below, both CARB and the U.S. EPA have established air pollution standards in an effort to protect human health and welfare. Geographic areas are designated attainment if these standards are met and nonattainment if they are not met. In addition, each agency has several levels of classifications based on severity of the problem.

FEDERAL REGULATIONS

The U.S. EPA is responsible for enforcing the federal Clean Air Act and the 1990 amendments to it, as well as the national ambient air quality standards (federal standards) that the U.S. EPA establishes. These standards identify levels of air quality for six criteria pollutants, which are considered the maximum levels of ambient (background) air pollutants considered safe, with an

adequate margin of safety, to protect public health and welfare. The six criteria pollutants are O_3, CO, NO_2, SO_2, PM_{10}, and lead. The U.S. EPA also has regulatory and enforcement jurisdiction over emission sources beyond state waters (outer continental shelf) and sources that are under the exclusive authority of the federal government, such as aircraft, locomotives, and interstate trucking.

As part of its enforcement responsibilities, the U.S. EPA requires each state with nonattainment areas to prepare and submit a State Implementation Plan (SIP) that demonstrates the means to attain the federal standards. The SIP must integrate federal, state, and local plan components and regulations to identify specific measures to reduce pollution in nonattainment areas, using a combination of performance standards and market-based programs.

STATE OF CALIFORNIA REGULATIONS

California Air Resources Board

CARB, a department of the California Environmental Protection Agency, oversees air quality planning and control throughout California. It is primarily responsible for ensuring implementation of the 1989 amendments to the California Clean Air Act (CCAA), responding to the federal CAAA requirements, and regulating emissions from motor vehicles and consumer products within the state. CARB has established emission standards for vehicles sold in California and for various types of equipment available commercially. It also sets fuel specifications to further reduce vehicular emissions.

The amendments to the CCAA establish ambient air quality standards for the state (state standards) and a legal mandate to achieve these standards by the earliest practical date. These standards apply to the same six criteria pollutants as the federal CAA and also include sulfate, visibility, hydrogen sulfide, and vinyl chloride. They are more stringent than the federal standards and, in the case of PM_{10} and NO_2, far more stringent.

DPM emissions in California are projected to decrease in the future and are reflected in the EMFAC2011 emissions data. New CARB regulations require on-road diesel trucks to be retrofitted with particulate matter controls or replaced to meet new 2010 engine standards that have much lower DPM and $PM_{2.5}$ emissions. This regulation will substantially reduce these emissions between 2013 and 2023, with the greatest reductions occurring in 2013 through 2015. While new trucks and buses will meet strict federal standards, this measure is intended to accelerate the rate at which the fleet either turns over so there are more cleaner vehicles on the road or retrofitted to meet similar standards. With this regulation, older, more polluting trucks would be removed from the roads much quicker. CARB anticipates a 68-percent reduction in $PM_{2.5}$ (including DPM) emission from trucks in 2014 with this regulation.

Tanner Air Toxics Act and Air Toxics "Hot Spots" Information and Assessment Act

California regulates TACs primarily through the Tanner Air Toxics Act (Tanner Act) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (Assembly Bill 2588).

The Tanner Act sets forth a formal procedure for CARB to designate substances as TACs. This includes research, public participation, and scientific peer review before CARB can designate a substance as a TAC. Once a TAC is identified, CARB then adopts an Airborne Toxics Control

Measure (ATCM) for sources that emit that particular TAC. If there is a safe threshold for a substance at which there is no toxic effect, the control measure must reduce exposure below that threshold. If there is no safe threshold, the measure must incorporate best available control technology (BACT) to minimize emissions.

In 1987, the California Legislature established the Air Toxics "Hot Spots" Information and Assessment Act of 1987, Assembly Bill (AB) 2588 (Health and Safety Code Sections 44300-44394). AB 2588 requires that existing facilities that emit toxic substances above a specified level (1) prepare a toxic-emission inventory, (2) prepare a risk assessment if emissions are significant, (3) notify the public of significant risk levels, and (4) prepare and implement risk reduction measures. CARB has adopted diesel exhaust control measures and more stringent emission standards for various on-road mobile sources of emissions, including transit buses and off-road diesel equipment (e.g., tractors, generators). In 1992, the "Hot Spots" Act was amended by Senate Bill (SB) 1731, which required facilities that pose a significant health risk to the community to reduce their risk through a risk management plan.

Senate Bill 656

In 2003, the California Legislature enacted SB 656 to reduce public exposure to PM_{10} and $PM_{2.5}$. In 2004, CARB approved a list of the most readily available, feasible, and cost-effective control measures that can be employed by air districts to reduce PM_{10} and $PM_{2.5}$ (collectively referred to as PM). The list is based on rules, regulations, and programs existing in California as of January 1, 2004, for stationary, area-wide, and mobile sources. In 2005, air districts adopted implementation schedules for selected measures from the list. The implementation schedules identify the appropriate subset of measures and the dates for final adoption, implementation, and the sequencing of selected control measures. In developing the implementation schedules, each air district prioritized measures based on the nature and severity of the PM problem in their area and cost-effectiveness. Consideration was also given to ongoing programs such as measures being adopted to meet national air quality standards or the state ozone planning process.

REGIONAL REGULATIONS

In 1955, the California Legislature created the Bay Area Air Quality Management District (BAAQMD). The agency is primarily responsible for assuring that the federal and state ambient air quality standards are attained and maintained in the Bay Area. The BAAQMD regulates air quality within Sunnyvale. The BAAQMD is responsible for many other activities, including:

- Adopting and enforcing rules and regulations concerning air pollutant sources
- Issuing permits for stationary sources of air pollutants
- Inspecting stationary sources of air pollutants
- Responding to citizen complaints
- Monitoring ambient air quality and meteorological conditions
- Awarding grants to reduce motor vehicle emissions
- Conducting public education campaigns

BAAQMD Rules and Regulations

The BAAQMD regulates the demolition of buildings and structures that may contain asbestos. Asbestos is a fibrous mineral that occurs naturally in ultramafic rock—a rock type commonly found in California—and was used in the past as a processed component of building materials. Because asbestos has been proven to cause serious adverse health effects, such as asbestosis and lung cancer, it is strictly regulated. The relevant local regulations are found in BAAQMD Regulation 11, Rule 2: Hazardous Materials; Asbestos Demolition, Renovation and Manufacturing.

In addition, the BAAQMD adopted Regulation 6, Rule 3, to control particulate matter emissions from wood-burning devices. The rule restricts operation of any indoor or outdoor fireplace, fire pit, wood or pellet stove, masonry heater, or fireplace insert on days during the winter when air quality conditions are forecasted to exceed the national ambient air quality standard (NAAQS) for $PM_{2.5}$. The rule also limits excess visible emissions from wood-burning devices and requires clean burning technology for wood-burning devices that are sold, resold, or installed in the Bay Area.

The BAAQMD's Regulation 7 limits odors from many different sources, excluding restaurants and agricultural practices. The requirements of this regulation become applicable when the BAAQMD receives odor complaints from 10 or more complainants within a 90-day period, alleging that a source has caused odors perceived at or beyond the property line of the source and deemed to be objectionable.

BAAQMD Air Quality Guidelines

In May 2011, the BAAQMD updated its guidelines to evaluate air quality impacts from projects (BAAQMD, 2011a). These guidelines included evaluation criteria for siting new sensitive receptors near sources of toxic air contaminants and air pollutants, as well as criteria for evaluating potential odor impacts. "Sensitive receptors" are defined as facilities where sensitive population groups, such as children, the elderly, the acutely ill, and the chronically ill, are likely to be located. These land uses include residences, schools, playgrounds, childcare centers, retirement homes, convalescent homes, hospitals, and medical clinics.

The guidelines recommend that plans identify special overlay zones around existing and proposed sources of toxic air contaminants, and that these overlay zones should be included in General Plans as well as other land use plans. The purpose of the overlay zones is to reduce exposures of sensitive land uses to unhealthy levels of toxic air contaminants, including $PM_{2.5}$, from substantial nearby sources. The BAAQMD's new guidelines rely on the guidance from CARB's *Air Quality and Land Use Handbook* (CARB, 2005), described above. In Sunnyvale, the primary overlay zones would likely be along U.S. Highway 101 (Highway 101) and State Routes (SR) 237 and 85. The BAAQMD has also recommended that lead agencies include the effects of major roadways and permitted stationary sources of air pollutants, which could affect the planning area.

The BAAQMD's guidelines also provide methods for analyzing the impacts of TAC sources to develop more refined overlay zones. These methods rely on modeling specific emissions from the roadways or sources, using emission factor models, dispersion modeling, and health risk criteria to determine where such sources result in significant exposures. These guidelines provide criteria for judging source-specific and cumulative impacts. The guidelines also recommend screening distances for various types of odor sources.

BAAQMD CARE Program

The BAAQMD initiated its Community Air Risk Evaluation (CARE) program in 2004 to evaluate and reduce health risks associated with exposures to outdoor TACs in the Bay Area. The program examines TAC emissions from point sources; area sources; on-road mobile sources, such as cars and trucks; and off-road mobile sources, such as construction equipment, trains, and aircraft. The CARE program focuses on DPM emissions, which is the major contributor to airborne health risk in California. Its goal is to identify areas with high emissions of TACs that have sensitive populations nearby, then reduce exposure to TACs through new regulations, incentive funding, and other programs.

In Phase I of the program, a 2-kilometer-by-2-kilometer gridded inventory of TAC emissions was developed for the year 2000. The data were then updated to include 2005 emission data. This emissions inventory was risk-weighted to reflect the differences in potency of the various TACs. For example, benzene has far higher cancer potency than many other compounds, such as methyl tertiary buytl ether (MTBE). In contrast, while DPM is not as potent as benzene, DPM emissions are much more prevalent. The Phase I study identifies diesel emissions from heavy-duty trucks as a major source of TAC emissions and identifies programs available to reduce these emissions.

In Phase II of the CARE program, the BAAQMD is performing regional and local-scale modeling to determine the significant sources of DPM and other TAC emissions locally in priority communities, as well as for the entire Bay Area. The BAAQMD has partnered with CARB, the Port of Oakland, the Pacific Institute, the West Oakland Environmental Indicators Project, and major railroads to prepare specific health risk assessments.

One highlight of the CARE program is the development of a Mitigation Action Plan, in which risk reduction activities are focused on the most at-risk communities. This plan identified six different at-risk communities that would benefit from targeted mitigation, based on TAC emissions and presence of sensitive land uses. Sunnyvale is not located in any of these at-risk communities.

In Phase III, the BAAQMD plans to conduct an extensive exposure assessment to identify and rank the communities as to their potential TAC exposures and determine the types of activities that place in the communities at highest risk. The BAAQMD will also pursue additional mitigations and attempt to develop a metric to measure the effectiveness of these efforts. The new BAAQMD CEQA Guidelines (BAAQMD, 2011a) included new significance thresholds for community risk and hazards that originated from this process. These new thresholds address both project (single-source) and cumulative exposures.

Air Quality Plans

To protect public health, the BAAQMD has adopted plans to achieve ambient air quality standards. The BAAQMD must continuously monitor its progress in implementing attainment plans and must periodically report to CARB and the U.S. EPA. It must also periodically revise its attainment plans to reflect new conditions and requirements.

In 1991, the BAAQMD, Metropolitan Transportation Commission (MTC), and Association of Bay Area Governments (ABAG) prepared the Bay Area 1991 Clean Air Plan. This air quality plan addresses the California Clean Air Act. Updates to this plan are developed approximately every

three years. The plans are meant to demonstrate progress toward meeting the more stringent 1-hour ozone California ambient air quality standard (AAQS). In 2010, the BAAQMD adopted the Bay Area 2010 Clean Air Plan (BAAQMD, 2010b). This Clean Air Plan updates the most recent ozone plan, the 2005 Ozone Strategy. Unlike previous Bay Area Clean Air Plans, the 2010 Clean Air Plan is a multi-pollutant air quality plan addressing four categories of air pollutants:

- Ground-level ozone and the key ozone precursor pollutants (reactive organic gases and NO_X), as required by state law.
- Particulate matter, primarily $PM_{2.5}$, as well as the precursors to secondary $PM_{2.5}$.
- Toxic air contaminant.
- Greenhouse gases (GHGs).

While previous Clean Air Plans have relied upon a combination of stationary and transportation control measures, the 2010 Clean Air Plan adds two new types of control measures: (1) Land Use and Local Impact Measures, and (2) Energy and Climate Measures. These types of measures would indirectly reduce air pollutant and GHG emissions through reductions in vehicle use and energy usage. In addition, the plan includes Further Study Measures, which will be evaluated as potential control measures.

The Bay Area 2010 Clean Air Plan proposes expanded implementation of transportation control measures (TCMs) and includes public outreach programs designed to educate the public about air pollution in the Bay Area and promote individual behavior changes that improve air quality. New measures in the Clean Air Plan are aimed at helping guide land use policies that would indirectly reduce air pollutant emissions. Some of these measures or programs rely on local governments for implementation. The clean air planning efforts for O_3 also will reduce PM_{10} and $PM_{2.5}$, as a substantial amount of particulate matter comes from combustion emissions such as vehicle exhaust. Conversely, strategies to reduce O_3 precursor emissions will reduce secondary formation of $PM_{2.5}$ and PM_{10}.

While the Clean Air Plan addresses state requirements, it will also provide the basis for developing future control plans to meet federal requirements (NAAQS) for ozone and $PM_{2.5}$. The U.S. EPA recently issued formal designations for O_3 under the most recent NAAQS. These new standards will trigger new planning requirements for the Bay Area and possibly more stringent federally enforceable control measures.

