3833 REDWOOD HIGHWAY/ 350 MERRYDALE ROAD AIR QUALITY ASSESSMENT

San Rafael, California

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Introduction

The purpose of this report is to address air quality impacts associated with a new multi-family residential project proposed at 3833 Redwood Highway/350 Merrydale Road in San Rafael, California. The air quality impacts would be associated with demolition of the existing uses at the site, construction of the new building and infrastructure, and operation of the project. Air pollutant emissions associated with construction and operation of the project were predicted using models. In addition, the potential construction health risk impact to nearby sensitive receptors and the impact of existing toxic air contaminant (TAC) sources affecting the proposed residences were evaluated. This analysis addresses those issues following the guidance provided by the Bay Area Air Quality Management District (BAAQMD).

Project Description

The project proposes to demolish existing structures and amenities and construct 44 three-story townhomes in eight buildings on a 2.44-acre site. The townhomes would include car garages and the project would include 15 surface parking spaces on site.

Setting

The project is located in Marin County, which is in the San Francisco Bay Area Air Basin. Ambient air quality standards have been established at both the State and federal level. The Bay Area meets all ambient air quality standards with the exception of ground-level ozone, respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$).

Air Pollutants of Concern

High ozone levels are caused by the cumulative emissions of reactive organic gases (ROG) and nitrogen oxides (NO_X). These precursor pollutants react under certain meteorological conditions to form high ozone levels. Controlling the emissions of these precursor pollutants is the focus of the Bay Area's attempts to reduce ozone levels. The highest ozone levels in the Bay Area occur in the eastern and southern inland valleys that are downwind of air pollutant sources. High ozone levels aggravate respiratory and cardiovascular diseases, reduced lung function, and increase coughing and chest discomfort.

Particulate matter is another problematic air pollutant of the Bay Area. Particulate matter is assessed and measured in terms of respirable particulate matter or particles that have a diameter of 10 micrometers or less (PM_{10}) and fine particulate matter where particles have a diameter of 2.5 micrometers or less ($PM_{2.5}$). Elevated concentrations of PM_{10} and $PM_{2.5}$ are the result of both region-wide (or cumulative) emissions and localized emissions. High particulate matter levels aggravate respiratory and cardiovascular diseases, reduce lung function, increase mortality (e.g., lung cancer), and result in reduced lung function growth in children.

Toxic Air Contaminants

TACs are a broad class of compounds known to cause morbidity or mortality (usually because they cause cancer) and include, but are not limited to, the criteria air pollutants. TACs are found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., diesel particulate matter [DPM] near a freeway). Because chronic exposure can result in adverse health effects, TACs are regulated at the regional, State, and federal level.

Diesel exhaust is the predominant TAC in urban air and is estimated to represent about three-quarters of the cancer risk from TACs (based on the Bay Area average). According to the California Air Resources Board (CARB), diesel exhaust is a complex mixture of gases, vapors, and fine particles. This complexity makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some of the chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by the CARB, and are listed as carcinogens either under the State's Proposition 65 or under the Federal Hazardous Air Pollutants programs. The most recent Office of Environmental Health Hazard Assessment (OEHHA) risk assessment guidelines were published in February of 2015.[1] See *Attachment 1* for a detailed description of the community risk modeling methodology used in this assessment.

Sensitive Receptors

There are groups of people 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 16, 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, and elementary schools. For cancer risk assessments, children are the most sensitive receptors, since they are more susceptible to cancer causing TACs. Residential locations are assumed to include infants and small children. The closest sensitive receptors to the project site are residents of an apartment building adjacent to the southeastern site boundary, with additional residences in the nearby area surrounding the project site. The project would include sensitive receptors.

Regulatory Agencies

The BAAQMD is the regional agency tasked with managing air quality in the region. At the State level, the CARB (a part of the California Environmental Protection Agency [EPA]) oversees regional air district activities and regulates air quality at the State level. The BAAQMD has recently published California Environmental Quality Act (CEQA) Air Quality Guidelines that are used in this assessment to evaluate air quality impacts of projects.

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[1] OEHHA, 2015. *Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments.* Office of Environmental Health Hazard Assessment. February.

Regulatory Setting

Federal Regulations

The United States Environmental Protection Agency (EPA) sets nationwide emission standards for mobile sources, which include on-road (highway) motor vehicles such trucks, buses, and automobiles, and non-road (off-road) vehicles and equipment used in construction, agricultural, industrial, and mining activities (such as bulldozers and loaders). The EPA also sets nationwide fuel standards. California also has the ability to set motor vehicle emission standards and standards for fuel used in California, as long as they are the same or more stringent than the federal standards.

In the past decade the EPA has established a number of emission standards for on- and non-road heavy-duty diesel engines used in trucks and other equipment. This was done in part because diesel engines are a significant source of NO_X and particulate matter (PM_{10} and $PM_{2.5}$) and because the EPA has identified DPM as a probable carcinogen. Implementation of the heavy-duty diesel on-road vehicle standards and the non-road diesel engine standards are estimated to reduce particulate matter and NO_X emissions from diesel engines up to 95 percent in 2030 when the heavy-duty vehicle fleet is completely replaced with newer heavy-duty vehicles that comply with these emission standards.[2]

In concert with the diesel engine emission standards, the EPA has also substantially reduced the amount of sulfur allowed in diesel fuels. The sulfur contained in diesel fuel is a significant contributor to the formation of particulate matter in diesel-fueled engine exhaust. The new standards reduced the amount of sulfur allowed by 97 percent for highway diesel fuel (from 500 parts per million by weight [ppmw] to 15 ppmw), and by 99 percent for off-highway diesel fuel (from about 3,000 ppmw to 15 ppmw). The low sulfur highway fuel (15 ppmw sulfur), also called ultra-low sulfur diesel (ULSD), is currently required for use by all vehicles in the U.S.

All of the above federal diesel engine and diesel fuel requirements have been adopted by California, in some cases with modifications making the requirements more stringent or the implementation dates sooner.

State Regulations

To address the issue of diesel emissions in the state, CARB developed the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles.[3] In addition to requiring more stringent emission standards for new on-road and off-road mobile sources and stationary diesel-fueled engines to reduce particulate matter emissions by 90 percent, a significant component of the plan involves application of emission control strategies to existing diesel vehicles and equipment. Many of the measures of the Diesel Risk Reduction Plan have been approved and adopted, including the federal on-road and non-road diesel engine emission standards for new engines, as well as adoption of regulations for low sulfur fuel in California.

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[2] USEPA, 2000. *Regulatory Announcement, Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements*. EPA420-F-00-057. December.

[3] California Air Resources Board, 2000. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles*. October.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of DPM. Several of these regulatory programs affect medium and heavy duty diesel trucks that represent the bulk of DPM emissions from California highways. CARB regulations require on-road diesel trucks to be retrofitted with particulate matter controls or replaced to meet 2010 or later engine standards that have much lower DPM and $PM_{2.5}$ emissions. This regulation will substantially reduce these emissions between 2013 and 2023. 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 is retrofitted to meet similar standards. With this regulation, older, more polluting trucks would be removed from the roads sooner.

CARB has also adopted and implemented regulations to reduce DPM and NO_X emissions from in-use (existing) and new off-road heavy-duty diesel vehicles (e.g., loaders, tractors, bulldozers, backhoes, off-highway trucks, etc.). The regulations apply to diesel-powered off-road vehicles with engines 25 horsepower (hp) or greater. The regulations are intended to reduce particulate matter and NO_X exhaust emissions by requiring owners to turn over their fleet (replace older equipment with newer equipment) or retrofit existing equipment in order to achieve specified fleet-averaged emission rates. Implementation of this regulation, in conjunction with stringent federal off-road equipment engine emission limits for new vehicles, will significantly reduce emissions of DPM and NO_X.

Bay Area Air Quality Management District (BAAQMD)

BAAQMD has jurisdiction over an approximately 5,600-square mile area, commonly referred to as the San Francisco Bay Area (Bay Area). The District's boundary encompasses the nine San Francisco Bay Area counties, including Alameda County, Contra Costa County, Marin County, San Francisco County, San Mateo County, Santa Clara County, Napa County, southwestern Solano County, and southern Sonoma County.

BAAQMD is the lead agency in developing plans to address attainment and maintenance of the National Ambient Air Quality Standards and California Ambient Air Quality Standards. The District also has permit authority over most types of stationary equipment utilized for the proposed project. The BAAQMD is responsible for permitting and inspection of stationary sources; enforcement of regulations, including setting fees, levying fines, and enforcement actions; and ensuring that public nuisances are minimized.

The BAAQMD California Environmental Quality Act (*CEQA) Air Quality Guidelines*[4] were prepared to assist in the evaluation of air quality impacts of projects and plans proposed within the Bay Area. The guidelines provide recommended procedures for evaluating potential air impacts during the environmental review process consistent with CEQA requirements including thresholds of significance, mitigation measures, and background air quality information. They also include assessment methodologies for air toxics, odors, and greenhouse gas emissions.

[4] Bay Area Air Quality Management District, 2017. *CEQA Air Quality Guidelines*. May.

San Rafael General Plan 2020

The San Rafael General Plan 2020 includes policies to reduce exposure of the City's sensitive population to exposure of air pollution and toxic air contaminants. The following policies are applicable to the proposed project:

AW-1. *State and Federal Standards.* Continue to comply and strive to exceed state and federal standards for air quality for the benefit of the Bay Area.