The Bay Area 2001 Ozone Attainment Plan was prepared to achieve the 1-hour NAAQS for ozone. Since that plan was submitted, the region was designated as a marginal nonattainment area for the 8-hour ozone NAAQS, and the 1-hour ozone NAAQS was revoked. This plan was a proposed revision to the Bay Area part of California's plan (State Implementation Plan, or SIP) to achieve the 1-hour ozone NAAQS. The plan was prepared in response to the U.S. EPA's partial approval and partial disapproval of the Bay Area's 1999 Ozone Attainment Plan. The U.S. EPA plans to designate the Bay Area as nonattainment with respect to the new 2008 8-hour ozone NAAQS. This would require the region to develop a new Ozone Attainment Plan to meet this standard. A new plan would likely contain many of the components listed in the 2010 Clean Air Plan described above, since that plan addresses the more stringent state ozone standards.

There is no formal clean air plan addressing PM_{10}. However, the clean air planning efforts for ozone will also reduce PM_{10} and $PM_{2.5}$, since a substantial amount of this air pollutant comes from

combustion emissions such as vehicle exhaust. In addition, the BAAQMD adopts and enforces rules to reduce particulate matter emissions and develops public outreach programs to educate the public to reduce PM_{10} and $PM_{2.5}$ emissions. One such program is the Winter Spare the Air program, which is similar to the standard Spare the Air program but focuses on $PM_{2.5}$ emissions that result from the use of fireplaces and wood stoves.

In addition, California's SB 656 (SB 656, Sher, 2003), which amended Section 39614 of the Health and Safety Code, required further action by CARB and air districts to reduce public exposure to PM_{10} and $PM_{2.5}$. Efforts identified by the BAAQMD in response to SB 656 are primarily targeting reductions in wood smoke emissions, adopting new rules to further reduce NO_X and particulate matter from internal combustion engines, and reducing particulate matter from commercial charbroiling activities.

Because the U.S. EPA designated the Bay Area nonattainment for the 24-hour $PM_{2.5}$ standard, CARB and the BAAQMD will have to develop a plan for meeting the standard by December 2014. CARB requested that the U.S. EPA make a determination that the Bay Area has attained the 2006 $PM_{2.5}$ NAAQS and determine that attainment-related SIP submittal requirements are not applicable for as long as the area continues to attain the standard. A determination of whether an area's air quality currently meets the $PM_{2.5}$ NAAQS is generally based upon the most recent three years of complete, quality-assured data. On October 29, 2012, the U.S. EPA proposed to determine that the San Francisco Bay Area has attained the $PM_{2.5}$ NAAQS. This proposed determination is based on ambient air monitoring data showing that this area has monitored attainment of the $PM_{2.5}$ NAAQS based on the 2009–2011 monitoring period. If the U.S. EPA finalizes this determination of attainment, the only SIP requirements would include an updated emission inventory for primary $PM_{2.5}$, as well as precursor pollutants that contribute to formation of secondary particulate matter and amendments to BAAQMD's New Source Review (NSR) to address $PM_{2.5}$. (These amendments were adopted in 2009.) The Bay Area's $PM_{2.5}$ emission inventory was submitted to the U.S. EPA on January 14, 2013.

CITY OF SUNNYVALE GENERAL PLAN

The City of Sunnyvale General Plan includes the following goal and policy relevant to the air quality impacts of the proposed projects:

GOAL EM-11 – Improved Air Quality: Improve Sunnyvale's air quality and reduce the exposure of its citizens to air pollutants.

Policy EM-11.3: Require all new development to utilize site planning to protect citizens from unnecessary exposure to air pollutants.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

Per Appendix G of the California Environmental Quality Act (CEQA) Guidelines and BAAQMD recommendations, air quality impacts are considered significant if implementation of the proposed projects would:

- Conflict with or obstruct implementation of an applicable air quality plan;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

The BAAQMD provides lead agencies in the Bay Area with guidance in assessing impacts. In June 2010, the BAAQMD adopted thresholds of significance to assist in the review of projects under CEQA. These thresholds were designed to establish the level at which the BAAQMD believed air pollution emissions would cause significant environmental impacts under CEQA. They were posted on the BAAQMD's website and included in the BAAQMD's updated CEQA Guidelines (updated May 2011). The significance thresholds identified by the BAAQMD and used in this analysis are summarized in **Table 4.2-4.**

The BAAQMD's adoption of the thresholds was called into question by an order issued March 5, 2012, in California Building Industry Association v. BAAQMD (Alameda Superior Court Case No. RGI0548693). The order requires the BAAQMD to set aside its approval of the thresholds until it has conducted environmental review under CEQA. The ruling made in the case concerned the environmental impacts of adopting the thresholds and how the thresholds would indirectly affect land use development patterns. Those issues were not relevant to the scientific basis of the BAAQMD's analysis of what levels of pollutants should be deemed significant. This analysis considers the science informing the thresholds as being supported by substantial evidence. Scientific information supporting the thresholds was documented in the BAAQMD's proposed thresholds of significance analysis (BAAQMD, 2009). Moreover, the thresholds will not cause any indirect impact in terms of land use development patterns insofar as these projects are concerned, because the proposals to construct the projects are not influenced by the BAAQMD guidelines. Accordingly, the analysis herein uses the thresholds and methodologies from the BAAQMD's May 2011 CEQA Air Quality Guidelines to determine the potential impacts of the projects on the existing environment.

PROJECT IMPACTS

<u>Impact AIR-1</u>: The projects would not conflict with or obstruct implementation of the applicable air quality plan. (LTS)

The most recent clean air plan is the *Bay Area 2010 Clean Air Plan* that was adopted by the BAAQMD in September 2010. The proposed projects would not conflict with the latest Clean Air planning efforts since (1) the projects would have emissions below the BAAQMD thresholds (see Impact AIR-2), (2) development of the project sites would be considered urban "infill," (3) development would occur near employment centers, and (4) development would be in proximity to existing transit with regional connections. The projects are too small to incorporate project-specific transportation control measures listed in the latest Clean Air Plan (i.e., *Bay Area 2010 Clean Air Plan*).

Table 4.2-4 Federal and State Ambient Air Quality Monitoring Attainment Status for San Francisco Bay Area Air Basin

Pollutant	Construction Thresholds Average Daily Emissions (pounds/day)	Operational Thresholds: Average Daily Emissions (pounds/day)	Operational Thresholds: Annual Average Emissions (tons/year)
Criteria Air Pollutants			
ROG	54	54	10
NO_x	54	54	10
PM_{10}	82	82	15
$PM_{2.5}$	54	54	10
CO	Not Applicable	9.0 ppm (8-hour average) or 20.0 ppm (1-hour average)	
Fugitive Dust	Construction Best Management Practices	Not Applicable	
Health Risks and Hazards for New Sources			
Excess Cancer Risk	10 per one million	10 per one million	
Chronic or Acute Hazard Index	1.0	1.0	
Incremental annual average $PM_{2.5}$	0.3 µg/m^3	0.3 µg/m^3	
Health Risks and Hazards for Sensitive Receptors (Cumulative from all Sources within 1,000-Foot Zone of Influence) and Cumulative Thresholds for New Sources			
Excess Cancer Risk	100 per one million		
Chronic Hazard Index	10.0		
Annual Average $PM_{2.5}$	0.8 µg/m^3		

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM10 = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, ppm = parts per million, µg/m^3 = micrograms per cubic meter.
Source: Illingworth & Rodkin, Inc., 2013.

Sares Regis Applicant Proposed Scenario. See above discussion.

Sares Regis Full Buildout Scenario. See above discussion.

Raintree Applicant Proposed Scenario. See above discussion.

Raintree Full Buildout Scenario. See above discussion.

Mitigation Measure AIR-1: No mitigation would be necessary. (LTS)

- Applies to Sares Regis Applicant Proposed Scenario: ☒

- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☒
- Applies to Raintree Full Buildout Scenario: ☒

Impact AIR-2: Construction of the Full Buildout Scenarios could result in a cumulatively considerable net increase of a criteria pollutant for which the project region is nonattainment under an applicable national or state ambient air quality standard.

The Bay Area is considered a nonattainment area for ground-level ozone and $PM_{2.5}$ under both the federal Clean Air Act and the California Clean Air Act. The area is also considered nonattainment for PM_{10} under the California Clean Air Act, but not the federal Clean Air Act. The area has attained both state and federal ambient air quality standards for carbon monoxide. As part of an effort to attain and maintain ambient air quality standards for ozone, $PM_{2.5}$ and PM_{10}, the BAAQMD has established the thresholds discussed above under "Significance Criteria."

The California Emissions Estimator Model Version 2011.1.1 (CalEEMod) was used to predict emissions from operation of the site for both the Applicant Proposed Scenario and the Full Buildout Scenario of both projects. The project land use types and size, trip generation rate, and other project-specific information were input to the model. The use of this model for evaluating air pollutant emissions from land use projects is recommended by the BAAQMD.

Construction Emissions

Annual and average daily emissions for construction were calculated, including both on-site and off-site activities. On-site activities would consist of the operation of off-road construction equipment, as well as on-site truck travel (e.g., haul trucks, water trucks, and concrete trucks). Emissions from off-road equipment were calculated by using emission factors from the CARB OFFROAD model for off-road construction equipment and the project construction schedule. On- and off-site vehicle emissions were computed using emission factors from CARB's EMFAC2011 mobile source emissions model.

Sares Regis Construction Schedule, Phases, and Equipment

It is anticipated that the Sares Regis project would be constructed over 21 months, from early 2014 through late 2015. Assuming about 22 construction days per month, there would be approximately 462 work days. The construction schedule, estimated hauling volumes, and anticipated on-site construction equipment used for the emission calculations are shown in Appendix D. Anticipated demolition and soil hauling volumes, and trips from cement trucks are also shown in Appendix D.

Raintree Construction Schedule, Phases, and Equipment

It is anticipated that the Raintree project would be constructed over 24 months, from late 2014 through late 2016. Assuming about 22 construction days per month, there would be approximately 528 work days. The construction schedule, estimated hauling volumes, and anticipated on-site construction equipment used for the emission calculations are shown in Appendix D. Anticipated demolition and soil hauling volumes, and trips from cement trucks are also shown in Appendix D.

Off-Site Construction Emissions

Emissions from haul trips, vendor trips, and construction worker trips were estimated using emission factors from EMFAC2011 and the estimated number of trips and trip lengths. Vendor, worker, and haul truck one-way trip lengths were estimated at 7.3 miles, 12.4 miles, and 20 miles, respectively. These are the default trip lengths assumed in the CalEEMod model. The number of haul trucks needed for construction of the projects was based on the amount of material to be hauled away during demolition and from excavation and grading activities at the site and was provided by the project applicants. The number of concrete trucks needed was also based on estimates provided by the project applicants.

On-Site Construction Emission Computations

On-site emissions from off-road construction equipment were calculated using emission rates from the OFFROAD model and the number and types of construction equipment needed, along with the anticipated length of their use for different phases of construction based on the site-specific construction activity schedules (see Appendix D). These construction schedules included the estimated number of days the equipment would operate for each phase and the average number of hours per day of operation. Off-road equipment horsepower estimates and load factors were based on the defaults used by CalEEMod, if available, or provided by the project applicants. Emission rates for construction equipment representative of U.S. EPA Tier 2 engine emission standards were assumed (a model year 2006 construction equipment fleet). Equipment load factors were based on the latest OFFROAD model guidance provided by CARB. Construction of the projects is anticipated to occur during the weekdays from 7:00 AM to 6:00 PM and 8:00 AM to 5:00 PM on Saturdays.

Emissions from water trucks export haul trucks, cement trucks and vendor trucks associated with construction activities while traveling on-site were calculated using emission factors from CARB's EMFAC2011 mobile source emissions model. While traveling on-site, these trucks were assumed to travel a 10 miles per hour (mph). Additionally, haul trucks and vendor trucks were assumed to idle on-site for 10 minutes (5 minutes per trip) and concrete trucks were assumed to idle for one hour (60 minutes per truck).

In addition, CalEEmod was used to estimate reactive organic gases (ROG) emissions due to architectural coatings during construction (i.e., painting). Architectural coating emission inputs were adjusted to account for BAAQMD regulations that reduce the volatile organic compound content in paints to about 150 grams per liter for typical paints used in this type of construction.

The refined emissions modeling of $PM_{2.5}$ exhaust from of on-site activities was predicted as part of the construction health risk assessment addressed later in this report.

Construction Emissions by Scenario

Sares Regis Applicant Proposed Scenario. **Table 4.2-5** shows annual and average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ exhaust during construction of the Sares Regis project. Daily emissions were computed from total emissions and dividing the number of construction days. Total emissions were the sum of the annual emissions. The number of construction days was computed at 462, assuming 22 days per month and 21 months of

construction. As indicated in Table 4.2-5, predicted average daily emissions would not exceed the BAAQMD thresholds. The impact associated with construction-period emissions is considered *less than significant* for the Applicant Proposed scenarios, but could be significant for the Full Buildout scenarios. Construction emission computations are provided in Appendix D.

Table 4.2-5 Sares Regis Project Construction Emissions

	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
Off-Road Equipment (tons)	0.2	2.7	0.1	0.1
On-Road Vehicles (tons)	0.1	0.3	0.1	0.0
Evaporative Emissions (tons)	3.6	--	--	--
Total Emissions (tons)	3.9	3.0	0.2	0.1
Average Emissions (pounds/day) based on 462 construction days	16.9	13.0	0.9	0.4
BAAQMD Thresholds (pounds/day)	*54*	*54*	*82*	*54*
Exceed Threshold?	*No*	*No*	*No*	*No*

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM10 = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, BAAQMD = Bay Area Air Quality Management District ,
Source: Illingworth & Rodkin, Inc., 2013.

Sares Regis Full Buildout Scenario. Since construction techniques, equipment usage, and schedules have not been identified for the Full Buildout Scenario, construction emissions cannot be calculated at this time. Thus, mitigation measures have been recommended to ensure that construction-related emissions for the Full Buildout Scenario would be less than significant.

Raintree Applicant Proposed Scenario. **Table 4.2-6** shows annual and average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ exhaust during construction of the project. Daily emissions were computed from total emissions and dividing the number of construction days. Total emissions were the sum of the annual emissions. The number of construction days was computed at 528, assuming 22 days per month and 24 months of construction. As indicated in Table 4.2-6, predicted average daily emissions would not exceed the BAAQMD thresholds. The impact associated with construction-period emissions is considered *less than significant*. Construction emission computations are provided in Appendix D.

Raintree Full Buildout Scenario. Since construction techniques, equipment usage, and schedule have not been identified for the Full Buildout Scenario, construction emissions cannot be calculated at this time. Thus, mitigation measures have been recommended to ensure that construction-related emissions for the Full Buildout Scenario would be less than significant.

Table 4.2-6 Raintree Project Construction Emissions

	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
Off-Road Equipment (tons)	0.6	7.7	0.4	0.4
On-Road Vehicles (tons)	0.3	0.8	0.2	0.1
Evaporative Emissions (tons)	8.5	--	--	--
Total Emissions (tons)	9.4	8.5	0.6	0.5
Average Emissions (pounds/day) based on 528 Construction Days	35.6	32.2	2.3	1.9
BAAQMD Thresholds (pounds/day)	*54*	*54*	*82*	*54*
Exceed Threshold?	*No*	*No*	*No*	*No*

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM10 = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, BAAQMD = Bay Area Air Quality Management District ,
Source: Illingworth & Rodkin, Inc., 2013.

Operational Emissions

The CalEEMod model, along with the projects' vehicle trip generation rates and estimates, were used to predict daily emissions associated with operation of the Applicant Proposed Scenarios and Full Buildout Scenarios under both projects. Adjustments to the modeling are described below. The CalEEMod operational emissions modeling output is also provided in Appendix D.

Sares Regis Land Use Descriptions

The proposed project land uses were input into CalEEMod, which included 205 mid-rise apartments under the Applicant Proposed Scenario and 259 mid-rise apartments under the Full Buildout Scenario.

Raintree Land Use Descriptions

The proposed project land uses were input into CalEEMod, which included 465 mid-rise apartments under the Applicant Proposed Scenario and 679 mid-rise apartments under the Full Buildout Scenario.

Sares Regis Year of Analysis

Emissions associated with vehicle travel depend on the year of analysis because emission control technology requirements are phased in over time. Therefore, the earlier the year analyzed in the model, the higher the emission rates CalEEMod uses. The earliest full year the Applicant Proposed Scenario could be possibly constructed and fully operated was assumed to be 2016. Use of this early date is considered conservative, as emissions associated with buildout later than 2016 would be lower. The earliest full year that the Full Buildout Scenario could be possibly constructed and fully operated was assumed to be 2018.

Raintree Year of Analysis

The earliest full year the Applicant Proposed Scenario could be possibly constructed and fully operated was assumed to be 2017. The earliest full year that the Full Buildout Scenario could be possibly constructed and fully operated was assumed to be 2019.

Trip Generation Rates

CalEEMod allows the user to enter specific trip generation rates. TJKM transportation consultants provided trip generation rates for the projects by land use type (TJKM, 2013). Under the Applicant Proposed Scenario, the daily rate is 6.66 trips per dwelling unit, and under the Full Buildout Scenario, the daily rate is 6.54 trips per dwelling unit.

Area Sources

Minor adjustments were made to the area source inputs of CalEEMod. These include an adjustment that no residences would use wood-burning stoves or fireplaces. All fireplaces were assumed to be natural-gas fired. Also, the model was adjusted to account for current BAAQMD regulations pertaining to architectural coatings (Reg. 8, Rule 3), which limits most paints to less than 150 grams of volatile organic compounds per liter.

Energy-Efficiency Measures

Energy-efficiency measures, such as exceeding California Title 24 standards by 15 percent or more, installing energy-efficient lighting and appliances, and using water-efficient landscaping, were included in the model runs. For a full list of these measures see Chapter 3, Project Description, and Chapter 4.4, Greenhouse Gas Emissions.

Operational Emissions by Scenario

Sares Regis Applicant Proposed Scenario. Project emissions are presented in **Table 4.2-7**. As shown in Table 4.2-7, average daily emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$ associated with project operation would not exceed the BAAQMD significance thresholds. Therefore, the impact is considered *less than significant*.

Sares Regis Full Buildout Scenario. Project emissions are presented in Table 4.2-7. As shown in Table 4.2-7, average daily emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$ associated with project operation would not exceed the BAAQMD significance thresholds. Therefore, the impact is considered *less than significant*.

Raintree Applicant Proposed Scenario. Project emissions are presented in **Table 4.2-8**. As shown in Table 4.2-8, average daily emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$ associated with project operation would not exceed the BAAQMD significance thresholds. Therefore, the impact is considered *less than significant*.

Table 4.2-7 Sares Regis Project Operational Emissions

	ROG	NOx	PM_{10}	$PM_{2.5}$
Applicant Proposed Scenario – 2016				
Emissions in tons per year	3.1	1.9	1.6	0.2
Emissions in average pounds per day	17	10	9	1
Full Buildout Scenario – 2018				
Emissions in tons per year	3.6	2.0	2.0	0.1
Emissions in average pounds per day	20	11	11	1
BAAQMD Thresholds (tons per year)	*10*	*10*	*15*	*10*
Significant?	***No***	***No***	***No***	***No***
BAAQMD Thresholds (pounds per day)	*54*	*54*	*82*	*54*
Significant?	***No***	***No***	***No***	***No***

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM10 = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, BAAQMD = Bay Area Air Quality Management District ,
Source: Illingworth & Rodkin, Inc., 2013.

Table 4.2-8 Raintree Project Operational Emissions

	ROG	NOx	PM_{10}	$PM_{2.5}$
Applicant Proposed Scenario – 2017				
Emissions in tons per year	6.7	3.9	3.6	0.3
Emissions in average pounds per day	37	21	20	2
Full Buildout Scenario – 2019				
Emissions in tons per year	9.4	4.9	5.2	0.3
Emissions in average pounds per day	52	27	28	2
BAAQMD Thresholds (tons per year)	*10*	*10*	*15*	*10*
Significant?	***No***	***No***	***No***	***No***
BAAQMD Thresholds (pounds per day)	*54*	*54*	*82*	*54*
Significant?	***No***	***No***	***No***	***No***

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM10 = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, BAAQMD = Bay Area Air Quality Management District ,
Source: Illingworth & Rodkin, Inc., 2013.

Raintree Full Buildout Scenario. Project emissions are presented in Table 4.2-8. As shown in Table 4.2-8, average daily emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$ associated with project operation would not exceed the BAAQMD significance thresholds. Therefore, the impact is considered *less than significant.*

> *Mitigation Measure AIR-2: When construction information is available for the Full Buildout Scenarios, a complete air emissions analysis for construction emissions shall be completed by the project applicants to address annual and average daily construction emissions of reactive organic gases (ROG), nitrogen oxides (NO_X), coarse particulate matter (PM_{10}) exhaust, and fine particulate matter ($PM_{2.5}$) exhaust during construction of the Sares Regis and Raintree projects. Average daily emissions shall be computed from total emissions. Total emissions shall be the sum of the annual emissions. If predicted average daily emissions would exceed the Bay Area Air Quality Management District (BAAQMD) thresholds, the applicants shall identify mitigation measures that would reduce construction-related emissions to below the BAAQMD thresholds. Such measures may include:*
>
> - *Phasing of the project to reduce daily emissions;*
> - *Use of newer or retrofitted construction equipment that has low emission rates; and*
> - *Use of alternatively fueled equipment; and modification of construction techniques to avoid use of diesel-powered equipment.*
>
> *Compliance with thresholds shall be verified by the City prior to issuance of any building permits. (LTS)*
>
> - Applies to Sares Regis Applicant Proposed Scenario: ☐
> - Applies to Sares Regis Full Buildout Scenario: ☒
> - Applies to Raintree Applicant Proposed Scenario: ☐
> - Applies to Raintree Full Buildout Scenario: ☒

Impact AIR-3: The projects would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. (LTS)

As discussed under Impact AIR-2, project operations would have emissions less than the significance thresholds adopted by the BAAQMD for evaluating impacts of ozone and particulate matter. Therefore, the projects would not contribute substantially to existing or projected violations of those standards. Carbon monoxide emissions from traffic generated by the project would be the pollutant of greatest concern at the local level. Congested intersections with a large volume of traffic have the greatest potential to cause high localized concentrations of carbon monoxide. Air pollutant monitoring data indicate that carbon monoxide levels have been at healthy levels (i.e., below state and federal standards) in the Bay Area since the early 1990s. As a result, the region has been designated as attainment for the standard. There is an ambient air quality monitoring station in Cupertino that measures carbon monoxide concentrations. The highest measured level over any 8-hour averaging period during the last 3 years is less than 1.0 part per million (ppm), compared to the ambient air quality standard of 9.0 ppm. BAAQMD screening guidance indicates that a project would have a less-than-significant impact with respect to carbon monoxide levels if project traffic projections indicate traffic levels would not increase at any affected intersection to more than 44,000 vehicles per hour. Because cumulative traffic volumes at all intersections

affected by the projects together would be far less, the projects would have a *less-than-significant impact* with respect to carbon monoxide.

Sares Regis Applicant Proposed Scenario. See above discussion.

Sares Regis Full Buildout Scenario. See above discussion.

Raintree Applicant Proposed Scenario. See above discussion.

Raintree Full Buildout Scenario. See above discussion.

Mitigation Measure AIR-3: No mitigation would be necessary. (LTS)

- Applies to Sares Regis Applicant Proposed Scenario: ☒
- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☒
- Applies to Raintree Full Buildout Scenario: ☒

Impact AIR-4: Sensitive receptors that are part of the proposed projects could be exposed to substantial pollutant concentrations. (S)

The projects would place sensitive receptors near potential sources of TAC emissions. The operation of the projects is not expected to cause any localized emissions that could expose sensitive receptors to unhealthy air pollutant levels. However, construction activities would generate dust and equipment exhaust on a temporary basis that could affect nearby land uses (see Impact AIR-5 below).

The proposed projects would locate new residences near Highway 101, North Fair Oaks Avenue, and several stationary sources that emit TACs. Proximity to busy streets and railroads is also associated with exposure to source of TACs or $PM_{2.5}$, predominantly from diesel exhaust emissions. The BAAQMD has identified significance thresholds for exposure to TACs and $PM_{2.5}$ as part of its CEQA Air Quality Guidelines (Guidelines) that were recently vacated. The BAAQMD Guidelines include thresholds to evaluate single source and cumulative source impacts of TACs and $PM_{2.5}$ on existing sensitive receptors and proposed sensitive receptors.

TAC Impacts from Roadways

A review of nearby roadways and traffic information indicates two roadways within 1,000 feet of the project sites with average daily traffic in excess of 10,000 average daily trips (ADT) or having a high percentage of heavy duty truck traffic: Highway 101 with 154,000 ADT (Caltrans, 2012a) and North Fair Oaks Avenue with and estimated at about 21,003 ADT (City of Sunnyvale, 2013).

Due to the nearby roadways with substantial traffic volumes, potential health risks and $PM_{2.5}$ concentrations from traffic emissions were evaluated in this assessment. According to the BAAQMD CEQA Air Quality Guidelines (BAAQMD, 2011a), a refined analysis is necessary to appropriately identify the impacts of nearby traffic emissions upon the project. The refined analysis for roadways takes into account local traffic conditions, site-specific meteorology (using the most

representative BAAQMD hourly meteorological data set), and roadway emissions that take into account future year exposures.

BAAQMD Google Earth Screening Tool

The proposed projects could develop residences within 100 feet of Highway 101 and North Fair Oaks Avenue. The BAAQMD provides a Google Earth Highway Screening Analysis Tool that can be used to identify screening level impacts from State highways (BAAQMD, 2011b). This tool identified community risk levels as shown in **Table 4.2-9.**

Table 4.2-9 Screening Roadway Health Impacts

Roadway/Setback	Daily Traffic	Cancer Risk (per million)	$PM_{2.5}$ Concentration (µg/m³)	Acute Hazard (HI)	Chronic Hazard (HI)
Highway 101 (100 feet)	154,000	55.1	0.38	0.05	0.05
North Fair Oaks Avenue (100 feet)	21,003	3.9	0.15	<0.1	<0.1

Note: PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, µg/m3 = micrograms per cubic meter
Source: Illingworth & Rodkin, Inc., 2013.

Since screening cancer risks and annual $PM_{2.5}$ concentrations from Highway 101 are above the BAAQMD community risk thresholds, a refined analysis of the impacts on the sites were modeled using refined emissions and dispersion modeling techniques. This refined analysis was focused only on Highway 101, since North Fair Oaks Avenue traffic would not have significant effects.

This analysis involved the development of DPM, organic TAC, and $PM_{2.5}$ emissions for traffic on Highway 101 and associated on- and off-ramps near the project sites using the latest version of CARB's emission factor model and traffic mix developed from Caltrans data. EMFAC2011 is the most recent version of the CARB motor vehicle emission factor model. Roadway and receptor coordinates, meteorological data, traffic volumes, and the emission factors were used with the CAL3QHCR roadway dispersion model to predict annual concentrations of TACs and $PM_{2.5}$ from roadway traffic. Traffic TAC concentrations are combined with risk factors to predict lifetime cancer risks at the project sites. **Figure 4.2-1** shows the project sites and the modeled line-sources and receptors.