AW-1a. *Cooperation with Other Agencies.* Cooperate with the Bay Area Air Quality Management District (BAAQMD) and other agencies in their efforts to ensure compliance with existing air quality regulations.

AW-2. *Land Use Compatibility.* To ensure excellent air quality, promote land use compatibility for new development by using buffering techniques such as landscaping, setbacks, and screening in areas where different land uses abut one another.

AW-2a. *Sensitive Receptors.* Through development review, ensure that siting of any new sensitive receptors provides for adequate buffers from existing sources of toxic air contaminants or odors. If development of a sensitive receptor (a facility or land use that includes members of the population sensitive to the effects of air pollutants, such as children, the elderly and people with illnesses) is proposed within 500 feet of U.S. Highway 101 or I-580, an analysis of mobile source toxic air contaminant health risks should be performed. Development review should include an evaluation of the adequacy of the setback from the highway and, if necessary, identify design mitigation measures to reduce health risks to acceptable levels.

AW-2b. *Buffers.* Through development review, ensure that any proposed new sources of toxic air contaminants or odors provide adequate buffers to protect sensitive receptors and comply with existing health standards.

AW-3. *Air Quality Planning with Other Processes.* Integrate air quality considerations with the land use and transportation processes by mitigating air quality impacts through land use design measures, such as encouraging project design that will foster walking and biking.

AW-3a. *Air Pollution Reduction Measures.* Consider revisions to zoning regulations to require developers to implement strategies for air quality improvement described in the BAAQMD/ABAG's guide "Design Strategies for Encouraging Alternatives to Auto Use Through Local Development Review" or subsequent standards.

AW-3b. *Smart Growth and Livable Communities Programs.* Participate in and implement strategies of Metropolitan Transportation Commission's regional "Smart Growth Initiative" and "Transportation for Livable Communities Program."

AW-4. *Particulate Matter Pollution Reduction.* Promote the reduction of particulate matter pollution from roads, parking lots, construction sites, agricultural lands and other activities.

AW-4a. *Pollution Reduction.* Through development review, ensure that any proposed new sources of particulate matter use latest control technology (such as enclosures, paving unpaved areas, parking lot sweeping and landscaping) and provide adequate buffer setbacks to protect existing or future sensitive receptors.

Significance Thresholds

In June 2010, BAAQMD adopted thresholds of significance to assist in the review of projects under CEQA. These thresholds were designed to establish the level at which BAAQMD believed air pollution emissions would cause significant environmental impacts under CEQA. The significance thresholds identified by BAAQMD and used in this analysis are summarized in *Table 1*. The BAAQMD's adoption of significance thresholds, where were contained in the 2011 *CEQA Air Quality Guidelines,* was called into question by an order issued March 5, 2012, in California Building Industry Association (CBIA) v. BAAQMD (Alameda Superior Court Case No. RGI0548693). In December 2015, the Supreme Court determined that an analysis of the impacts of the environment on a project – known as "CEQA-in-reverse" – is only required under two limited circumstances: (1) when a statute provides an express legislative directive to consider such impacts; and (2) when a proposed project risks exacerbating environmental hazards or conditions that already exist (Cal. Supreme Court Case No. S213478). Because the Supreme Court's holding concerns the effects of the environment on a project (as contrasted to the effects of a proposed project on the environment), and not the science behind the thresholds, the significance thresholds contained in the CEQA Air Quality Guidelines are applied to this project. BAAQMD's updated 2017 *CEQA Air Quality Guidelines* are the most recent guidance and address the Court's ruling. This guidance and the recommended significance thresholds were applied to this study. Although not a CEQA impact, this study evaluates the effect of existing sources of TACs and air pollutants upon new project receptors in accordance with the City's General Plan Policy AW-2a Sensitive Receptors that requires that an analysis of mobiles source TAC health risks should be performed and appropriate measures to reduce exposure be identified. Guidance for this type of analysis contained in the BAAQMD CEQA Air Quality Guidelines was followed.

Table 1. Air Quality Significance Thresholds

Criteria Air Pollutant	Construction Thresholds	Operational Thresholds	
	Average Daily Emissions (lbs./day)	Average Daily Emissions (lbs./day)	Annual Average Emissions (tons/year)
ROG	54	54	10
NO_x	54	54	10
PM_{10}	82 (Exhaust)	82	15
$PM_{2.5}$	54 (Exhaust)	54	10
CO	Not Applicable	9.0 ppm (8-hour average) or 20.0 ppm (1-hour average)	
Fugitive Dust	Construction Dust Ordinance or other Best Management Practices	Not Applicable	
Health Risks and Hazards	**Single Sources Within 1,000-foot Zone of Influence**	**Combined Sources (Cumulative from all sources within 1,000-foot zone of influence)**	
Excess Cancer Risk	>10 per one million	>100 per one million	
Hazard Index	>1.0	>10.0	
Incremental annual $PM_{2.5}$	>0.3 $\mu g/m^3$	>0.8 $\mu g/m^3$	

Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM_{10} = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (μm) or less, $PM_{2.5}$ = fine particulate matter or particulates with an aerodynamic diameter of 2.5μm or less.

Impacts and Mitigation Measures

Impact 1: Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable State or federal ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?

The Bay Area is considered a non-attainment 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 non-attainment for PM_{10} under the California Clean Air Act, but not the federal 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 and PM_{10}, the BAAQMD has established thresholds of significance for these air pollutants and their precursors. These thresholds are for ozone precursor pollutants (ROG and NO_X), PM_{10}, and $PM_{2.5}$ and apply to both construction period and operational period impacts.

Construction activities, particularly during site preparation and grading, would temporarily generate fugitive dust in the form of PM_{10} and $PM_{2.5}$. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site would deposit mud on local streets, which could be an additional source of airborne dust after it dries. The BAAQMD *CEQA Air Quality Guidelines* consider these impacts to be less-than-significant if best management practices are implemented to reduce these emissions. *The first part of Mitigation Measure AQ-1 would implement BAAQMD-recommended best management practices.*

The California Emissions Estimator Model (CalEEMod) Version 2016.3.2 was used to estimate emissions from construction and operation of the site assuming full build-out of the project. The project land use types and size, and anticipated construction schedule were input to CalEEMod. The model output from CalEEMod is included as *Attachment 2*.

Construction period emissions

CalEEMod provided annual emissions for construction. CalEEMod provides emission estimates for both on-site and off-site construction activities. On-site activities are primarily made up of construction equipment emissions, while off-site activity includes worker, hauling, and vendor traffic. A construction build-out scenario, including equipment list and schedule, was based on CalEEMod defaults for a project of this type and size and applicant information.

The proposed project land uses were input into CalEEMod, which included: 44 dwelling units entered as "Condo/Townhouse" and 15 spaces as "Parking Lot". In addition, 18,100 square feet (sf) of building demolition, and 2,000 cubic yards (cy) of export and 10,000 cy of import for the grading phase were entered into the model.

The construction schedule assumed that the project would be built out over a period of approximately 12 months, beginning in January 2019. Based on the provided construction schedule and equipment usage assumptions, there were an estimated 256 construction workdays. Average daily emissions were computed by dividing the total construction emissions by the number of construction days. *Table 2* shows average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ exhaust during construction of the project. As indicated in *Table 2,* predicted the construction period emissions would not exceed the BAAQMD significance thresholds.

Table 2. Construction Period Emissions

Scenario	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
Total construction emissions (tons)	0.9 tons	2.4 tons	0.1 tons	0.1 tons
Average daily emissions (pounds)[1]	7.3 lbs./day	18.6 lbs./day	1.0 lbs./day	1.0 lbs./day
BAAQMD Thresholds (pounds per day)	*54* lbs./day	*54* lbs./day	*82* lbs./day	*54* lbs./day
Exceed Threshold?	**No**	**No**	**No**	**No**

Notes: [1]Assumes 256 workdays.

Operational Period Emissions

Operational air emissions from the project would be generated primarily from autos driven by future residents. Evaporative emissions from architectural coatings and maintenance products (classified as consumer products) are typical emissions from these types of uses. CalEEMod was used to estimate emissions from operation of the proposed project assuming full build-out.

Land Uses

The project land uses were input to CalEEMod, as described above for the construction period modeling.

Model Year

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 utilized by CalEEMod. The earliest the project could possibly be constructed and begin operating would be late 2020. Emissions associated with build-out later than 2020 would be lower.

Trip Generation Rates

The default trip generation rates, trip lengths, and trip types specified by CalEEMod were used.

Energy

CalEEMod defaults for energy use were used, which include the 2016 Title 24 Building Standards. Indirect emissions from electricity were computed in CalEEMod. The model has a default rate of 641.3 pounds of CO_2 per megawatt of electricity produced, which is based on PG&E's 2008 emissions rate. The rate was adjusted to account for PG&E's projected 2020 CO_2 intensity rate. This 2020 rate is based, in part, on the requirement of a renewable energy portfolio standard of 33 percent by the year 2020. The derived 2020 rate for PG&E was estimated at 290 pounds of CO_2 per megawatt of electricity delivered.[5]

Other Inputs

Wood-burning stoves and fireplaces are not allowed in new developments in the Bay Area; however, it was assumed that residential units could contain gas-powered fireplaces. Default model assumptions for emissions associated with solid waste generation and water/wastewater use were applied to the project. Water/wastewater use were changed to 100% aerobic conditions to represent wastewater treatment plant conditions.

Existing Uses

A CalEEMod model run was developed to computed emissions from use of the existing building as if it was operating in 2020. Inputs for this modeling scenario included 21,000 sf of "General Office Building" and 47,000 sf of "Parking Lot" to represent the existing commercial uses, and along with CalEEMod default trip rate generation rates, all inputs were applied to the modeling in the same manner described for the proposed project.

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[5] Pacific Gas & Electric, 2015. *Greenhouse Gas Emission Factors: Guidance for PG&E Customers*. November.

As shown in *Table 3*, operational emissions would not exceed the BAAQMD significance thresholds. This would be considered a *less-than-significant* impact.

Table 3. Operational Emissions

Scenario	ROG	NOx	PM_{10}	$PM_{2.5}$
2020 Project Operational Emissions (*tons/year*)	0.50 tons	0.29 tons	0.22 tons	0.07 tons
2020 Existing Use Emissions (*tons/year*)	0.15 tons	0.19 tons	0.16 tons	0.05 tons
Net Annual Emissions (*tons/year*)	0.35 tons	0.10 tons	0.06 tons	0.02 tons
BAAQMD Thresholds (tons /year)	*10 tons*	*10 tons*	*15 tons*	*10 tons*
Exceed Threshold?	***No***	***No***	***No***	***No***
Net Annual Emissions (*lbs/day*)	1.9 lbs.	0.5 lbs.	0.3 lbs.	0.1 lbs.
BAAQMD Thresholds (pounds/day)	*54* lbs.	*54* lbs.	82 lbs.	*54* lbs.
Exceed Threshold?	***No***	***No***	***No***	***No***

Notes: [1] Assumes 365-day operation.

***Mitigation Measure AQ-1:* Include basic measures to control dust and exhaust during construction.**

During any construction period ground disturbance, the applicant shall ensure that the project contractor implement measures to control dust and exhaust. Implementation of the measures recommended by BAAQMD and listed below would reduce the air quality impacts associated with grading and new construction to a less-than-significant level. The contractor shall implement the following best management practices that are required of all projects:

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. Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

In addition to the BAAQMD-recommended best management practices listed above, Mitigation Measure AQ-1 would require that the project develop a plan demonstrating that the off-road equipment used on-site to construct the project would achieve a fleet-wide average 87 percent reduction in particulate matter exhaust emissions or more. This is to address construction-related health risk impacts that are evaluated below, under Impact 3. One feasible plan to achieve this reduction would include the following:

- All diesel-powered off-road equipment, larger than 25 horsepower, operating on the site for more than two days continuously shall, at a minimum, meet U.S. EPA particulate matter emissions standards for Tier 2 engines with CARB-certified Level 3 Diesel Particulate Filters or equivalent. The use of equipment meeting U.S. EPA Tier 4 standards for particulate matter would also meet this requirement. Alternatively, the use of equipment that includes alternatively-fueled equipment (i.e., non-diesel) would meet this requirement. Other measures may be the use of added exhaust devices, or a combination of measures, provided that these measures are approved by the City and demonstrated to reduce community risk impacts to less-than-significant.

Effectiveness of Mitigation Measure AQ-1

Implementation of Mitigation Measure AQ-1 is considered to reduce fugitive dust emissions by over 70 percent and reduce on-site diesel exhaust emissions by over 85 percent.

Impact 2: Violate any air quality standard or contribute substantially to an existing or projected air quality violation?

As discussed under Impact 1, the project would have emissions less than the BAAQMD thresholds. Therefore, the project 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. The highest measured level over any 8-hour averaging period during the last 3 years in the Bay Area is less than 3.0 parts per million (ppm), compared to the ambient air quality standard of 9.0 ppm. Intersections affected by the project would have traffic volumes less than the BAAQMD screening criteria and, thus, would not cause a violation of an ambient air quality standard or have a considerable contribution to cumulative violations of these standards.[6] The project would not cause the violation of an air quality standard or worsen an existing violation of an air quality standard. This would be a *less-than-significant* impact.

Impact 3: Expose sensitive receptors to substantial pollutant concentrations?

Project impacts related to increased community risk can occur either by introducing a new sensitive receptor, such as a residential use, in proximity to an existing source of TACs or by introducing a new source of TACs with the potential to adversely affect existing sensitive receptors in the project vicinity. The project would introduce new residents that are sensitive receptors. In addition, temporary project construction activity would generate dust and equipment exhaust on a temporary basis that could affect nearby sensitive receptors. Community risk impacts are addressed by increased predicting lifetime cancer risk, the increase in annual $PM_{2.5}$ concentrations and computing the Hazard Index (HI) for non-cancer health risks. The methodology for computing community risks impacts is contained in *Attachment 1*.

Operational Community Risk Impacts

Community health risk assessments typically look at all substantial sources of TACs that can affect sensitive receptors that are located within 1,000 feet of a project site. These sources can include freeways or highways, railways, busy surface streets, and stationary sources identified by BAAQMD. Traffic on high volume roadways is a source of TAC emissions that may adversely affect sensitive receptors in close proximity to the roadway. A review of the project area indicates that traffic on U.S. Highway 101, located approximately 100 feet east of the project site, would exceed 10,000 vehicles per day. Other nearby streets are assumed to have less than 10,000 vehicles per day. In addition, the Sonoma-Marin Rail Transit (SMART) rail line, located approximately 375 feet north of the project site, includes the operation of diesel-powered passenger trains. *Figure 1* shows the site location relative to nearby TAC sources. Community risk impacts from these sources upon the project are reported in *Table 4*. Community risk screening calculations are included in *Attachment 3*.

[6] For a land-use project type, the BAAQMD CEQA Air Quality Guidelines state that a proposed project would result in a less-than-significant impact to localized carbon monoxide concentrations if the project would not increase traffic at affected intersections with more than 44,000 vehicles per hour.

Figure 1. Project Site and Nearby TAC and $PM_{2.5}$ Sources

Table 4. Community Risk Impact to New Project Residences

Source		Cancer Risk (per million)	Annual $PM_{2.5}$ ($\mu g/m^3$)	Hazard Index
U.S. Highway 101 at 100 ft east Link 674 (6ft elevation)		**29.9**	0.22	0.05
SMART Train Line at 375 ft northwest		<3.5	<0.01	<0.01
	Cumulative Total	*33.4*	*<0.23*	*<0.06*
BAAQMD Single-Source Threshold Significant?		***>10.0 Yes***	***>0.3 No***	***>1.0 No***
BAAQMD Cumulative Source Threshold Significant?		***>100 No***	***>0.8 No***	***>10.0 No***

Highways – U.S. Highway 101

BAAQMD provides a *Highway Screening Analysis* Google Earth Map tool to identify estimated risk and hazard impacts from highways throughout the Bay Area. Cumulative risk, hazard and $PM_{2.5}$ impacts at various distances from the highway are estimated for different segments of the highways. The tool uses the average annual daily traffic (AADT) count, fleet mix and other modeling parameters specific to that segment of the highway. Impacts from Link 674 (6ft elevation) of U.S. Highway 101 to the project site, which would be about 100 feet west of the highway, were identified.

The cancer risk identified using the BAAQMD tool was adjusted using a factor of 1.3744 to account for new Office of Environmental Health Hazard Assessment (OEHHA) guidance. This factor was provided by BAAQMD for use with their CEQA screening tools that are used to predict cancer risk.[7] Estimated cancer risk from the highway traffic would be 29.9 per million and $PM_{2.5}$ concentration would be 0.22 $\mu g/m^3$. The maximum of chronic or acute HI for the highway would be 0.05. The predicted cancer risk is above the threshold of 10 chances per million. This would be a *potentially significant impact.*

SMART Train Line

The SMART railroad lies approximately 375 feet northwest of proposed project site. The SMART trains uses this rail line on a regular basis. Environmental studies were performed for each proposed rail use along the line in Marin and Sonoma counties and used to predict community risk levels from these activities.[8,9] Both studies predicted maximum risk levels for a position of 30 feet from the rail line. Although these predictions are for positions much closer than depicted for project site, they were used as screening values for this analysis. Both health risk studies for these environmental evaluations were conducted prior to BAAQMD's adoption of age-sensitivity factors, which account for the greater sensitivity of infants and small children to cancer-causing TACs. The levels predicted in each study were increased by a factor of 1.7 to account for the age-sensitivity factors that assume the presence of infants and small children at residences and were then also increased by a factor of 1.3744 to reflect new OEHHA guidance (see *Attachment 1*). The predicted cancer risk, annual $PM_{2.5}$ concentrations and non-cancer hazards at 30 feet from the tracks would not exceed the BAAQMD significance thresholds. These levels would be considerably lower at 375 feet from the tracks where project residences would be located.

Cumulative Community Risk at Project Site

As shown in *Tables 4*, cancer risk from U.S. Highway 101 would exceed the BAAQMD threshold. This is a *potentially significant* impact. The effect of the SMART train line upon the site and the combined TAC and $PM_{2.5}$ sources within 1,000 feet of the project sites would not exceed the BAAQMD risk thresholds. *Implementation of Mitigation Measure AQ-2 would reduce this impact to a level of less-than-significant.*

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[7] Correspondence with Alison Kirk, BAAQMD, November 23, 2015.