Traffic Emissions

DPM emissions in California are projected to decrease in the future and are reflected in the EMFAC2011 emissions data. A new CARB regulation requires on-road diesel trucks to be retrofitted with particulate matter controls or replaced to meet new 2010 engine standards that have much lower DPM and $PM_{2.5}$ emissions. This regulation will substantially reduce these emissions between 2013 and 2023, with the greatest reductions occurring in 2013 through 2015. While new trucks and buses will meet strict federal standards, this measure is intended to accelerate the rate at which the fleet either turns over so there are more cleaner vehicles on the road, or retrofitted to meet similar standards. With this regulation, older, more polluting trucks

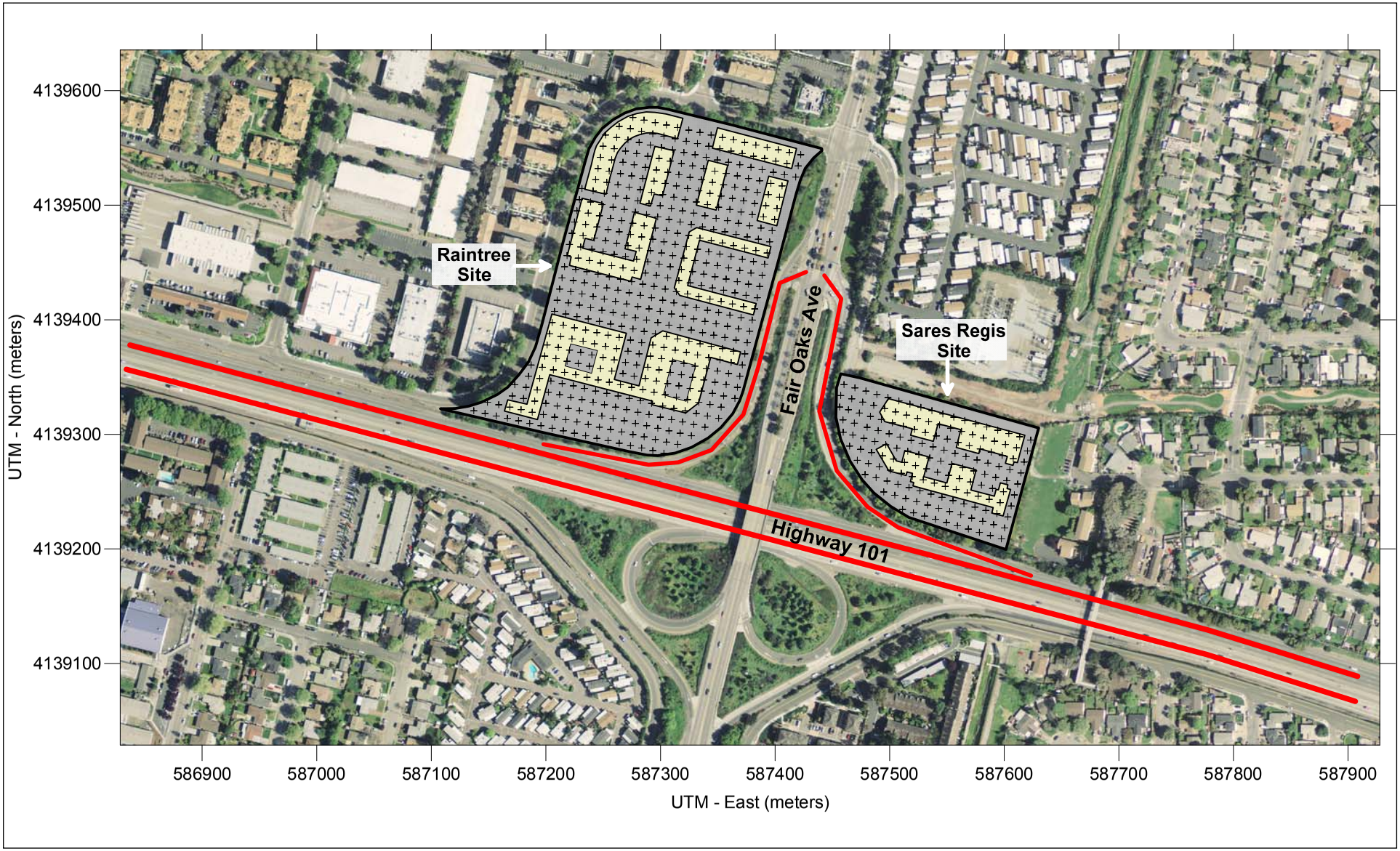

Figure 4.2-1

SOURCE: Illingworth & Rodkin, Inc., 2013

PROJECT SITES, ROADS AND RECEPTORS

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would be removed from the roads much quicker. CARB anticipates a 68-percent reduction in $PM_{2.5}$ (including DPM) emission from trucks in 2014 with this regulation.

DPM emission factors were developed for 2016, 2020, and 2025 using the EMFAC2011 model with default model vehicle fleet age distributions for Santa Clara County. The EMFAC2011 results were then adjusted to the traffic volume and mix of diesel-fueled vehicles on Highway 101 reported by Caltrans.

Average daily traffic volumes (Caltrans, 2012a) and truck percentages (Caltrans, 2012b) were based on Caltrans data for Highway 101 for 2011. For the off-ramp to Fair Oaks Avenue and the on-ramp to Highway 101 from Fair Oaks Avenue, traffic volume data from Caltrans ramp volumes for 2011 (Caltrans, 2012c) was used along with the Highway 101 truck percentages. Volumes were assumed to increase 1 percent per year. Average hourly traffic distributions for Santa Clara County roadways were developed using the EMFAC model,[1] which were then applied to the site-specific average daily traffic volumes to obtain estimated hourly traffic volumes and emissions for Highway 101.

Traffic speeds were assumed to be 65 mph for light-duty vehicles and 60 mph for trucks on Highway 101 with the exception of the 2-hour period in the morning and evening peak traffic periods. For peak periods, an average speed of 30 mph was used for westbound Highway 101 during the morning period (7:00 AM to 9:00 AM) and 60 mph used for all other peak periods and directions. These average peak period speeds were based on the Santa Clara Valley Transportation Authority's 2011 Monitoring and Conformity Report (VTA, 2011). For the Highway 101 on- and off-ramps at Fair Oaks Avenue, an average speed of 45 mph was assumed. The hourly traffic distributions and emission rates used in the analysis are shown in Appendix D.

In addition to evaluating health risks from DPM, the BAAQMD recommends evaluating health effects from total organic gases (TOG) emissions from tailpipes of non-diesel vehicles and TOG emissions from evaporative running losses from non-diesel vehicles (BAAQMD, 2012c). Emissions of TOG were calculated for 2016, 2020, and 2025 using the EMFAC2011 model. These TOG emissions were then used in the modeling the organic TACs. TOG emissions from both exhaust and running evaporative loses from gasoline vehicles were calculated using EMFAC2011 default model values for Santa Clara County along with the traffic volumes and vehicle mixes for Highway 101.

$PM_{2.5}$ emissions from all vehicle types (diesel and non-diesel) on Highway 101 were calculated for 2016, 2020, and 2025 using the EMFAC2011 model. Average hourly traffic volumes were calculated in a similar manner as discussed above for DPM; however, the traffic volumes used from the EMFAC model were for all vehicles, not just diesel vehicles. The DPM, TOG, and $PM_{2.5}$ emission calculations and emission factors are provided in Appendix D.

[1] The Burden output from EMFAC2007, CARB's previous version of the EMFAC model, was used for this since the current web-based version of EMFAC2011 does not include Burden type output with hour by hour traffic volume information.

Roadway Dispersion Modeling

Dispersion modeling of roadway TAC and $PM_{2.5}$ emissions was conducted using the CAL3QHCR model, which is recommended by the BAAQMD for this type of analysis. A 5-year set of hourly meteorological data (1991 to 1995) for San Jose International Airport obtained from the BAAQMD was used in the modeling. Other inputs to the model included road geometry, hourly traffic volumes, and emission rates. An aerial view showing the project sites and the section of Highway 101 modeled is shown in Figure 4.2-1. A series of receptors, spaced every 10 meters (33 feet), throughout both project sites were used as locations to calculate TAC and $PM_{2.5}$ concentrations. All receptors were placed 1.8 meters (5.9 feet) from the above the ground. Since Highway 101 is relatively flat and at grade with the project, second story or higher receptors would have slightly lower exposures than those receptors modeled in this analysis. Inputs used for the modeling are summarized in Appendix D.

Cancer Risk

Using the modeled long-term average DPM and TOG concentrations, the individual cancer risks were computed at both project sites using the most recent methods recommended by BAAQMD (BAAQMD, 2010a). The factors used to compute cancer risk are highly dependent on modeled concentrations, exposure period or duration, and the type of receptor. The exposure level is determined by the modeled concentration; however, it has to be averaged over a representative exposure period. The averaging period is dependent on many factors, but mostly the type of sensitive receptor that would reside at a site. Recommended inputs for cancer risk predictions are developed by the State Office of Environmental Health Hazard Assessments (OEHHA) and adopted by air districts. OEHHA describes many of these assumptions to develop computed cancer risks (OEHHA, 2003 and 2012). A key assumption is duration of exposure. This analysis uses the assumptions for residency. The average period of U.S. residency at any one location is approximately nine years and the 90th percentile of US residency (used by the U.S. EPA and OEHHA as “reasonable maximum exposure” estimates) is 30 years. The U.S. Census Bureau (2012) indicates that the average person will move 11.7 times in a lifetime. Residency time was found to be less for renters compared to homeowners. Studies performed by CARB, and reported by OEHHA (2012), indicate that 29 years is the 91st percentile residency period. For permitting air pollution sources, such as power plants, the BAAQMD considers an almost continuous 70-year exposure period. This exposure period is meant to clearly represent a worst-case scenario. This would be representative of the longest exposure periods reasonably possible. Furthermore, this exposure period assumes almost continuous exposure to the TAC source (i.e., 350 out of 365 days per year). In addition, cancer risk predictions assume that women in the third trimester, infants, and children that are more susceptible to carcinogens are present at the beginning of the exposure period. This assessment conservatively assumed nearly continuous long-term residential exposures of 70 years, as recommended by the BAAQMD (2010a and 2011c). It should be noted that the cancer risk calculations for 70-year residential exposures reflect use of the BAAQMD’s most recent cancer risk calculation method, adopted in January 2010. The cancer risk calculations were based on applying age sensitivity weighting factors for each emissions period modeled. Age-sensitivity factors reflect the greater sensitivity of infants and small children to cancer-causing TACs.

Maximum cancer risks were modeled at the receptors closest to Highway 101. Cancer risks are greatest closest to Highway 101 and decrease with distance from the highway. **Figures 4.2-2** and

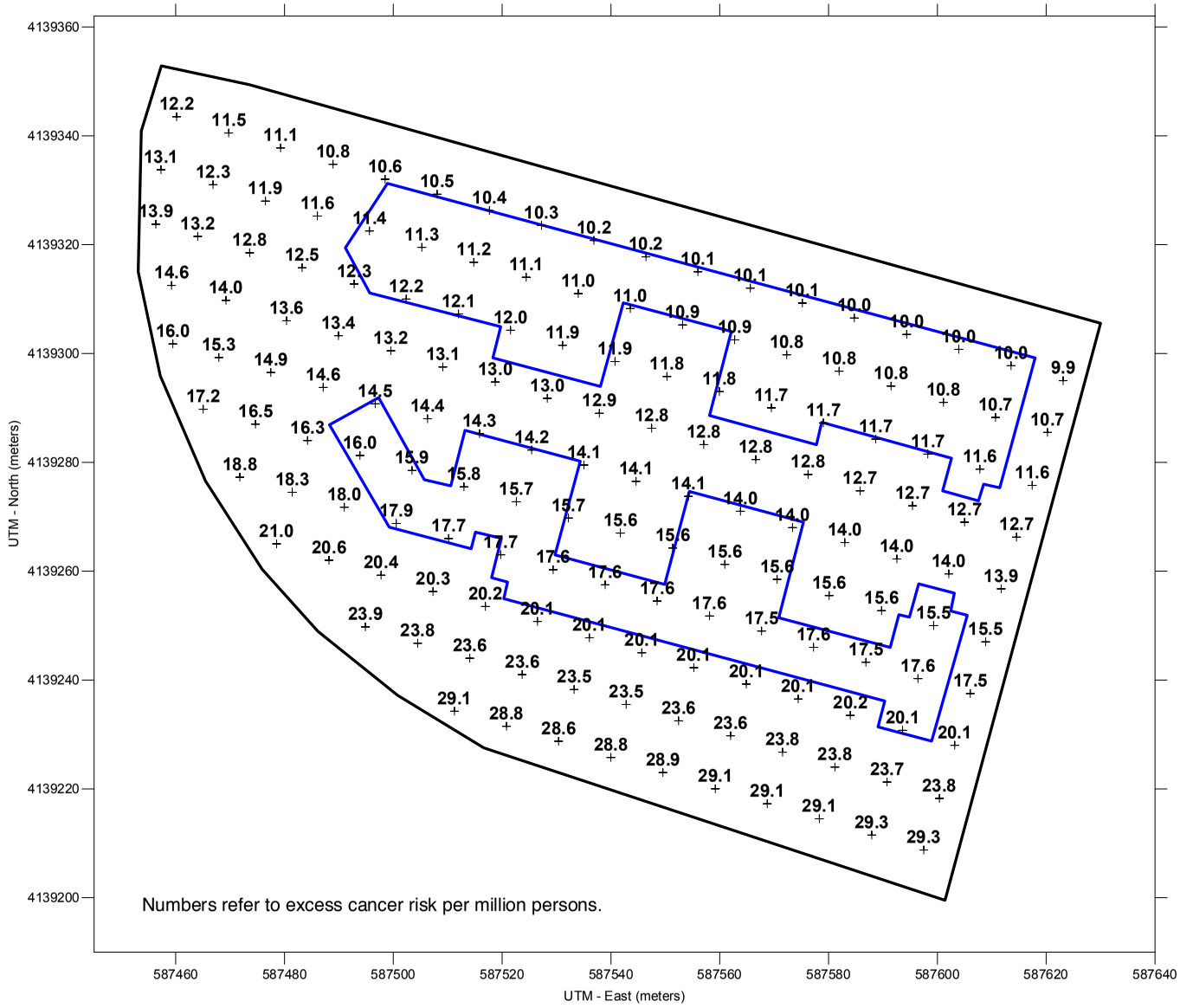

Figure 4.2-2

SOURCE: Illingworth & Rodkin, Inc., 2013

SARES REGIS EXCESS CANCER RISK FROM U.S. 101 HIGHWAY TRAFFIC

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4.2-4 show the maximum cancer risks for receptors at the Sares Regis and Raintree sites, respectively.

$PM_{2.5}$ Concentrations

In addition to the evaluation of the health risks from TACs, potential impacts from $PM_{2.5}$ emissions from vehicles traveling on Highway 101 were evaluated. $PM_{2.5}$ concentrations were modeled to evaluate the potential impact of exposure to exhaust produced from all traffic on Highway 101 near the sites. The same basic modeling approach that was used for assessing TAC impacts was used in the modeling of $PM_{2.5}$ concentrations. The assessment involved, first, calculating $PM_{2.5}$ emission rates from traffic traveling near the sites. Then, dispersion modeling using emission factors and traffic volumes was applied. The dispersion model provides estimated annual $PM_{2.5}$ concentrations. The dispersion modeling of traffic using the CAL3QHCR model was conducted in the same manner as the TAC modeling. **Figures 4.2-3** and **4.2-5** show the annual maximum $PM_{2.5}$ concentration for receptors at the Sares Regis and Raintree sites, respectively.

Hazard Index

The BAAQMD Screening Google Earth Highway Screening Analysis Tool indicates that the hazard index for acute and chronic exposure to Highway 101 emissions would be less than 0.1 for both sites, which is well below the BAAQMD threshold of 1.0. No further analysis of acute or chronic exposures was conducted.

Sares Regis Site Computed Cancer Risk and Modeled $PM_{2.5}$ Concentrations

The maximum excess lifetime cancer risk for the Sares Regis site is 29.3 per million. Under the Applicant Proposed Scenario, excess cancer risk would range from 20.1 to 10.0 per million. For the Sares Regis site, cancer risk would be above 10 in one million for all except the units on the very northeast portion of the site. Exposures above 10 per million are considered significant. The maximum annual $PM_{2.5}$ concentration at the site would be 0.63 $\mu g/m^3$. Under the Applicant Proposed Scenario, annual $PM_{2.5}$ concentration at the site would range from 0.63 to 0.21$\mu g/m^3$. Annual $PM_{2.5}$ concentrations in excess of 0.3 $\mu g/m^3$ would extend about 210 feet from the edge of the freeway across the project site (measured from the nearest travel lane). Figure 4.2-3 shows modeled annual $PM_{2.5}$ concentrations at the Sares Regis site.

Raintree Computed Cancer Risk and Modeled $PM_{2.5}$ Concentrations

The maximum excess lifetime cancer risk for the Raintree site is 34.9 per million. Under the Applicant Proposed Scenario, excess cancer risk would range from 26.3 to 5.3 per million. For the Raintree site, cancer risks would be above 10 in one million at locations less than about 360 feet from the edge of the near freeway lane. Exposures above 10 per million are considered significant. The maximum annual $PM_{2.5}$ concentration at the site would be 0.75 $\mu g/m^3$. Under the Applicant Proposed Scenario, annual $PM_{2.5}$ concentration at the site would range from 0.56 to 0.09$\mu g/m^3$. Exposures above 0.3$\mu g/m^3$would be considered significant. At the Raintree site, annual $PM_{2.5}$ concentrations in excess of 0.3 $\mu g/m^3$ would extend about 190 feet from the edge of the freeway across the project site (measured from the nearest travel lane). Figure 4.2-5 shows modeled annual $PM_{2.5}$ concentrations at the Raintree site.

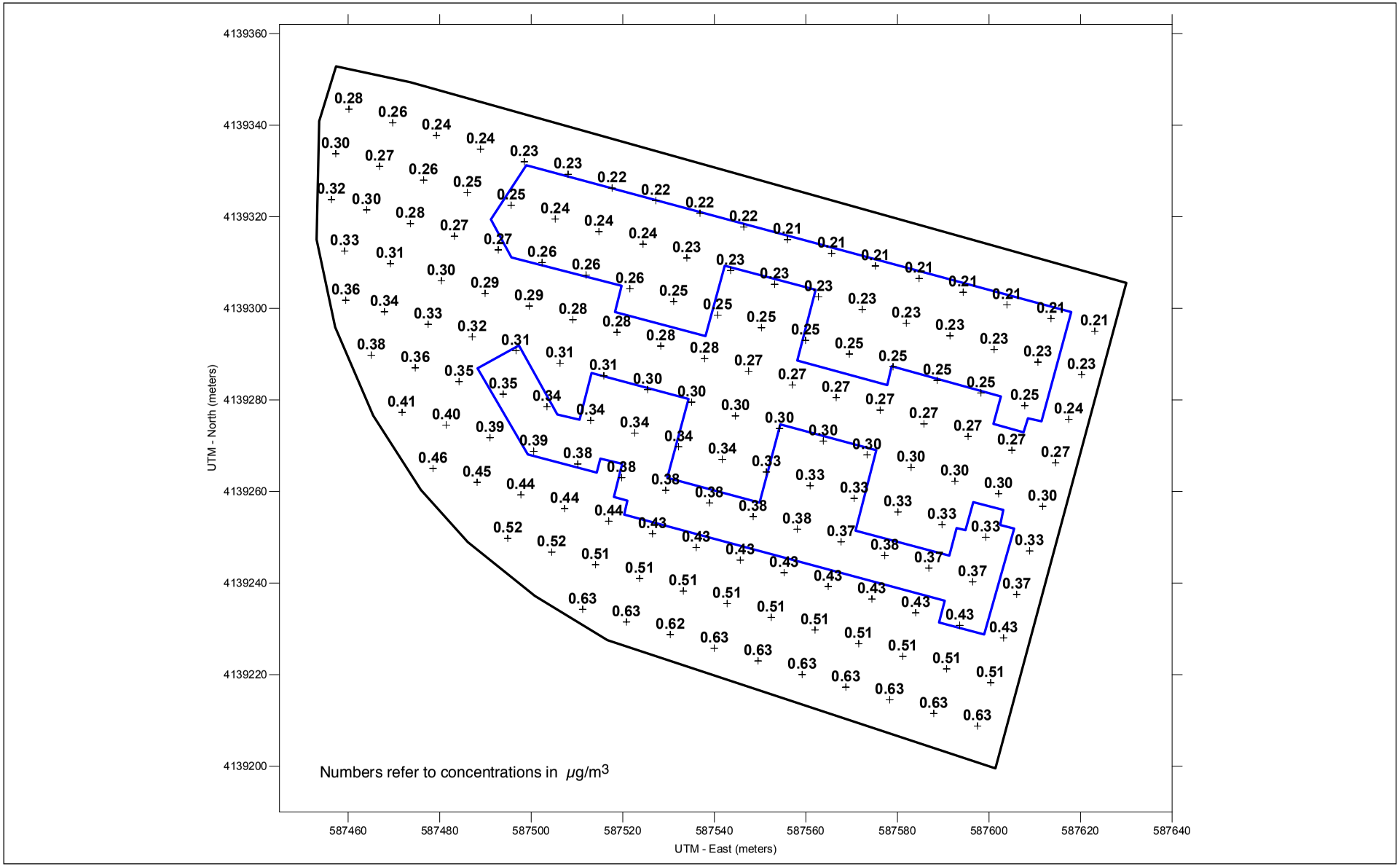

Figure 4.2-3

SOURCE: Illingworth & Rodkin, Inc., 2013

SARES REGIS ANNUAL PM2.5 FROM U.S. 101 HIGHWAY TRAFFIC

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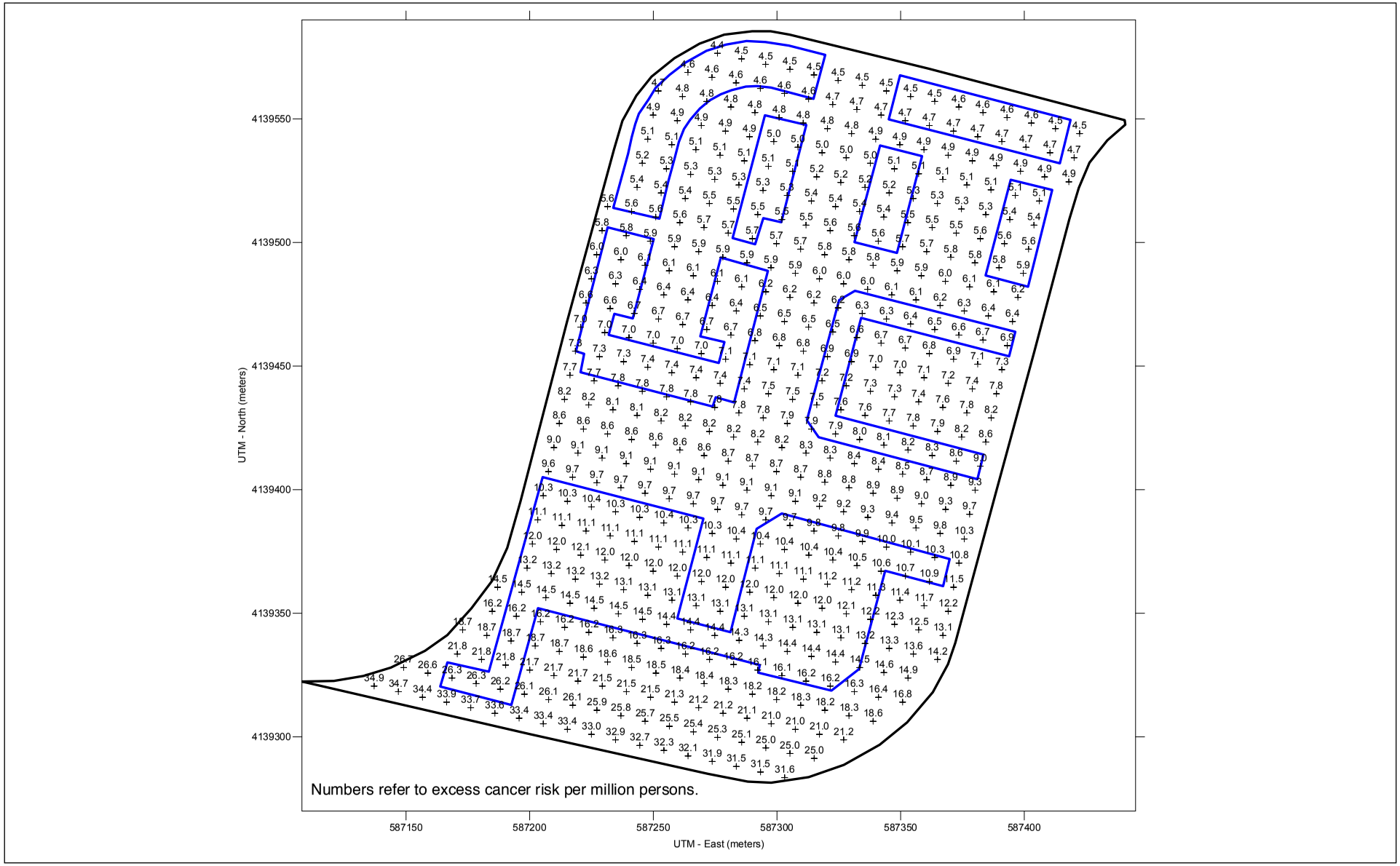