[8] Draft Environmental Impact Report (DEIR) for the North Coast Railroad Authority Project (SCH 2007072052)

[9] Supplemental Environmental Impact Report (SEIR) for the Sonoma-Marin Area Rail Transit Project (SCH 2002112033)

Mitigation Measure AQ-2: **Include high-efficiency particulate filtration systems in residential ventilation systems.**

The significant exposure for new project receptors is judged by two effects: (1) increased cancer risk, and (2) annual $PM_{2.5}$ concentration. Exposure to cancer risk from U.S. Highway 101 are significant. Cancer risk is based on exposure to exhaust emissions while annual $PM_{2.5}$ concentrations are based on the exposure to $PM_{2.5}$ resulting from emissions attributable to truck and auto exhaust, the wearing of brakes and tires and re-entrainment of roadway dust from vehicles traveling over pavement. $PM_{2.5}$ exposure drives the mitigation plan. Reducing $PM_{2.5}$ exposures to less than significant would also reduce cancer risk to less than significant levels.

The project shall include the following measures to minimize long-term annual $PM_{2.5}$ exposure for new project occupants:

1. Install air filtration in residential dwellings. Air filtration devices shall be rated MERV13 or higher. To ensure adequate health protection to sensitive receptors (i.e., residents), this ventilation system, whether mechanical or passive, all fresh air circulated into the dwelling units shall be filtered, as described above.

2. 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.

3. Ensure that the use 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 or 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.

<u>Significance After Mitigation Measure AQ-2</u>

A properly installed and operated ventilation system with MERV13 filters should achieve reductions of 80 percent. $PM_{2.5}$ exposures for MERV13 filtration cases were calculated assuming a combination of outdoor and indoor exposure. For use of MERV13 filtration systems, without the additional use of sealed, inoperable widows and no balconies, three hours of outdoor exposure to ambient $PM_{2.5}$ concentrations and 21 hours of indoor exposure to filtered air was assumed. In this case, the effective control efficiency using a MERV13 filtration system is about 70 percent from U.S. Highway 101 for TAC particulate matter exposure. This would reduce the maximum cancer risk to 9 chances per million or less and further reduce annual $PM_{2.5}$ concentrations. *Implementation of Mitigation Measure AQ-2 would reduce this impact to a level of less-than-significant.*

Project Construction Activity

Construction equipment and associated heavy-duty truck traffic generates diesel exhaust, which is a known TAC. These exhaust air pollutant emissions would not be considered to contribute substantially to existing or projected air quality violations. Construction exhaust emissions may still pose health risks for sensitive receptors such as surrounding residents. The primary community risk impact issues associated with construction emissions are cancer risk and exposure to $PM_{2.5}$. Diesel exhaust poses both a potential health and nuisance impact to nearby receptors. A health risk assessment of the project construction activities was conducted that evaluated potential health effects of sensitive receptors at these nearby residences from construction emissions of DPM and $PM_{2.5}$.[10] The closest sensitive receptors to the project site are residents of an apartment building adjacent to the southeastern site boundary, with additional residences in the nearby area surrounding the project site (see *Figure 2*). Dispersion modeling was conducted to predict the off-site concentrations resulting from project construction, so that lifetime cancer risks and non-cancer health effects could be evaluated.

Construction Emissions

Construction period emissions were computed using CalEEMod along with projected construction activity, as described above. The CalEEMod model provided total annual PM_{10} exhaust emissions (assumed to be DPM) for the off-road construction equipment and for exhaust emissions from on-road vehicles, with total emissions from all construction stages of 0.1308 tons (217 pounds). The on-road emissions are a result of haul truck travel during demolition and grading activities, worker travel, and vendor deliveries during construction. A trip length of one mile was used to represent vehicle travel while at or near the construction site. It was assumed that these emissions from on-road vehicles traveling at or near the site would occur at the construction site. Fugitive $PM_{2.5}$ dust emissions were calculated by CalEEMod as 0.0093 tons (19 pounds) for the overall construction period.

Dispersion Modeling

The U.S. EPA AERMOD dispersion model was used to predict DPM and $PM_{2.5}$ concentrations at sensitive receptors (residences) that would be present in the vicinity of the project site during construction activities. Emission sources for the construction site were grouped into two categories: exhaust emissions of DPM and fugitive $PM_{2.5}$ dust emissions. The AERMOD modeling utilized two area sources to represent the on-site construction emissions, one for exhaust emissions and one for fugitive dust emissions. To represent the construction equipment exhaust emissions, an emission release height of 6 meters (19.7 feet) was used for the area source. The elevated source height reflects the height of the equipment exhaust pipes plus an additional distance for the height of the exhaust plume above the exhaust pipes to account for plume rise of the exhaust gases. For modeling fugitive $PM_{2.5}$ emissions, a near-ground level release height of 2 meters (6.6 feet) was used for the area source. Emissions from the construction equipment and on-road vehicle travel were distributed throughout the modeled area sources. Construction emissions were modeled as occurring daily between 7 a.m. and 4 p.m., when the majority of construction activity would occur. *Figure 2* shows the project site, emission source locations, and nearby sensitive receptor locations where health impacts were evaluated.

The modeling used a five-year data set (2006-2010) of hourly meteorological data from the Gnoss Field Airport in Novato that was prepared for use with the AERMOD model by CARB for health

[10] DPM is identified by California as a toxic air contaminant due to the potential to cause cancer.

risk assessments. The airport is about 10 miles north of the project site. Annual DPM and $PM_{2.5}$ concentrations from construction activities during the 2019 construction period were calculated using the model. DPM and $PM_{2.5}$ concentrations were calculated at nearby sensitive receptors. Receptor heights of 1.5 meters (5 feet) and 4.5 meters (15 feet) were used to represent the breathing heights of residents in nearby homes and apartment buildings on the first and second floor levels, respectively.

The maximum DPM and $PM_{2.5}$ concentrations occurred at the second floor level (4.5 meter receptor height) of the apartment building adjacent to the southeastern project site boundary. Using the maximum annual modeled DPM concentration, the maximum increased cancer risk at the location of the maximally exposed individual (MEI) was calculated using BAAQMD recommended methods.

Predicted Cancer Risk and Hazards

Figure 2 shows the locations where the maximum-modeled DPM and $PM_{2.5}$ concentrations occurred. The cancer risk calculations are based on applying the BAAQMD recommended age sensitivity factors to the TAC concentrations. Age-sensitivity factors reflect the greater sensitivity of infants and small children to cancer causing TACs. BAAQMD-recommended exposure parameters were used for the cancer risk calculations, as described in *Attachment 1*. Infant and adult exposures were assumed to occur at all residences through the entire construction period.

Results of this assessment indicate that the maximum increased residential cancer risks would be 78.3 in one million for an infant exposure and 1.4 in one million for an adult exposure. The maximum residential excess cancer risk would be above the BAAQMD significance threshold of 10.0 in one million. *Implementation of Mitigation Measure AQ-1 would reduce this impact to a level of less-than-significant.*

Predicted Annual $PM_{2.5}$ Concentration

The maximum-modeled annual $PM_{2.5}$ concentration, which is based on combined exhaust and fugitive dust emissions, was 0.51 $\mu g/m^3$. This maximum annual $PM_{2.5}$ concentration would be above the BAAQMD significance threshold of greater than 0.3 $\mu g/m^3$. *Implementation of Mitigation Measure AQ-1 would reduce this impact to a level of less-than-significant.*