Figure 4.2-4

SOURCE: Illingworth & Rodkin, Inc., 2013

RAINTREE EXCESS CANCER RISK FROM U.S. 101 HIGHWAY TRAFFIC

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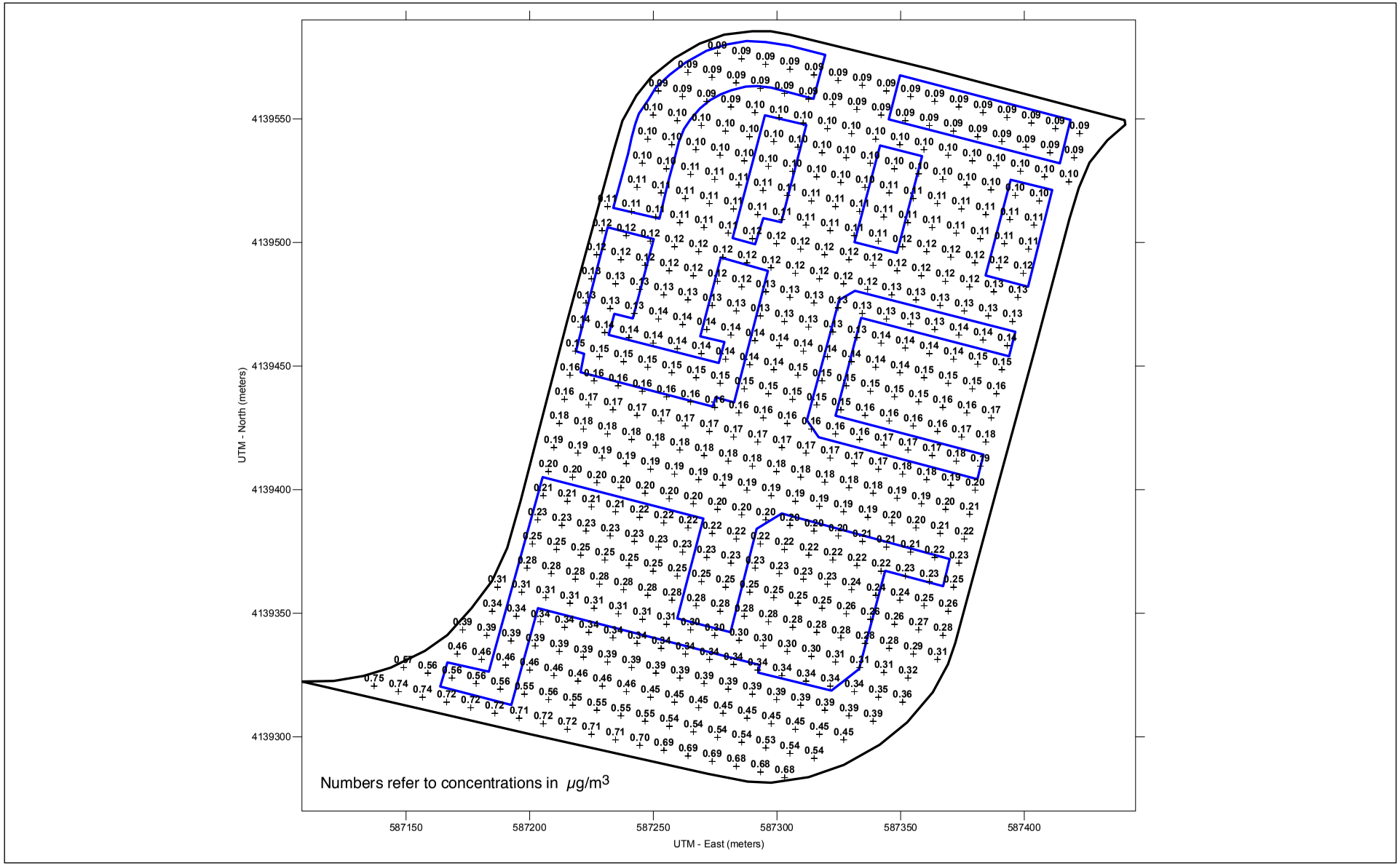

Figure 4.2-5

SOURCE: Illingworth & Rodkin, Inc., 2013

RAINTREE ANNUAL PM2.5 FROM U.S. 101 HIGHWAY TRAFFIC

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Effects of the Vegetation Barrier

It should be noted that the cancer risks and $PM_{2.5}$ concentrations discussed above and shown in Figures 4.2-2 through 4.2-5 do not reflect the potential effects of the intervening vegetation between Highway 101 and the project sites. There is a substantial section of vegetation along the freeway adjacent to both sites. This area of vegetation, comprised of tree layers of varying height and shrubs, is about 20 feet in depth and about 15 to 20 feet high.

BAAQMD CEQA Air Quality Guidelines recommend, among other mitigation measures, that for projects that propose sensitive receptors near sources of DPM (e.g., freeways, major roadways, rail lines, and rail yards), tiered plantings of trees such as redwood, deodar cedar, live oak, and oleander to reduce DPM exposure should be considered. This recommendation is based on a laboratory study conducted by U.C Davis (Fujii, et al., 2008) that measured the removal rates of $PM_{2.5}$ 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 to 85 percent of very fine particles at wind velocities below 1.5 meters per second (approximately 3 miles per hour [mph]), with redwood and deodar cedar being the most effective. Even greater removal rates were predicted for ultra-fine particle matter (i.e., aerodynamic resistance diameter of 0.1 micrometer or less).

Trees and other vegetation appear to act as efficient filters of airborne particulates because of their large size, high surface to volume ratio of foliage, and frequently hairy or rough leaf and bark surfaces. Interception and retention of particles occur as winds carry them through the vegetation (Chakre, 2006). In addition to trees, hedges can act as an effective filter mechanism for particulate matter. In a study in England (Tiwary, et al., 2008), it was found that a 2.2-meter-tall Hawthorne hedge collected PM_{10} with an average collection efficiency of 34 percent at wind speeds of 1.8 to 4.8 meters per second.

Effects of Barriers or Sound Wall

The applicant proposals for both sites include parking structures that would buffer much of the sites from freeway traffic. The project sites would include parking structures along the Highway 101 boundary. The effect of the structures in reducing air pollutant exposures cannot be evaluated, since there are no modeling techniques that account for such structures. There are studies that have included measurements behind sound walls that indicate lower concentrations due to the presence of the obstruction/barrier. A combination of sound walls and vegetation has been shown to disperse pollutants more consistently and to greater distances than either walls or vegetation alone, with up to about a 60-percent reduction in near roadway levels (CARB, 2012).However, the evaluation presented in this report did not address any of the specific peer-reviewed studies that have been conducted.

Improvements could be made to the vegetative barrier to increase the density and provide a continuous barrier along the southern, eastern, and western boundaries. If it is assumed that an improved vegetation barrier between the highway and the project sites, combined with the parking garage structures, could remove 30 percent of the roadway DPM. Both sites include some possible residences at positions that would be mostly unaffected by the combination of the vegetative barriers and parking structures. However, many of the proposed residences in the

applicant development plans would benefit from the vegetation and parking structures, reducing the increased cancer risk at units behind the parking structures to 14 per million or lower for most of the Sares Regis site (applicant's proposal) and 18.4 per million or lower for much of the Raintree site (applicant's proposal).

Mechanical Ventilation with Filtration

The BAAQMD CEQA Air Quality Guidelines recommend as mitigation that projects install and maintain air filtration systems of fresh air supply. These systems should be installed on either 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 certain effectiveness.

The U.S. EPA reports particle size removal efficiency for filters rated MERV13 of 90 percent for particles in the size range of 1 to 3 µm and less than 75 percent for particles 0.3 to 1 µm (American Society of Heating, Refrigerating and Air Conditioning Engineers, 2007 and U.S. EPA, 2009). MERV16 filters are listed to have removal efficiency for those particles (i.e., 0.3 to 3 µm) of 90 percent or greater. Recent studies by the South Coast Air Quality Management District indicate that MERV13 filters could achieve reductions of about 60 percent for ultra-fine particles and about 35 percent for black carbon, while MERV16 filters exceeded 85 percent (SCAQMD, 2009).

In 2012, CARB compiled a synthesis of the status of potential mitigation concepts to reduce exposure to nearby traffic air pollution (CARB, 2012). Because mechanical ventilation has not been used in residential buildings until recently, there has been limited assessment of its impact on entry of particles and other pollutants into homes. CARB-reviewed studies of homes and schools have shown that high-efficiency filtration in mechanical ventilation systems can be effective in reducing levels of incoming outdoor particles. They noted that one study of residences in Northern California found that the homes with active filtration in a mechanical system had a notably lower portion of indoor particles from outdoors when the systems were on (filtration active) than when they were turned off (no filtration). In another study reviewed by CARB that included modeling study of Korean residential units with mechanical ventilation, filters rated lower than MERV7 were insufficient for reducing contaminants that enter through the ventilation filter; the study concluded that filters should exceed MERV11. The CARB review also notes that in a school pilot study, a combination of MERV16 filters used as a replacement for the normal panel filter in the ventilation system and in a separate filtration unit reduced indoor levels of outdoor-generated black carbon, ultrafine particles and $PM_{2.5}$ by 87 percent to 96 percent in three Southern California schools (SCAQMD, 2009). Use of the MERV16 panel filter alone in the HVAC system achieved average particle reductions of nearly 90 percent. Another study reviewed by CARB found indoor submicron particle counts in a Utah school were reduced to just one-eighth of the outdoor levels in a building with a mechanical system using a MERV8 filter.

TAC Impacts from Stationary Sources Near Project Sites

Permitted stationary sources of air pollution near the project site were identified using the BAAQMD's *Stationary Source Risk and Hazard Analysis Tool*. This mapping tool uses Google Earth to identify the location of stationary sources and their estimated risk and hazard impacts. At BAAQMD's direction, risk and $PM_{2.5}$ concentrations from diesel generators and gasoline stations were adjusted for distance based on BAAQMD distance adjustment factors. All of the sources

within 1,000 feet of the project sites were identified to have maximum reported risks or $PM_{2.5}$ concentrations below the BAAQMD thresholds. This tool identified sources that could affect the project sites.

Plant 8251, which includes an emergency back-up generator located at 1139 Karstad Drive operated by Aixtron, Inc., is about 700 feet northwest of the Raintree project site. The BAAQMD was contacted, since the preliminary analysis indicates cancer risk from the source greater than 10 per million. Following BAAQMD instructions, the BAAQMD Toxic Inventory 2009 emissions data were used to predict screening risk. This procedure used the BAAQMD Risk and Hazard Screening Calculator and the distance multipliers. This calculator uses emissions data for each TAC to predict risk. This calculator indicates that nearly all of the risk from the facility is associated with the diesel generator. Therefore, the BAAQMD's Diesel Distance Multiplier was applied to predict screening risk at the distance where a sensitive receptor is located. Use of this procedure (and adjusted for the 700-foot distance) indicates an excess cancer risk of 1.0 per million and no $PM_{2.5}$ impacts or hazards well below the thresholds at the portion of the site closest to this source.

Plant 18976 at 444 Toyama Drive is a data center, operated by Switch and Data CA Eleven LLC, which includes four emergency back-up diesel generators located. This source is permitted to operate by the BAAQMD and includes emissions standards and a maximum number of hours the source can operate (i.e., no more than 50 hours annually). The BAAQMD *Stationary Source Risk and Hazard Analysis Tool* (BAAQMD, 2012b) indicates that screening risk levels are above 10 in one million at the Raintree site. However, annual $PM_{2.5}$ concentrations would be below 0.3 $\mu g/m^3$.

Because screening excess cancer risks are above 10 in one million at the Raintree site, a refined analysis of this source was conducted using facility emissions data obtained from the BAAQMD (BAAQMD, 2013a and 2013b). The generators are situated about 260 feet northwest of the Raintree site. The 2012 source emissions data for this facility were obtained from the BAAQMD (see Appendix D). According to the BAAQMD inventory, these generators each emit 7.25 pounds of DPM annually. The emissions from these generators were modeled using U.S. EPA's ISCST3 dispersion to predict concentrations of DPM at existing residences at the project site. The ISCST3 modeling used a single point source with an exhaust stack height of 15 feet to represent the four generators since the generators are in close proximity to each other. The total emissions from all generators (29 pounds per year) were modeled as being emitted from this source. Emission source parameters for the generators were assumed to be typical of 2,000-megawatt diesel generators. Since the generators are adjacent to the data center building, the effects of building downwash were included in the modeling. Concentrations were modeled at the grid of receptors that represent potential new residences at the Raintree site. The Sares Regis site is located over 1,000 feet from this facility and therefore was not included in the analysis. Corresponding excess cancer risks were computed based on the maximum modeled concentrations and the most recent cancer risk calculation methods recommended by the BAAQMD (BAAQMD, 2010a). This source would result in a maximum excess cancer risk of 8.5 per million at the Raintree site. As a result, this source has a less-than-significant impact.

Summary of Impacts

Table 4.2-10 summarizes the predicted community risk levels at the Sares Regis project site and **Table 4.2-11** summarizes the predicted community risk levels at the Raintree project site. Both maximum single- and cumulative-source levels are reported.

Table 4.2-10 Community Risk to Project Sensitive Receptors – Sares Regis Site

Source	Cancer Risk[a]	Chronic Hazard	Acute Hazard	$PM_{2.5}$ Concentration (µg/m3)
Sares Regis Site Applicant Proposed Scenario				
Highway 101 Traffic	20.1[b]	0.09[b]	0.09[b]	0.43[b]
North Fair Oaks Avenue	3.9[c]	<0.03[c]	<0.03[c]	0.15[c]
Cumulative Sources	24.0	<0.12	<0.12	0.58
Sares Regis Site Full Buildout Scenario				
Highway 101 Traffic	29.3[b]	0.13[b]	0.13[b]	0.63[b]
North Fair Oaks Avenue	3.9[c]	<0.03[c]	<0.03[c]	0.15[c]
Cumulative Sources	33.2	<0.16	<0.16	0.78

Notes: PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, µg/m3 = micrograms per cubic meter.
[a] Cancer risk reported in excess cases per million.
[b] Modeled using Highway 101 traffic, EMFAC2011 with Mineta San Jose International Airport meteorological data.
[c] Data obtained from BAAQMD Roadway Analysis Tables. These tables indicate acute and chronic hazard indexes are well below 1.0.
Source: Illingworth & Rodkin, Inc., 2013.

Sares Regis Applicant Proposed Scenario. Emissions from Highway 101 traffic would cause significant excess cancer risk throughout the entire site (see Figure 4.2-2). Significant annual $PM_{2.5}$ concentrations (i.e., greater than 0.3 µg/m^3) occur across portions of the Sares Regis site.

The portion of the site affected by significant annual $PM_{2.5}$ concentrations would extend about 200 feet from the edge of the highway onto the site. (See Figure 4.2-3 to identify portions of site above 0.3 µg/m^3.)

Sares Regis Full Buildout Scenario. See above discussion.

Raintree Applicant Proposed Scenario. Emissions from Highway 101 traffic would cause significant excess cancer risk and annual $PM_{2.5}$ concentrations to occur across portions of the Raintree site. The portion of the site affected by significant excess cancer risk would extend about 340 feet from the edge of the highway onto the site (see Figure 4.2-4 to identify portions of site above 10.0 per million). The portion of the site affected by significant annual $PM_{2.5}$ concentrations would extend about 230 feet from the edge of the highway onto the site. (See Figure 4.2-5 to identify portions of site above 0.3 µg/m^3.)

Raintree Full Buildout Scenario. See above discussion. In addition, annual $PM_{2.5}$ concentrations from cumulative sources would exceed the significance threshold of 0.8 µg/m^3.