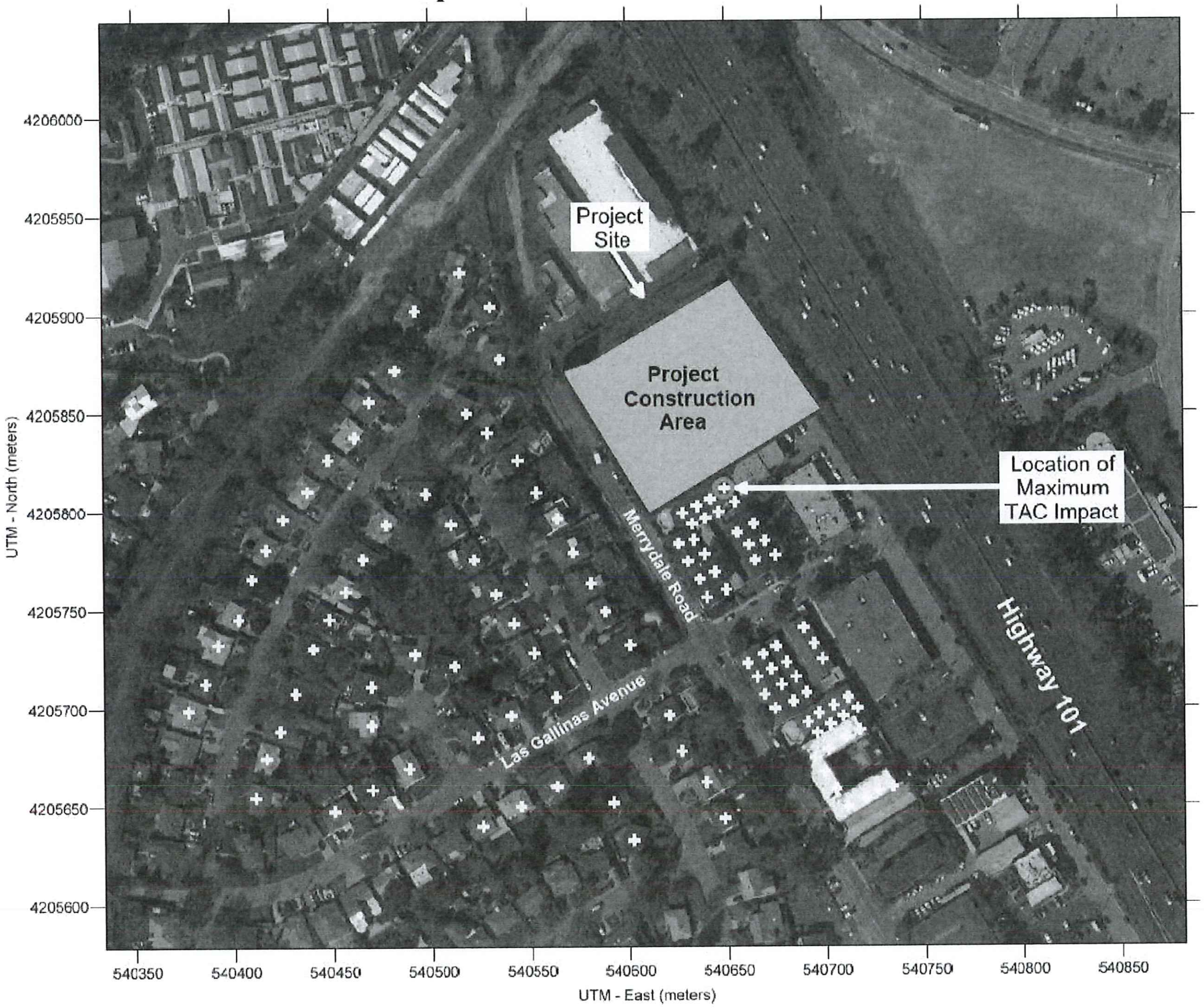
Non-Cancer Hazards

The maximum modeled annual residential DPM concentration (i.e., from construction exhaust) was 0.4770 $\mu g/m^3$. The maximum computed HI based on this DPM concentration is 0.095, which is lower than the BAAQMD significance criterion of a HI greater than 1.0.

The project would have a *significant* impact with respect to community risk caused by project construction activities, since maximum cancer risk is above the single-source thresholds of 10.0 per million for cancer risk and the maximum annual $PM_{2.5}$ concentration would be above the BAAQMD significance threshold of greater than 0.3 $\mu g/m^3$. Mitigation measure AQ-1 would reduce this impact to less than significant.

Attachment 4 includes the emission calculations and source information used in the modeling and the cancer risk calculations.

Figure 2. Project Construction Site and Locations of Off-Site Sensitive Receptors and Maximum TAC Impacts



Mitigation Measure: See Mitigation Measure AQ-1 described above.

Effectiveness of Mitigation Measure AQ-1

Implementation of Mitigation Measure AQ-1 is considered to reduce fugitive dust emissions by over 70 percent and reduce on-site diesel exhaust emissions by over 85 percent. This would reduce the residential infant cancer risk proportionally, such that the mitigated risk at the residential receptor with the greatest impact would be less than 8.6 in one million and the maximum annual $PM_{2.5}$ concentration would be reduced to less than 0.06 $\mu g/m^3$, which is less than the BAAQMD significance thresholds. After implementation of these mitigation measures, the project would have a *less-than-significant* impact with respect to community risk caused by construction activities.

Cumulative Impact on Construction MEI

The cumulative impacts of TAC emissions from construction of the project, traffic on U.S. 101, and the SMART train line on the construction MEI have been summarized in *Table 5*. The construction MEI would represent the worst-case scenario as its calculated unmitigated maximum cancer risk concentrations exceeded the BAAQMD single-source threshold. The screening levels reported for cumulative sources were computed in the same manner described above for project residential occupants.

As shown in *Table 5*, the sum of impacts from combined sources at the construction MEI would not exceed the cumulative thresholds. The cumulative impact would be *less-than-significant.*

Table 5. Impacts from Combined Sources at Construction MEI

Source		Maximum Cancer Risk (per million)	$PM_{2.5}$ concentration ($\mu g/m^3$)	Hazard Index
Project Construction	Unmitigated	**78.3 (infant)**	0.51	0.10
	Mitigated	8.6 (infant)	0.06	0.01
U.S. Highway 101 at 250 ft east Link 674 (6ft elevation)		17.6	0.13	0.04
SMART Train Line at 675 ft northwest		<3.5	<0.01	<0.01
Combined Sources	*Unmitigated*	99.4	<0.65	<0.15
	Mitigated	29.7	<0.20	<0.06
BAAQMD Threshold – Combined Sources		***100***	***0.8***	***10.0***
	Significant?	***No***	***No***	***No***

Greenhouse Gases

Setting

Gases that trap heat in the atmosphere, GHGs, regulate the earth's temperature. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate. The most common GHGs are carbon dioxide (CO_2) and water vapor but there are also several others, most importantly methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). These are released into the earth's atmosphere through a variety of natural processes and human activities. Sources of GHGs are generally as follows:

- CO_2 and N_2O are byproducts of fossil fuel combustion.
- N_2O is associated with agricultural operations such as fertilization of crops and a small component of vehicle exhaust.
- CH_4 is commonly created by off-gassing from agricultural practices (e.g., keeping livestock) and landfill operations.
- Chlorofluorocarbons (CFCs) were widely used as refrigerants, propellants, and cleaning solvents but their production has been stopped by international treaty.
- HFCs are now used as a substitute for CFCs in refrigeration and cooling.

- PFCs and sulfur hexafluoride emissions are commonly created by industries such as aluminum production and semi-conductor manufacturing.

Each GHG has its own potency and effect upon the earth's energy balance. This is expressed in terms of a global warming potential (GWP), with CO_2 being assigned a value of 1 and sulfur hexafluoride being several orders of magnitude stronger. In GHG emission inventories, the weight of each gas is multiplied by its GWP and is measured in units of CO_2 equivalents (CO_2e).

An expanding body of scientific research supports the theory that global climate change is currently affecting changes in weather patterns, average sea level, ocean acidification, chemical reaction rates, and precipitation rates, and that it will increasingly do so in the future. The climate and several naturally occurring resources within California are adversely affected by the global warming trend. Increased precipitation and sea level rise will increase coastal flooding, saltwater intrusion, and degradation of wetlands. Mass migration and/or loss of plant and animal species could also occur. Potential effects of global climate change that could adversely affect human health include more extreme heat waves and heat-related stress; an increase in climate-sensitive diseases; more frequent and intense natural disasters such as flooding, hurricanes and drought; and increased levels of air pollution.

Recent Regulatory Actions

Assembly Bill 32 (AB 32), California Global Warming Solutions Act (2006)

AB 32, the Global Warming Solutions Act of 2006, codified the State's GHG emissions target by directing CARB to reduce the State's global warming emissions to 1990 levels by 2020. AB 32 was signed and passed into law by Governor Schwarzenegger on September 27, 2006. Since that time, the CARB, CEC, California Public Utilities Commission (CPUC), and Building Standards Commission have all been developing regulations that will help meet the goals of AB 32 and Executive Order S-3-05.

A Scoping Plan for AB 32 was adopted by CARB in December 2008. It contains the State's main strategies to reduce GHGs from business-as-usual emissions projected in 2020 back down to 1990 levels. Business-as-usual (BAU) is the projected emissions in 2020, including increases in emissions caused by growth, without any GHG reduction measures. The Scoping Plan has a range of GHG reduction actions, including direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system.

Senate Bill 375, California's Regional Transportation and Land Use Planning Efforts (2008)

California enacted legislation (SB 375) to expand the efforts of AB 32 by controlling indirect GHG emissions caused by urban sprawl. SB 375 provides incentives for local governments and applicants to implement new conscientiously planned growth patterns. This includes incentives for creating attractive, walkable, and sustainable communities and revitalizing existing communities. The legislation also allows applicants to bypass certain environmental reviews under CEQA if they build projects consistent with the new sustainable community strategies. Development of more alternative transportation options that would reduce vehicle trips and miles traveled, along with traffic congestion, would be encouraged. SB 375 enhances CARB's ability to reach the AB 32 goals by directing the agency in developing regional GHG emission reduction targets to be achieved from the transportation sector for 2020 and 2035. CARB works with the metropolitan planning organizations (e.g. Association of Bay Area Governments [ABAG] and Metropolitan Transportation Commission [MTC]) to align their regional transportation, housing, and land use plans to reduce vehicle miles traveled and demonstrate the region's ability to attain its GHG reduction targets. A similar process is used to reduce transportation emissions of ozone precursor pollutants in the Bay Area.

SB 350 Renewable Portfolio Standards

In September 2015, the California Legislature passed SB 350, which increases the states Renewables Portfolio Standard (RPS) for content of electrical generation from the 33 percent target for 2020 to a 50 percent renewables target by 2030.