Table 4.2-11 Community Risk to Project Sensitive Receptors – Raintree Site

Source	Cancer Risk[a]	Chronic Hazard	Acute Hazard	$PM_{2.5}$ Concentration (µg/m3)
Raintree Site Applicant Proposed Scenario				
Highway 101 Traffic	26.3[b]	0.13[b]	0.13[b]	0.56[b]
North Fair Oaks Avenue	3.9[c]	<0.03[c]	<0.03[c]	0.15[c]
Plant 8251, Aixtron (1139 Karstad Drive)	1.0[e]	0.01[e]	0.01[e]	0.00[e]
Plant 18796, Switch and Data CA Eleven (444 Toyama Drive)	<8.5[f]	<0.1[g]	<0.1[g]	<0.08[g]
Cumulative Sources	26.6	<0.27	<0.27	0.66
Raintree Site Full Buildout Scenario				
Highway 101 Traffic	34.9[b]	0.15[b]	0.15[b]	0.75[b]
North Fair Oaks Avenue	3.9[c]	<0.03[c]	<0.03[c]	0.15[c]
Plant 8251, Aixtron (1139 Karstad Drive)	1.0[e]	0.01[e]	0.01[e]	0.00[e]
Plant 18796, Switch and Data CA Eleven (444 Toyama Drive)	8.5[f]	<0.1[g]	<0.1[g]	<0.08[g]
Cumulative Sources	48.3	<0.29	<0.29	0.98

Notes: PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, µg/m3 = micrograms per cubic meter.
[a] Cancer risk reported in excess cases per million.
[b] Modeled using Highway 101 traffic, EMFAC2011 with Mineta San Jose International Airport meteorological data.
[c] Data obtained from BAAQMD *Roadway Analysis Tables*. These tables indicate acute and chronic hazard indexes are well below 1.0.
[e] Obtained from BAAQMD SSIF Request (BAAQMD, 2013a).
[f] Obtained from BAAQMD SSIF Request (BAAQMD, 2013b) and modeled using ISCST3 with BAAQMD source data and Mineta San Jose International Airport meteorological data.
[g] Based on BAAQMD's Stationary Source Risk & Hazard Analysis Tool.
Source: Illingworth & Rodkin, Inc., 2013.

<u>Mitigation Measure AIR-4</u>: The two projects shall include the following measures to minimize long-term toxic air contaminant (TAC) exposure for new residences:

1. *Design buildings and sites to limit exposure from sources of TAC and fine particulate matter ($PM_{2.5}$) emissions. The site layout shall locate windows and air intakes as far as possible from Highway 101 traffic lanes and provide additional tree plantings along the highway edge to maintain a uniform and continuous vegetative barrier per Bay Area Air Quality Management District (BAAQMD) recommended plantings. Any modifications to the site design shall incorporate buffers between residences and the freeway.*
2. *Install air filtration in residential or other buildings that would include sensitive receptors that have predicted $PM_{2.5}$ concentrations above 0.3 micrograms per cubic meter*

(μg/m^3) or excess lifetime cancer risk of 10.0 per million or greater. Air filtration devices shall be rated MERV13 or higher. To ensure adequate health protection to sensitive receptors, a ventilation system shall meet the following minimal design standards (Department of Public Health, City and County of San Francisco, 2008):

- *A MERV13 or higher rating;*
- *At least one air exchange(s) per hour of fresh outside filtered air;*
- *At least four air exchange(s) per hour recirculation; and*
- *At least 0.25 air exchange(s) per hour in unfiltered infiltration.*

As part of implementing this measure, an ongoing maintenance plan for the buildings' heating, ventilation, and air conditioning (HVAC) air filtration system shall be required. Recognizing that emissions from air pollution sources are decreasing, the maintenance period shall last as long as significant excess cancer risk or annual $PM_{2.5}$ exposures are predicted. Subsequent studies could be conducted to identify the ongoing need for the ventilation systems as future information becomes available.

3. *Ensure that the lease agreement and other property documents (1) require cleaning, maintenance, and monitoring of the affected buildings for air flow leaks; (2) include assurance that new owners and tenants are provided information on the ventilation system; and (3) include provisions that fees associated with owning or leasing a unit(s) in the building include funds for cleaning, maintenance, monitoring, and replacements of the filters, as needed.*

4. *Consider phasing developments located within 330 feet of Highway 101 to avoid significant excess cancer risks and required installation of filtered ventilation systems (described above). Note that new United States Environmental Protection Agency (U.S. EPA) engines standards combined with California Air Resources Board (CARB) rules and regulations will reduce on-road emissions of diesel particulate matter (DPM) and $PM_{2.5}$ substantially, especially after 2014.*

5. *Require that, prior to building occupancy, an authorized air pollutant consultant verify the installation of all necessary measures to reduce toxic air contaminant (TAC) exposure.*

   A properly maintained vegetative barrier could reduce particulate concentrations, including DPM, by an estimated 30 percent. Combined with the vegetation barrier along the freeway, a properly installed and operated ventilation system with MERV13 air filters may reduce $PM_{2.5}$ concentrations from DPM mobile and stationary sources by approximately 70 percent indoors when compared to outdoors. A ventilation system with MERV16 filters could achieve reductions of 90 percent. The air intake for these units should be located as far away as possible from Highway 101. The overall effectiveness calculations take into consideration time spent outside and the outdoor exposure of each affected unit. The U.S. EPA reports that people, on average, spend 90 percent of their time indoors. The overall effectiveness calculations should take into effect time spent outdoors. Assuming 2 hours of outdoor exposure plus 1 hour of open windows (calculated as outdoor exposure) per day, the overall effectiveness of filtration systems would be about 60 percent for MERV13 systems and about 80 percent for MERV16 systems.

A ventilation system with MERV13 filtration would be necessary to reduce cancer risk to less-than-significant levels for areas where cancer risk is between 10 and 25.0 per million. A more efficient filtration system would be required for cancer risks that exceed 25.0 per million. A ventilation system with MERV16 filters would result in cancer risk of less than 10 per million where outdoor cancer risk is predicted to be 50.0 per million or less. A system with MERV14 or MERV15 could also be used, but those systems were not evaluated.

$PM_{2.5}$ concentrations would also be reduced with the ventilation system that uses a MERV13 filter or greater. Maximum annual $PM_{2.5}$ concentrations of 0.75µg/m^3 or less could be mitigated using ventilation systems with MERV13 filters.

The above measures would reduce the potential air quality impact to a less-than-significant level. (LTS)

- Applies to Sares Regis Applicant Proposed Scenario: ☒
- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☒
- Applies to Raintree Full Buildout Scenario: ☒

<u>Impact AIR-5</u>: Existing sensitive receptors could be exposed to substantial pollutant concentrations during construction of the projects. (S)

The proposed projects would have emissions of fugitive dust and exhaust emissions during the construction period. The project does not include long-term operation emissions of TACs that could affect nearby sensitive receptors.

Construction activity is anticipated to include abatement and demolition of existing buildings, grading and parking garage excavation, building construction, paving, and application of architectural coatings. Exhaust emissions both on-site and off-site from these activities were computed using the OFFROAD model and reported under Impact AIR-2 above. During demolition, grading, and excavation activities, dust would be generated. Most of the dust would result during grading activities. The amount of dust generated would be highly variable and is dependent on the size of the area disturbed at any given time, amount of activity, soil conditions, and meteorological conditions. Typical winds during late spring through summer are from the north. Nearby land uses, particularly the apartments located adjacent to the north end of the Raintree project site, could be adversely affected by dust generated during construction activities. The BAAQMD CEQA Air Quality Guidelines consider these impacts to be less than significant if best management practices are employed to reduce these emissions.

Construction equipment and associated heavy-duty truck traffic generates diesel exhaust, which is a known TAC. As indicated under Impact AIR-2, these exhaust air pollutant emissions would not be considered to contribute substantially to existing or projected air quality violations. Since existing residences are located immediately adjacent to the project, a refined health risk assessment of the construction activity was conducted that evaluated emissions of DPM. Emissions and dispersion modeling was conducted to predict the off-site concentrations resulting from project construction, so that lifetime cancer risks could be predicted. The locations of the

construction modeling sources, receptors used, and residential and school MEIs from project construction are shown in **Figure 4.2-6**.

There are existing residential apartment buildings located near the north and west edges of the Raintree site. Single-family residences are located to the north and east of the Sares Regis site. A health risk assessment of the project construction activities was conducted that evaluated potential health effects of sensitive receptors from construction emissions of DPM. A dispersion model was used to predict the off-site DPM concentrations resulting from project construction so that lifetime cancer risks could be predicted.

On-site construction period diesel exhaust emissions were computed using emission factors from the CARB OFFROAD model for off-road construction equipment and from the EMFAC2011 model for emissions from trucks (e.g., haul trucks, water trucks, concrete trucks, and vendor trucks). The number and types of construction equipment and diesel vehicles, along with the anticipated length of their use, for different phases of construction were based on site-specific construction activity schedules (see Appendix D). A description of the construction emissions is contained in the discussion for Impact AIR-1. All of the construction equipment was assumed to be from model year 2006, which is representative of U.S. EPA Tier 2 equipment. Haul truck trips were based on the amount of material to be hauled away during demolition of the existing structures, concrete truck trips were based on the amount of concrete needed by the project, and vendor trips were estimated using the CalEEMod model. Construction at the Sares Regis project site is anticipated to occur over an approximate 22-month period year period (January 2014 to October 2015) and construction at the Raintree project site is anticipated to occur over a 2-year period (September 2014 to September 2016). The projected construction schedules for the two sites are shown in Appendix D. The DPM emission calculations are also provided in Appendix D.

The U.S. EPA ISCST3 dispersion model was used to predict concentrations of DPM at existing residences surrounding the project sites. For each project construction site, the ISCST3 modeling included one area source to represent the on-site construction activities and a series of line sources (modeled as a series of volume sources along a path) to represent the off-site truck travel routes of the construction-related trucks. On-site truck travel emissions were included in the area source emissions. An emission release height of 6 meters (about 18 feet) was used for the construction area source. The elevated source height reflects the height of the equipment exhaust pipes and buoyancy of the exhaust plume. For off-site truck travel, trucks were assumed to travel along North Fair Oaks Avenue and on East Weddell Drive to the sites. Model receptors were placed to represent locations of the existing residences near each of the sites. Receptor heights were modeled at 1.8 meters (almost 6 feet) and 4.85 meters (almost 16 feet) above ground level to represent the first and second floor levels of residences. Emissions were modeled as occurring daily between 7:00 AM to 4:00 PM when a majority of the construction activity involving equipment usage would occur.[2] The model used a 5-year data set of hourly meteorological data (1991 to 1995) from the Mineta San Jose International Airport, the same meteorological data used for the traffic modeling, described previously. Annual DPM concentrations from construction activities were predicted for 2014 through 2016.

[2] Note that while construction may occur from 7:00 AM to 6:00 PM, most equipment emissions are expected to occur between 7:00 AM and 4:00 PM.

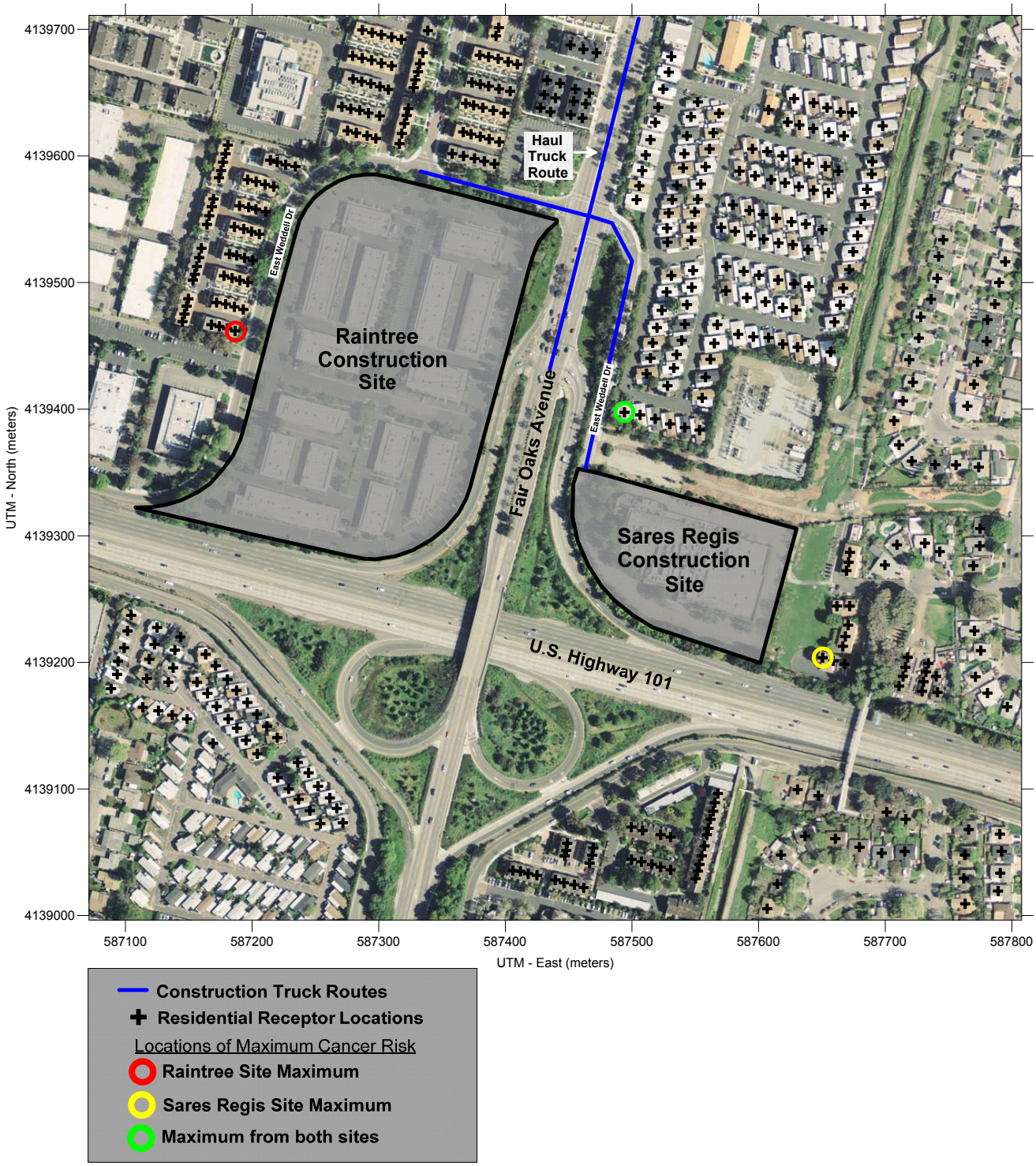

Figure 4.2-6

PROJECT SITES, CONSTRUCTION AREAS, TRUCK ROUTE AND OFF-SITE RECEPTORS

SOURCE: Illingworth & Rodkin, Inc., 2013

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Increased lifetime cancer risks were calculated using the maximum modeled annual concentration and BAAQMD recommended risk assessment methods for both a child exposure (third trimester through 2 years of age) and an adult exposure. Since the modeling was conducted assuming emissions occurred 365 days per year, the default BAAQMD exposure period of 350 days per year was used. It was conservatively assumed that infant and child exposures would occur at residences throughout the entire construction period. Appendix D includes the emission calculations used for the construction area source modeling and the cancer risk calculations.