Executive Order EO-B-30-15 (2015) and SB 32 GHG Reduction Targets

In April 2015, Governor Brown signed Executive Order which extended the goals of AB 32, setting a greenhouse gas emissions target at 40 percent of 1990 levels by 2030. On September 8, 2016, Governor Brown signed SB 32, which legislatively established the GHG reduction target of 40 percent of 1990 levels by 2030. In November 2017, CARB issued *California's 2017 Climate Change Scoping Plan*. While the State is on track to exceed the AB 32 scoping plan 2020 targets, this plan is an update to reflect the enacted SB 32 reduction target.

The new Scoping Plan establishes a strategy that will reduce GHG emissions in California to meet the 2030 target (note that the AB 32 Scoping Plan only addressed 2020 targets and a long-term goal). Key features of this plan are:

- Cap and Trade program places a firm limit on 80 percent of the State's emissions;
- Achieving a 50-percent Renewable Portfolio Standard by 2030 (currently at about 29 percent statewide);
- Increase energy efficiency in existing buildings (note that new
- Develop fuels with an 18-percent reduction in carbon intensity;
- Develop more high-density, transit oriented housing;
- Develop walkable and bikeable communities
- Greatly increase the number of electric vehicles on the road and reduce oil demand in half;
- Increase zero-emissions transit so that 100 percent of new buses are zero emissions;
- Reduce freight-related emissions by transitioning to zero emissions where feasible and near-zero emissions with renewable fuels everywhere else; and
- Reduce "super pollutants" by reducing methane and hydrofluorocarbons or HFCs by 40 percent.

In the updated Scoping Plan, CARB recommends statewide targets of no more than 6 metric tons CO_2e per capita (statewide) by 2030 and no more than 2 metric tons CO_2e per capita by 2050. The statewide per capita targets account for all emissions sectors in the State, statewide population forecasts, and the statewide reductions necessary to achieve the 2030 statewide target under SB 32 and the longer-term State emissions reduction goal of 80 percent below 1990 levels by 2050.

San Rafael Climate Change Action Plan (CCAP)

The San Rafael CCAP was adopted by the City Council on April 20, 2009. This document lays out the goals and implementation plan for achieving a 25% reduction of GHG by 2020, and an ambitious 80% reduction by 2050 to meet state targets. The Implementation Plan is broken down into several distinct areas of action: Lifestyles, Buildings, Environment, Economy, Community Outreach, and City Operations.

Significance Thresholds

The BAAQMD's CEQA Air Quality Guidelines recommended a GHG threshold of 1,100 metric tons or 4.6 metric tons (MT) per capita. These thresholds were developed based on meeting the 2020 GHG targets set in the scoping plan that addressed AB 32. Development of the project would occur beyond 2020, so a threshold that addresses a future target is appropriate. Although BAAQMD has not published a quantified threshold for 2030 yet, this assessment uses a "Substantial Progress" efficiency metric of 2.6 MT CO_2e/year/service population. This is calculated for 2030 based on the GHG reduction goals of EO B-30-15, taking into account the 1990 inventory and the projected 2030 statewide population and employment levels.[11]

Impact 4: Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

GHG emissions associated with development of the proposed project would occur over the short-term from construction activities, consisting primarily of emissions from equipment exhaust and worker and vendor trips. There would also be long-term operational emissions associated with vehicular traffic within the project vicinity, energy and water usage, and solid waste disposal. Emissions for the proposed project are discussed below and were analyzed using the methodology recommended in the BAAQMD CEQA Air Quality Guidelines.

CalEEMod Modeling

CalEEMod was used to predict GHG emissions from operation of the site assuming full build-out of the project. The project land use types and size and other project-specific information were input to the model, as described above. CalEEMod output is included in *Attachment 1*.

The electricity produced emission rate was modified in CalEEMod. CalEEMod has a default emission factor of 641.3 pounds of CO_2 per megawatt of electricity produced, which is based on PG&E's 2008 emissions rate. PG&E published 2015 emissions rates for 2009 through 2015, which showed the emission rate for delivered electricity had been reduced to 405 pounds CO_2 per

[11] Association of Environmental Professionals, 2016. *Beyond 2020 and Newhall: A Field Guide to New CEQA Greenhouse Gas Thresholds and Climate Action Plan Targets for California.* April.

megawatt of electricity delivered.[12] The projected GHG intensity factor for the year 2020 is 290 pounds of CO_2 per megawatt of electricity produced, which was input to the model.[13]

Service Population Emissions

The project service population efficiency rate is based on the number of future residences. The number of future residences is estimated at 111 based on the latest California Department of Finance data of 2.53 average persons per household for the City of San Rafael.[14]

Construction Emissions

GHG emissions associated with construction were computed to be 297 MT of CO_2e for the total construction period. These are the emissions from on-site operation of construction equipment, vendor and hauling truck trips, and worker trips. Neither the City nor BAAQMD have an adopted threshold of significance for construction-related GHG emissions, though BAAQMD recommends quantifying emissions and disclosing that GHG emissions would occur during construction. BAAQMD also encourages the incorporation of best management practices to reduce GHG emissions during construction where feasible and applicable. Best management practices assumed to be incorporated into construction of the proposed project include but are not limited to: using local building materials of at least 10 percent and recycling or reusing at least 50 percent of construction waste or demolition materials.

Operational Emissions

The CalEEMod model, along with the project vehicle trip generation rates, was used to estimate daily emissions associated with operation of the fully-developed site under the proposed project. In 2020 as shown in *Table 6*, annual emissions resulting from operation of the proposed project are predicted to be 322 MT of CO_2e. The annual emissions from operation of the existing buildings in 2020 are computed as 237 MT of CO_2e. The net emissions resulting from the project would be 85 MT of CO_2e. The net emission increase would not exceed the BAAQMD threshold of 1,100 MT of CO_2e/yr. This would be considered a *less-than-significant* impact.

Table 6. Annual Project GHG Emissions (CO_2e) in Metric Tons

Source Category	Existing in 2020	Proposed Project in 2020	Proposed Project in 2030
Area	<1	2	2
Energy Consumption	58	83	83
Mobile	162	222	164
Solid Waste Generation	10	10	10
Water Usage	6	5	5
Total	237	322	264

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[12] PG&E 2017. Climate Change. See http://www.pgecorp.com/corp_responsibility/reports/2017/en02_climate_change.html accessed March 13, 2018.

[13] PG&E. 2015. Greenhouse Gas Emission Factors: Guidance for PG&E Customers See: https://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

[14] State of California, Department of Finance. "E-5 Population and Housing Estimates for Cities, Counties, and the State, 2011-2018." Accessed: July 18, 2018. Available at: http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/

Net New Emissions		85	27
Significance Threshold / Exceed?		**1,100 / No**	**1,100 / No**
Service Population Emissions		2.9	2.4
Significance Threshold / Exceed?		**4.6 in 2020 / No**	**2.6 in 2030 / No**

Supporting Documentation

Attachment 1 is the methodology used to compute community risk impacts, including the methods to compute lifetime cancer risk from exposure to project emissions.

Attachment 2 includes the CalEEMod output for project construction and operational criteria air pollutant. The operational output for existing uses is also included in this attachment. Also included are any modeling assumptions.

Attachment 3 includes the screening community risk calculations from sources affecting the project and MEI.

Attachment 4 is the construction health risk assessment. AERMOD dispersion modeling files for this assessment, which are quite voluminous, are available upon request and would be provided in digital format.

Attachment 1: Health Risk Calculation Methodology

A health risk assessment (HRA) for exposure to Toxic Air Contaminates (TACs) requires the application of a risk characterization model to the results from the air dispersion model to estimate potential health risk at each sensitive receptor location. The State of California Office of Environmental Health Hazard Assessment (OEHHA) and California Air Resources Board (CARB) develop recommended methods for conducting health risk assessments. The most recent OEHHA risk assessment guidelines were published in February of 2015.[15] These guidelines incorporate substantial changes designed to provide for enhanced protection of children, as required by State law, compared to previous published risk assessment guidelines. CARB has provided additional guidance on implementing OEHHA's recommended methods.[16] This HRA used the recent 2015 OEHHA risk assessment guidelines and CARB guidance. The BAAQMD has adopted recommended procedures for applying the newest OEHHA guidelines as part of Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants.[17] Exposure parameters from the OEHHA guidelines and the recent BAAQMD HRA Guidelines were used in this evaluation.

Cancer Risk

Potential increased cancer risk from inhalation of TACs are calculated based on the TAC concentration over the period of exposure, inhalation dose, the TAC cancer potency factor, and an age sensitivity factor to reflect the greater sensitivity of infants and children to cancer causing TACs. The inhalation dose depends on a person's breathing rate, exposure time and frequency of exposure, and the exposure duration. These parameters vary depending on the age, or age range, of the persons being exposed and whether the exposure is considered to occur at a residential location or other sensitive receptor location.

The current OEHHA guidance recommends that cancer risk be calculated by age groups to account for different breathing rates and sensitivity to TACs. Specifically, they recommend evaluating risks for the third trimester of pregnancy to age zero, ages zero to less than two (infant exposure), ages two to less than 16 (child exposure), and ages 16 to 70 (adult exposure). Age sensitivity factors (ASFs) associated with the different types of exposure are an ASF of 10 for the third trimester and infant exposures, an ASF of 3 for a child exposure, and an ASF of 1 for an adult exposure. Also associated with each exposure type are different breathing rates, expressed as liters per kilogram of body weight per day (L/kg-day). As recommended by the BAAQMD, 95th percentile breathing rates are used for the third trimester and infant exposures, and 80th percentile breathing rates for child and adult exposures. Additionally, CARB and the BAAQMD recommend the use of a residential exposure duration of 30 years for sources with long-term emissions (e.g., roadways).

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[15] OEHHA, 2015. *Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*. Office of Environmental Health Hazard Assessment. February.

[16] CARB, 2015. *Risk Management Guidance for Stationary Sources of Air Toxics*. July 23.

[17] BAAQMD, 2016. *BAAQMD Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines*. December 2016.

Under previous OEHHA and BAAQMD HRA guidance, residential receptors are assumed to be at their home 24 hours a day, or 100 percent of the time. In the 2015 Risk Assessment Guidance, OEHHA includes adjustments to exposure duration to account for the fraction of time at home (FAH), which can be less than 100 percent of the time, based on updated population and activity statistics. The FAH factors are age-specific and are: 0.85 for third trimester of pregnancy to less than 2 years old, 0.72 for ages 2 to less than 16 years, and 0.73 for ages 16 to 70 years. Use of the FAH factors is allowed by the BAAQMD if there are no schools in the project vicinity that would have a cancer risk of one in a million or greater assuming 100 percent exposure (FAH = 1.0).

Functionally, cancer risk is calculated using the following parameters and formulas:

Cancer Risk (per million) = $CPF \times Inhalation\ Dose \times ASF \times ED/AT \times FAH \times 10^{6}$

Where:

CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = $C_{air} \times DBR \times A \times (EF/365) \times 10^{-6}$

Where:

C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

The health risk parameters used in this evaluation are summarized as follows:

Parameter	*Exposure Type →*	Infant		Child		Adult
	Age Range →	3rd Trimester	0<2	2 < 9	2 < 16	16 - 30
DPM Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$		1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
Daily Breathing Rate (L/kg-day)*		361	1,090	631	572	261
Inhalation Absorption Factor		1	1	1	1	1
Averaging Time (years)		70	70	70	70	70
Exposure Duration (years)		0.25	2	14	14	14
Exposure Frequency (days/year)		350	350	350	350	350
Age Sensitivity Factor		10	10	3	3	1
Fraction of Time at Home		0.85-1.0	0.85-1.0	0.72-1.0	0.72-1.0	0.73

* 95th percentile breathing rates for 3rd trimester and infants and 80th percentile for children and adults

Non-Cancer Hazards

Potential non-cancer health hazards from TAC exposure are expressed in terms of a hazard index (HI), which is the ratio of the TAC concentration to a reference exposure level (REL). OEHHA has defined acceptable concentration levels for contaminants that pose non-cancer health hazards. TAC concentrations below the REL are not expected to cause adverse health impacts, even for sensitive individuals. The total HI is calculated as the sum of the HIs for each TAC evaluated and the total HI is compared to the BAAQMD significance thresholds to determine whether a significant non-cancer health impact from a project would occur.

Typically, for residential projects located near roadways with substantial TAC emissions, the primary TAC of concern with non-cancer health effects is diesel particulate matter (DPM). For DPM, the chronic inhalation REL is 5 micrograms per cubic meter ($\mu g/m^3$).

Annual $PM_{2.5}$ Concentrations

While not a TAC, fine particulate matter ($PM_{2.5}$) has been identified by the BAAQMD as a pollutant with potential non-cancer health effects that should be included when evaluating potential community health impacts under the California Environmental Quality Act (CEQA). The thresholds of significance for $PM_{2.5}$ (project level and cumulative) are in terms of an increase in the annual average concentration. When considering $PM_{2.5}$ impacts, the contribution from all sources of $PM_{2.5}$ emissions should be included. For projects with potential impacts from nearby local roadways, the $PM_{2.5}$ impacts should include those from vehicle exhaust emissions, $PM_{2.5}$ generated from vehicle tire and brake wear, and fugitive emissions from re-suspended dust on the roads.

Attachment 2: CalEEMod Modeling Output

3833 Redwood Blvd. - Marin County, Annual

3833 Redwood Hwy
Marin County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	15.00	Space	0.00	6,000.00	0
Condo/Townhouse	44.00	Dwelling Unit	2.00	89,000.00	126

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	69
Climate Zone	5			**Operational Year**	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	290	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - PG&E Intensity Factor Updated

Land Use - Values from Project Specifications

Construction Phase - added trenching

Off-road Equipment -

Off-road Equipment -

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - added trenching

Trips and VMT -

Demolition - 18,100sf demo

Grading - 2,000cy exported, 10,000cy imported

Energy Use -

Off-road Equipment - Default Construction Equipment and hours

Off-road Equipment -

Woodstoves - No woodmass, wood moved to gas

Water And Wastewater - WTP treatment, 100% aerobic

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	PhaseEndDate	12/10/2019	12/24/2019
tblConstructionPhase	PhaseEndDate	11/12/2019	11/26/2019
tblConstructionPhase	PhaseEndDate	11/26/2019	12/10/2019
tblConstructionPhase	PhaseStartDate	11/27/2019	12/11/2019
tblConstructionPhase	PhaseStartDate	2/6/2019	2/20/2019
tblConstructionPhase	PhaseStartDate	11/13/2019	11/27/2019
tblFireplaces	FireplaceWoodMass	228.80	0.00
tblFireplaces	NumberGas	6.60	14.08
tblFireplaces	NumberWood	7.48	0.00
tblGrading	MaterialExported	0.00	2,000.00
tblGrading	MaterialImported	0.00	10,000.00
tblLandUse	LandUseSquareFeet	44,000.00	89,000.00
tblLandUse	LotAcreage	0.13	0.00
tblLandUse	LotAcreage	2.75	2.00
tblOffRoadEquipment	LoadFactor	0.38	0.38
tblOffRoadEquipment	LoadFactor	0.37	0.37
tblOffRoadEquipment	OffRoadEquipmentType		Excavators
tblOffRoadEquipment	OffRoadEquipmentType		Tractors/Loaders/Backhoes
tblProjectCharacteristics	CO2IntensityFactor	641.35	290
tblTripsAndVMT	HaulingTripNumber	1,500.00	0.00
tblWater	AerobicPercent	87.46	100.00

tblWater	AerobicPercent	87.46	100.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	SepticTankPercent	10.33	0.00
tblWater	SepticTankPercent	10.33	0.00
tblWoodstoves	WoodstoveWoodMass	582.40	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.9400	2.3777	1.9322	3.4400e-003	0.0580	0.1314	0.1894	0.0174	0.1253	0.1428	0.0000	295.4305	295.4305	0.0564	0.0000	296.8407
Maximum	**0.9400**	**2.3777**	**1.9322**	**3.4400e-003**	**0.0580**	**0.1314**	**0.1894**	**0.0174**	**0.1253**	**0.1428**	**0.0000**	**295.4305**	**295.4305**	**0.0564**	**0.0000**	**296.8407**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.9400	2.3777	1.9322	3.4400e-003	0.0580	0.1314	0.1894	0.0174	0.1253	0.1428	0.0000	295.4302	295.4302	0.0564	0.0000	296.8404

Maximum	0.9400	2.3777	1.9322	3.4400e-003	0.0580	0.1314	0.1894	0.0174	0.1253	0.1428	0.0000	295.4302	295.4302	0.0564	0.0000	296.8404

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	1-1-2019	3-31-2019	0.6827	0.6827
2	4-1-2019	6-30-2019	0.7290	0.7290
3	7-1-2019	9-30-2019	0.7370	0.7370
		Highest	0.7370	0.7370

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.4209	5.3100e-003	0.3286	3.0000e-005		1.9300e-003	1.9300e-003		1.9300e-003	1.9300e-003	0.0000	2.2917	2.2917	5.5000e-004	3.0000e-005	2.3152
Energy	5.3900e-003	0.0461	0.0196	2.9000e-004		3.7200e-003	3.7200e-003		3.7200e-003	3.7200e-003	0.0000	82.5639	82.5639	3.9400e-003	1.5800e-003	83.1341
Mobile	0.0713	0.2381	0.7894	2.4300e-003	0.2128	2.8600e-003	0.2156	0.0571	2.6900e-003	0.0598	0.0000	221.6297	221.6297	8.0100e-003	0.0000	221.8300
Waste						0.0000	0.0000		0.0000	0.0000	4.1085	0.0000	4.1085	0.2428	0.0000	10.1787
Water						0.0000	0.0000		0.0000	0.0000	1.0143	2.8726	3.8869	3.7800e-003	2.2700e-003	4.6563
Total	**0.4976**	**0.2895**	**1.1376**	**2.7500e-003**	**0.2128**	**8.5100e-003**	**0.2213**	**0.0571**	**8.3400e-003**	**0.0655**	**5.1228**	**309.3579**	**314.4807**	**0.2591**	**3.8800e-003**	**322.1143**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.4209	5.3100e-003	0.3286	3.0000e-005		1.9300e-003	1.9300e-003		1.9300e-003	1.9300e-003	0.0000	2.2917	2.2917	5.5000e-004	3.0000e-005	2.3152
Energy	5.3900e-003	0.0461	0.0196	2.9000e-004		3.7200e-003	3.7200e-003		3.7200e-003	3.7200e-003	0.0000	82.5639	82.5639	3.9400e-003	1.5800e-003	83.1341
Mobile	0.0713	0.2381	0.7894	2.4300e-003	0.2128	2.8600e-003	0.2156	0.0571	2.6900e-003	0.0598	0.0000	221.6297	221.6297	8.0100e-003	0.0000	221.8300
Waste						0.0000	0.0000		0.0000	0.0000	4.1085	0.0000	4.1085	0.2428	0.0000	10.1787
Water						0.0000	0.0000		0.0000	0.0000	1.0143	2.8726	3.8869	3.7800e-003	2.2700e-003	4.6563
Total	**0.4976**	**0.2895**	**1.1376**	**2.7500e-003**	**0.2128**	**8.5100e-003**	**0.2213**	**0.0571**	**8.3400e-003**	**0.0655**	**5.1228**	**309.3579**	**314.4807**	**0.2591**	**3.8800e-003**	**322.1143**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2019	1/28/2019	5	20	
2	Site Preparation	Site Preparation	1/29/2019	1/30/2019	5	2	
3	Grading/Excavation	Grading	1/31/2019	2/5/2019	5	4	
4	Building - Exterior	Building Construction	2/20/2019	11/26/2019	5	200	
5	Paving	Paving	11/27/2019	12/10/2019	5	10	
6	Building - Interior/Architectural Coating	Architectural Coating	12/11/2019	12/24/2019	5	10	
7	Trenching/Foundation	Trenching	2/6/2019	2/19/2019	5	10	