Construction Health Risks by Scenario

Sares Regis Applicant Proposed Scenario. Results of this assessment indicate that, without mitigation or a construction plan to reduce on-site exhaust emissions, the maximum construction residential child cancer risk would be 11.4 in one million and a residential adult cancer risk of 0.6 in one million. While the residential adult cancer risk is below the BAAQMD's threshold of 10 in one million excess cancer cases per million, the increased cancer risk for a residential child exposure is greater than the significance threshold. The maximum annual $PM_{2.5}$ concentrations would be 0.13 $\mu g/m^3$, which would be below the significance threshold of 0.3 $\mu g/m^3$. Associated non-cancer hazards would be well below BAAQMD thresholds for DPM, with a hazard index computed as 0.026. This hazard index is much lower than the BAAQMD significance criterion of a hazard index greater than 1.0. Because predicted child cancer risk exceeds 10.0 per million, the Sares Regis project would have a *significant impact* with respect to community risk caused by construction activities.

Sares Regis Full Buildout Scenario. See above discussion. The construction health risks cannot be identified for this scenario, since there are no detailed construction plans. However, they are anticipated to be similar to, but slightly greater than, the Applicant Proposed Scenario. A *significant impact* with respect to community risk caused by construction activities would occur.

Raintree Applicant Proposed Scenario. Results of this assessment indicate that, without mitigation or a construction plan to reduce on-site exhaust emissions, the maximum construction residential child cancer risk would be 19.0 in one million and a residential adult cancer risk of 1.0 in one million. While the residential adult cancer risk is below the BAAQMD's threshold of 10 in one million excess cancer cases per million, the increased cancer risk for a residential child exposure is greater than the significance threshold. The maximum annual $PM_{2.5}$ concentrations would be 0.22 $\mu g/m^3$, which would be below the significance threshold of 0.3 $\mu g/m^3$. Associated non-cancer hazards would be well below the significance hazard index threshold of 1.0 for DPM, with a hazard index computed as 0.043. Because predicted child cancer risk exceeds 10.0 per million, the Raintree project would have a *significant impact* with respect to community risk caused by construction activities.

Raintree Full Buildout Scenario. See above discussion. The construction health risks cannot be identified for this scenario, since there are no detailed construction plans. However, they are anticipated to be similar, but slightly greater than the Applicant Proposed Scenario. A *significant impact* with respect to community risk caused by construction activities would occur.

Impact of Combined Applicant Proposed Scenarios

Results of this assessment indicate that, without mitigation or a construction plan to reduce on-site exhaust emissions, the maximum construction residential child cancer risk resulting from construction of both Applicant Proposed Scenarios would be 19.7 in one million and the residential adult cancer risk would be 1.0 in one million. While the residential adult cancer risk would be below the BAAQMD's threshold of 10 in one million excess cancer cases per million, the increased cancer risk for a residential child exposure is greater than the significance threshold. The maximum annual $PM_{2.5}$ concentrations would be 0.23 $\mu g/m^3$, which would be below the significance threshold of 0.3 $\mu g/m^3$. Associated non-cancer hazards would be well below the significance hazard index threshold of 1.0 for DPM, with a hazard index computed as 0.045. Because predicted child cancer risk exceeds 10.0 per million, the combined projects would have a *significant impact* with respect to community risk caused by construction activities.

Mitigation Measure AIR-5a: The projects shall include the following measures recommended by the Bay Area Air Quality Management District (BAAQMD) (i.e., Best Management Practices) to reduce construction dust and on-site construction exhaust emissions by 5 percent:

1. *All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.*
2. *All haul trucks transporting soil, sand, or other loose material off-site shall be covered.*
3. *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.*
4. *All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph).*
5. *All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.*
6. *Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California Airborne Toxics Control Measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.*
7. *All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.*
8. *A publicly visible sign shall be posted with the telephone number and person to contact at the City of Sunnyvale regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Bay Area Air Quality Management Air District's phone number shall also be visible to ensure compliance with applicable regulations.*
9. *A plan shall be developed demonstrating that the off-road equipment (more than 50 horsepower and on-site for more than two consecutive workdays) to be used in project construction would achieve an additional 50-percent reduction in exhaust particulate matter emissions, compared to similar equipment that meets U.S. EPA Tier 2*

standards. Based on the construction plans presented for this project, a feasible method to achieve this objective would be the following:

- *All diesel-powered air compressors, welders, forklifts (including rough terrain forklifts), paint spray rigs, and all types of cranes, forklifts or aerial lifts (man lifts, boom lifts, etc.) used during all construction phases shall meet or exceed U.S. EPA Tier 4 standards for particulate matter emissions or substituted with alternatively fueled equipment (e.g., LPG fuel).*
- *All other off-road construction equipment used on the site shall, on a fleet-wide average, meet U.S. EPA Tier 2 emission standards.*
- *Portable diesel generators operating for more than two days shall be prohibited. Grid power electricity shall be used to provide power at construction sites, or non-diesel generators (or diesel generators using bio-diesel fuel) may be used when grid power electricity is not feasible.*

The above measures shall be included in contract specifications for both projects.

The mitigation measures listed above, applied to the Raintree Applicant Proposed Scenario and the Sares Regis Applicant Proposed Scenario, would reduce the child excess cancer risk from each of the projects as well as the combination of the two projects to below 9.9 per million. Since construction techniques, equipment usage, and schedules have not been identified for the Full Buildout Scenarios, Mitigation Measure AIR-5b is included below.

- Applies to Sares Regis Applicant Proposed Scenario: ☒
- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☒
- Applies to Raintree Full Buildout Scenario: ☒

<u>Mitigation Measure AIR-5b</u>: When construction information is available for the Full Buildout Scenario, a complete air emissions analysis for construction emissions shall be completed by the project applicants to address health risk impacts (i.e., excess cancer risk, annual $PM_{2.5}$ concentration and Hazard Index) during construction of the Sares Regis and Raintree projects. If predicted excess cancer risk, annual $PM_{2.5}$ concentration, or Hazard Index exceed the BAAQMD thresholds, the applicants shall identify mitigation measures that would reduce construction-related health risks to below the BAAQMD thresholds. Such measures may include:

- *Use of newer or retrofitted construction equipment that has low emission rates;*
- *Use of alternatively fueled equipment; and*
- *Modification of construction techniques to avoid use of diesel-powered equipment.*

Compliance with thresholds shall be verified by the City prior to issuance of any building permits. (LTS)

- Applies to Sares Regis Applicant Proposed Scenario: ☐
- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☐
- Applies to Raintree Full Buildout Scenario: ☒

Impact AIR-6: The projects would not create objectionable odors affecting a substantial number of people. (LTS)

The projects would generate localized emissions of diesel exhaust during construction equipment operation and truck activity. These emissions may be noticeable from time to time by adjacent receptors. However, they would be localized and would not be likely to adversely affect people off-site in that they would result in confirmed odor complaints.

The projects propose residential uses on the project sites. The sites are not affected by existing odor sources that would cause odor complaints from future residents.

Sares Regis Applicant Proposed Scenario. See above discussion.

Sares Regis Full Buildout Scenario. See above discussion.

Raintree Applicant Proposed Scenario. See above discussion.

Raintree Full Buildout Scenario. See above discussion.

Mitigation Measure AIR-6: No mitigation would be necessary. (LTS)

- Applies to Sares Regis Applicant Proposed Scenario: ☒
- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☒
- Applies to Raintree Full Buildout Scenario: ☒

CUMULATIVE IMPACTS

Impact AIR-7: Project emissions of criteria air pollutants or their precursors would not make a considerable contribution to cumulative air quality impacts. (LTS)

Air pollution, by nature, is mostly a cumulative impact. The significance thresholds applicable to construction and operational aspects of a project represent the levels at which a project's individual emissions of criteria pollutants and precursors would result in a cumulatively considerable contribution to the region's air quality conditions as determined by the BAAQMD.

The proposed projects' operational emissions would not exceed the significance thresholds, and therefore project operations would not make a considerable contribution to cumulative air quality impacts. This analysis included cumulative traffic conditions for the project area and found that violations of the carbon monoxide standards would not occur. For project air emissions during construction, Mitigation Measure AIR-5 would minimize fugitive dust emissions by employing Best Management Practices identified by the BAAQMD for minimizing fugitive dust (PM_{10}) impacts.

This assessment identified significant cancer risk and $PM_{2.5}$ exposure for new project residences located near Highway 101 (see Impact AIR-4). Mitigation Measure AIR-4 would reduce this impact to a less-than-significant level. Impacts associated with community risk incorporate future projections of traffic conditions and emissions along with existing stationary sources. As shown in

Table 4.2-10 and 4.2-11, the projects would not result in a significant cumulative community risk because projected cancer risks, annual $PM_{2.5}$ concentrations, and the Hazard Index resulting from all substantial sources within 1,000 feet of the sites would all be below the cumulative thresholds recommended by the BAAQMD and used in this analysis.

As described under Impact AIR-5, results of this assessment indicate that, without mitigation or construction plans to reduce on-site exhaust emissions, the maximum construction residential child cancer risk would be 10.6 in one million for the Sares Regis site and 19.0 in one million for the Raintree site. The combination of construction of both sites would result in the maximum construction residential child cancer risk of 19.7 in one million and a residential adult cancer risk of 1.0 in one million. While the residential adult cancer risk is below the BAAQMD's threshold of 10 in one million excess cancer cases per million, the increased cancer risk for a residential child exposure is greater than the significance threshold. Mitigation Measure AIR-5 would reduce this impact to a less-than-significant level.

The maximum annual $PM_{2.5}$ concentration associated with construction of each site would be 0.12 $\mu g/m^3$ for the Sares Regis site and 0.22 $\mu g/m^3$ for the Raintree site. The maximum annual $PM_{2.5}$ concentration associated with construction of both sites would be 0.22 $\mu g/m^3$. The maximum hazard index from the construction of each site, as wells as the combination of both sites, would be well below the thresholds recommended by the BAAQMD and used in this analysis.

The combination of the maximum excess child cancer risk, annual $PM_{2.5}$ concentrations and Hazard Index resulting from construction were added to cumulative TAC sources near the receptor most affected by project construction (referred to as the maximum exposed individual or MEI). The combination of these impacts is reported in **Table 4.2-12**. As shown, the cumulative risk would be below the thresholds recommended by the BAAQMD and used in this analysis.

Sares Regis Applicant Proposed Scenario. See above discussion.

Sares Regis Full Buildout Scenario. See above discussion.

Raintree Applicant Proposed Scenario: See above discussion.

Raintree Full Buildout Scenario. See above discussion.

Mitigation Measure AIR-7: The projects would be required to comply with Mitigation Measures AIR-4 and AIR-5; no additional mitigation would be necessary. (LTS)

- Applies to Sares Regis Applicant Proposed Scenario: ☒
- Applies to Sares Regis Full Buildout Scenario: ☒
- Applies to Raintree Applicant Proposed Scenario: ☒
- Applies to Raintree Full Buildout Scenario: ☒

Table 4.2-12 Cumulative Risk from Construction of the Sares Regis and Raintree Projects

Source	Cancer Risk[a]	Chronic Hazard	Acute Hazard	$PM_{2.5}$ Concentration (µg/m3)
Construction	19.7 (child)[b] 1.0 (adult)[b]	0.04[b]	0.04[b]	0.22[b]
Highway 101	12.2[c]	0.06[c]	0.06[c]	0.28[c]
North Fair Oaks Avenue	3.9d[c]	<0.03[d]	<0.03[d]	0.15[d]
Total Cumulative Sources	35.8	<0.13	<0.13	0.65
Cumulative Risk Threshold	100	10.0	10.0	0.8

Notes: PM2.5 = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less, µg/m3 = micrograms per cubic meter.
[a] Cancer risk reported in excess cases per million.
[b] Modeled using construction information, OFFROAD2010 factors, ISCST3 model with Mineta San Jose International Airport meteorological data.
[c] Modeled using Highway 101 traffic, EMFAC2011 with Mineta San Jose International Airport meteorological data.
[d] Data obtained from BAAQMD *Roadway Analysis Tables*. These tables indicate acute and chronic hazard indexes are well below 1.0.
Source: Illingworth & Rodkin, Inc., 2013.

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