Acres of Grading (Site Preparation Phase): 3

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 180,225; Residential Outdoor: 60,075; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area:

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Rubber Tired Dozers	1	8.00	247	0.40
Demolition	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Site Preparation	Graders	1	8.00	187	0.41
Site Preparation	Scrapers	1	8.00	367	0.48
Site Preparation	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Grading/Excavation	Graders	1	8.00	187	0.41
Grading/Excavation	Rubber Tired Dozers	1	8.00	247	0.40
Grading/Excavation	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Trenching/Foundation	Excavators	1	8.00	158	0.38
Trenching/Foundation	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Building - Exterior	Cranes	1	8.00	231	0.29
Building - Exterior	Forklifts	2	7.00	89	0.20
Building - Exterior	Generator Sets	1	8.00	84	0.74
Building - Exterior	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Building - Exterior	Welders	3	8.00	46	0.45
Building - Interior/Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Cement and Mortar Mixers	1	8.00	9	0.56
Paving	Pavers	1	8.00	130	0.42
Paving	Paving Equipment	1	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	5	13.00	0.00	82.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading/Excavation	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Trenching/Foundation	2	5.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building - Exterior	8	34.00	6.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building - Interior/Architectural	1	7.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					8.9100e-003	0.0000	8.9100e-003	1.3500e-003	0.0000	1.3500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0230	0.2268	0.1489	2.4000e-004		0.0129	0.0129		0.0120	0.0120	0.0000	21.4161	21.4161	5.4500e-003	0.0000	21.5524
Total	**0.0230**	**0.2268**	**0.1489**	**2.4000e-004**	**8.9100e-003**	**0.0129**	**0.0218**	**1.3500e-003**	**0.0120**	**0.0134**	**0.0000**	**21.4161**	**21.4161**	**5.4500e-003**	**0.0000**	**21.5524**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	4.0000e-004	0.0128	3.8000e-003	3.0000e-005	6.9000e-004	5.0000e-005	7.4000e-004	1.9000e-004	5.0000e-005	2.4000e-004	0.0000	3.1661	3.1661	1.9000e-004	0.0000	3.1707
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.9000e-004	3.5000e-004	3.4200e-003	1.0000e-005	1.0200e-003	1.0000e-005	1.0300e-003	2.7000e-004	1.0000e-005	2.8000e-004	0.0000	0.9429	0.9429	2.0000e-005	0.0000	0.9435
Total	**8.9000e-004**	**0.0132**	**7.2200e-003**	**4.0000e-005**	**1.7100e-003**	**6.0000e-005**	**1.7700e-003**	**4.6000e-004**	**6.0000e-005**	**5.2000e-004**	**0.0000**	**4.1089**	**4.1089**	**2.1000e-004**	**0.0000**	**4.1142**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					8.9100e-003	0.0000	8.9100e-003	1.3500e-003	0.0000	1.3500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0230	0.2268	0.1489	2.4000e-004		0.0129	0.0129		0.0120	0.0120	0.0000	21.4161	21.4161	5.4500e-003	0.0000	21.5524
Total	**0.0230**	**0.2268**	**0.1489**	**2.4000e-004**	**8.9100e-003**	**0.0129**	**0.0218**	**1.3500e-003**	**0.0120**	**0.0134**	**0.0000**	**21.4161**	**21.4161**	**5.4500e-003**	**0.0000**	**21.5524**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.0000e-004	0.0128	3.8000e-003	3.0000e-005	6.9000e-004	5.0000e-005	7.4000e-004	1.9000e-004	5.0000e-005	2.4000e-004	0.0000	3.1661	3.1661	1.9000e-004	0.0000	3.1707
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	4.9000e-004	3.5000e-004	3.4200e-003	1.0000e-005	1.0200e-003	1.0000e-005	1.0300e-003	2.7000e-004	1.0000e-005	2.8000e-004	0.0000	0.9429	0.9429	2.0000e-005	0.0000	0.9435
Total	**8.9000e-004**	**0.0132**	**7.2200e-003**	**4.0000e-005**	**1.7100e-003**	**6.0000e-005**	**1.7700e-003**	**4.6000e-004**	**6.0000e-005**	**5.2000e-004**	**0.0000**	**4.1089**	**4.1089**	**2.1000e-004**	**0.0000**	**4.1142**

3.3 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.5900e-003	0.0000	1.5900e-003	1.7000e-004	0.0000	1.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.7600e-003	0.0215	0.0119	2.0000e-005		8.5000e-004	8.5000e-004		7.9000e-004	7.9000e-004	0.0000	2.2013	2.2013	7.0000e-004	0.0000	2.2187
Total	**1.7600e-003**	**0.0215**	**0.0119**	**2.0000e-005**	**1.5900e-003**	**8.5000e-004**	**2.4400e-003**	**1.7000e-004**	**7.9000e-004**	**9.6000e-004**	**0.0000**	**2.2013**	**2.2013**	**7.0000e-004**	**0.0000**	**2.2187**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	2.0000e-005	2.1000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0580	0.0580	0.0000	0.0000	0.0581
Total	**3.0000e-005**	**2.0000e-005**	**2.1000e-004**	**0.0000**	**6.0000e-005**	**0.0000**	**6.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0580**	**0.0580**	**0.0000**	**0.0000**	**0.0581**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.5900e-003	0.0000	1.5900e-003	1.7000e-004	0.0000	1.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.7600e-003	0.0215	0.0119	2.0000e-005		8.5000e-004	8.5000e-004		7.9000e-004	7.9000e-004	0.0000	2.2013	2.2013	7.0000e-004	0.0000	2.2187
Total	**1.7600e-003**	**0.0215**	**0.0119**	**2.0000e-005**	**1.5900e-003**	**8.5000e-004**	**2.4400e-003**	**1.7000e-004**	**7.9000e-004**	**9.6000e-004**	**0.0000**	**2.2013**	**2.2013**	**7.0000e-004**	**0.0000**	**2.2187**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	2.0000e-005	2.1000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0580	0.0580	0.0000	0.0000	0.0581
Total	**3.0000e-005**	**2.0000e-005**	**2.1000e-004**	**0.0000**	**6.0000e-005**	**0.0000**	**6.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0580**	**0.0580**	**0.0000**	**0.0000**	**0.0581**

3.4 Grading/Excavation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					0.0138	0.0000	0.0138	6.8400e-003	0.0000	6.8400e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.0600e-003	0.0455	0.0203	4.0000e-005		2.1500e-003	2.1500e-003		1.9700e-003	1.9700e-003	0.0000	3.7036	3.7036	1.1700e-003	0.0000	3.7329
Total	**4.0600e-003**	**0.0455**	**0.0203**	**4.0000e-005**	**0.0138**	**2.1500e-003**	**0.0159**	**6.8400e-003**	**1.9700e-003**	**8.8100e-003**	**0.0000**	**3.7036**	**3.7036**	**1.1700e-003**	**0.0000**	**3.7329**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.0000e-005	5.0000e-005	5.3000e-004	0.0000	1.6000e-004	0.0000	1.6000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1451	0.1451	0.0000	0.0000	0.1452
Total	**8.0000e-005**	**5.0000e-005**	**5.3000e-004**	**0.0000**	**1.6000e-004**	**0.0000**	**1.6000e-004**	**4.0000e-005**	**0.0000**	**4.0000e-005**	**0.0000**	**0.1451**	**0.1451**	**0.0000**	**0.0000**	**0.1452**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0138	0.0000	0.0138	6.8400e-003	0.0000	6.8400e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.0600e-003	0.0455	0.0203	4.0000e-005		2.1500e-003	2.1500e-003		1.9700e-003	1.9700e-003	0.0000	3.7036	3.7036	1.1700e-003	0.0000	3.7329